

PCB Prototyping Machine

Eleven Auto
FPZ-31AT / FPZ-73AT



Command Manual

MITS
Electronics

Contents

Notes of Caution	P.4
----------------------------------	-----

Basic Information	P.5
-----------------------------------	-----

- [Name of Parts of Eleven Auto \(Front\)](#) P.6
- [Name of Parts of Eleven Auto \(Rear\)](#) P.7
- [Name of Parts of FPZ-31AT/73AT \(Front\)](#) P.8
- [Name of Parts of FPZ-31AT/73AT \(Rear\)](#) P.9

Tools	P.10
-----------------------	------

- [Tools](#) P.11
- [Tools with Distance Ring](#) P.12

Software Install	P.15
----------------------------------	------

- [Install the Software](#) P.16
- [Registration](#) P.17
- [Copy Backup Data on Windows Vista](#) P.18
- [Copy Backup Data on Windows 2000/XP](#) P.20
- [USB Setting on Windows Vista](#) P.21
- [USB Setting on Windows 2000/XP](#) P.23

Setting Up the Prototyping Machine	P.24
--	------

- [Connect Prototyping Machine to PC and Other Equipment](#) P.25
- [Air Compressor Specification](#) P.26
- [Air Regulator Connection](#) P.27
- [Contact and Non-Contact Method](#) P.28

Activate the Prototyping Machine	P.29
--	------

- [Start Up the System](#) P.30
- [Change Application](#) P.31
- [Port Setting](#) P.32

<u>Preparing Fabrication</u>	P.33
<ul style="list-style-type: none"> • Concept of P1P2 Revised • Concept of Registration Pin • Set Plastic Plates and Underlay • Set P3 • Drill Holes for Registration Pins • Backup P3 Info • Set Adjust Method • Enter Thickness of the Board 	<ul style="list-style-type: none"> P.34 P.35 P.36 P.37 P.38 P.39 P.40 P.41
<u>Manual Operation</u>	P.42
<ul style="list-style-type: none"> • Launch Design Pro • Manual Operation • Manual Operation Screen • Tool Change Manually • Dummy Tool • Tool Change in the Job • Adjust Depth of Cut • Make Hole for Registration Pin on Board 	<ul style="list-style-type: none"> P.43 P.44 P.45 P.49 P.50 P.51 P.52 P.53
<u>Procedure for Fabrication</u>	P.54
<ul style="list-style-type: none"> • Display Milling Data • Prepare Tools for Working with Standard FR-4 • Start Job • Adjust to Call Up the Manual Operation Screen • Set P1 Point and Confirm P2 Location • Size of Board Material • Adjust Depth of Cut • Drill (Top) and Mill (Top) • Turn Over the Board • Mill (Bottom) • ESC Key to Pause • Redo • Mill Selectively • Start Job (Routing) • Ensure Depth of the Cut (Routing) 	<ul style="list-style-type: none"> P.55 P.56 P.57 P.58 P.59 P.60 P.61 P.62 P.63 P.64 P.65 P.66 P.67 P.68 P.70
<u>Step Milling</u>	P.71
<ul style="list-style-type: none"> • Step Milling • Calibrate Thickness 	<ul style="list-style-type: none"> P.72 P.74

[Option – Fiducial Positioning Camera](#) P.75

- [Fiducial Positioning Camera](#) P.76
- [Attach Camera Holder to Prototyping Machine](#) P.77
- [Attach Camera to the Holder](#) P.78
- [Install USB Camera Driver](#) P.79
- [Install UCAM Camera Driver on Windows Vista](#) P.80
- [Install UCAM Camera Driver on Windows 2000/XP](#) P.82
- [Install My-CAM Camera Driver on Windows Vista](#) P.84
- [Install My-CAM Camera Driver on Windows 2000/XP](#) P.86
- [Start MITS Design Pro and Design View](#) P.87
- [Set Camera Monitor ON](#) P.88
- [Adjust Angle of Camera](#) P.89
- [Adjust Focus on UCAM Camera](#) P.90
- [Set Distance from Spindle to Camera](#) P.91
- [Calibration](#) P.93
- [P1/P2 Alignment with Camera](#) P.94

[Option - Vacuum Table](#) P.95

- [Name of Parts of Vacuum Table](#) P.96
- [Attach Nozzle into the Vacuum Table](#) P.97
- [Place Vacuum Table on Machine Table](#) P.98
- [Connect Vacuum Cleaner](#) P.99
- [Enter Table Thickness](#) P.100
- [Place Board on Vacuum Table](#) P.101

[Trouble Shooting](#) P.102

- [Trouble Shooting – RS232C Cable](#) P.103
- [Trouble Shooting – USB Cable](#) P.104
- [Setting USB Root Hub](#) P.105
- [Recovery after Accidental Stop](#) P.106
- [Recovery of Auto Tool Change](#) P.107

Notes of Caution



DO NOT get close to the prototyping machine during milling

Be especially careful around the area of the spindle head.
Be sure not to get your face injured or your hand caught in the mechanism.
Also, please wear protective goggles or similar protective equipment while the prototyping machine is operating.



Attach the dummy tool when the machine is not in use

While the prototyping machine is not used, attach the dummy tool bit to the chuck of the spindle motor.
It is useful to expand the lifetime of the chuck of the spindle motor.



Recovery from the hard limit error

If the spindle head passes outside the maximum milling range, the message "Hard limit detected" will appear on the screen.
In such an event, you need to recover the prototyping machine's home point.
Click **To Initial** on the Manual Operation screen.
Another way is to shut down the prototyping machine and Design Pro and then restart both.

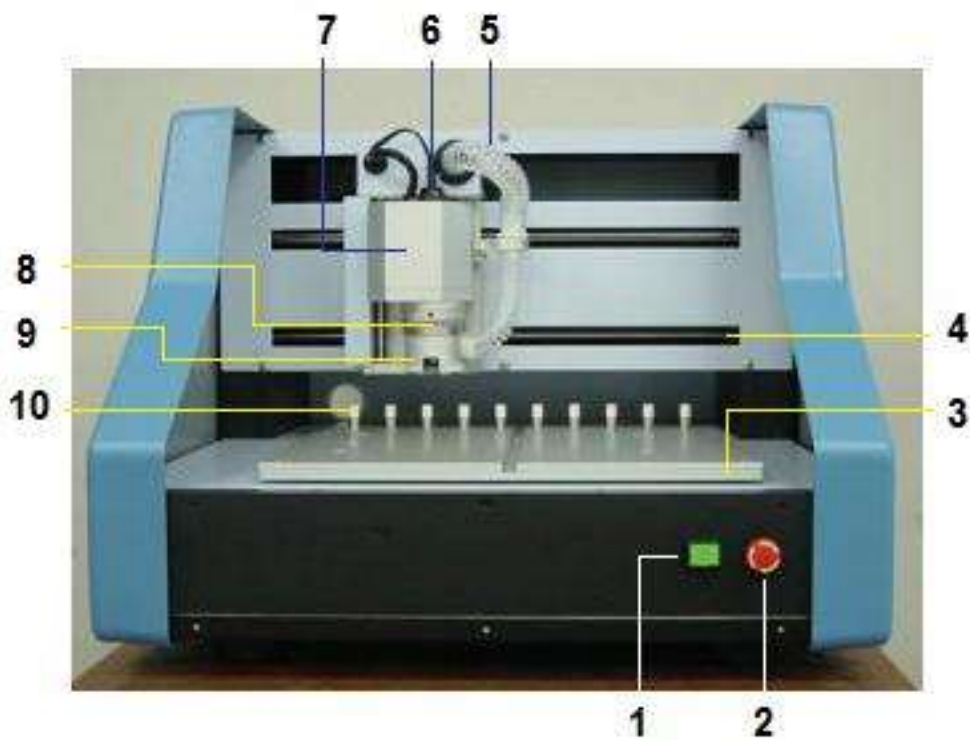


SHIFT+ESC key to cancel waiting

If you click the icon to start the communication to the prototyping machine which is still turned off, the mouse pointer changed to the timer icon will keep waiting for the reply from the prototyping machine.
In this event, press SHIFT+ESC key to cancel waiting for the reply.
Ctrl+Alt+Del is **NOT** necessary.

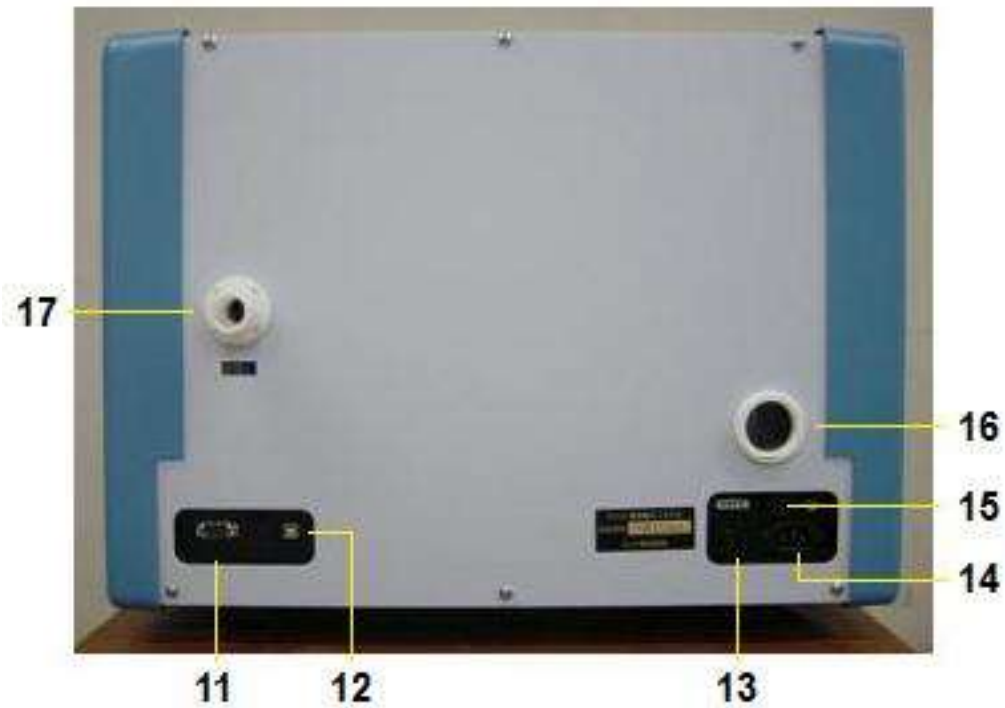
Basic Information

Name of Parts of Eleven Auto (Front)



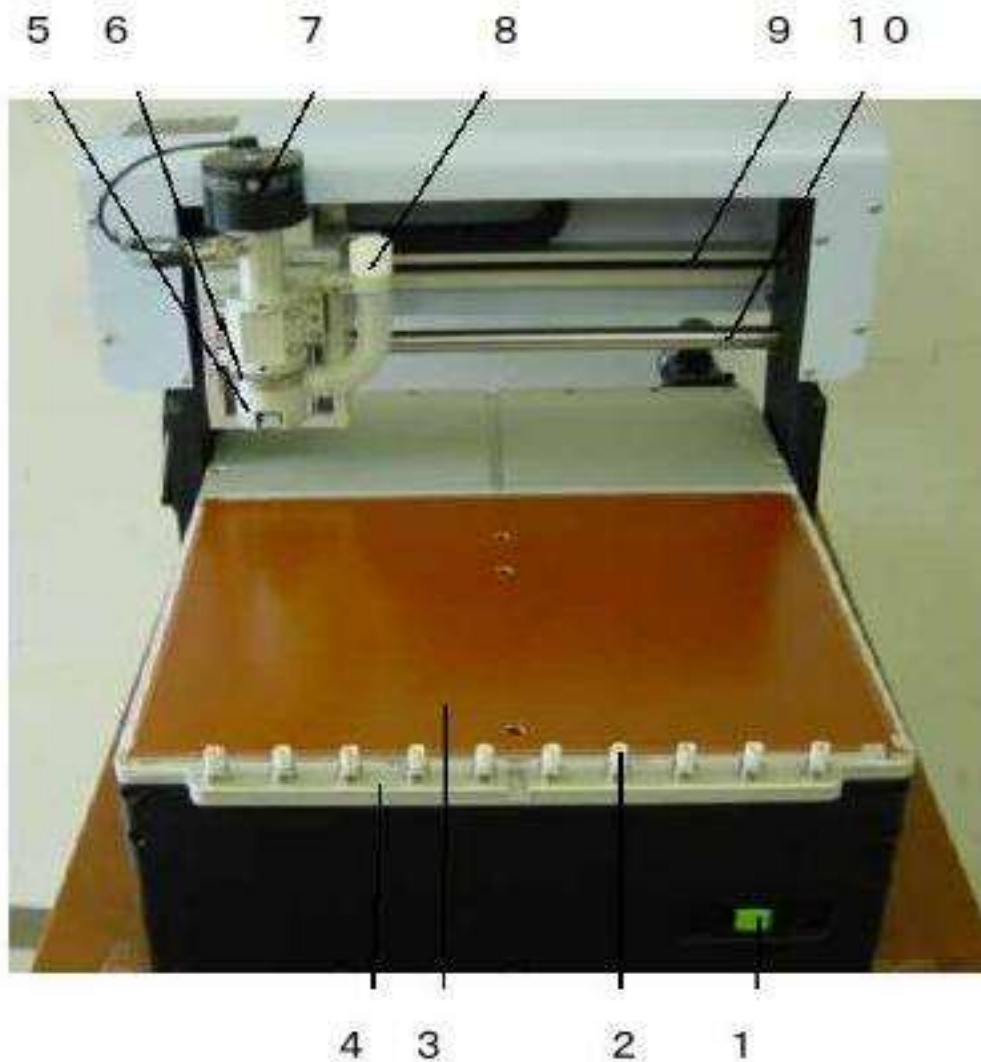
1. Power Switch
2. Emergency Switch
3. Table (Y axis)
4. X axis
5. Vacuum Suction Hose
6. Spindle Motor
7. Head (Z axis)
8. Depth Adjustment Screw
9. Pressure Foot
10. Tool Post

Name of Parts of Eleven Auto (Rear)



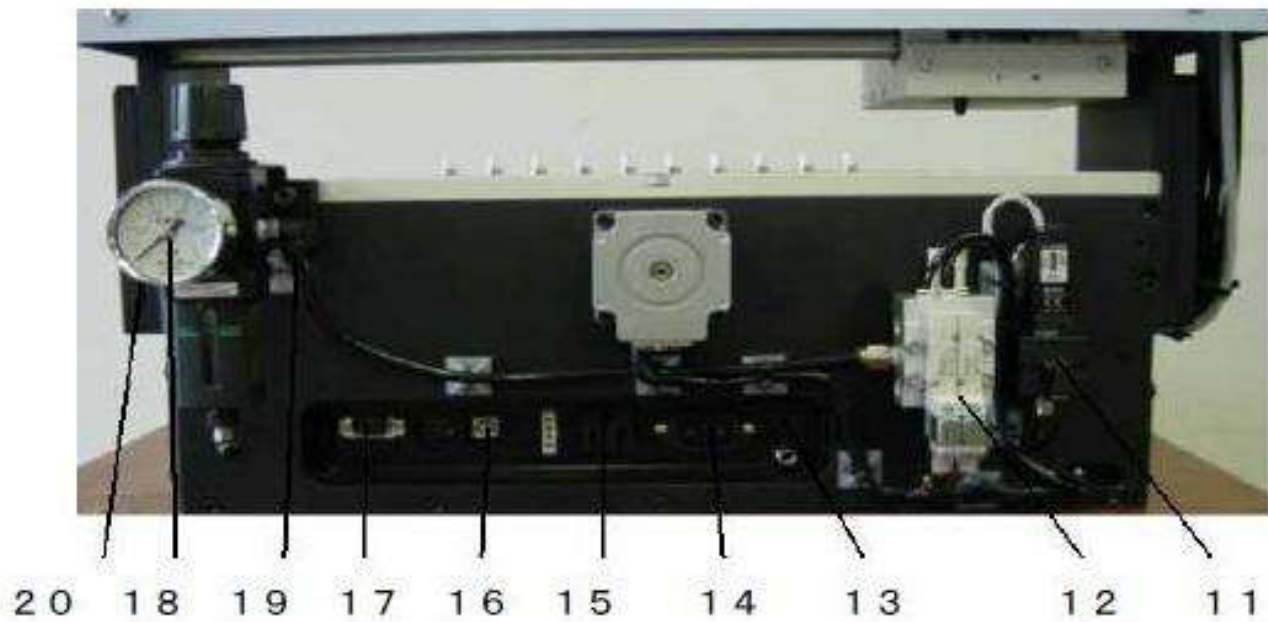
11. COM Port (RS232 Serial Port)
12. USB Port
13. Plug for Vacuum Cleaner
14. Power Plug
15. Fuse
16. Exit for Vacuum Table
17. Exit for Vacuum Suction Hose

Name of Parts of FPZ-31AT/73AT (Front)



1. Power Switch
2. Tool Post
3. Underlay
4. Table
5. Pressure Foot
6. Depth Adjustment Screw
7. Spindle Motor
8. Vacuum Suction Nozzle
9. Lead Screw of X axis
10. Linear Shaft of X axis






Name of Parts of FPZ-31AT/73AT (Rear)



11. Air Pressure Sensor
12. Air Valve
13. Fuse
14. Power Plug
15. Plug for Vacuum Cleaner
16. USB Port
17. COM Port (RS232 Serial Port)
18. Air Pressure Meter
19. Air Junction
20. Air Regulator

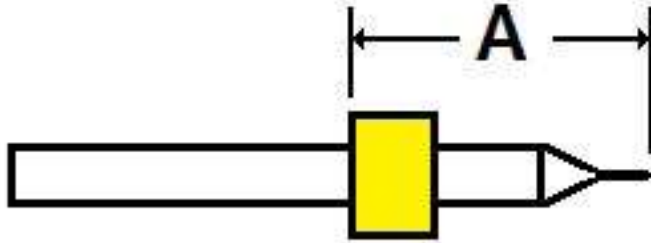
Tools

Tools

Tool	Size	Application
Milling bit 	90 degree 60 degree (The tip is pointed-end)	<div style="background-color: #0000FF; color: white; padding: 5px;"> For standard FR-4 material such as 1.6mm (0.063") thickness. </div> <ul style="list-style-type: none"> • For milling outlines and rubout • 36mm (1.42") overall length
Endmill 	1.0mm (0.40") and more	<div style="background-color: #0000FF; color: white; padding: 5px;"> For standard FR-4 material such as 1.6mm (0.063") thickness. </div> <ul style="list-style-type: none"> • For removing copper with large width. • 36mm (1.42") overall length
RF Milling 	0.2mm (0.008") 0.3mm (0.012") 0.5mm (0.020") and more	<div style="background-color: #FF0000; color: white; padding: 5px;"> For Teflon(PTFE) and/or thin materials </div> <ul style="list-style-type: none"> • For milling outlines and rubout. • 38.1mm (1.5") overall length. • Recommended to use with the machine equipped with non-contact pressure foot.
Drill 	various	<ul style="list-style-type: none"> • For drilling holes. • 38.1mm (1.5") overall length.
Router (Forming cutter) 	0.8mm (0.31") 1.0mm (0.39") 2.0mm (0.78") and more.	<ul style="list-style-type: none"> • For routing inner and outer board contours. • 38.1mm (1.5") overall length.

Tools with Distance Ring

Tools with Distance Ring



Tools with distance rings are required for automatic tool change machines.

See the chart for ring position.

*Milling: A=17mm (0.67")

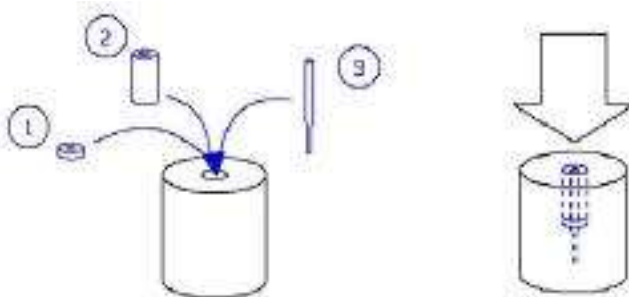
*Drill/Router: A=19mm (0.75")

How to Install the ring to Tools

Drill bit 38.1mm (1.5") length

Milling bit 36mm (1.42") length

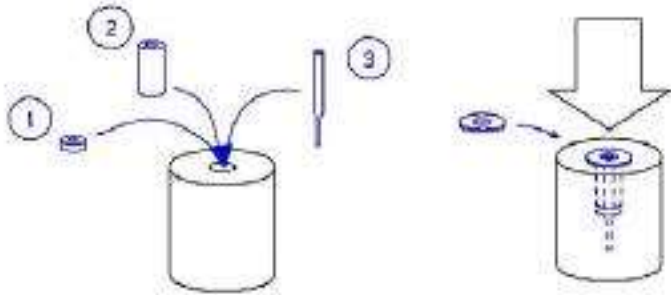
Attach the ring to the tool bit using the accessory equipment. Insert in the order of ring, tube, and tool bit into the equipment. Push the tool bit in with the hammer.



Router bit 38.1mm (1.5") length

If you wish to make routing on the board slightly shallower, place the washer and push in the tool bit.

Shallower milling will ensure that the board does not pop out and that it doesn't leave scars on the underlay.

