Instructions for Setup and Programming of the Midwest Rapid Tool Inc. Automatic Tool Changer – Vertical Installation

To use the following procedures for setup and use of the Midwest Rapid Tool Inc. Automatic Tool Changer, the following conditions must exist:

- The Z axis must home at the top of its travel.
- The Tool Pallet is setup along the Y axis along the left side (-X) of the table.
- A zero plate must be used for setting the Z height. If you do not currently use a zero plate. This link will discuss how to make and set one up.

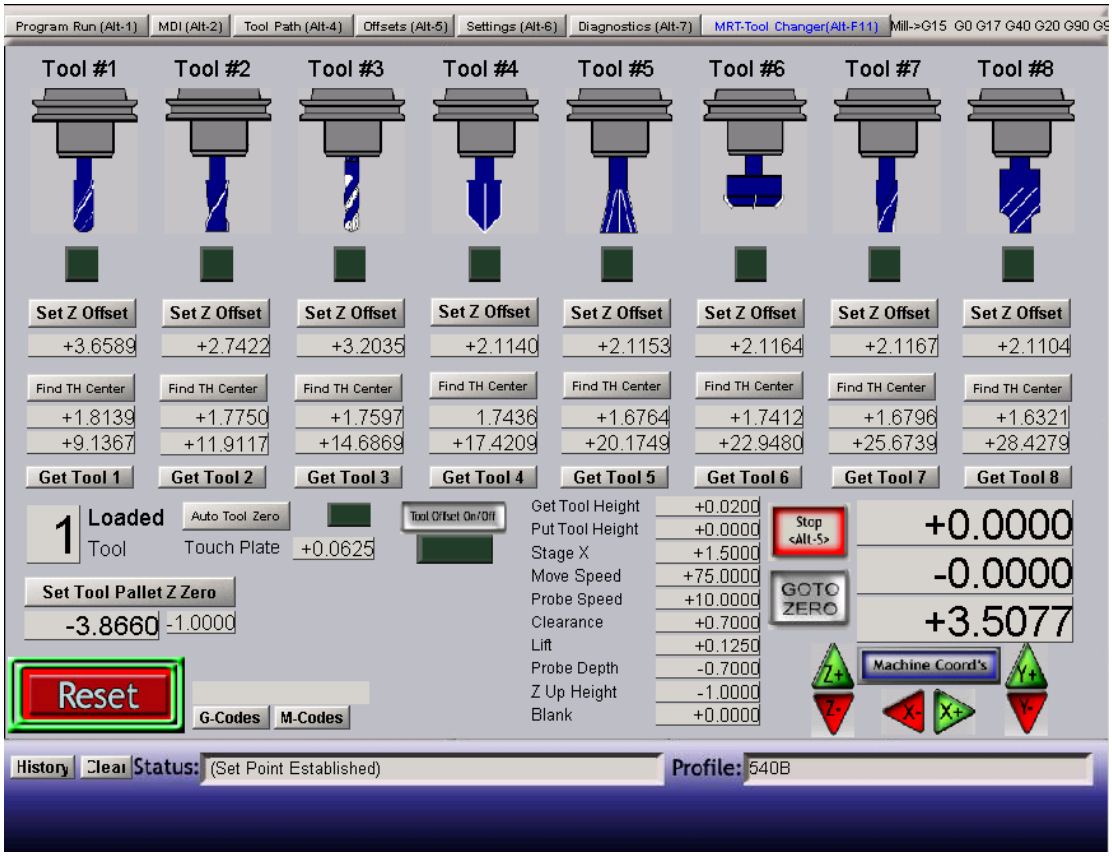
http://www.machsupport.com/forum/index.php/topic,10088.0.html . Additional information can be found at http://www.machsupport.com/forum/index.php and do a search for ñzero plateò
This software can be used for both Metric and Imperial setups. There are several variables which must be set before the software can be used.

