



# DMSF PCB ROUTER OPERATION GUIDE

## A. Preparation of NC files for PCB Router

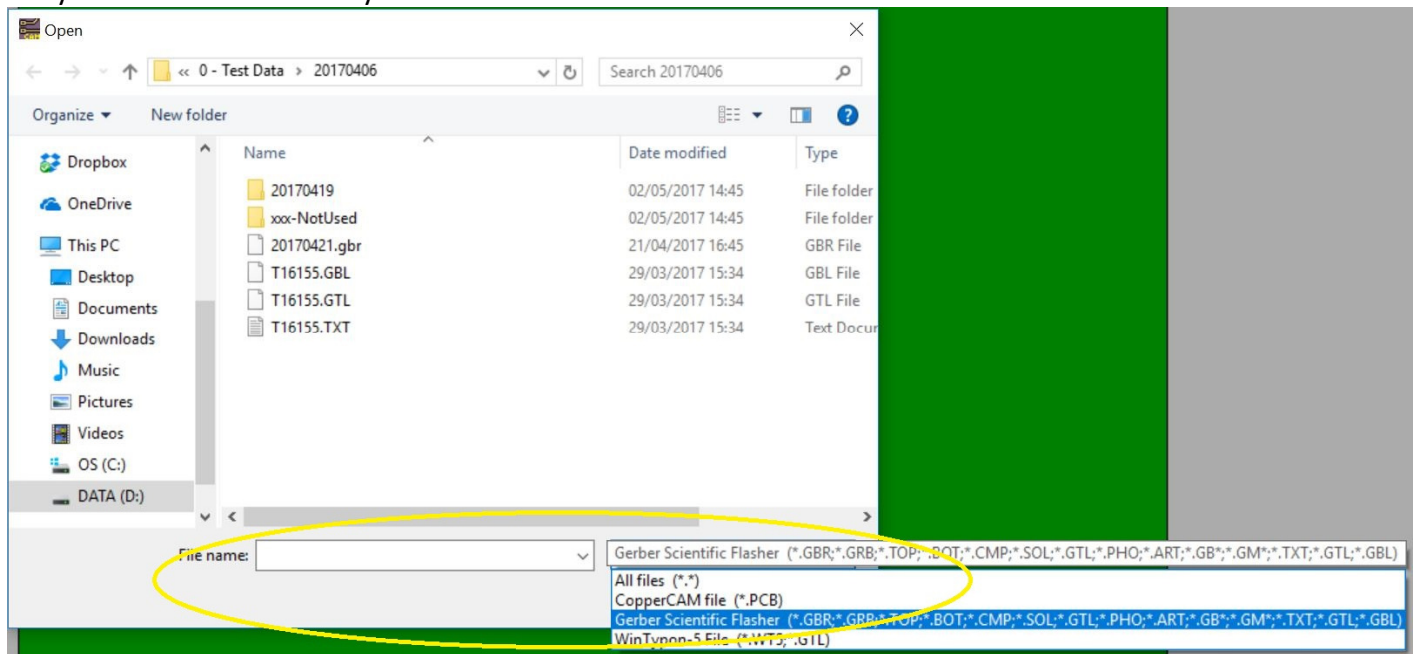
The input to the PCB router is NC file that contain commands and data being readable by the controller of the router’s controller. These commands and data will instruct the router to move the cutting tool to perform drilling and isolation cutting.

For the machining of 2-side PCB, the following 4 NC files will be generated:

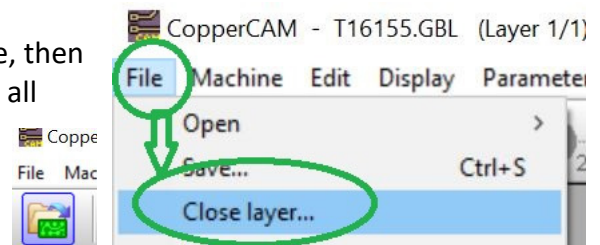
1. Alignment Holes Drilling NC file (“c:\DMSFApps\AlignHoleDrill.nc”)
2. PCB Holes Drilling NC file (“01-Drill.nc”)
3. PCB Top Layer Isolation Cutting NC file (“02-Top.nc”)
4. PCB Bottom Layer Isolation Cutting NC file (“03-Bot.nc”)