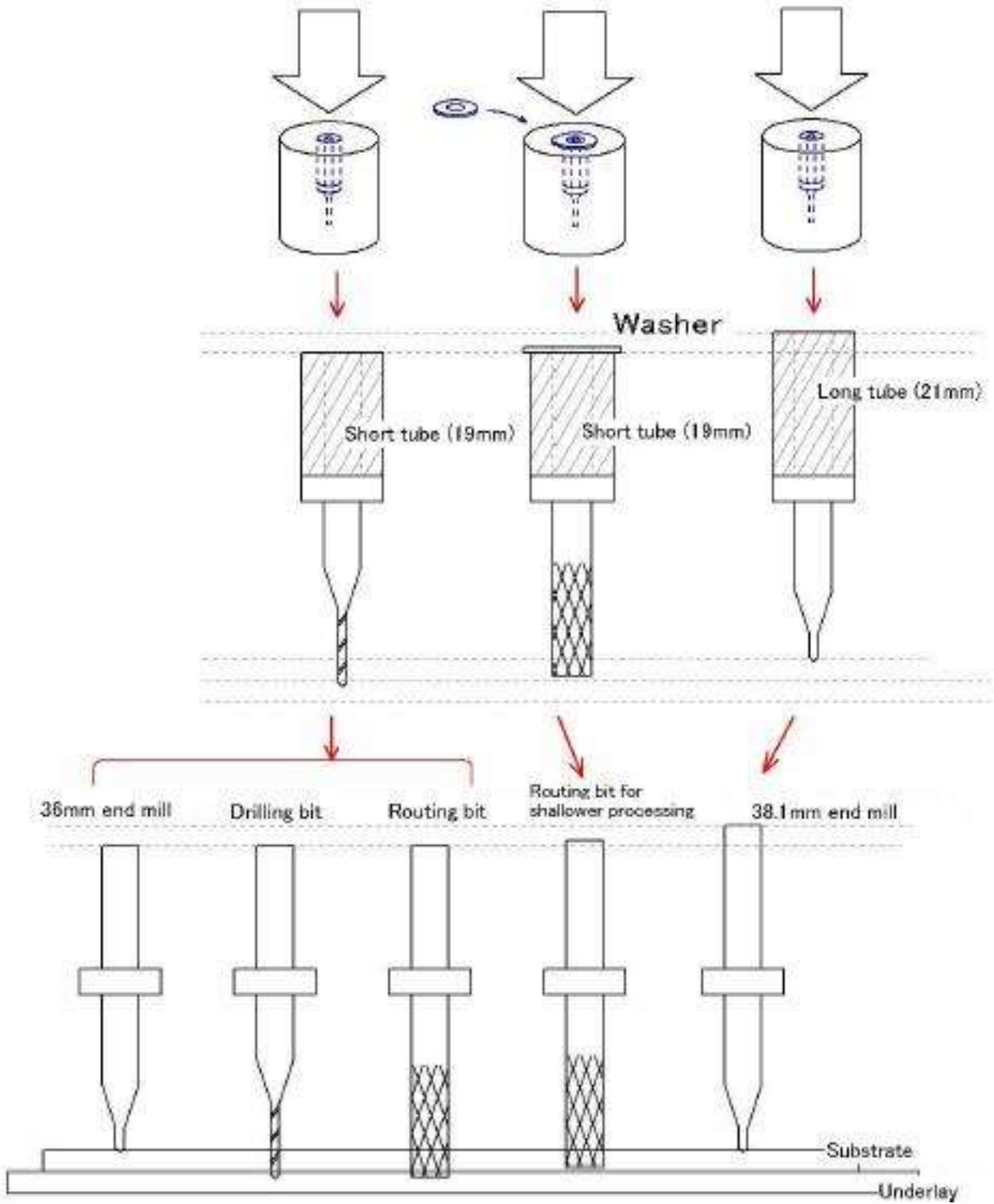


Milling bit 38.1mm (1.5") length

Please use longer tube with 21mm (0.82") length in order to put ring to 38.1mm milling bit.

It makes 2mm (0.08") difference under the ring of tool.

Comparison of bit length with ring



Software Install

Install the Software

MITS Design Pro is software for PCB designing, converting data from other CAD system and controls the machine.

PC Specification:

OS: Windows 2000(SP4 and newer edition)/XP Home (SP2)/XP Pro (SP2)/ Vista
NOT supported in 64bit operating system.
RS232C serial port or USB port required.

Install Procedures:

Open CD-ROM and start Designpro_en_setup.exe to install the program.

Choose the appropriate items in the list during the set-up procedure:

Component Name	Request Space
<input checked="" type="checkbox"/> Common Component	9,986,645 byte
<input type="checkbox"/> CAM-21RS	22,974 byte
<input type="checkbox"/> CAM-Circuit2	23,000 byte
<input type="checkbox"/> CAM-T	22,992 byte
<input type="checkbox"/> CAM-TP	23,508 byte
<input type="checkbox"/> CAM-Z	22,929 byte
<input type="checkbox"/> DFM-300	23,429 byte

*Common component must be installed together with the applications.
It includes Converter and EASYCAD.

Choose one of the following applications related to your prototyping machine:

*CAM-21RS controls FP-7A / FP-21A < including HP option>.

*CAM-Circuit2 controls Seven mini / Eleven-T < including HP option>.

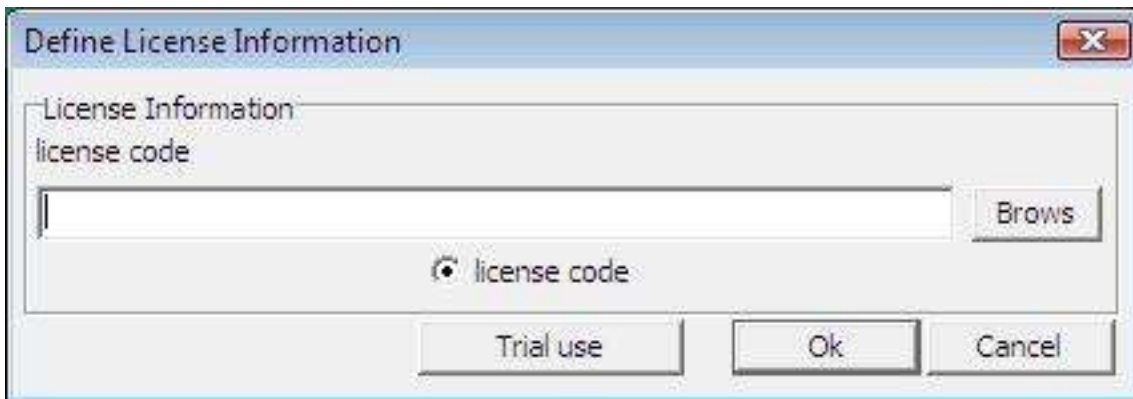
*CAM-TP controls FP-21T Precision.

*CAM-T controls FP-21T < including HP option>.

*CAM-Z controls Eleven Auto / FPZ-31AT / FPZ-73AT.

Registration

Registration is necessary to continue to use MITS Design Pro and board maker. The following screen is displayed when MITS Design Pro is started.



Please enter the license code and click **OK** to finish the registration. Otherwise, click "Trial use" to evaluate the software for 1 month.



MITS Electronics submit 2 type of license code:

- Activates optional EASYCAD
- No optional EASYCAD (Converter+CAM ONLY)



License Policy:

One prototyping machine includes one license of Mits Design Pro software.

With this one license, you can install it to a PC for the control of the machine, and to another PC for making milling data for the machine.

When you install to 2nd PC, enter same license code of 1st PC.

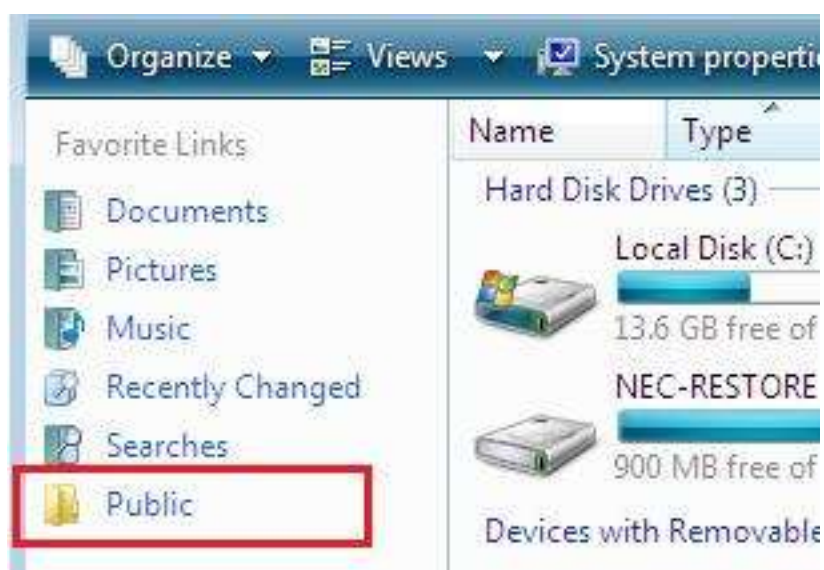
If you need more license, please purchase one license per PC.

Copy Backup Data on Windows Vista

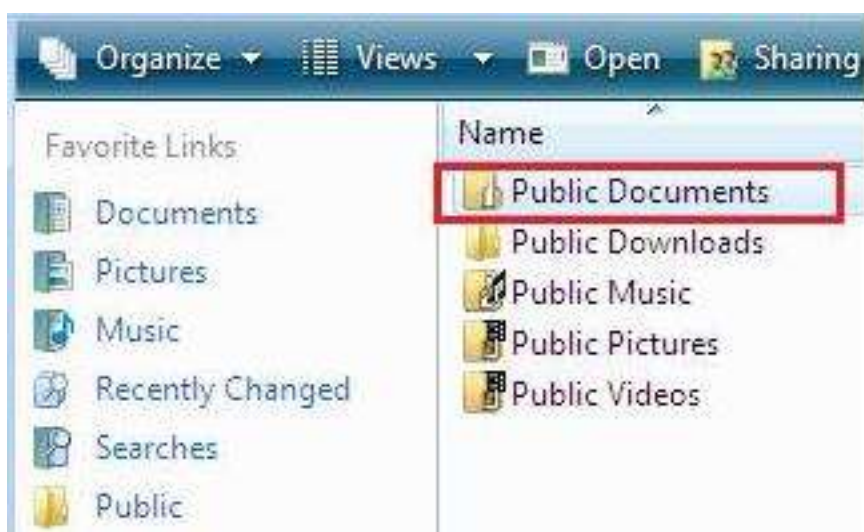
After the setup process of Mits Design Pro, it is necessary to copy the individual setting file manually to your hard disk.

Use “explore” to open the location which the backup data will be stored.

Right click on **Start** → **Explore** → **Computer** and click **Public**



Click **Public Documents** → **Mits Software** → **MT Path**



Please copy the following 2 files to “Fpz” folder (illustrated below). These data is provided from CD-ROM.

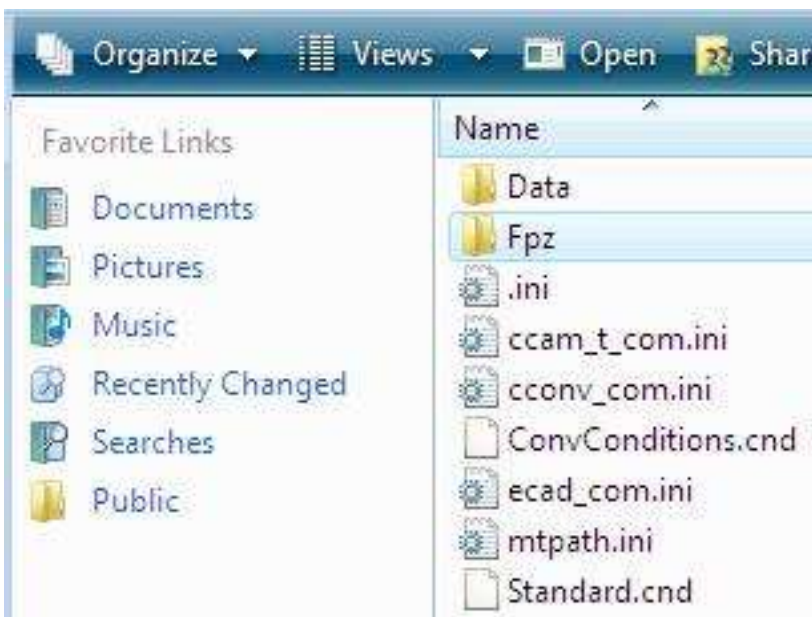
Proc.sys → Fpz folder

Pcnativ.sys → Fpz folder

If your machine is FPZ-73AT

Please copy one more file:

xxxxxx.p3i → Fpz folder



Copy Backup Data on Windows 2000/XP

After the setup process of Mits Design Pro, it is necessary to copy the individual setting file manually to your hard disk.

Use “explore” to open the location which the backup data will be stored.

1. Right click **Start** → **Explore** → go to **My Computer**
2. Click **Shared Document**
3. Click **Mits Software** → **MT Path**

If you don't see **Shared Document** in **My Computer**, do as follows:

1. Right click **Start** → **Explore** → go to **My Computer**
2. Click **C:** → **Documents and Settings** → **All Users**
3. Click **Mits Software** → **MT Path**

You will find several folders and files in MT Path folder.



Please copy the following 2 files to “Fpz” folder (illustrate on the left). These data is provided from the CD-ROM.

Proc.sys → Fpz folder
Pcnativ.sys → Fpz folder

If your machine is FPZ-73AT
Please copy one more file:

xxxxxx.p3i → Fpz folder

USB Settings on Windows Vista

If your prototyping machine has a USB port, you can connect to the computer via USB cable.

USB Cable

Prepare a USB cable TYPE A to TYPE B.

Install USB Driver

Turn on the prototyping machine.

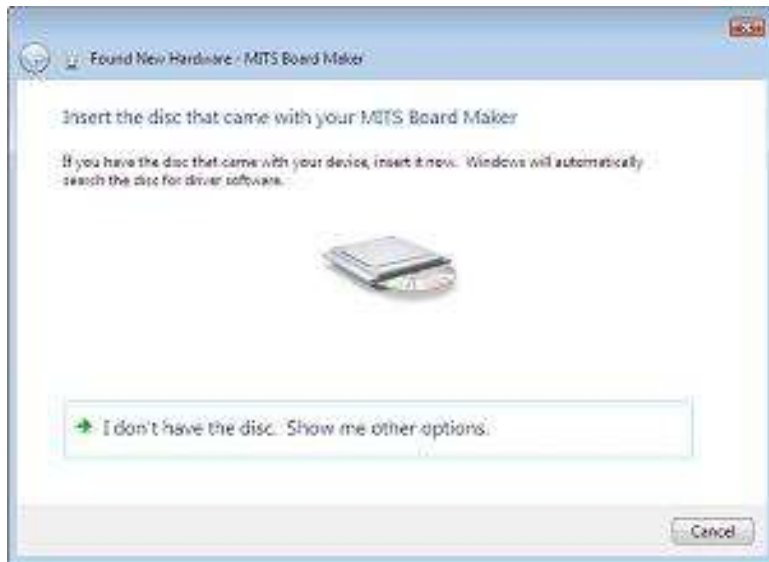
Found New Hardware screen appears.
Click on **Locate and install drive software**.



User Account Control screen will appear. Windows needs your permission to continue.

Click **Continue**.

Insert the CD-ROM.



Windows Security screen appears.
Click **Install this driver software anyway**



Finally, the USB driver has been successfully installed.



USB Settings on Windows 2000/XP

IF your prototyping machine has a USB port, it is possible to communicate with your PC via USB.

USB Cable

Prepare a USB cable TYPE A to TYPE B.

Install USB Driver



Connect your prototyping machine and computer with USB cable and then turn on the prototyping machine.

Windows will recognize and start "Found New Hardware wizard".

Click **Next**.



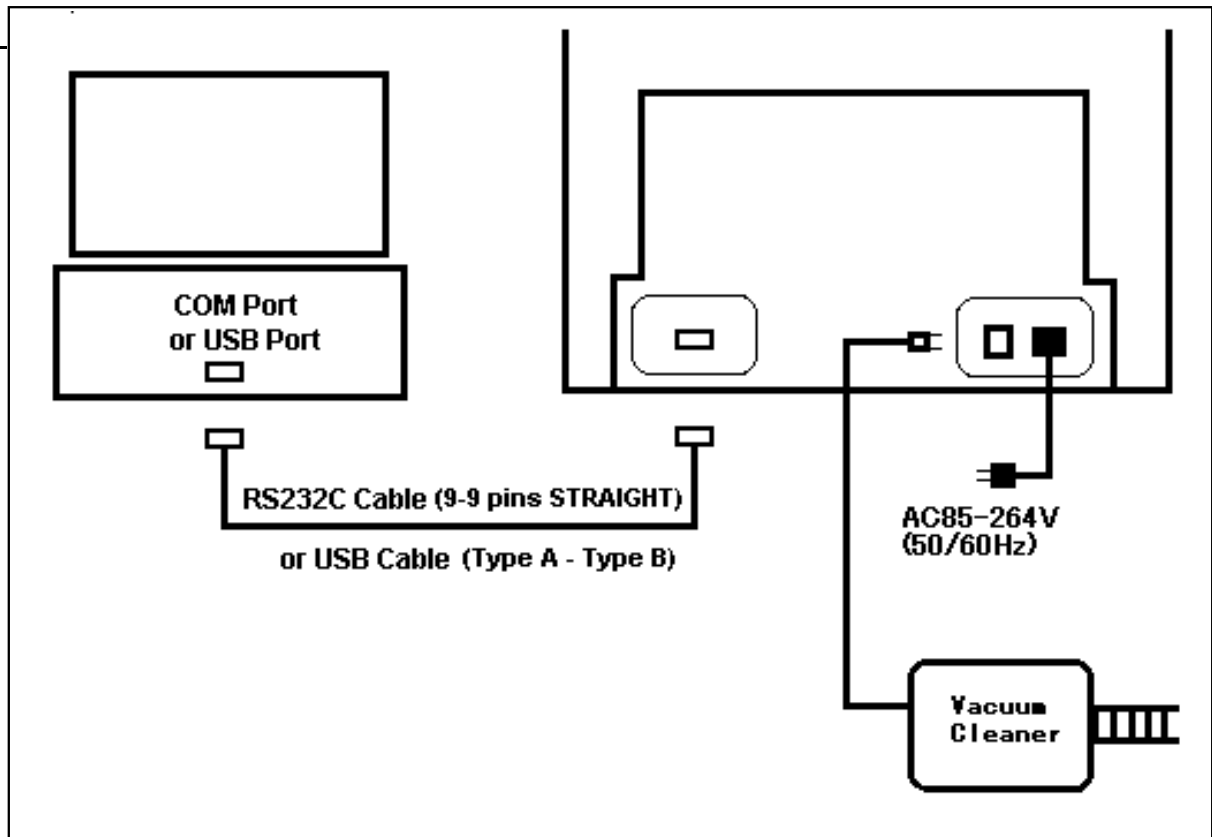
The location of the USB driver is **Drivers** folder in the CD-ROM.

Click **Next** and the wizard will finish the rest of process

Setting Up the Prototyping Machine

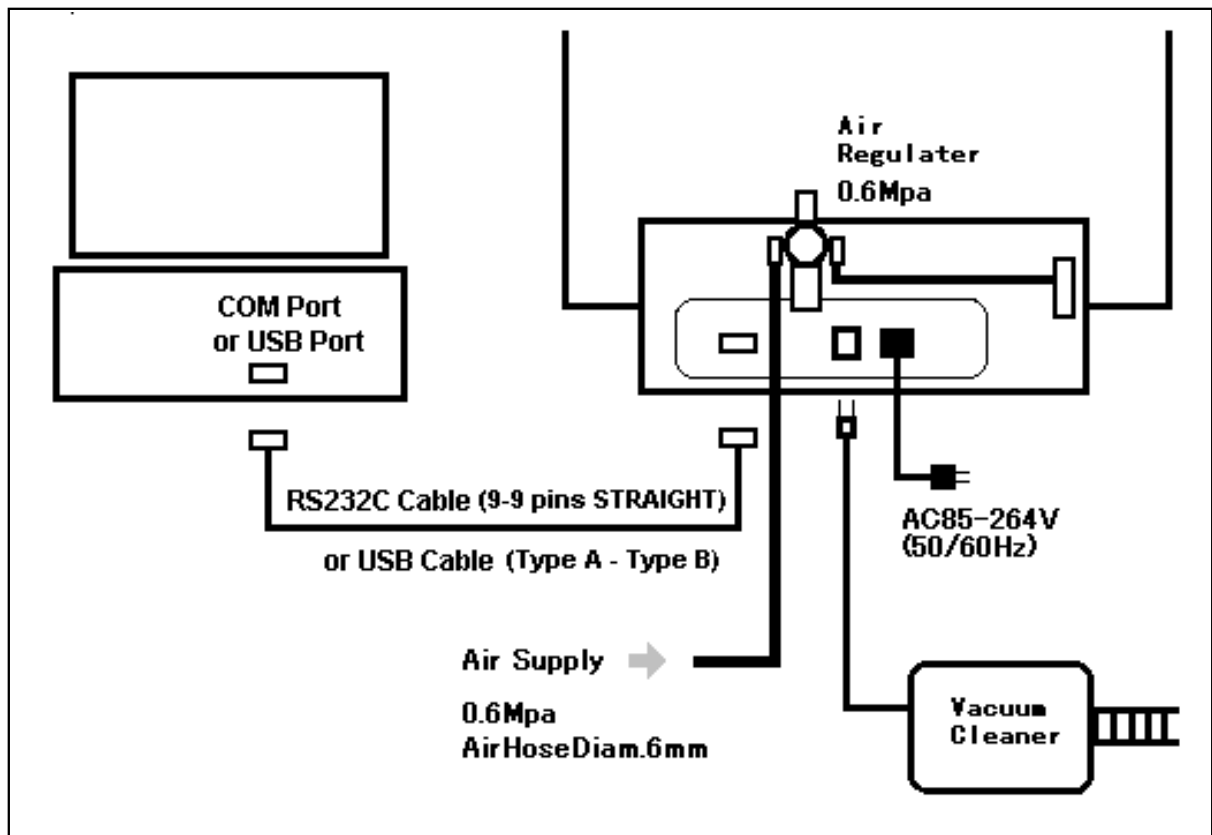
Connect Prototyping Machine to PC and Other Equipment

Eleven
Auto



FPZ-
31AT

FPZ-
73AT



Air Compressor Specifications

Pressure and Flow Rate

These values required for prototyping machine depends on the auto tool changing function, Non-contact pressure foot (HP) and their combination.

Model	Pressure (Mpa)	Flow Rate (litter/min.)
Auto tool changing	0.6 or higher	Small
Auto tool changing & non-contact foot(HP)	0.6 or higher	At least 60
Non-contact foot (HP)	0.5 or higher	At least 60

Filter



The air regulator on the back of prototyping machine is not large and filter ability is restricted. Another filter on the air compressor side is necessary.

Other Specifications (Preferable)

The following specifications are not mandatory.

- Oil less
If your air compressor is not oil-less, prepare not only water filter but also oil filter.
- Low Noise

Air Hose Connection

Prepare air hose from the outlet of your air compressor to the inlet of air regulator which is mounted on the back of machine. Air hose diameter is 6mm. Please refer to air regulator connection.

Air Regulator Connection

Prepare air compressor and air hose diam.
6mm.

(outer diameter 6mm)

Connect to the inlet of air regulator on the back of prototyping machine.

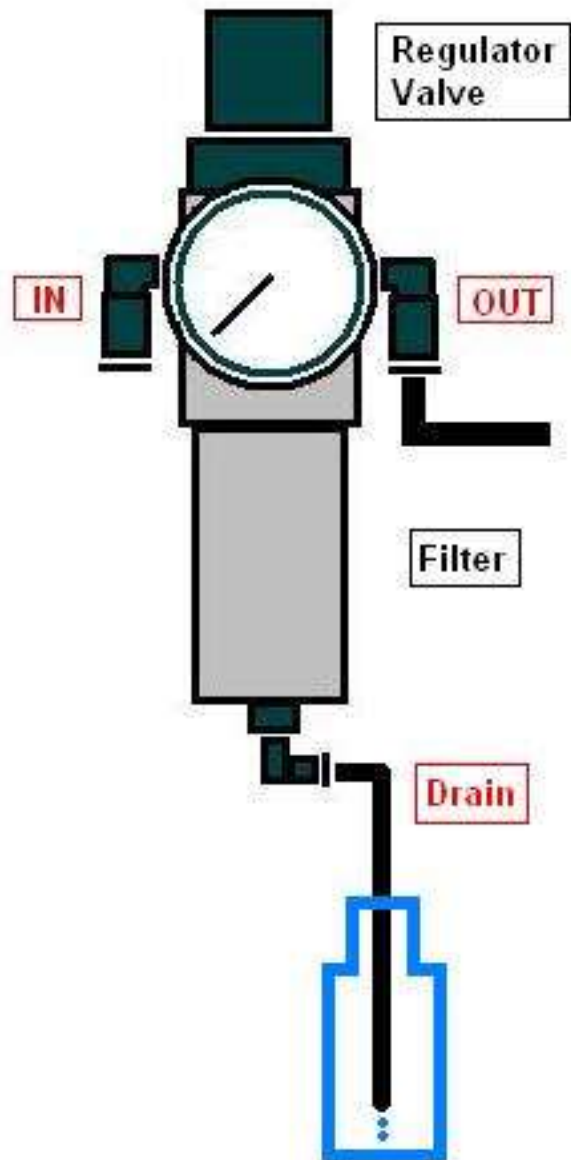


Connect the attached drain hose to the drain port.

Other end of hose should be inserted into a bottle.

Water removed by filter will be drawn into the bottle.

Turn on the air compressor. Open the valve of air regulator. Pressure from air compressor should be lowered by the regulator to stabilize the air supply.



Model	Regulator Indicator (Mpa)
Auto tool changing	0.55-0.6
Auto tool changing & Non-contact foot(HP)	0.55-0.6
Non-contact foot (HP)	0.4-0.45



The air regulator is not large and filter ability is restricted. Another filter on the air compressor side is necessary.

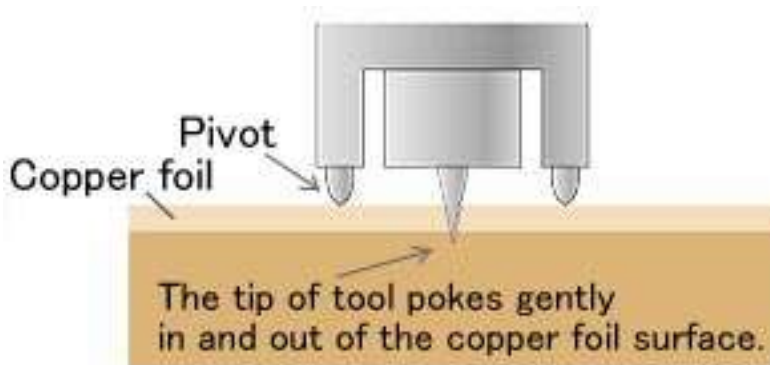


Make sure to remove the water in the drain tank of the air compressor occasionally. Otherwise, water might flow into the machine and spindle motor.

Contact & Non-Contact Method

When making boards with fine patterns, normally we adopt the incremental milling method in which the material board is held down and the tool tip is made to stick out accurately from the very point where the board is being held down. For holding down the material boards, there are two methods called the contact method and the non-contact method.

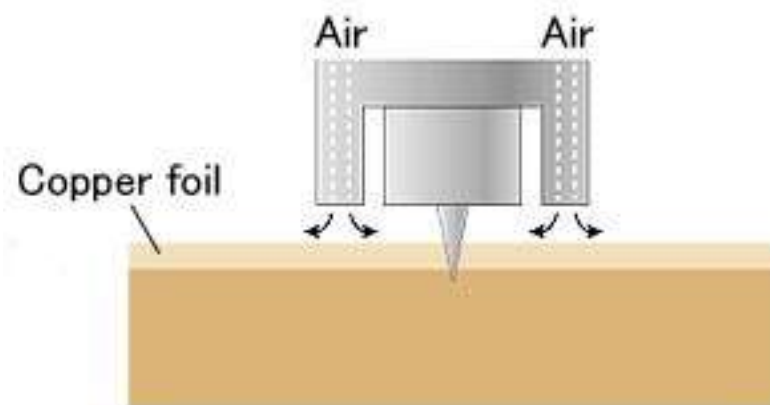
Contact Method



This system leaves the thin trace of pivot touch on the surface of copper foil. (But this pivot does not leave any scratch.)

You don't have an air compressor using contact method.

Non-Contact Method (HP option)



As the jet of air pushes down the board without touching it, this system leaves no trace on the copper foil.

Therefore, this system is suitable for the processing of thin or soft materials. However, you have to have an air compressor additionally.

Activate the Prototyping Machine

Start Up the System

The Sequence of Starting Up the Equipment

1. Turn on the computer (Windows).
2. Start **Design Pro**.
3. Turn on the prototyping machine.

At this time, the spindle head will automatically confirm the movement limits of the X, Y, and Z axis.

It then will move to the initial point (home point) of the machine and stops.

This point is located at the far left, when facing the prototyping machine from the front.



Do NOT turn on the prototyping machine until the computer has been completely started up. Otherwise, connection between the computer and the prototyping machine will fail.



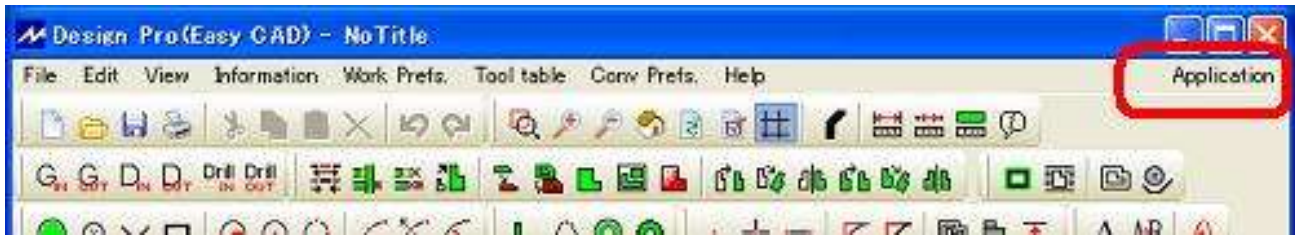
Be sure to prepare the air supply if your prototyping machine needs it.



The "Found New Hardware Wizard" message will appear when the prototyping machine was turned on for the first time via USB.

Please refer to "USB settings for installing USB driver" in this manual.

Change Application



There are 3 applications in Design Pro:

EasyCAD: Used for designing print circuit boards

Converter: Converts Gerber and DXF files

CAM-Z: Operates prototyping machine

To operate Eleven Auto, FPZ-31AT and FPZ-73AT, choose the application

"CAM-Z" in the Application menu at the upper right corner of the screen:

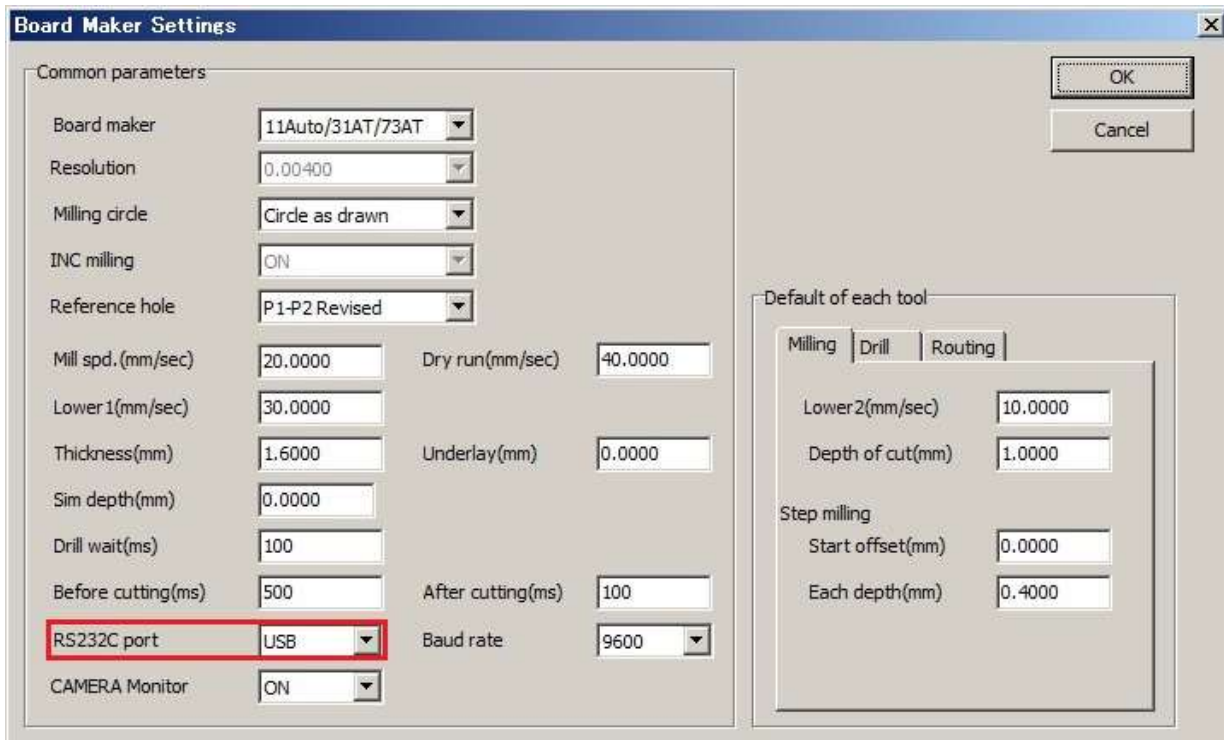


Before the milling operation, it is necessary to prepare the milling data using EasyCAD or Converter. For operation, please refer to the manual in CD-ROM.

Port Setting

Before operating the prototyping machine, you first need to set the port that the computer and the prototyping machine is connected through.

Go to **CAM Prefs.** → **Board Maker**



Board Maker Settings

Common parameters

Board maker: 11Auto/31AT/73AT
Resolution: 0.00400
Milling circle: Circle as drawn
INC milling: ON
Reference hole: P1-P2 Revised

Mill spd.(mm/sec): 20.0000 Dry run(mm/sec): 40.0000
Lower1(mm/sec): 30.0000
Thickness(mm): 1.6000 Underlay(mm): 0.0000
Sim depth(mm): 0.0000
Drill wait(ms): 100
Before cutting(ms): 500 After cutting(ms): 100
RS232C port: USB Baud rate: 9600
CAMERA Monitor: ON

Default of each tool

Milling | Drill | Routing

Lower2(mm/sec): 10.0000
Depth of cut(mm): 1.0000

Step milling
Start offset(mm): 0.0000
Each depth(mm): 0.4000

OK
Cancel

Connection with RS232C Serial Cable

- Set RS232C port to the available COM port such as "COM1"

Connection with USB Cable

- Set RS232C port to "USB"
- It is not necessary to set "Baud rate"



Restart the software when the port settings are changed. This setting will apply from the next time the software is opened.

Preparing Fabrication

Concept of P1P2 Revised

P1 P2 points are reference point of the milling pattern data. These points are automatically set by our software in order to process circuit board.

P1 point is located 2mm to the left and down from the bottom left corner of the milling pattern data. P2 point is located 2mm to the right and up from the upper right corner of the milling pattern data. Please see the diagram below for reference.

When the prototyping machine is processing top layer, the P1P2 points will be;

P1 – Front left corner

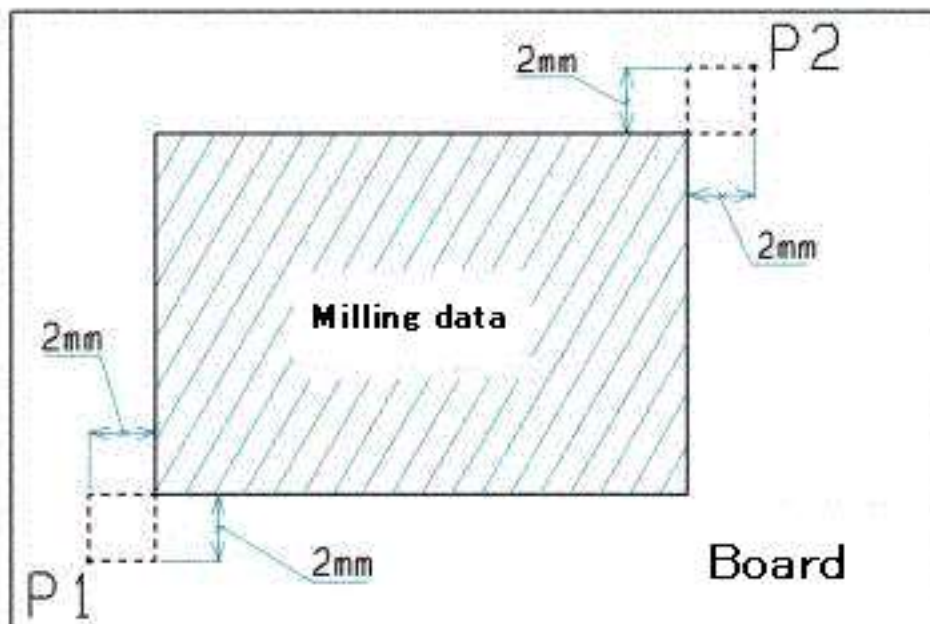
P2 – Back right corner

If the board is turned over to process bottom layer, the position for these points will shift;

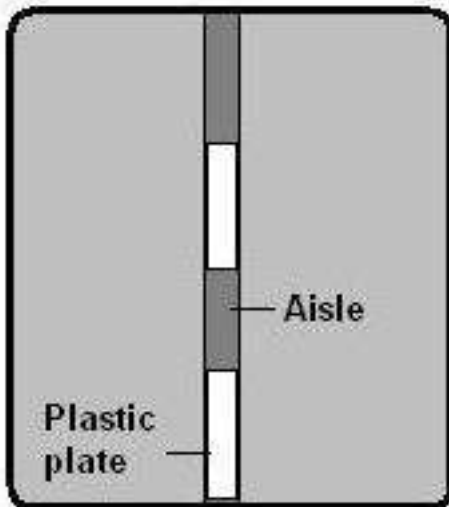
P1 – Front right corner

P2 – Back left corner

It is necessary to set P1 and P2 point before the fabrication, because there is a chance that the milling pattern data is set outside the board, which would result the fabrication to fail and damage the surface of the prototyping machine.

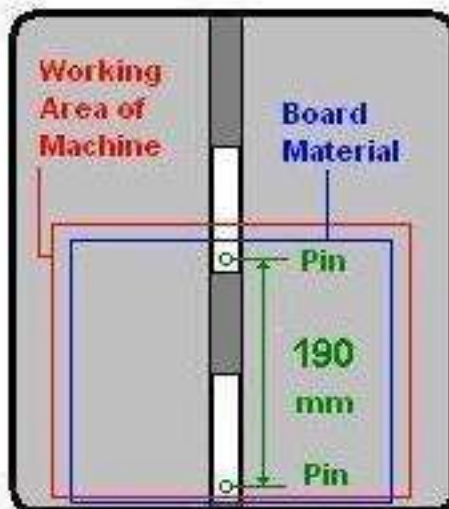


Concept of Registration Pin

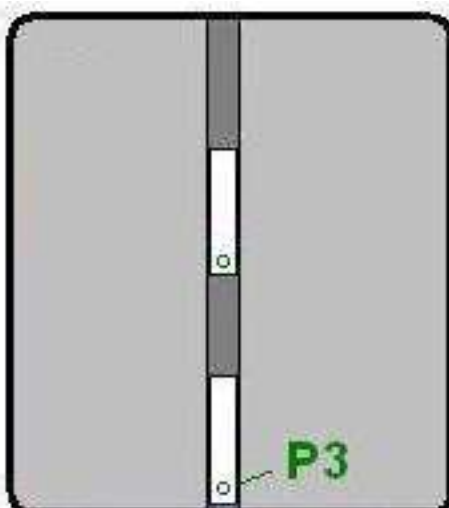


The Concept of the Registration Pin

The registration pin is a reference point for fabricating double-sided boards. By using the registration pin, after the milling on top side is finished, you can simply turn over the board and place it in to the registration pin to process the bottom side. With registration pin, realigning/readjustment is not necessary.



When we think about the board average material size and the working area of the machine, it is recommended that we make 2 holes on the plastic plate in 190mm distance away from each other.

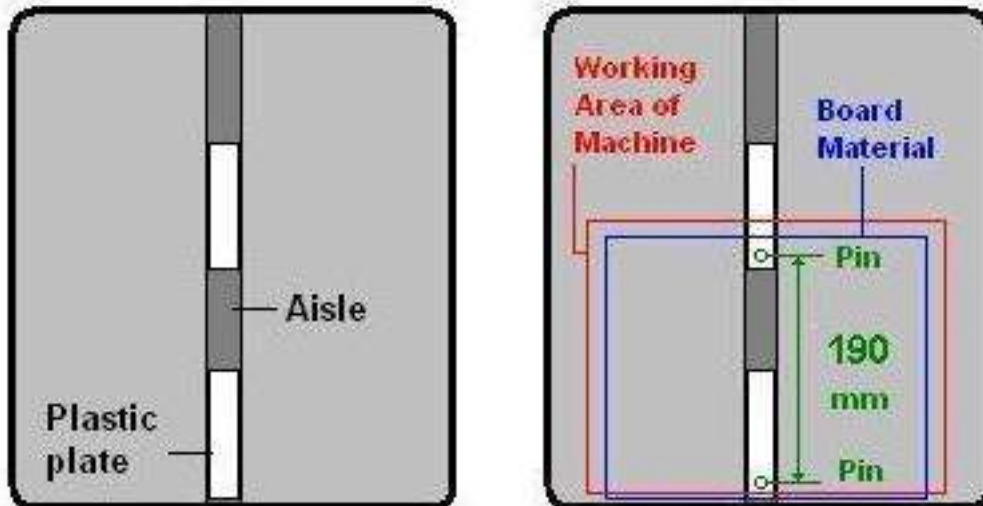


In software, the front location of the registration pin of the table is called "P3".

Please note that this is one of the recommendations and there may be other suitable settings of the location of the registration pins depending on your situations.

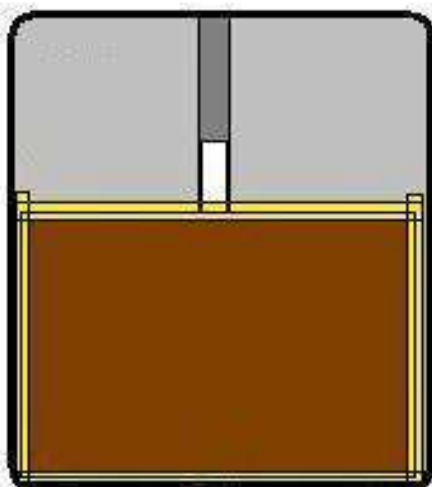
Set Plastic Plates and Underlay

Before drilling the holes for registration pins, you first need to set up the machine table. Insert and set 2 plastic plates in the open aisle on the machine table.



Please make sure to insert the plastic plate all the way. After the plastic plates are set, place the underlay on top and secure it with the tape.

Since holes will be drilled on the plastic plates later, please be sure to set the underlay on top of the both plastic plates.

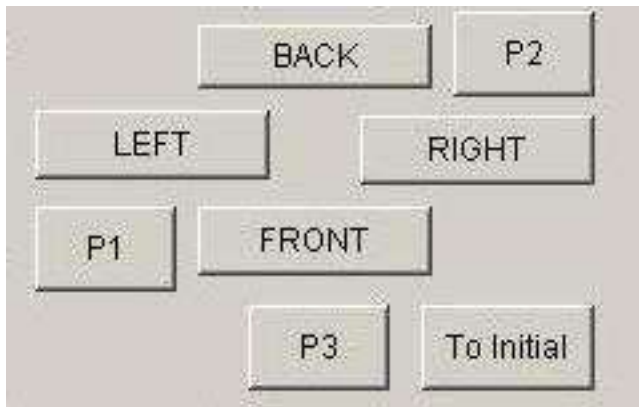


Set P3

You will now set P3 point, which is a front point of the registration point.



Click on **Manual Operation** icon.



Move the head to the desired P3 location using the manual operation screen.

You may move down the spindle head by clicking **DOWN** button.

It is easier to see the location when the spindle head is down.

Click **Set P3** temporarily to register the P3 location to the software.

In order to check if the registration pin in the back would be in the working area of the prototyping machine, move the head backwards 190mm from the P3 point.

Input 190 for **Move distance** and click **BACK**.

If P3 location is necessary to re-adjust, move the spindle head to the desired location and then click **Set P3** again.



If you encounter the hard limit error, click **To Initial** on the manual operation screen. It will retrieve the current location of the spindle head. Otherwise, the software will lose the position.

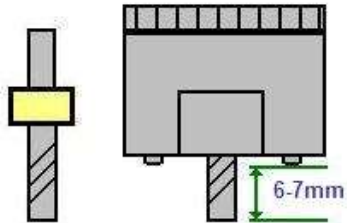


If you don't see **Set P3** button in manual operation screen, close the screen and go to **CAM Prefs.** → **Board Maker** screen. Set **Reference hole** to P1-P2 Revised and try again.