### A.1 Alignment Holes Drilling NC file

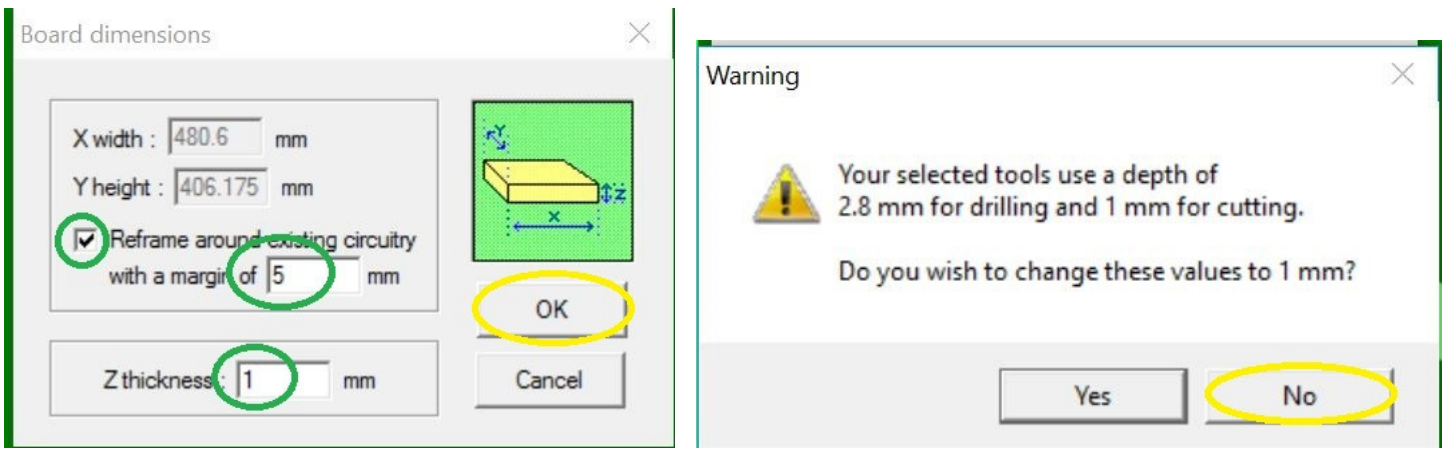
- Double-click the Apps icon of **CopperCAM** on the desktop.
- If there is no previous data in CopperCAM working space, then CopperCAM will ask you to select the first layer of PCB:



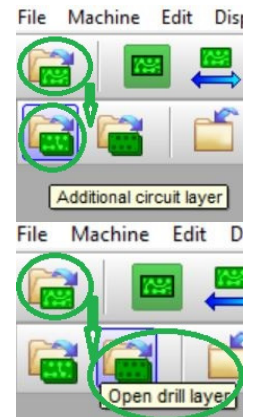
- If there is previous data in CopperCAM working space, then select pull-down menu “File -> Close layer...” to close all layers.
- After all layers are closed, then click “Open Project” button



- Ensure that the file type of “Gerber Scientific Flasher” is selected, and then select the required PCB **Top** layer Gerber file (either \*.GTL or \*.GBL file).
- After the GTL or GBL file is opened, within the “Board dimensions” dialogue box, then specify the required “Reframe Margin”, say, 5 mm.
  - “Reframe around existing circuitry with a margin of ...” is checked ON.
  - Default value of “Z Thickness” = 1 mm.
- Click “OK” button.
- For the “Warning” dialogue box, click the “No” button to keep the drilling depth of 2.8 mm.

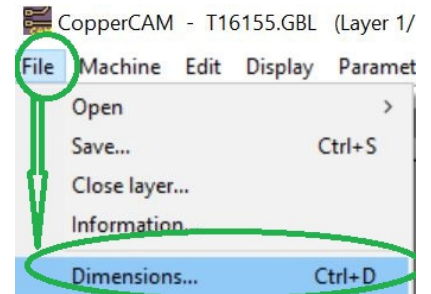
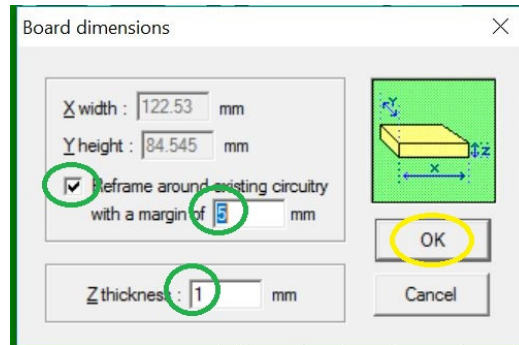


- Browse to “Open Project” button, and then select “Additional circuit layer” button.
- Select the required PCB **Bottom** layer Gerber file (either \*.GTL or \*.GBL file).
- Browse to “Open Project” button, and then select “Open drill layer” button.
- Select the required PCB hole drilling layer **EXCELLON** file (\*.TXT).
- Check that the imported holes are matched with the position of the top and/or bottom layer, then click the “Yes” button of the “Excellon” dialogue box:

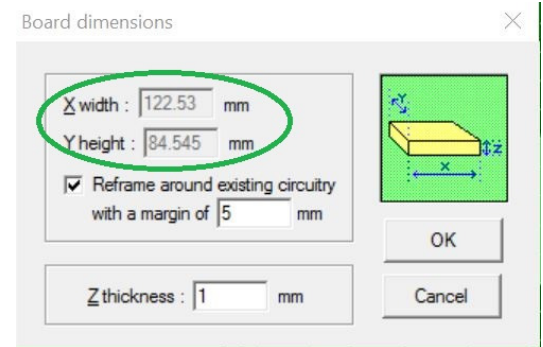




- Select pull-down menu “File -> Dimension...” or use “CTRL+D” to display the “Board dimensions” dialogue box.

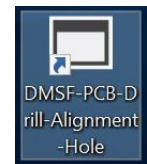


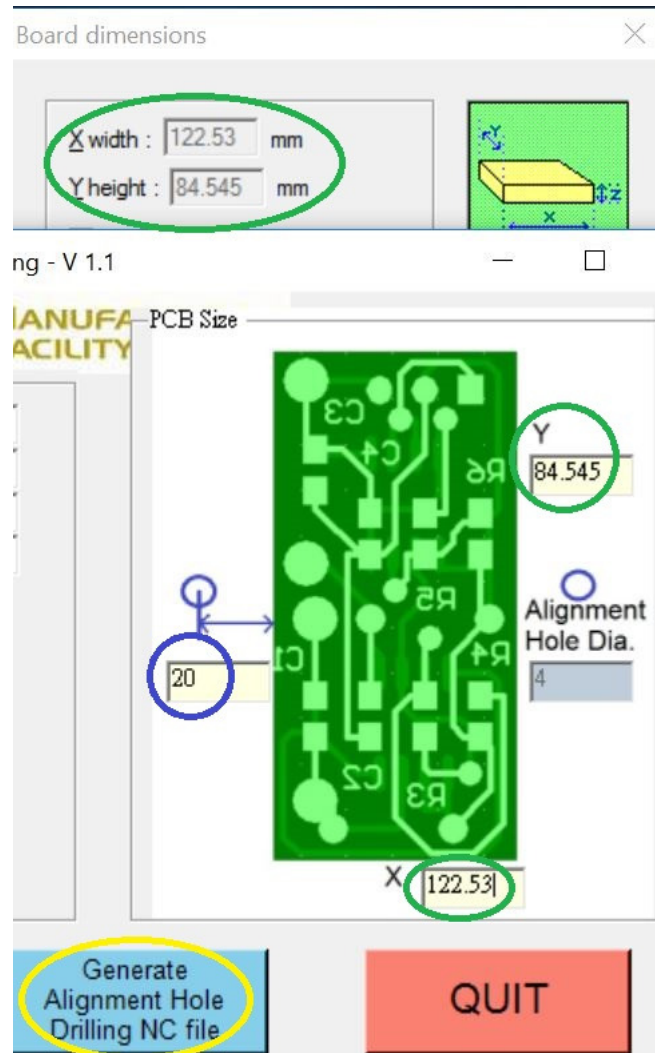
- Specify the required “Reframe Margin”, say, 5 mm.
  - “Reframe around existing circuitry of ...” is checked ON.
  - Default value of “Z Thickness” = 1 mm.
- Click “OK” button.
- Again select pull-down menu “File -> Dimension...” or use “CTRL+D” to display the “Board Dimension” dialogue box.



- Please note the “X width” and “Y height” of the PCB.