Drill Holes for Registration Pins

After registering the pin location, we will drill the holes for pins.

Click **P3** button in the manual screen so that the head go back to the location where you have register for P3 before.



Insert the special drill bit to opened tool post. Click on **ATC** button and change the tool to the special drill bit.

Turn the depth adjustment screw to shallower (counter-clockwise) so that the special drill bit is at least 6 - 7mm (0.28") out of the bottom of the pressure foot.

Click on **Surface** button.

Z- and **Z+** buttons allow you to move the head up and down incrementally.

Z move field is the move distance of clicking **Z-** and **Z+** each time.



Click **Z+** to move the head down so that the tip of bit reaches the surface of the underlay board.

At this point, change the **Z move** value to 1mm (0.040").

Click **Z+** to move the bit down into the underlay for the first step.

Click **Z+** 6 more steps so that the bit goes into the table in total 7 mm (0.28").

Click **Up** and **Cancel** to bring the spindle head up and close the screen.

You now drilled a hole for P3 pin.

Follow the same procedure for another pin hole on the back side.

Move the spindle head backwards 190mm.

Repeat the procedures for making pin hole.

Backup P3 Info

After making holes for the registration pin, it is recommended to make backup file of P3 coordinates.

Close Manual Operation Screen.

Choose **CAM Prefs.** → **Save P3.**

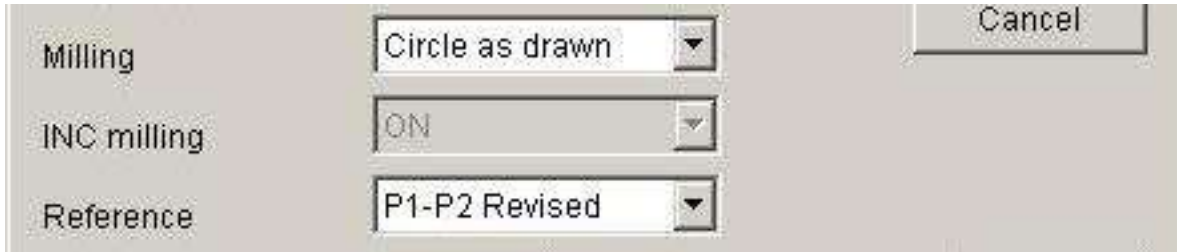
Enter the file name and then click **Save.**

P3 coordinates are saved as a file.

If the coordinates are lost accidentally, you can retrieve P3 coordinates by **Load P3** in **CAM Prefs.** menu.

Set Adjust Method

Open the Board Maker screen from **CAM Prefs.** menu.



Set **Reference holes** to **P1-P2 Revised**.



P1-P2 Revised is one of the adjust (alignment) methods and the further operations will be explained later.

Enter Thickness of the Board

Open the **Board Maker** screen from **CAM Prefs.** menu.

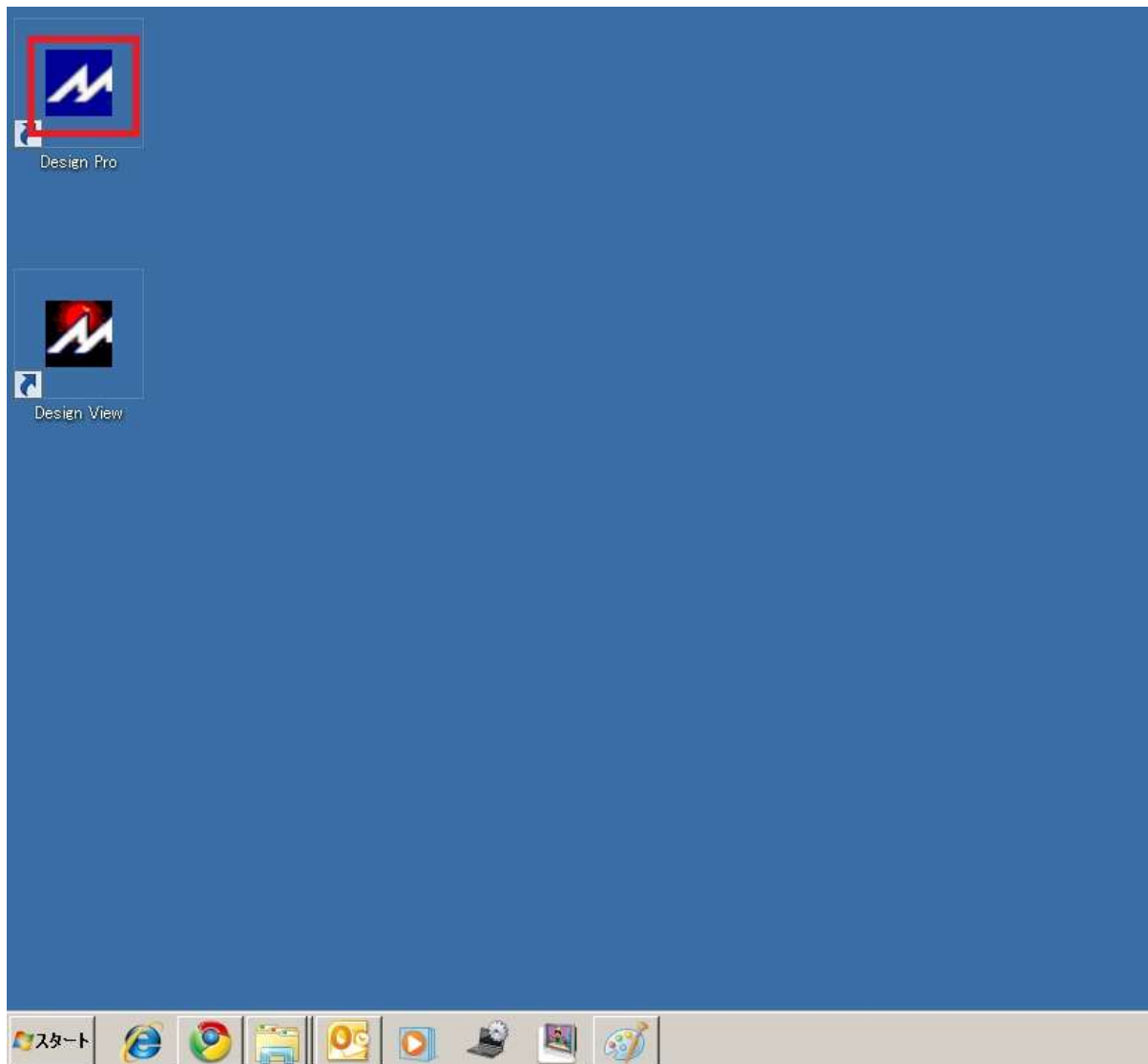
Mill spd.(mm/sec)	<input type="text" value="12.0000"/>	Dry run(mm/sec)	<input type="text" value="20.0000"/>
Lower1(mm/sec)	<input type="text" value="12.0000"/>		
Thickness(mm)	<input type="text" value="1.6000"/>	Underlay(mm)	<input type="text" value="1.6000"/>

1. Enter Thickness of the board. (For this example, 1.6mm)
2. Enter Thickness of underlay. (For this example, 1.6mm)

Manual Operation

Launch Design Pro

To begin operating the machine, launch **Design Pro** by double-clicking the **Design Pro** icon.



Manual Operation

In this section, you will learn how to operate manual operation. When fabricating a PCB, the operation is done automatically. However, there are times where manual operation (operate the machine manually) will be used for precision.

WARNING: Do not set a tool bit in tool post number 10. Normally the machine is holding dummy tool before shipment and tool post number 10 is for the dummy tool. Use post number 1 through 9 only.

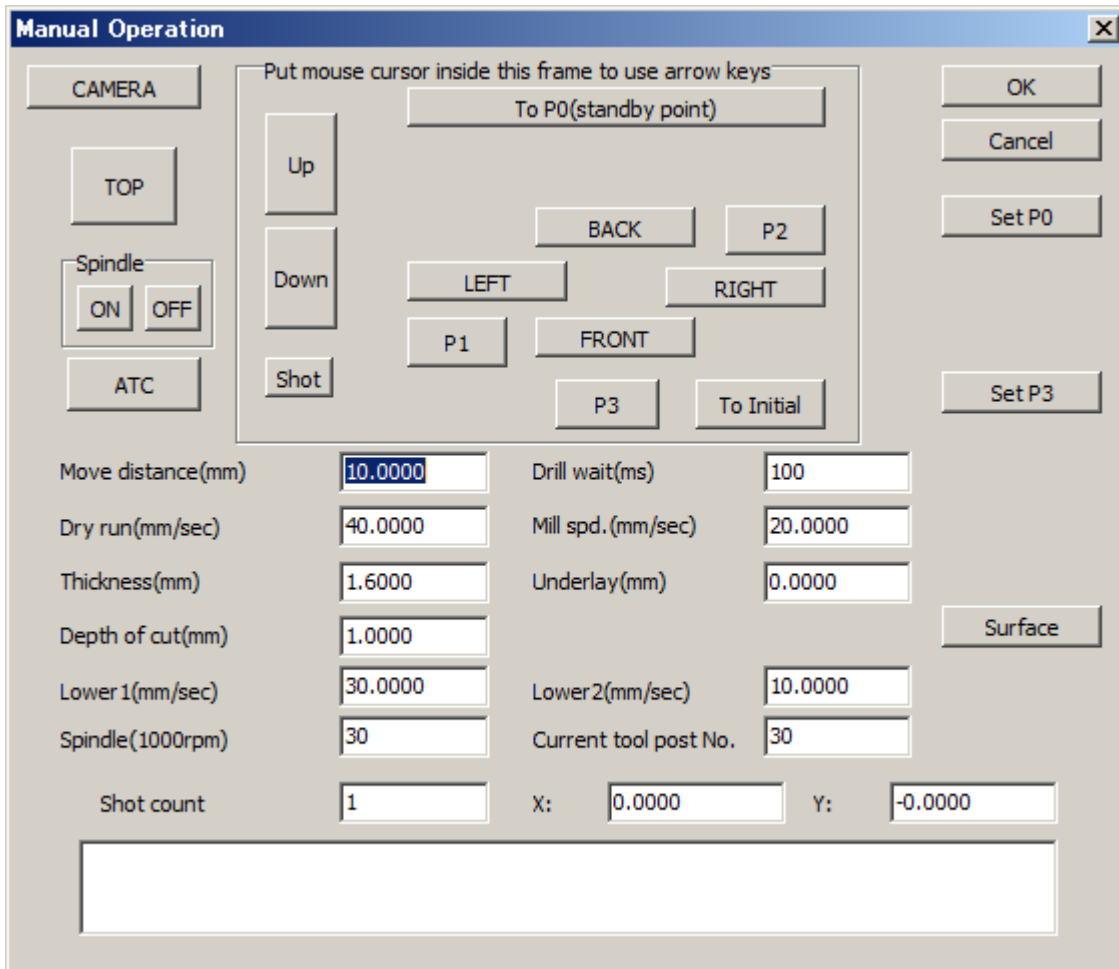
Connect the prototyping machine and the computer and launch CAM-Z under the application. Close the cabinet and check the emergency switch is off. Turn the power on and the machine will activate and move to the initial position (the spindle head will move initial position of the machine).

(If it does not move to the initial position, check is the emergency switch or the interlock is on.)

Click on the **Manual Operation** icon.

The spindle head will move forward (to the P1 point), and manual operation window will open.

Manual Operation Screen



TOP BOTTOM

This button will switch from TOP side (component placing side) to the BOTTOM side (solder side) and vice versa. By doing so, it will invert the P1 and P2 points. On the TOP side, the P1 is lower left corner and P2 is upper right corner. As for the BOTTOM side, the P1 is lower right corner and P2 is upper left corner.

Spindle ON Spindle OFF

It will turn the spindle on or off.

UP DOWN

It will move the spindle head up or down.

To Initial

It will move the spindle head to the initial position.

FRONT BACK LEFT RIGHT (Directional Button)

It will move the spindle head to the direction of the button clicked.

P1 P2 P3

It will move the spindle head to the point of the button clicked.

To P0 (standby points)

It will move the spindle head to the standby point.

ATC

It will change the tool bit.

Move distance

You can input the distance of the spindle head movement for each click on the button (FRONT BACK LEFT RIGHT button).

Set P0

It will set the standby point.

Standby Point – Position used to check the milling results or to turn the substrate over. It can be set manually.

Setting – Move the spindle head to the position where you would like to set it at the standby point and click “Set P0”. The machine will keep the position data once it is set even if the computer or machine is turn off after. To change the standby point, simply go through the same procedure.

Drill Wait

You can input the wait time (the time while spindle head is in DOWN position) during the hole drilling process.

Dry run

You can input the velocity of the spindle head movement in X and Y-axis directions while the spindle head is in UP position.

Mill spd.

You can input the velocity of the spindle head movement in X and Y-axis directions while the spindle head is in DOWN position.

Thickness

You can input the thickness of the substrate which will be processed.

Underlay

You can input the thickness of the underlay. The thickness of the underlay included in the shipment is 1.6mm.

Depth of cut

It indicates the how much the force is pressed down to the board. Please leave the value as the default, 3mm.

Lower 1

You can input the descending speed of the spindle head up to 5mm above ground level.

Lower 2

You can input the descending speed of the spindle head from 5mm above the ground level.

Spindle

You can set the revolution speed of the spindle motor.

ATC Number

It will display the tool post number of the tool that machine is currently holding.

Solder Shot

These buttons are not used in normal process.

Surface

Please refer to next page.

When you click on the “Manual Operation” icon when the machine is turned off, the sandglass mark will appear. Use the SHIFT + ESC command and to cancel the manual operation. Close the Design Pro and launch it again for the manual operation to process. Please make sure to turn on the machine first before operating the manual operation mode.

While operating the manual operation, the software will indicate “limit error” when the spindle head is commanded to move out from its working area. Click on “To Initial” and move the spindle head to the initial position. The spindle head will not be able to move in all direction if this command is not executed.

Surface Button

This button is used for absolute milling method. For the normal milling, incremental milling method is used.

Incremental milling method is a method that the pressure foot holds the substrate down and milling is done by the tool bit sticking out from the pressure foot. Absolute milling method is a method that does not hold the substrate down. Instead, the position of the Z-axis (the depth) is controlled and fixed numerically by the software.

Click on the “Surface” button on manual operation window. The spindle motor will activate and the surface window will open.

Normally, when you click on the “DOWN” button on the manual operation window, the spindle head will go all the way down. In the surface window, by changing the “Z move” values, you can control the movement of the spindle head by clicking the “Z+” “Z-” button.

The distance from the tip of the tool bit to the surface is written in the “To Surface” field. By clicking on the “Z-” button, the spindle head will lower down and the value in the “To Surface” will also decrease.

When the tip of the tool bit is about to touch the substrate, theoretically the value in the “To Surface” should be 0. However, in actuality there is an error. This error is accumulated from the many criteria; thickness of the substrate, underlay, length of the tools, flatness of the table, etc.

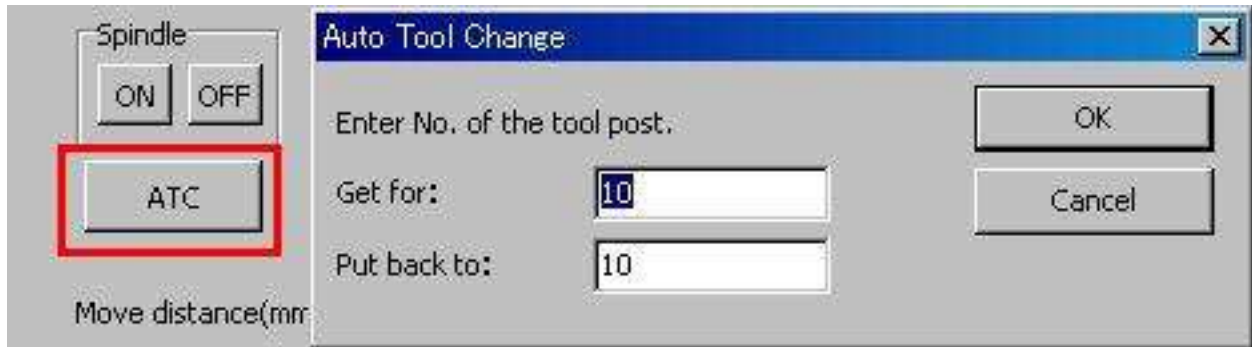
You can revise this error by adding the value to the “Thickness” or “Underlay” in manual operation window. The more accurate you have the distance to the surface from the tool bit the more accurate milling depth result will follow.

For the incremental milling method, since the pressure foot is holding the substrate down, the milling depth is determined by how much tool bit is sticking out from the pressure foot. In absolute milling method, it is possible to mill semi-three-dimensional. In that case, the pressure foot must be displaced.

WARNING: This machine is capable of performing semi-three-dimensional milling. However, since there is a spring installed inside the Z-axis movement controller, the desired milling depth will not be resulted if there is a force or pressure exceeding the force of the spring.

Tool Change Manually

Call up the manual operation screen and click **ATC** button. The screen illustrated below will appear.



Enter the No. of the tool post which you want to get from into the field named **Get for**.

Click **OK** and the spindle head will return the tool bit to the post number entered in **Put back to**.

WARNING: If you see “-1”...

This number will appear when the last tool change was not done properly. In this situation, the machine is unaware of the tool post number of the tool bit it's holding. Please input the correct number in both “Get from” and Return to” and process tool change.

Please make sure that there is no tool bit inserted in the returning tool post.

For your information:

In this section, we instructed how to change tools in manual operation window. For the actual data milling operation, the machine will change its tools automatically following the settings assigned by the user.

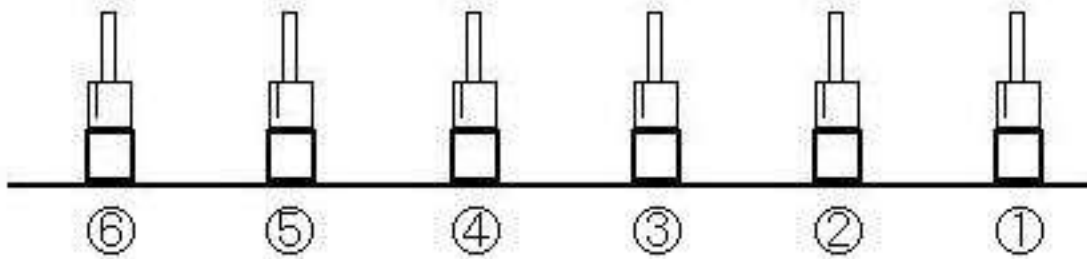
Dummy Tool

The tool bit on the last tool post is called Dummy tool.

- Eleven Auto : No.10 post
- FPZ-31AT : No.10 post
- FPZ-73AT : No.26 post

When the prototyping machine finishes the job, it will return the tool bit to the tool post and stop after picking up the dummy tool.

Tool Change in the Job



The screenshot shows a dialog box titled 'Milling Tool Setting' with a table of tool settings. The table has columns for Skip, No., Diam., Speed, RPM, POST, Depth, Lower2, Step, and Comment. The 'Speed' column is highlighted in blue. The 'Depth' and 'Lower2' columns are shaded grey, indicating they are not necessary to be set.

Skip	No.	Diam.	Speed	RPM	POST	Depth	Lower2	Step	Comment
	0	0.3000	12.0000	30	1	0.0000	0.0000		
	1	0.3000	12.0000	30	1	0.0000	0.0000		
	2	0.3000	12.0000	30	1	0.0000	0.0000		
	3	0.3000	12.0000	30	1	0.0000	0.0000		
	4	0.3000	12.0000	30	1	0.0000	0.0000		
	5	0.0000	12.0000	30	1	0.0000	0.0000		
	6	0.0000	12.0000	30	1	0.0000	0.0000		
	7	0.2000	12.0000	30	1	0.0000	0.0000		
	8	0.2000	12.0000	30	1	0.0000	0.0000		

There are the setting screens for tool bits in the **CAM Prefs**.menu:

- Milling
- Drill
- Routing

Change the post No. to the number where the bit is actually placed in the post of the prototyping machine before starting the milling job.

The prototyping machine will pick up the tool bit automatically during the milling job.



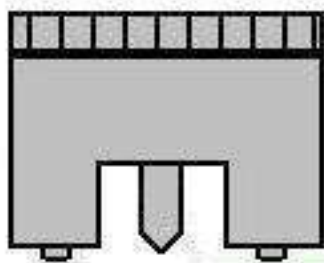
Some fields in dark are not necessary to be set.
The default in the board maker screen is applied.



When you click Skip field, it shows [X] mark and skips the process of using the tool which you don't want to mill. To release skip, click Skip field again.

Adjust Depth of Cut

Make a test cut to check the width of the channel cut by the milling cutter. Change the tool to milling bit.

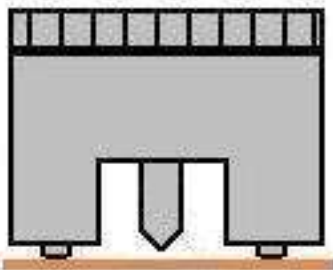


Shallower
→
浅

First, turn the adjustment screw enough to make the milling bit shallower and not touch the surface of the board.

Move the spindle head to the outside of P1-P2 milling area.
(using the directional buttons as needed)

Turn **ON** the spindle motor.
Click **DOWN** to lower the head.



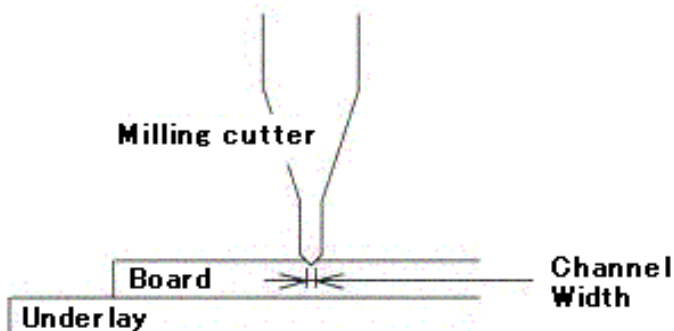
Deeper
←
深

Turn the depth adjustment screw deeper until the tip of bit touches the surface of board.