- Double-click the Apps icon of **DMSF-PCB-Drill-Alignment-Hole** on the desktop.
- Enter the following values:
  - Required margin between alignment pins and boundary of PCB (say, 20 mm)
  - PCB Size – X and Y (matches with values in “Board dimensions”)

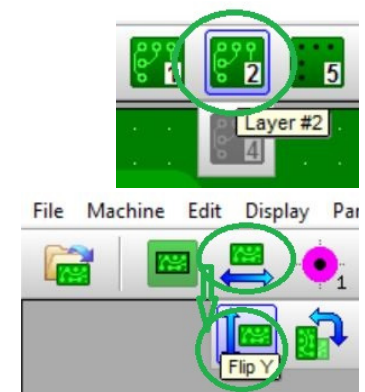


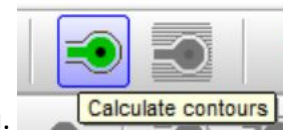
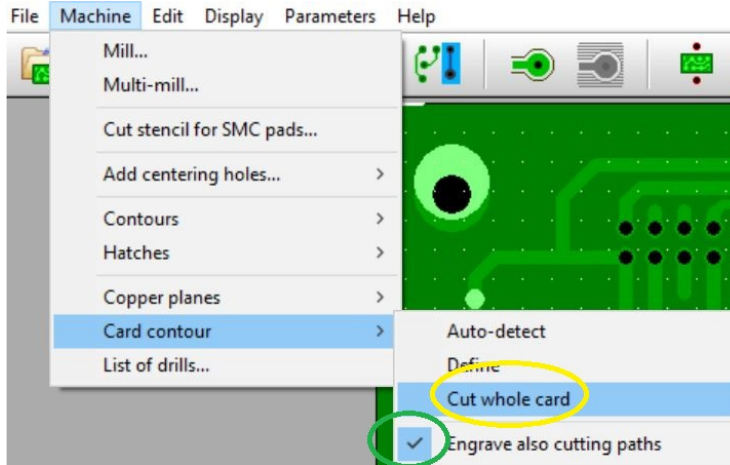


- Click “Generate Alignment Hole Drilling NC file” button to generate the Alignment Holes Drilling NC file.
  - The alignment hole drilling NC file will be created as “c:\DMSFApps\AlignHoleDrill.nc”.

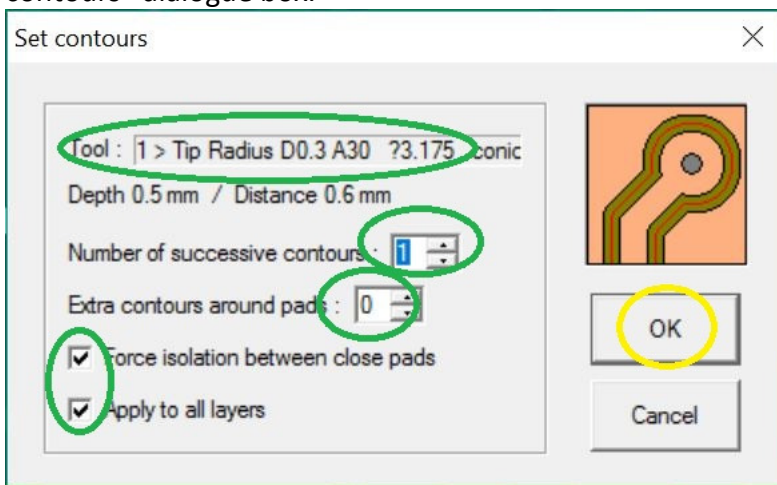
### A.2 PCB Holes Drilling NC file

- Click the “Layer 2” button at the right-hand side of ribbon menu.
  - This will activation the layer 2 (i.e. bottom layer)
- Browse to “Flip ...” button and click “Flip Y” button once.
  - You will notice that now the holes and bottom layer are not aligned.
- Select pull-down menu “Machine -> Card contour”
  - Ensure that “Engrave also cutting paths” is checked ON.
  - Click “Cut whole card”.





- Click the “Calculate contours” button around middle of ribbon menu.
- Ensure that the following shown values are correct, and the click the “OK” button of the “Set contours” dialogue box.



- Click the “Mill” button at the middle of ribbon menu.
- Enter “2.8” for “Drilling depth”.
- Ensure that the following shown values are correct, and the click the “OK” button of the “Active tools” dialogue box.