In this position, press one of the directional buttons once and a trial cut will be made.

Click "UP" to raise the spindle head.
Turn **OFF** the spindle motor.

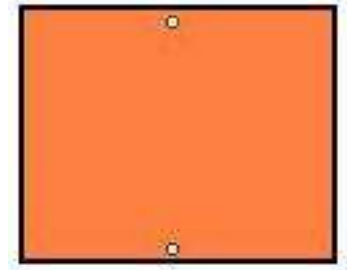
Move the spindle head to the position where you can check the result of cut. Check the width of the channel that was cut.



Adjust the milling cutter depth and make trial cut several times until the width of this channel is the same as the diameter of the tool specified in EASYCAD or the Converter program for milling outlines.

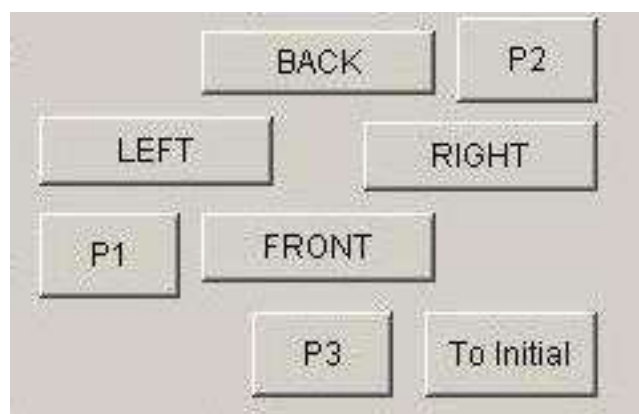
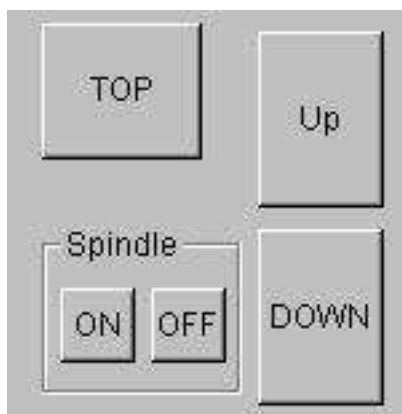
Make Hole for Registration Pin on Board

When processing double-sided board, the holes for the registration pins are necessary on the board.



Change the tool to 3mm drill.

When the depth screw is adjusted correct position with the milling bit which is 2mm shorter than the drill bit, the 3mm drill bit is 2mm out of the pressure foot.



Click **P3** to move the head on p3 point.

To drill a hole to the board, move the spindle head to the P3 point, click spindle **ON** and then click **DOWN** to lower the spindle head.

Click **UP** to raise the head, move 190 mm backwards and drill the hole. Insert the registration pin into the hole.

You may also insert registration pin when milling top side is finished in order to align bottom side.

Procedure for Fabrication

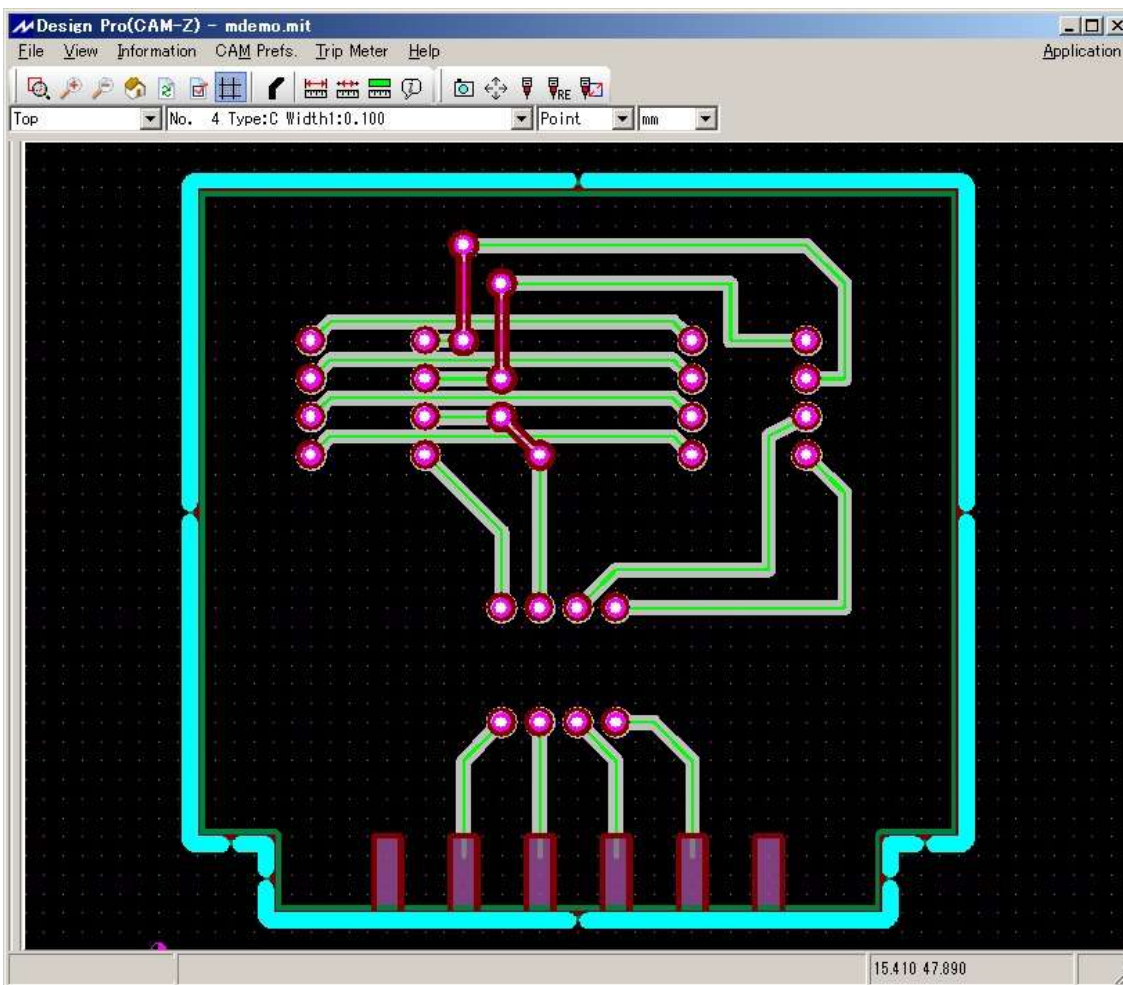
Display Milling Data

For fabrication, you first need to open the data file to process on the board.

Choose **Open** from the File menu and select the file name from the list. Then click Open to display the data on screen.

For this example, open mdemo.mit

This file is stored in **Data** folder located under **MT Path**. For the location of **MT Path**, please refer to **Software Install** section which applies to your OS.



Before the milling operation with the prototyping machine, it is necessary to prepare the milling data using EasyCAD or Converter.

Please refer another manual for how to use EasyCAD and Converter

Preparing Tools for Working with Standard FR-4

Since this prototyping is automatic tool change machine, it is necessary to prepare the following tool bits and insert it to the correct tool post.

Go to **Information** → **Tool List**

Layer Name : Mill Top				
Tool No.	Tool Size	Time Estimated	Type	Notes
11	0.300 mm	0:2:00	Outline	
11	0.300 mm	0:1:00	Manual Draw	
	Total	0:3:00		
Layer Name : Mill Bottom				
Tool No.	Tool Size	Time Estimated	Type	Notes
11	0.300 mm	0:2:00	Outline	
11	0.300 mm	0:1:00	Manual Draw	
	Total	0:3:00		
Layer Name : Routing				
Tool No.	Tool Size	Time Estimated	Type	Notes
1	1.000 mm	0:1:00	Routing	
	Total	0:1:00		
Layer Name : Drill				
Tool No.	Tool Size	Time Estimated	Type	Notes

Check the Tool No. for each layer. Go to **CAM Prefs.** → **Milling**
 Find the corresponding Tool No. to the tool list and check number in **POST**.
POST is the number of the tool post on the prototyping machine.

Skip	No.	Diam.	Speed	RPM	POST	Depth	Lower2	Step	Comment
	0	0.3000	12.0000	30	1	0.0000	0.0000		
	1	0.3000	12.0000	30	1	0.0000	0.0000		
	2	0.3000	12.0000	30	1	0.0000	0.0000		
	3	0.3000	12.0000	30	1	0.0000	0.0000		
	4	0.3000	12.0000	30	1	0.0000	0.0000		
	5	0.0000	12.0000	30	1	0.0000	0.0000		
	6	0.0000	12.0000	30	1	0.0000	0.0000		
	7	0.1500	12.0000	30	1	0.0000	0.0000		
	8	0.2000	12.0000	30	1	0.0000	0.0000		

Insert the corresponding milling bit to the correct tool post.

Do the similar procedure for with drill bit and routing bit.

For drill bit, go to **CAM Prefs.** → **Drilling**

For routing bit, go to **CAM Prefs.** → **Routing**

Start Job



Click the **Start Job** icon.

Milling Sequence Settings

X quantity: 1

Y quantity: 1

OK

Cancel

Milling Job List

- Mill (Top)
- Drill (Top)
- Routing (Top)
- Mill (Btm)
- Drill (Btm)
- Routing (Btm)

Milling Sequence List

- Drill (Top)
- Mill (Top)
- Mill (Btm)

>>

<<

Sort by direction

Simulation mode

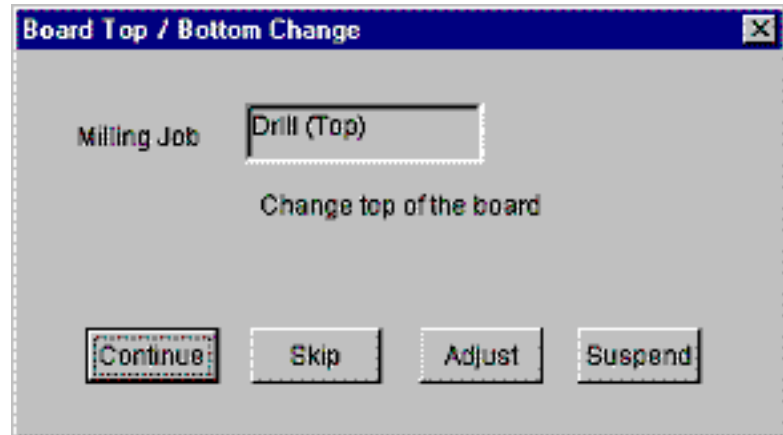
For this example, select:

1. Drill (Top)
2. Mill (Top)
3. Mill (Btm)

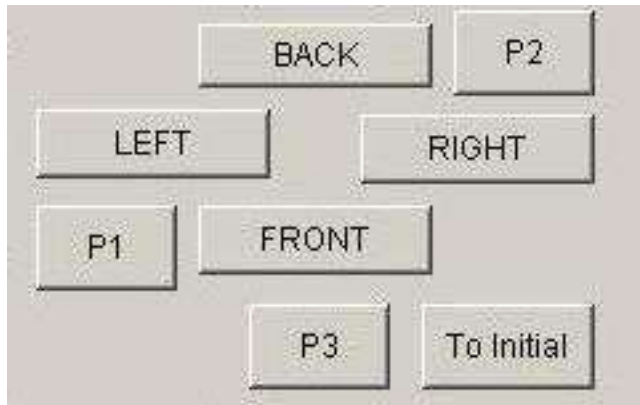
Click **OK**.

Adjust to Call Up the Manual Operation Screen

When **OK** is clicked in the Milling Sequence Settings screen, the **Board Top/ Bottom Change** screen will appear.



Click **Adjust** to call up the Manual Operation screen.



You can move the head to left, right, front and back using directional button in the manual operation screen

Set P1 Point and Confirm P2 Location

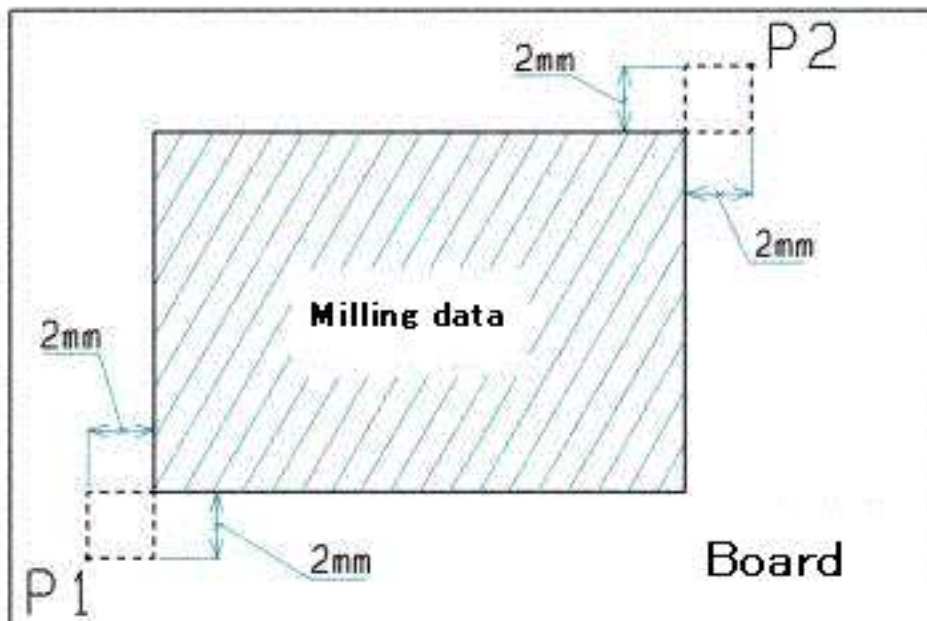
Adjust

First, we need to set the milling reference point (P1).

- Click on the directional buttons to move the spindle head to any location on the board.
- Click on the **HOME** button and that point will become P1.
- At this time, < Align P2? > message will appear, but click **No**.
- When P1 has been set, please check the location of P2: Click the **P2** button and the spindle head will move to P2.

Please confirm that the milling area fits within the board.

If you want to change P1, move the head again to the desired location and click **HOME**.

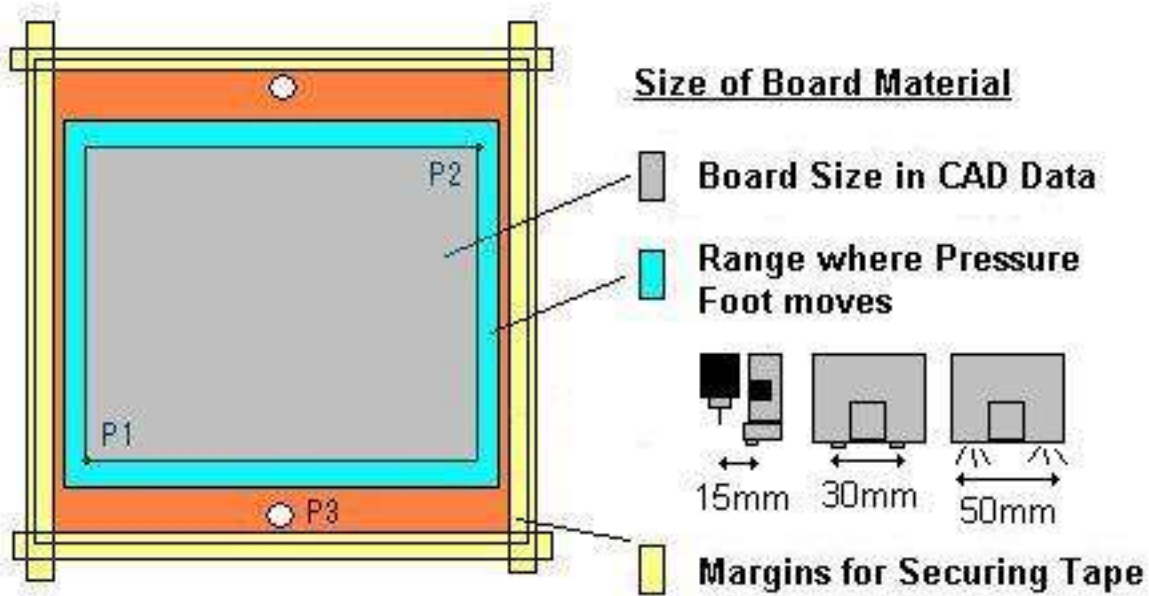


It is very important to check the location of P2.

If the spindle head goes outside of the board during milling, it may cause accident such as breaking the bit and damaging the surface of the machine table.

Size of Board Material

It is necessary to prepare the board material which has enough size to mill. It is easier to understand what the enough size is by putting the board material temporarily on the machine table and move the spindle head from P1 to P2.

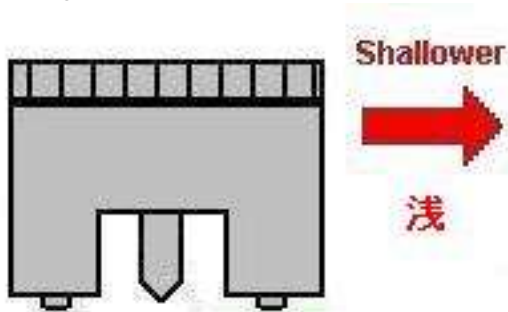


- **Range where Pressure Foot Moves:**
It requires 15 - 50mm margin for pressure foot. Please note that it will vary depending on the model of Pressure Foot.
- **Margin for Securing Tape:**
It requires approx. 5mm margin for securing tape.
- **Space for Stuck Pins:**
It requires 3 mm holes for stuck pin to the underlay and the board material. The stuck pins should stand outside the range of the pressure foot.

Put board on table and secure it with tape.

Adjust Depth of Cut

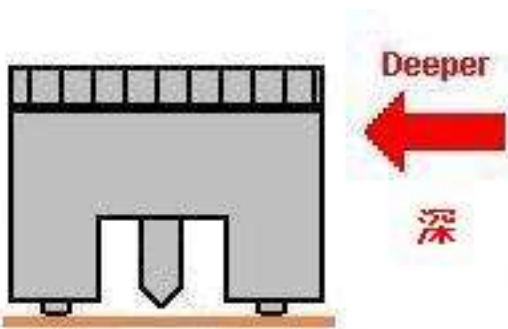
Make a test cut to check the width of the channel cut by the milling cutter. Change the tool to milling bit.



First, turn the adjustment screw enough to make the milling bit shallower and not touch the surface of the board.

Move the spindle head to the outside of P1-P2 milling area.
(using the directional buttons as needed)

Turn **ON** the spindle motor.
Click **DOWN** to lower the head.

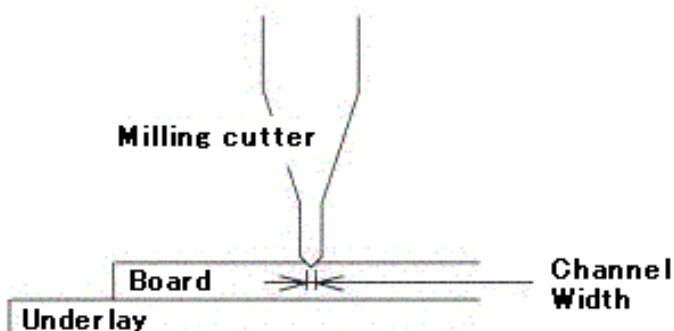


Turn the depth adjustment screw deeper until the tip of bit touches the surface of board.

In this position, press one of the directional buttons once and a trial cut will be made.

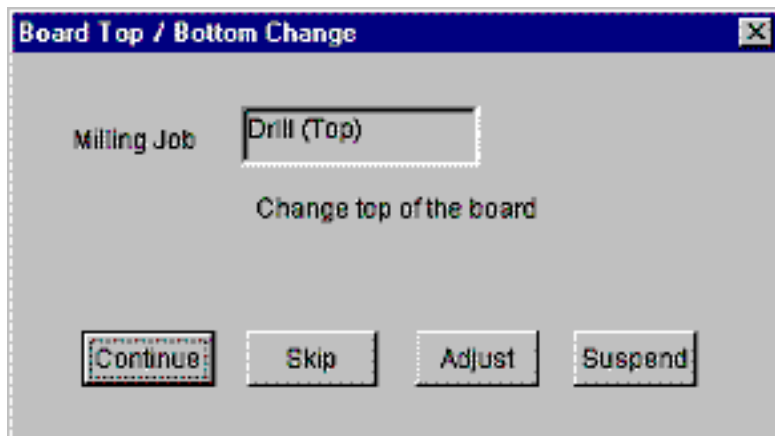
Click "UP" to raise the spindle head.
Turn **OFF** the spindle motor.

Move the spindle head to the position where you can check the result of cut. Check the width of the channel that was cut.



Adjust the milling cutter depth and make trial cut several times until the width of this channel is the same as the diameter of the tool specified in EASYCAD or the Converter program for milling outlines.

Drill (Top) and Mill (Top)



You will now fabricate a circuit board. Click **Continue** to start drilling process.

After the drilling process is finished, the prototyping machine will change tool automatically to milling bit and begins milling process.



DO NOT touch the spindle motor or allow your face to get near it during fabrication.



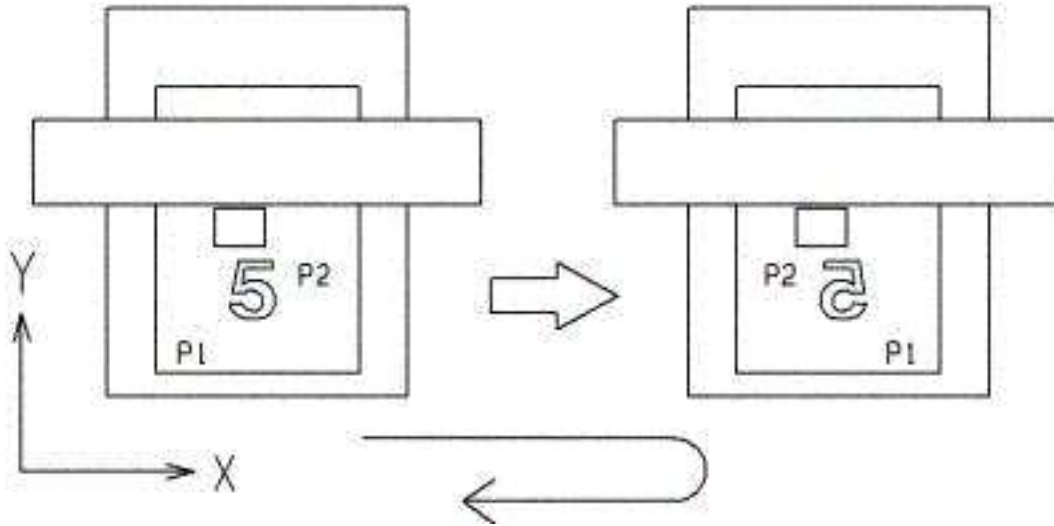
To interrupt the operation, press ESC key. The operation will stop after it process the data which has been already sent.