Active tools

ENGRAVING TOOL  
1 > Tip Radius D0.3 A30 ?3.175 conical 3  
Depth : 0.5 mm => Radius 0.3 mm  
Margin : 0 mm => Distance 0.3 mm  
Engraving speed : 500 mm/min

HATCHING TOOL  
2 > EM D4R0 ?4 cylindrical  
Depth : 0.1 mm => Radius 2 mm  
Margin : 0 mm => Overlap 50%  
Hatching speed : 800 mm/min

CUTTING TOOL  
1 > Tip Radius D0.3 A30 ?3.175 conical 3  
Cutting depth : 1 mm  
Cutting speed : 500 mm/min

CENTERING TOOL  
4 > Drill D4 - Alignment Hole ?4 cylindrical  
Hole diameter : 3.17 mm  
Extra depth : 6 mm

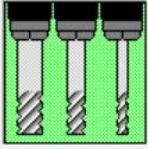
DRILLING TOOLS  
 Use one single tool for all drills, with circular boring  
--> 3 > Drill D1 ?1 cylindrical  
 Use for each drill the closest smaller tool, with circular boring  
 Use for each drill the closest greater tool, without circular boring

Selected tools

|    |                             |   |
|----|-----------------------------|---|
| 1  | 3 > Drill D1 ?1 cylindrical | X |
| 2  |                             | X |
| 3  |                             | X |
| 4  |                             | X |
| 5  |                             | X |
| 6  |                             | X |
| 7  |                             | X |
| 8  |                             | X |
| 9  |                             | X |
| 10 |                             | X |

Allow circular boring for all holes over 1 mm

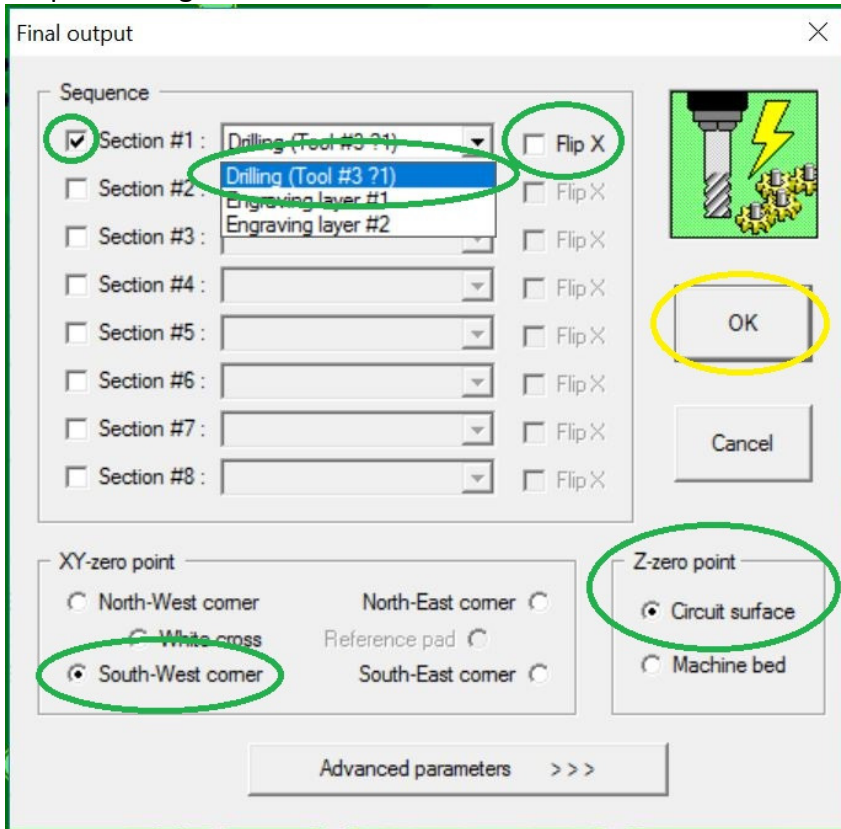
Drilling depth : 2.8 mm Boring speed : 80 mm/min  
In case of a boring cycle :  Drill at centre  Lift-up at centre



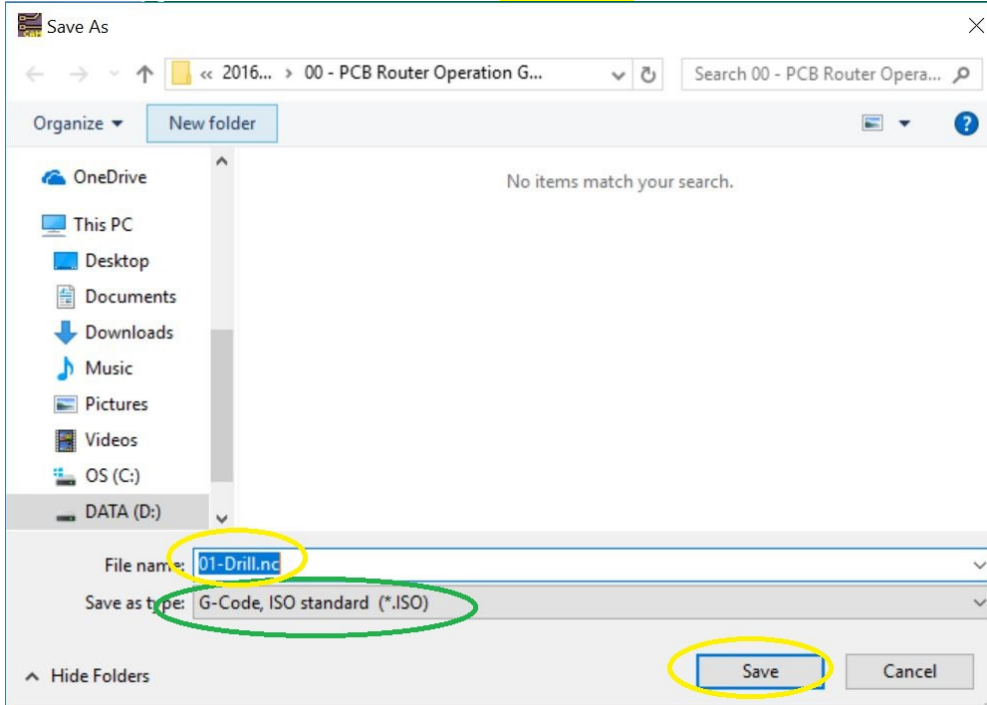
OK

Cancel

- Ensure that the following shown values are correct, and the click the “OK” button of the “Final output” dialogue box.

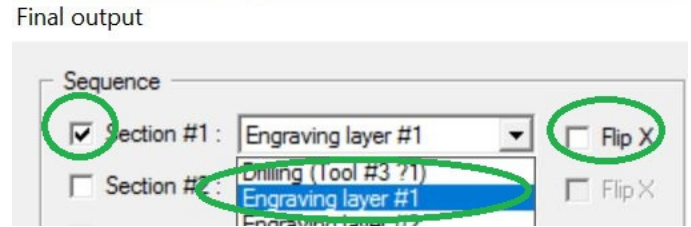


- Enter the required NC filename (say, “01-Drill.nc”) at your preferred folder.

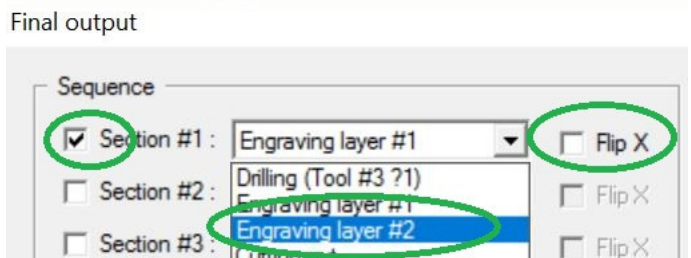




- Again click the “Mill” button at the middle of ribbon menu.
- Click the “OK” button of the “Active tools” dialogue box.
- Select “Engraving layer #1”, and the click the “OK” button of the “Final output” dialogue box.
- Enter the required NC filename (say, “02-Top.nc”) at your preferred folder.



- Again click the “Mill” button at the middle of ribbon menu.
- Click the “OK” button of the “Active tools” dialogue box.
- Select “Engraving layer #2”, and the click the “OK” button of the “Final output” dialogue box.
- Enter the required NC filename (say, “03-Bot.nc”) at your preferred folder.



### B. Router Preparation

The router is enclosed by a safety cover.

- By opening the front door of the safety cover will trigger the machine to stop XYZ movement.
  - However, the spindle is still rotating!
  - Please remember to STOP the SPINDLE via the controlling software.
- The side door of the safety cover is for emergency use only.
  - Please DO NOT open the side door!

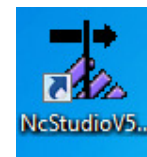
#### B.1 Turn ON the Router

- Turn on the router by pressing the GREEN button at the front of the control box