If emergency stop is needed, turn off the power switch.

Turn Over the Board

To process the bottom side of the board, turn over the board as illustrated below.



Please make sure to place the board into the registration pins.



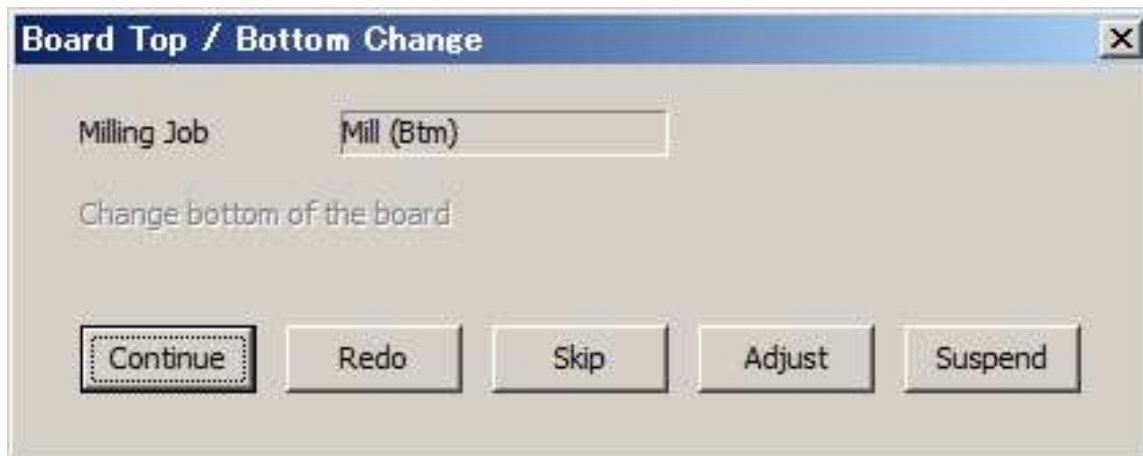
From TOP view, P1 is located on the front-left.
When it's turned over, P1 is located on the front-right.



Please make sure the drilling and milling result before turning the board over.
If it is necessary to redo the fabrication, please refer to P.66 of this manual.

Mill (Bottom)

After the board is turned over, click **Continue** to begin milling process for bottom layer.



The **Closing Confirmation** screen will appear, click **Close** to end the fabrication.



After the milling process is finished, the prototyping machine will return the milling bit back to tool post No.1 and change to dummy tool in tool post No.10.



If it is necessary to redo the fabrication, please refer to P.66 of this manual.

ESC Key to Pause

To pause the operation, press **ESC** key.

The operation will stop after processing the data which has been already sent (shown by red color in the screen).



If emergency stop is needed, turn off the power switch.
For Eleven Auto, press the emergency switch.

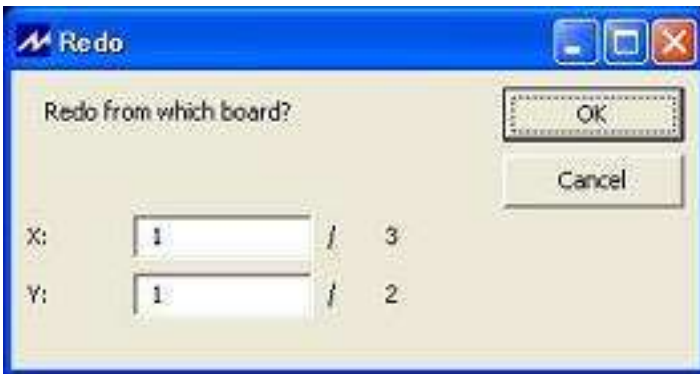
Redo

In the event that a drill or milling bit breaks during milling or you find there is still a part of the board that has not been milled, the software offers you 3 methods to mill just the part of the board that still needs it:

Redo, Mill selectively and Resume.

Redo

When Redo is clicked, the Redo screen appears and asks you to enter which board in the sequence you would like to redo milling from. The number on the right of the entry field indicates the total number of boards in the sequence.



When the message appears, click on the element from which milling is to be redone (started again). The data that will be milled is displayed in the red and yellow.



If step milling is checked, software will ask which step you would like to start from.

Redo from 0 or 1 means redo from 1st step.

When the element to be redone is confirmed, the Tool Change screen will appear. Click **Continue** to start milling.

Mill Selectively



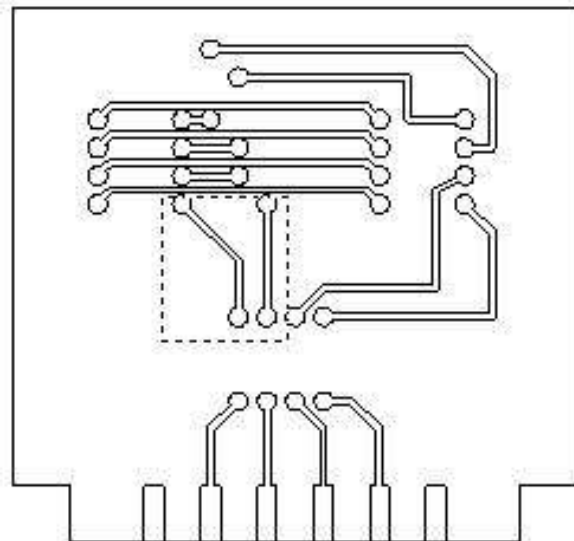
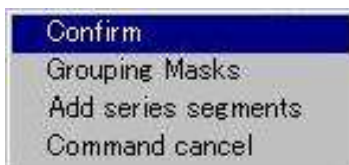
Click **Mill selectively** icon.



Most of operations are very similar to the regular fabrication.
The difference is that it needs an operation to select area to be milled.
This operation is done after **Continue** is clicked in the Board Top/Bottom Change screen.

Click on an element or drag rectangle
so that element(s) change its color.
It is "selected".

After selection,
right-click → **Confirm**
to go to the next step.



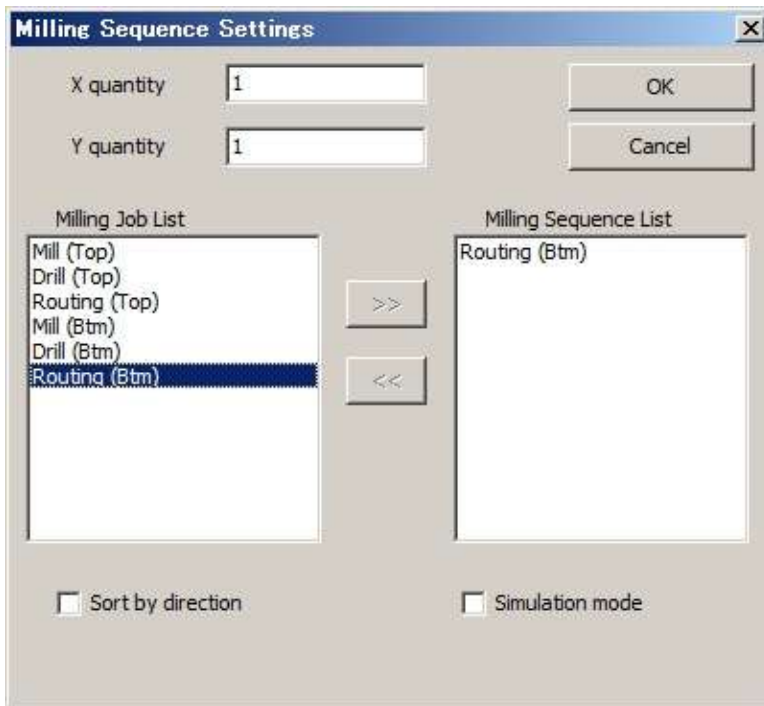
The rest of operation is the same as the normal operation.
The software will mill only the selected area.

Start Job (Routing)



Click the **Start Job** icon.

And then select **Routing (Btm)** in the Milling Sequence Settings screen.



Click **OK**.

When **Board Top / Bottom Change** screen appears, click **Adjust** to check for milling speed.

On the Manual Operation screen, be absolutely sure to check the milling speed.

If this speed is too high, it could cause the tool to break.

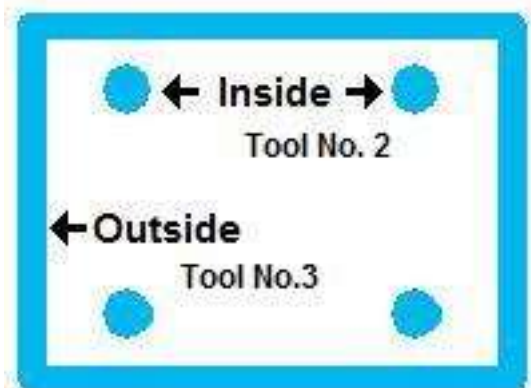
Close the Manual Operation screen and click **OK** on the Board Top/Bottom Change screen to begin routing.

When the drawings have the inside routing data, it is good to separate the tool No. for inside and outside.

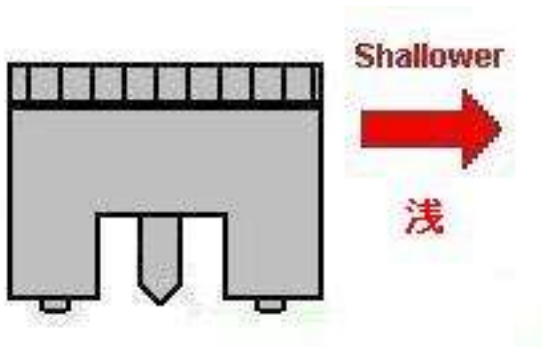
And also, tool No. for inside should be smaller than one for outside because contour routing will process smaller tool No. first.

Please refer Converter and EasyCAD manual for how to generate routing data.

When routing inside data, the depth of cut is same as drill.

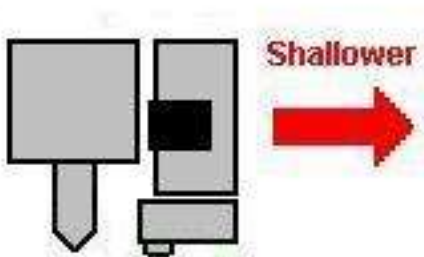


When routing outside data, adjust the depth of the tool so that milling is made slightly shallower. Shallower milling will ensure that the board does not pop away and that it doesn't leave the scars on underlay.



Turn the adjustment screw shallower one revolution and 15-20 notches so that depth of cut becomes 0.5 mm + approx. 60um shallower.

Turn the adjustment screw shallower one round and more 5-6 notches so that depth of cut becomes 0.5 mm + approx. 60um shallower.



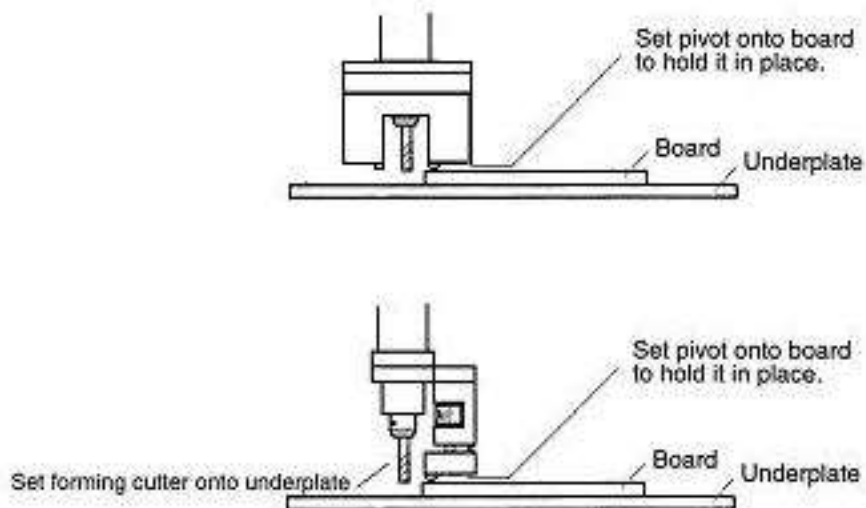
Ensure Depth of Cut (Routing)

If you want to ensure the depth of cut of routing bit, the following procedure is helpful to make sure the depth.

Setting the Routing (Forming Cutter) Depth

Follow the procedure below to adjust the depth of the routing bit:

- Click **Manual Operation** icon to call up the Manual Operation screen.
- Use the directional buttons to move the spindle head to the location shown in the illustration below.



- Turn the depth adjustment screw to make the tool bit shallower.
- Click spindle **ON** and click the **DOWN** button.
- Turn the depth adjustment screw little by little so that the depth of the routing bit will gradually deepens.
- When the router bit reaches a depth where the tip of the bit will slightly scratch the surface of the underlay, click the **Up** button and turn the spindle motor **OFF**.
- From that point, turn the adjustment screw shallower by 15-20 notches.

Once this adjustment is complete, double-sided board can be milled at a depth so that just enough of the copper plating will remain on the board.

Step Milling

Step Milling

When you want to mill the thick material, the incremental milling is not suitable for this kind of job.

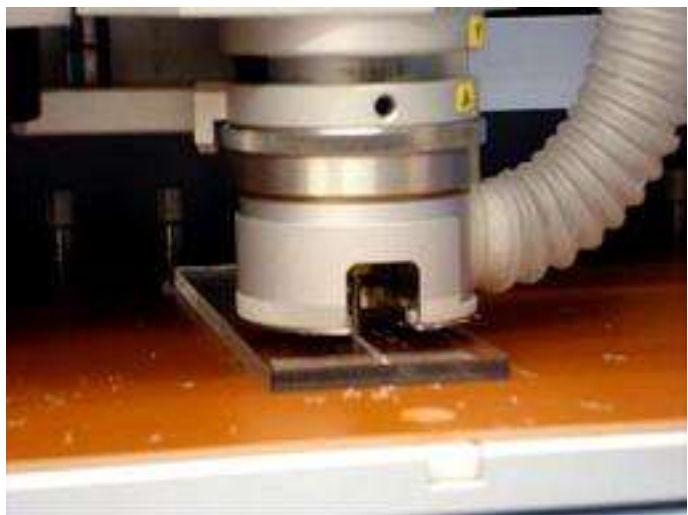
(The incremental milling means pressing print circuit board with pressure foot during milling)

Because the spindle head will always press the board down and there is a chance that it might fall into a large hole which has been routed while operation.



When you mill thick materials, we adopt "Absolute Milling". With this method, the material is not pressed with pressure foot because z axis is controlled numerically.

And also "step milling" function is effective approach:
Instead of cutting at once, the same line is traced several times increasing cutting depth incrementally.



Using step milling, the prototyping machine can mill plastic and metal. But it is the different concept of PCB prototyping machine. Don't put overload on the machine.

To activate step milling,
open tool settings screen for each tools in **CAM prefs** menu.

Skip	No.	Diam.	Speed	RPM	POST	Depth	Lower2	Step	Comment
	0	0.3000	12.0000	30	1	0.0000	0.0000		
	1	0.3000	12.0000	30	1	0.0000	0.0000		
	2	0.3000	12.0000	30	1	0.0000	0.0000		
	3	0.3000	12.0000	30	1	0.0000	0.0000		
	4	0.3000	12.0000	30	1	0.0000	0.0000		
	5	0.0000	12.0000	30	1	0.0000	0.0000		
	6	0.0000	12.0000	30	1	0.0000	0.0000		
	7	0.2000	12.0000	30	1	0.0000	0.0000		
	8	0.2000	12.0000	30	1	0.0000	0.0000		

Click on Step field to turn **ON**

You can also set Depth and Lower2, if you want to set depth and Z speed individually

Depth	Lower2	Step
0.0000	0.0000	
0.0000	0.0000	
3.0000	0.0000	ON
0.0000	0.0000	
0.0000	0.0000	



Each step distance of step milling and other fields in dark are specified in **Board Maker** screen in **CAM Prefs.** menu.

Calibrate Thickness

In absolute milling and absolute step milling, we recommend to calibrate the board thickness.

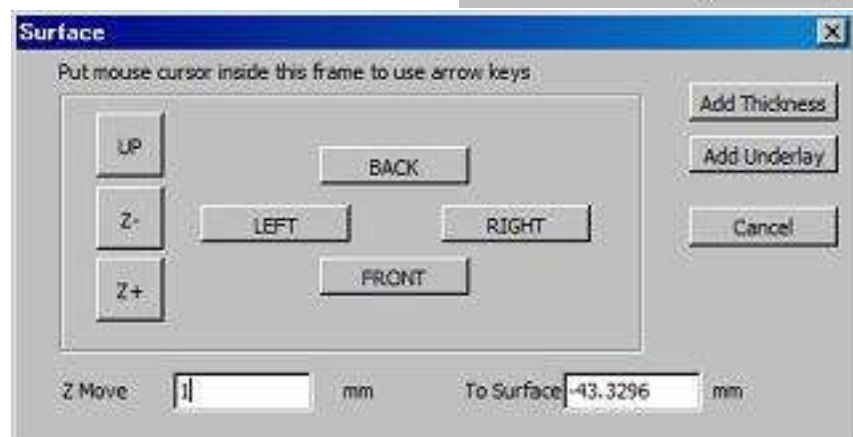
Sometimes when the thickness value is not calibrated, the tool bit goes into the surface too deep or too shallow. It may cause not only the unexpected result of milling but also the overload of tool and spindle motor.

When **Down** button is clicked in Manual screen, the spindle head goes down to the table with non-stop.



When **Surface** button is clicked in Manual screen, Surface screen appears.

Z- and **Z+** buttons allows you to move the head up and down incrementally.



Z move field is the move distance of clicking Z- and Z+ each time. To surface field shows the distance left between the tip of drill bit and the board surface.

Click **Z+** to move the spindle head down.

Getting close to the surface, **To surface** value is reduced.

Finally, the tip of bit reaches the surface.

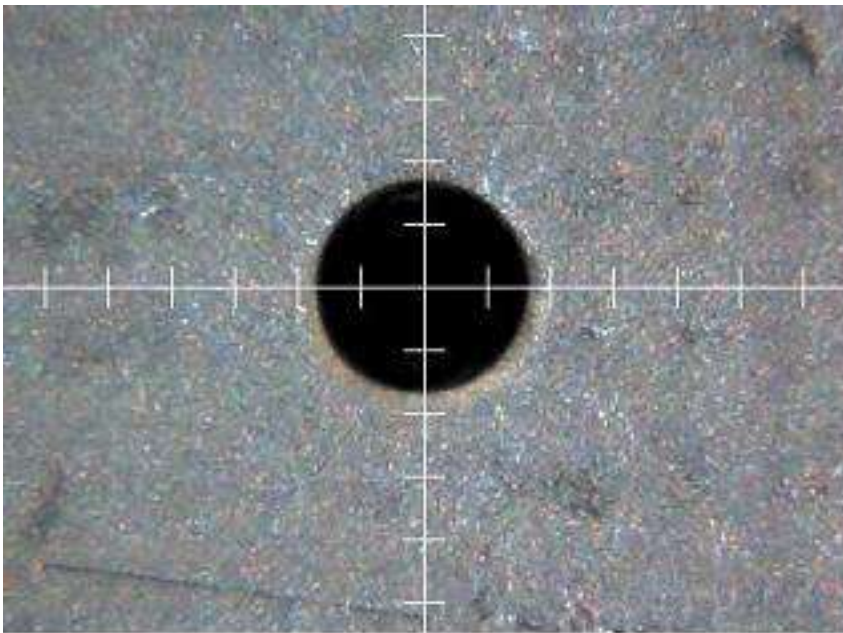
At this point, we believe To surface field shows zero theoretically. In many case, however, it is not zero. We know it is a tolerance. You can add this tolerance to the thickness of Board or Underlay. This is how to calibrate the board thickness.

Option – Fiducial Positioning Camera

Fiducial Positioning Camera



It is the useful option for the precision alignment.



Move the camera onto the reference hole called P1 and P2, register P1 and P2 location and the program will align the angle.

Mostly, the registration pin is not necessary by using camera option. However, the right side 70mm of milling area is out of range of view field.

So when milling

large board, the registration pin will be necessary although you have the camera system.

And this system is not auto-image-process.

Attach Camera Holder to Prototyping Machine

Attach the camera holder to prototyping machine as the pictures below.



Attach Camera to the Holder

Attach the camera to the camera holder as the pictures below.



Insert the camera to the holder slowly.

For now, tighten the screws of the holder to hold the camera temporarily.

We will finalize the position of the camera after installing the camera software.





The top side and the bottom side of the camera are shown in the picture left.

For now, you don't have to connect the camera to your computer.

Install USB Camera Driver

Please check the label on your camera:

UCAM label	
Please refer to install UCAM camera driver	
No label	
Please refer to install My-CAM camera driver	

Install UCAM Camera Driver on Windows Vista



DO NOT CONNECT THE CAMERA BEFORE INSTALLING THE DRIVER

- Open from MITS Design Pro CD-ROM → Drivers
→ Camera_UCAM Start Setup.exe.
- User Account Control screen appears.
Windows needs your permission to continue.
- Choose setup language
- Continue with the setup procedures.
Finally, installer will ask you to restart your computer.

After restarted, connect the camera to your computer.