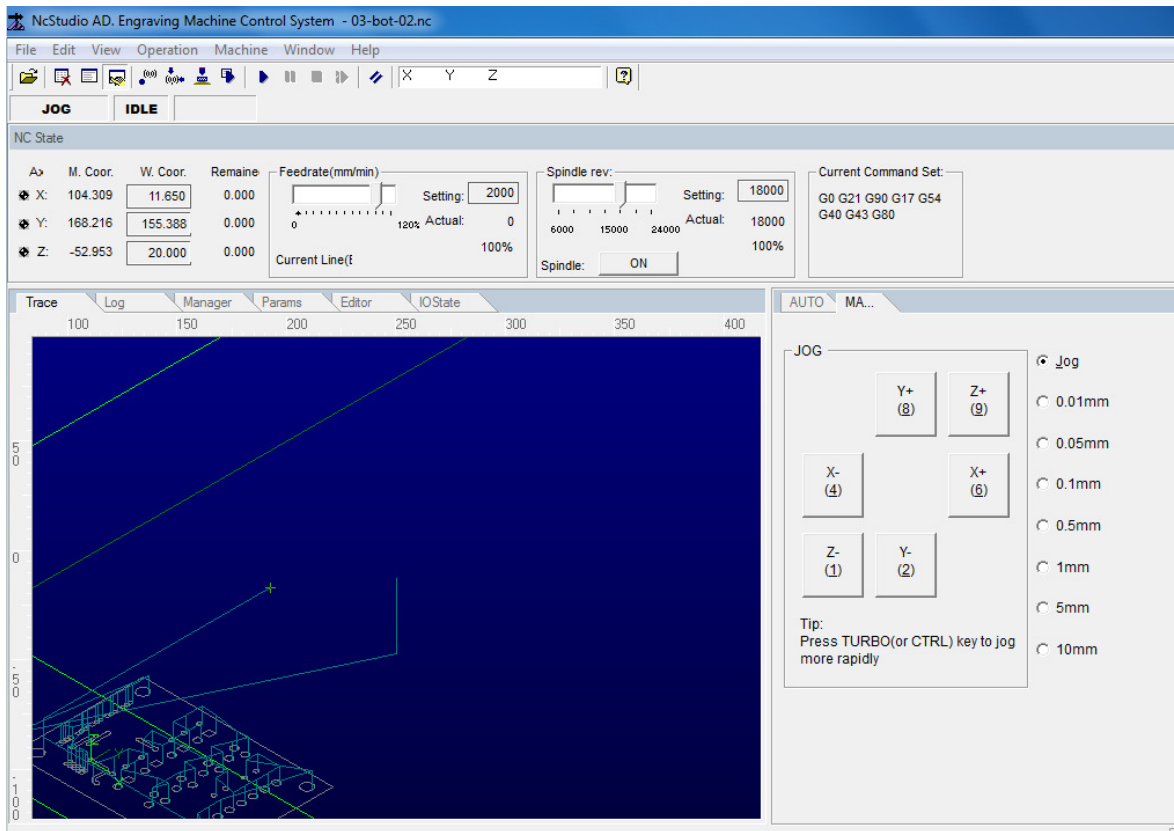


### C. Launch Contoller App of Hand-wheel and Router

- Double-click the “HB03AutoEn” icon on desktop to launch the App of hand-wheel.
- Double-click the “NcStudioV5...” icon on desktop to launch the App of NC Controller.







## D. PCB Machining

- Use the physical hand-wheel to control the X-, Y- and Z-axis movement for:
  - Workpiece coordinate system setting (i.e. X = 0, Y = 0)
  - Tool length setting (i.e. Z = 0)

### D.1 Setup the PCB Board

- Take the raw materials of the PCB board.
- Apply double-side adhesive tape to the back of the board.
- Fix the board on the machinable resin block.
- Setup the workpiece coordinate system (0,0).

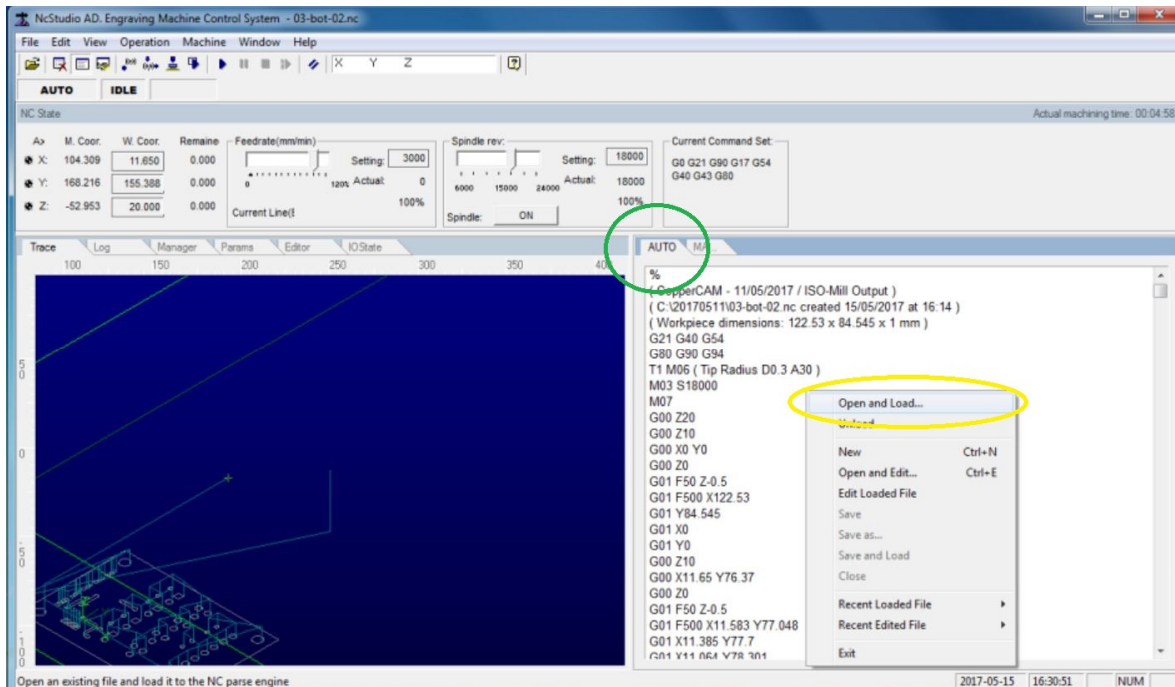
### D.2 Setup Drill bit of 4mm Diameter

- Take the 4mm collet and the 4mm diameter drill bit.
- Install the collet and drill bit at spindle head.
- Reset the "Z=0" for this drill bit.

### D.3 Alignment Hole Drilling

- Load the "AlignHoleDrill.nc" file into NcStudio.
  - Right-click in the "AUTO" page of NcStudio, then select "Open and Load...":





- Check that the loaded file is correct.
- Press the “Start / Pause” button on the hand-wheel to start the machining.
- Upon the completion of the machining:
  - Select the “Z” by the dial switch.
  - Move up the tool by turning the hand-wheel.



#### D.4 Fix PCB Board by 2 x Alignment Pins

- Take 2 x 4mm alignment pins.
- Press the pins into the alignment holes firmly.

#### D.5 Setup Drill bit of 1mm Diameter

- Dismantle the 4mm drill bit and the 4mm collet.
- Take the 3.175mm collet and the 1mm diameter drill bit.
- Install the collet and drill bit at spindle head.
- Reset the “Z=0” for this drill bit.

#### D.6 PCB Board Hole Drilling

- Load the “01-Drill.nc” file into NcStudio.
- Check that the loaded file is correct.
- Press the “Start / Pause” button on the hand-wheel to start the machining.
- Upon the completion of the machining:
  - Select the “Z” by the dial switch.
  - Move up the tool by turning the hand-wheel.

#### D.7 Setup V-bit of 0.2mm Tip Width, Angle=20°



- Dismantle the drill bit of 1mm diameter.
- Take the V-bit of 0.2mm Tip Width, Angle=20°.
- Install the V-bit into the collet.
- Reset the “Z=0” for this V-bit.

#### **D.8 PCB Board Top Layer Engraving**

- Load the “02-Top.nc” file into NcStudio.
- Check that the loaded file is correct.
- Press the “Start / Pause” button on the hand-wheel to start the machining.
- **Upon the completion of the machining:**
  - Select the “Z” by the dial switch.
  - Move up the tool by turning the hand-wheel.

#### **D.9 Prepare PCB Board for Bottom Layer Engraving**

- Dismantle the 2 x alignment pins.
- Take out the PCB board from the machinable resin block.
- Clear the double-side adhesive tape at the bottom layer of PCB board.
- Apply double-side adhesive tape at the top layer of PCB board.
- Fix the PCB board on the machinable resin block, with bottom layer facing upward.
- Press the pins into the alignment holes firmly.

#### **D.10 PCB Board Bottom Layer Engraving**

- Load the “02-Bot.nc” file into NcStudio.
- Check that the loaded file is correct.
- Press the “Start / Pause” button on the hand-wheel to start the machining.
- **Upon the completion of the machining:**
  - Select the “Z” by the dial switch.
  - Move up the tool by turning the hand-wheel.

#### **REMARKS:**

- For any assistance, please contact Mr. William Tai (2358.8097) / Mr. Anthony Yam (2358.8900) / Mr. Jeremy Tam (2358.8899).