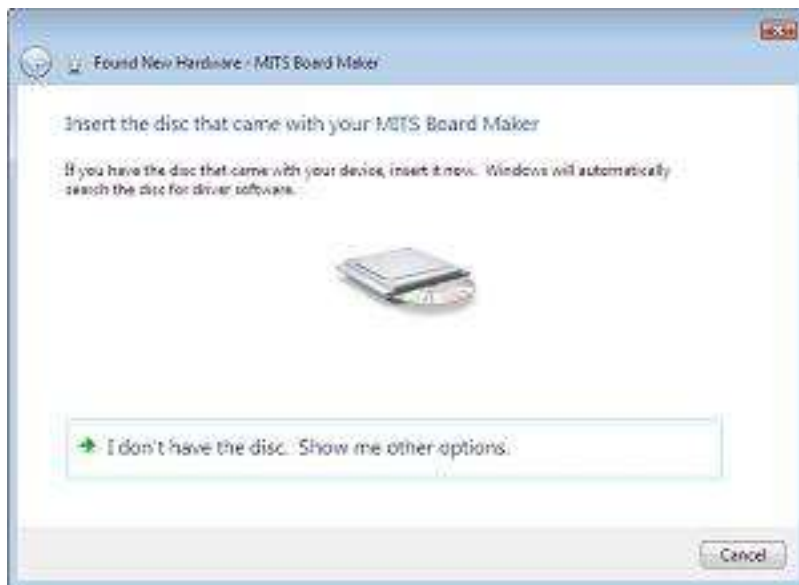


Found New Hardware screen will appear.

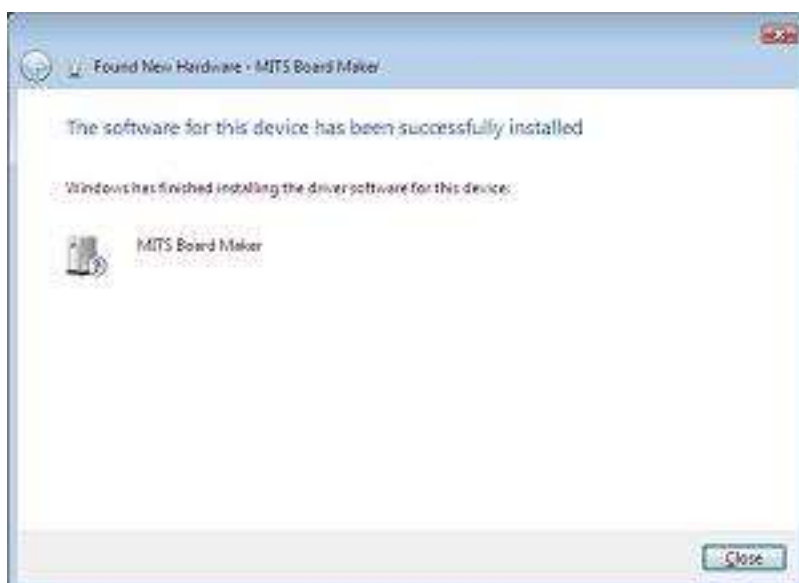
Click **Locate and install driver software**

User Account Control screen will appear.
Windows needs your permission to continue.

Click **Continue**.



Windows Security screen will appear.
Click **Install this driver software anyway**



Finally, the USB driver has been successfully installed.

Install UCAM Camera Driver on Windows 2000/XP



DO NOT CONNECT THE CAMERA BEFORE INSTALLING THE DRIVER

- Open from MITS Design Pro CD-ROM → Drivers
→ Camera_UCAM Start Setup.exe.
- User Account Control screen appears.
Windows needs your permission to continue.
- Choose setup language
- Continue with the setup procedures.
Finally, installer will ask you to restart your computer.

After restarted,
connect the camera
to your computer.

**Found New
Hardware** will
start
automatically.

Choose **No**, not
this time and click
Next.



Select **Install the software automatically (Recommended)** and click **Next**.

Proceed setup procedures. Finally, installer will finish the installation.



Install My-CAM Camera Driver on Windows Vista

Connect My-CAM camera to your computer with USB cable.

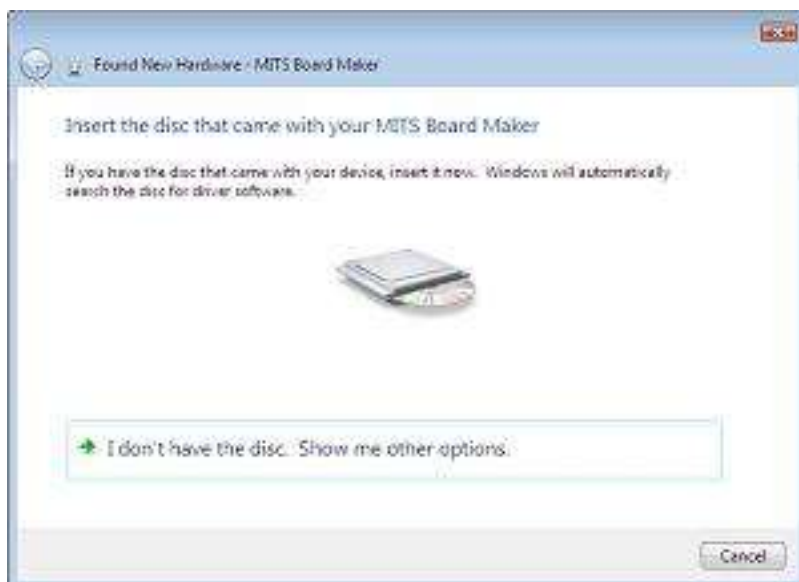


Found New Hardware screen will appear.

Click **Locate and install driver software**.

User Account Control screen will appear. Windows needs your permission to continue.

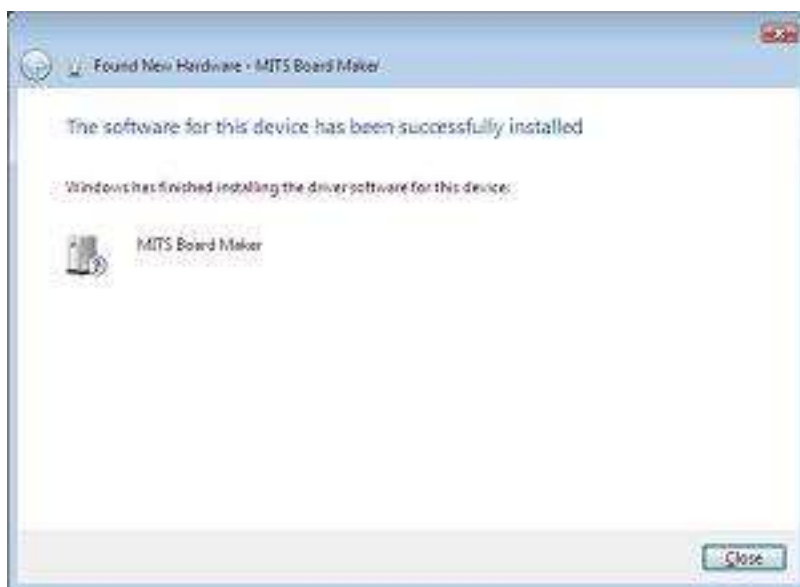
Click **Continue**.



Insert the master disk.



Windows Security screen will appear. Click **Install this driver software anyway**.



Finally, the USB driver has been successfully installed.

Install My-CAM Camera Driver on Windows 2000/XP

Connect the camera to your computer and the **Found New Hardware** will start automatically.

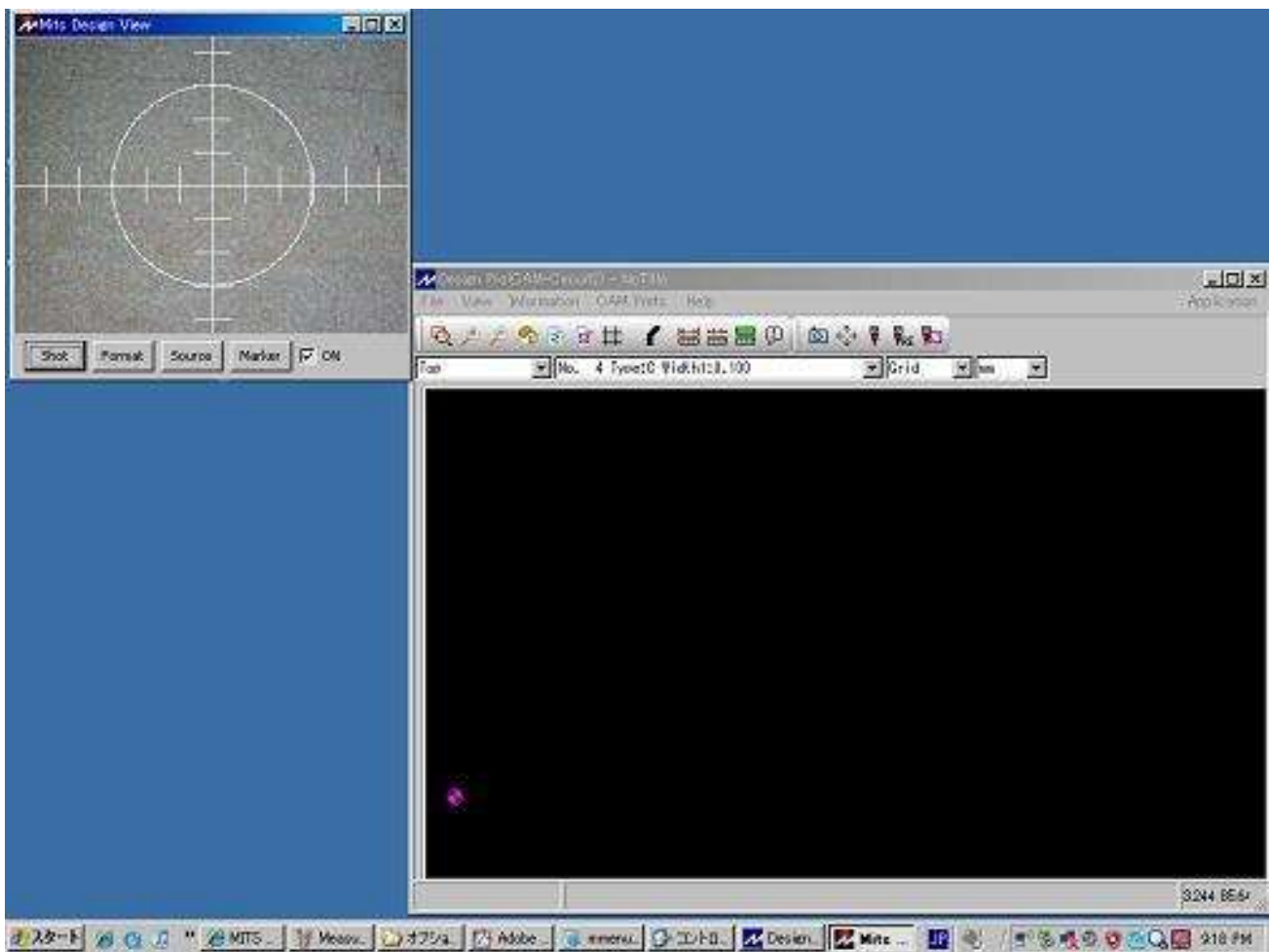
Choose **Install from a list or specific location** and then click **Next**.

The device driver is stored in **Drivers** folder in the master disk. **Drivers** → Camera_MYCAM



Start MITS Design Pro and Design View

Start MITS Design Pro and Design View.



Set Camera Monitor ON

Change the application to the appropriate CAM application for the prototyping machine you have.

Choose **CAM Prefs.** → **Board Maker.**

Set **CAMERA Monitor ON.**

RS232C port	COM1	Baudrate	9600
CAMERA Monitor	ON		

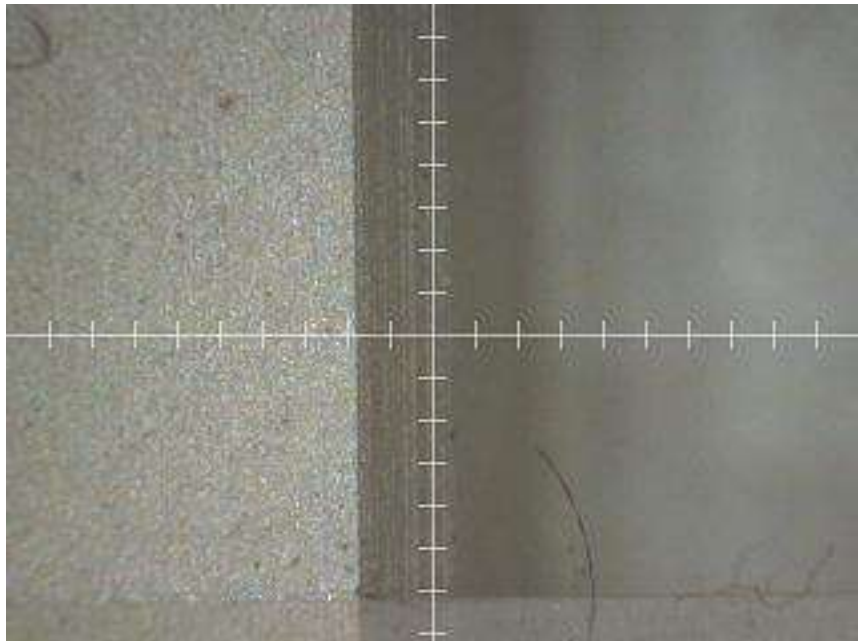
Adjust Angle of Camera

Click the icon **Set distance from spindle to camera**.

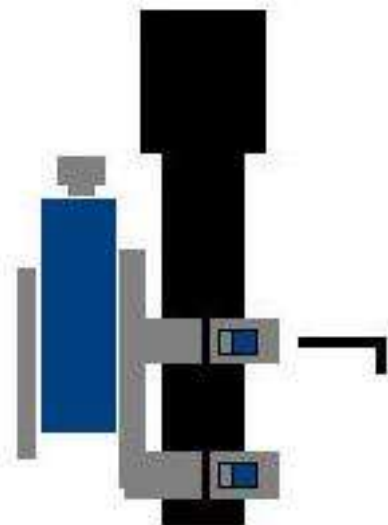


Move the spindle head of the prototyping machine using the manual operation screen, and camera screen will scroll according to the movement of the spindle head.

The screen illustrated on the right shows that the camera is watching at the aisle of the table.

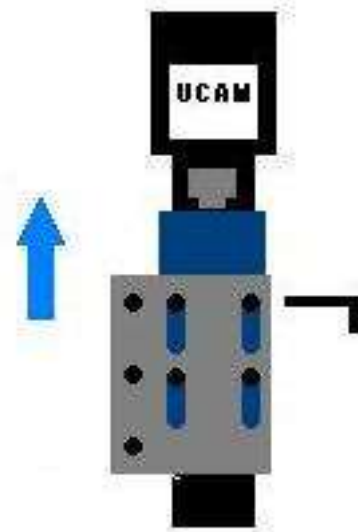


If the display is leaned or slanted, loosen the screws of the camera holder and adjust the angle of camera.



Adjust Focus of UCAM Camera

If your camera is a **UCAM** and it's mounted on FP-21T and FPZ-31AT, loosen the screws of the left side of the camera holder and lift it up to adjust the focus of the camera.



Set Distance from Spindle to Camera

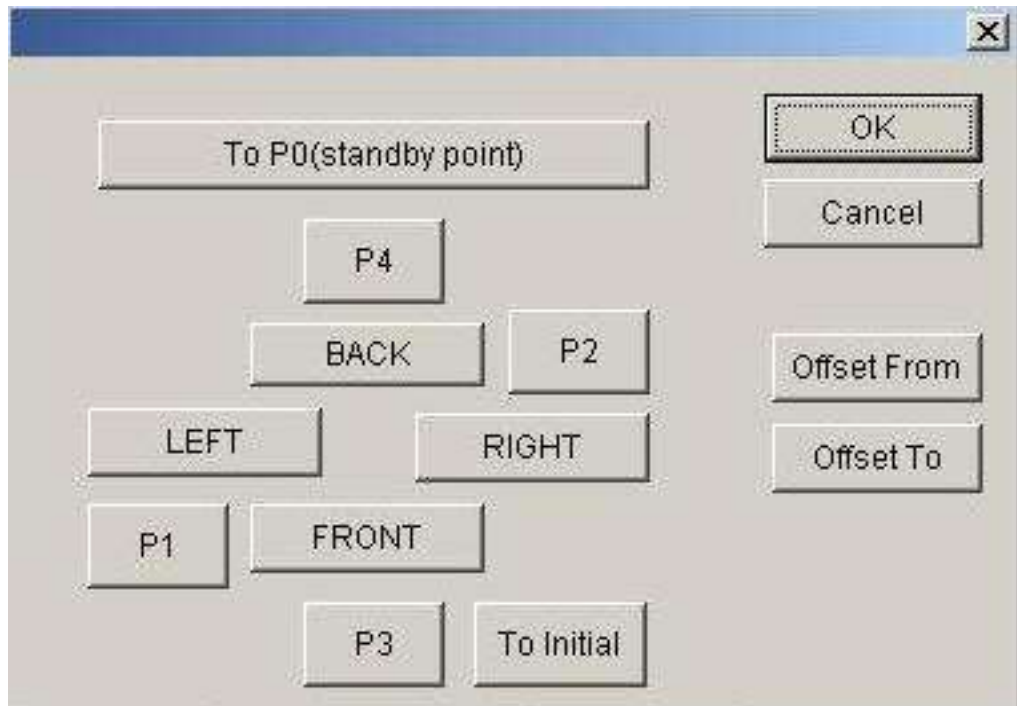
The camera is mounted besides the spindle head of the prototyping machine. It is necessary to set the distance between the spindle and the camera.

Click the icon **Set distance from spindle to camera**.



Move the spindle head to any location.

Drill a hole for a reference and then click **Offset From**.



Move the camera to the location where the marker on Design View matches the center of the hole.

Then click **Offset to**.

The program will calculate the distance from spindle motor to the camera.

Click **Marker** button on Design View. Marker Preference screen enables you to change marker shape and color. It helps you to match the hole and marker.

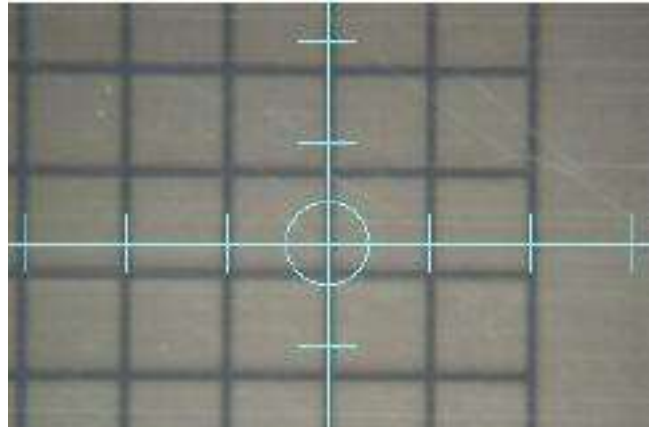


Calibration

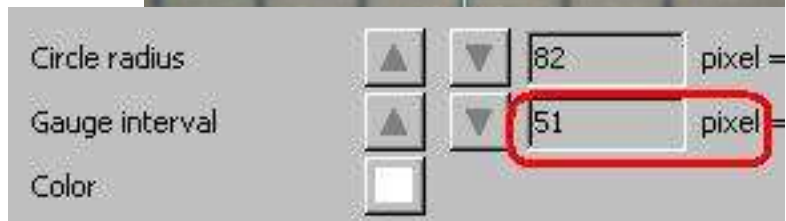
A film which has grids printed is enclosed in the camera. This film is called "Calibration sheet".

Place the calibration sheet on the machine table.

Move the camera using manual operation screen on CAM and adjust gauge interval using marker preference screen on Design View to match the grid of the sheet.

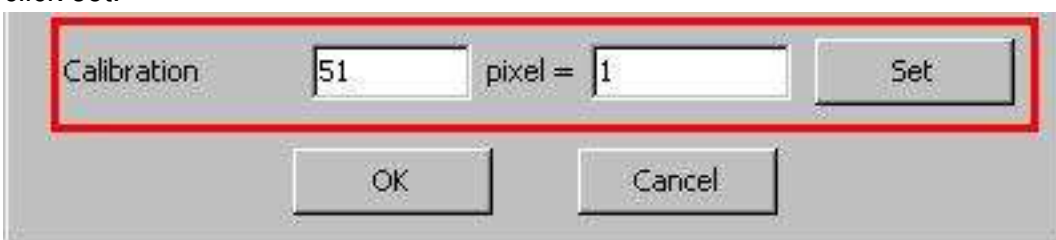


In this example, when the gauge of marker matches the grid on sheet, Gauge Interval on marker preference screen says 51 pixel.

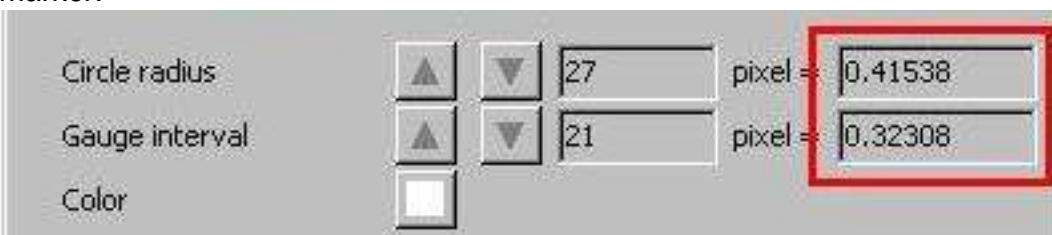


The interval of grid on sheet is 1mm (0.03937").

So enter "51" pixel = "1" or "0.03937" in the calibration field and then click set.



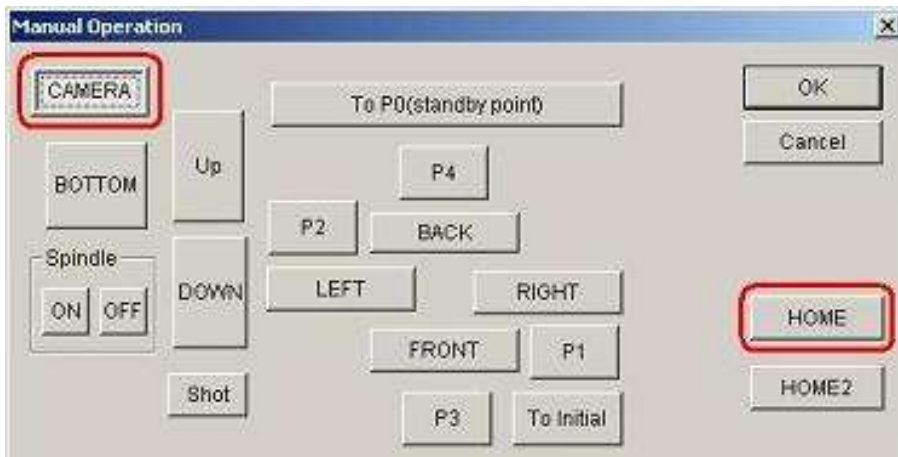
After this setting, you can get the value with unit which you like according to change the gauge interval and circle radius of marker.



P1/P2 Alignment with Camera

How to align P1 and P2 location precisely with camera (for bottom):

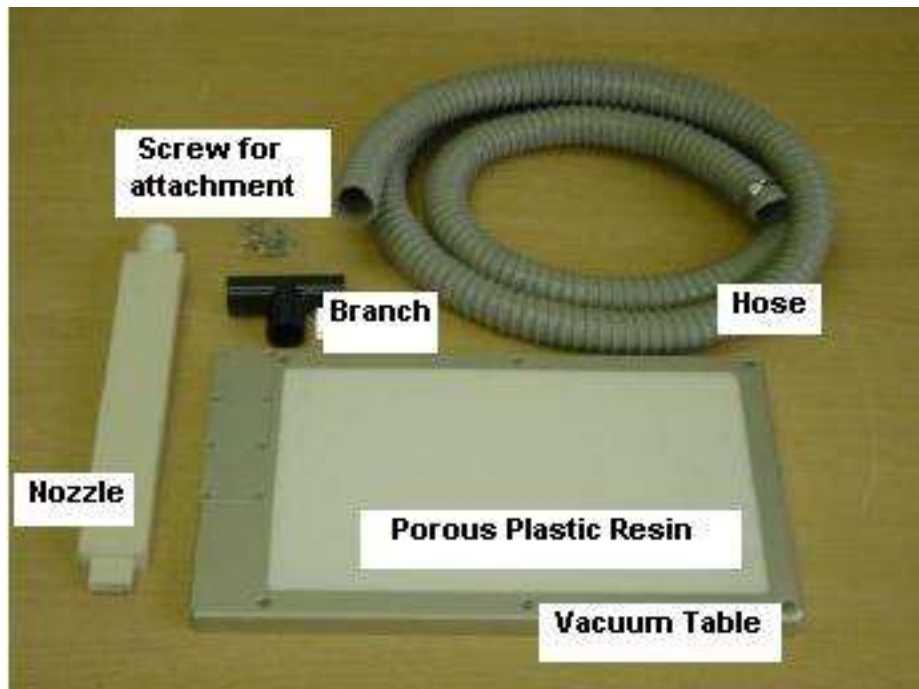
Before making the alignment of P1 and P2, click **CAMERA** button to the state of pressed. Software knows that you want to work from the view of camera and move the camera to the current location.



- When the **Move the head to P1 and click Home** message appears, use the directional button to move the spindle head to P1.
- When the center of camera marker match the center of hole, click on **HOME** and the system will recognize the point as P1.
- When **Align P2?** message appears, you must set P2.
- Click on "OK", and the prototyping machine will recognize that the board has been turned over in parallel with the X axis, and the head will move to P2.
- Change the movement distance to either 1 mm or 0.1 mm and move the camera to the exact location of P2.
- Once the camera is aligned with P2, click **HOME** so that the software recognizes where P2 is located. The software then calculates any deviation in board alignment and compensates as needed.
- Click **CAMERA** to pop-up and software moves the spindle onto the current location.
- Click **OK** to close the Manual Operation screen.

Option – Vacuum Table

Name of Parts of Vacuum Table

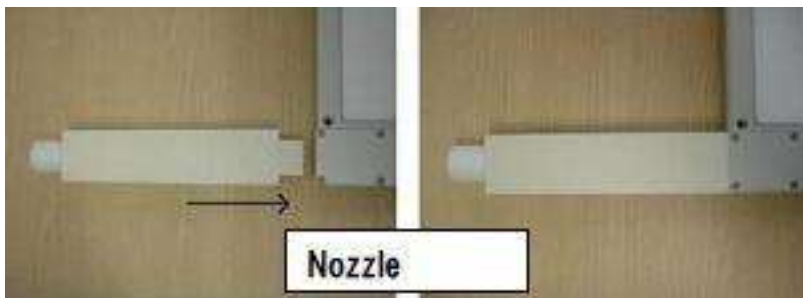


Attach Nozzle into the Vacuum Table

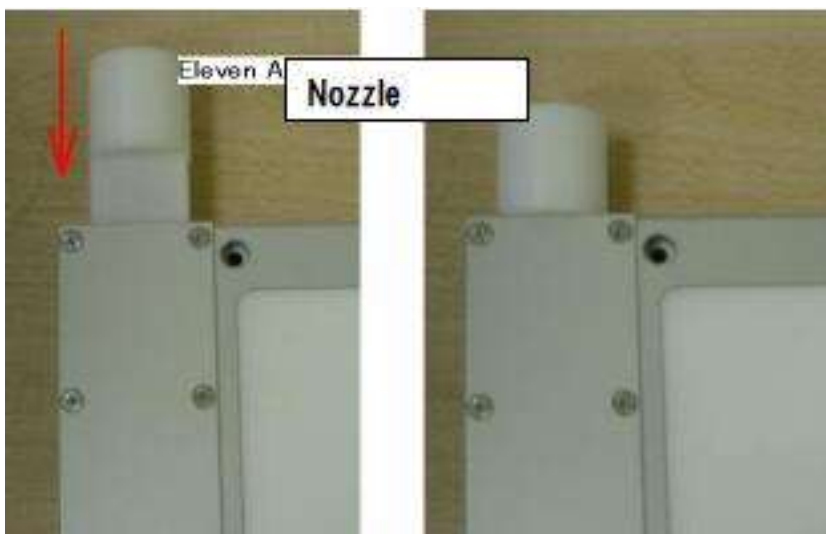
* How to attach the nozzle to the vacuum table.

1. Loosen 8 screws at the nozzle connection area of the vacuum table.
2. Hook up the nozzle to the nozzle connection of the vacuum table.
3. Tighten 8 screws.

FP-21T / FPZ-31AT



Eleven Auto



Place Vacuum Table on Machine Table

Place the vacuum table on the table of the machine.



Fasten the six screws attached in the kit.



Connect Vacuum Cleaner

Insert the hose from the behind of the machine.
Insert the nozzle into the hose. Fix the hose by band fastener.



Connect the vacuum cleaner and the hose.



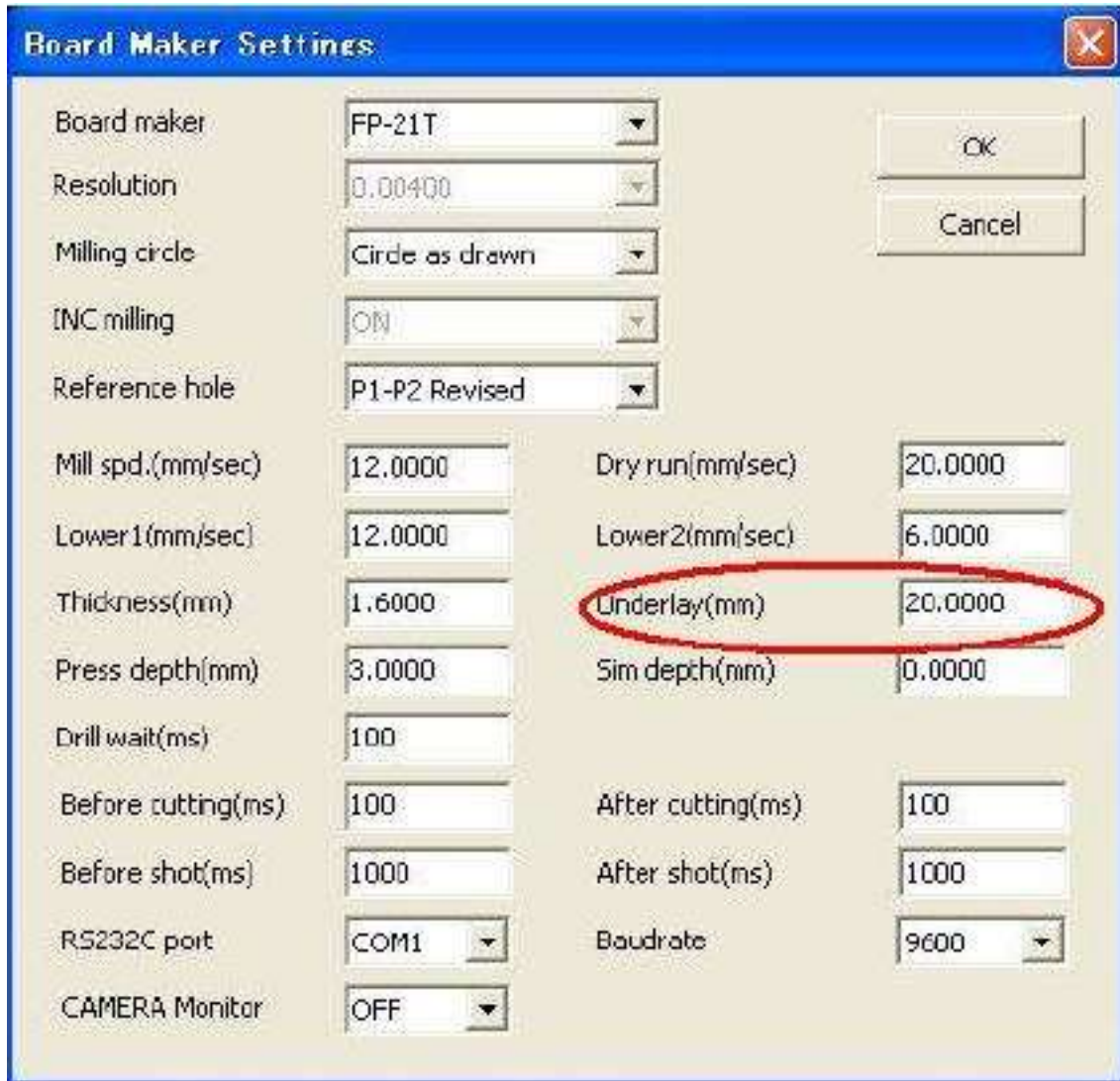
The power supply of the vacuum cleaner (No.4 in the illustration) must not be from the prototyping machine itself, but from other independent power supply.

Enter Table Thickness

Choose **CAM Prefs.**→**Board Maker** on CAM screen.

Change the **Underlay** to 20mm and click **OK**.

Since the thickness of the vacuum table is 20mm, please make sure that you configure this value. Otherwise, it will not mill/process properly..



The screenshot shows the 'Board Maker Settings' dialog box with the following configuration:

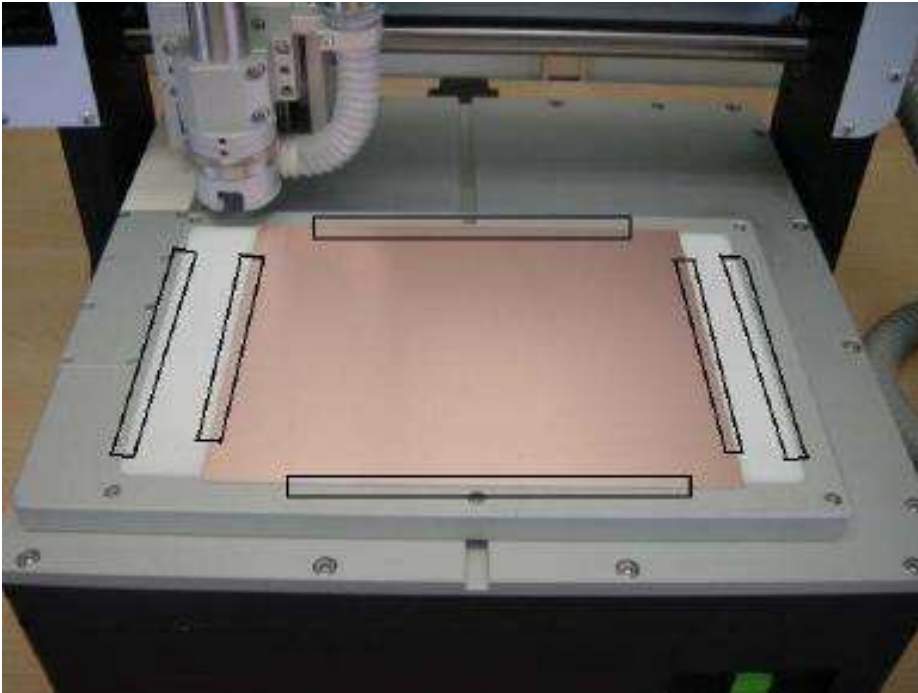
Parameter	Value
Board maker	FP-21T
Resolution	0.00400
Milling circle	Circle as drawn
INC milling	ON
Reference hole	P1-P2 Revised
Mill spd.(mm/sec)	12.0000
Dry run(mm/sec)	20.0000
Lower1(mm/sec)	12.0000
Lower2(mm/sec)	6.0000
Thickness(mm)	1.6000
Underlay(mm)	20.0000
Press depth(mm)	3.0000
Sim depth(mm)	0.0000
Drill wait(ms)	100
Before cutting(ms)	100
After cutting(ms)	100
Before shot(ms)	1000
After shot(ms)	1000
RS232C port	COM1
Baudrate	9600
CAMERA Monitor	OFF

Place Board on Vacuum Table

After placing the substrate board on the vacuum table, please turn the vacuum cleaner on manually.

Fix the side of the porous plastic resin and the substrate board using the Scotch tape.

This procedure is required in order to avoid the displacement of the substrate in case the machine was turned off and the hose comes off from the machine.



Do not turn off the vacuum cleaner until the processing finishes!



When performing the double-sided processing, please insert the registration pin in the porous plastic resin. Please refer to P.35.



The porous plastic resin is considered as a consumable.
When the surface of the porous plastic resin becomes not flat with many scratches/scars, please exchange the resin.



When fabricating a small circuit board, please make sure to cover the porous plastic resins. Since the porous plastic resin had microscopic holes which sucks the air in, the suction to the board will weaken if it is not covered.

Trouble Shooting

Trouble Shooting – RS232C Cable

1. No response (mouse pointer keeps hourglass)

-Press Shift+ESC to cancel the communication at once. And then check the following items:

- Power is not turned on yet.
- RS232C serial cable is not connected.
- RS232C cable is wrong (Straight/Reverse)

Refer also to P.25.

2. Message "Port Open Error" or "Port No. Error"

- Port No. is wrong.

Choose **CAM Prefs.** → **Board Maker.**

Re-confirm that RS-232C field is correct port number. (COMx)

- Re-start the software when RS-232C field is changed.

The settings will apply from the next time the software is opened.

Trouble Shooting – USB Cable

1. Message "Port Open Error"
 - Power is not turned on yet.
 - USB driver is not installed yet.
 - USB cable is not connected.

In this case, there is no MITS USB driver in device manager screen.

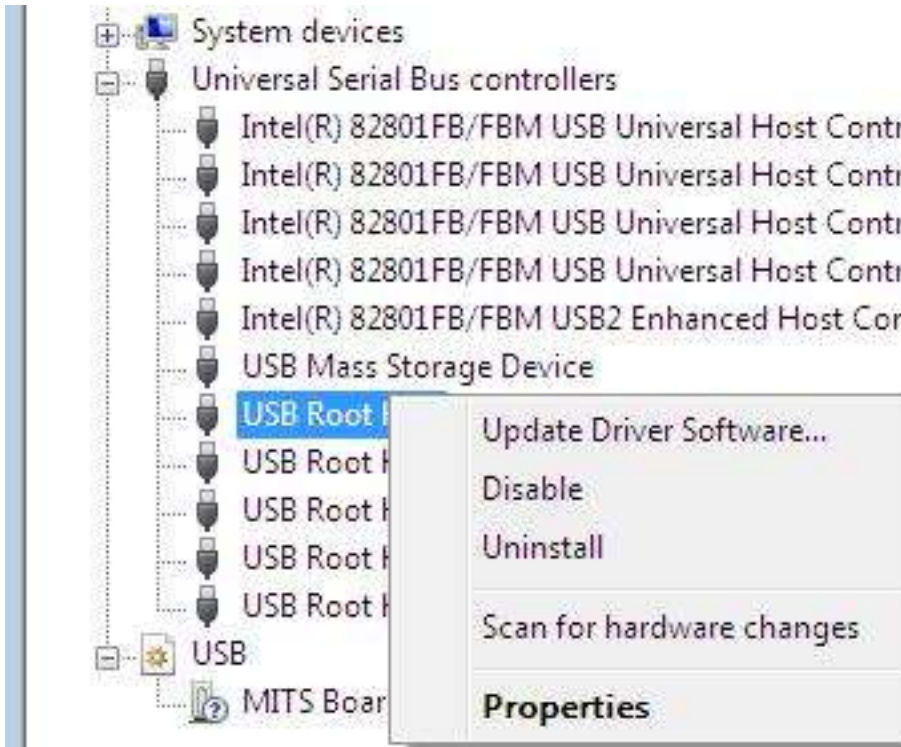
2. There is MITS USB driver in device manager screen.
However, no response when "Start Job" icon is clicked.
 - Press Shift+ESC to cancel the communication at once.
And then try again.
 - If there are no response without message, go to
CAM Prefs → **Board Maker**
and re-confirm that RS-232C field is set to USB. and
re-start the software.
3. No response when "Start Job" icon is clicked and Shift+ESC key cannot cancel the communication.
 - Turn off the prototyping machine and then try Shift+ESC key to cancel.
 - If this situation frequently happens, change the properties of USB root hub in device manager of your computer (See another page)

If everything mentioned above cannot solve the problem, or the communication is unstable, we recommend using RS-232C serial communication.

If your computer has no RS-232c port, try USB-Serial conversion cable which is sold in PC shop.

Setting USB Root Hub

Open the device manager screen in control panel on Windows. Right click on **USB Root Hub** and click **Properties**.



Click **Power Management** tab,
Check off the **Allow the computer to turn off this device to save power**



There are several USB Root Hubs on the device manager screen.
Do the same settings on all the USB Root Hubs.

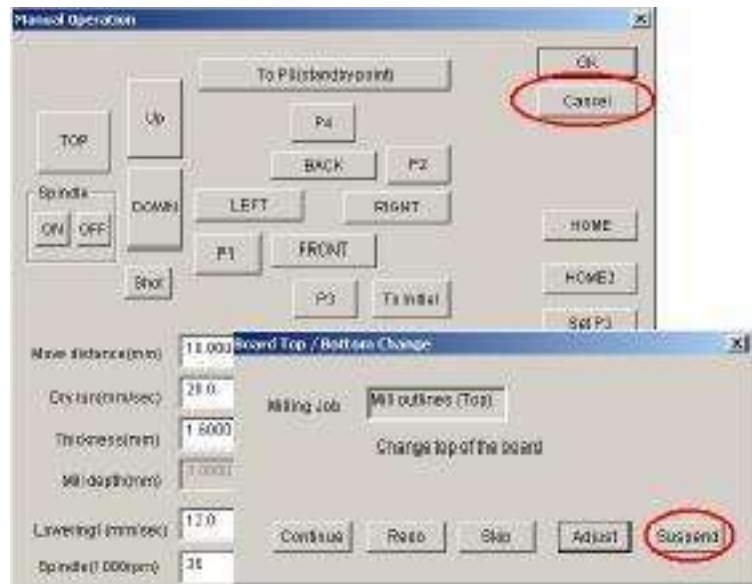
Recovery after Accidental Stop



If a problem occurred during the previous session and milling had to be stopped or the power was turned off by mistake or some other unusual event occurred, please do the following procedures for recovery. Otherwise, it may cause unexpected action.

Recovery after Accidental Stop

Close all dialogs (screens). As the software keeps idling/waiting (it look like not responding), press **SHIFT+ESC** to cancel the communication.



Confirm that there are no dialog boxes displayed.
Turn off the power switch.

Release emergency switch

To release the switch, rotate the switch a little and it will pop up.

Turn the power switch back on.



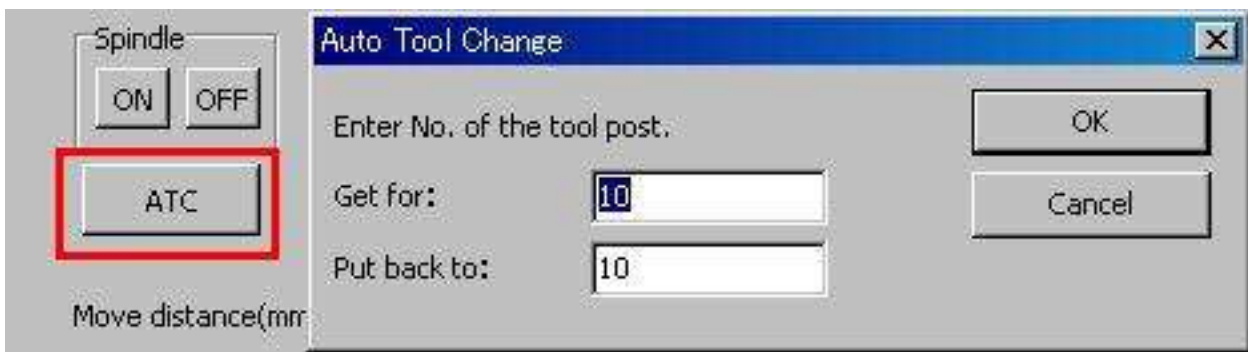
Recovery of Auto Tool Change



If a problem occurred during the previous session and milling had to be stopped or the power was turned off by mistake or some other unusual event occurred, please do the following procedures for recovery. Otherwise, it may cause the unexpected action.

Recovery after Accidental Stop

Call up the manual operation screen and click **ATC** button.
The screen illustrated below will appear.



1. In the case that tool change failed in the previous session, the screen shows -1 in the tool No. field.
This means that software is unaware of the tool that the machine is currently holding.
2. In field **Put back to**, enter the No. of the tool post which the prototyping machine actually has. Be sure that the actual tool post is empty which is specified as **Put back to**.
3. Enter a different tool No. in field [Get for].
4. Click **OK**, and the spindle head returns the tool it is holding to the tool post **Put back to**.
And the spindle head picks up the tool from the post **Get for**.
5. Now software knows what tool is held.