Copy Files

The first thing you will need to do is copy the files required to setup and run the MRT Tool Changer to the correct locations. Copy the files MRT-Screens.set and MRT-Add-Vert.set to the root directory of your Mach3 software. Next, open the Mach3\Macros sub directory and copy all the .m1s files into the configuration folder you plan to use with the MRT Tool Changer. Copy the MRT-Bitmap folder into the Mach3\Bitmaps folder

Screen Set

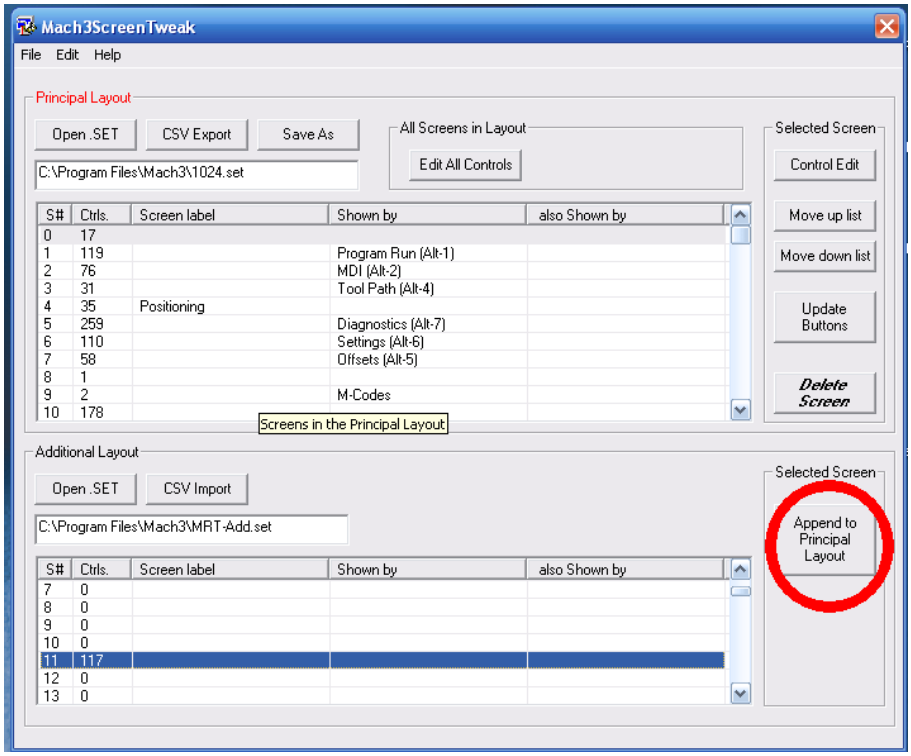
A page has been added to the Mach3 software which contains the information necessary to setup and use the MRT Automatic Tool Changer.



If you have modified the default screen set which comes with Mach3, you will have to add the MRT-Add-Vert.set page to your screen set. If you have made no changes to the screen set which originally came with Mach3, you can load the MRT-Screen.set by opening Mach3, click View along the top, click Load Screens and select MRT-Screens.set. Skip the following section.

Adding a Screen to Your Existing Screen Set

To add the MRT-Add-Vert.set page to your existing screen set you need to install theMach3Screen and ScreenTweak applications located at http://www.artsoftcontrols.com/downloads.php at the bottom of the page under Screens. Open ScreenTweak and in the Principal Layout load your current <screen>.set file. Open the MRT-Add.set in the Additional Layout section. Highlight S# 11 and click Append to Principal Layout. You should get a Success message that ñControls have been copied to Principal Layoutòscreen 11. If screen 11 is not where they were placed, go to the S# shown in the message box, highlight it and use the ñMove up listòor ñMove down listòbutton to position the new controls in S#11. Click File>Principal Layout ï Save As and give it a new name such as MRT-Controls.set.



Open Mach3Screen and load the new MRT-Controls.set (or whatever it was named). Click on the P (Persistent) page. Move the Mode placeholder to the right. Copy the Diagnostic (Alt7) button and place it next to the original Diagnostic button. Open the new button by double clicking it. In the OemCode box change the value to 11. Click the Set Hot Key button and while holding the ALT key hit F11. The ASCII code 2170 should display in the ScanCode box. In the Button Name/Caption box replace the text withòMRT-Tool Change (Alt-F11)ù Hit enter and ok to any messages. Resize the new Alt-F11 box if necessary. Save file as a new name. Open Mach 3. Click View>Load Screens and select the new .set file. You should be able to access the new MRT screen by either clicking the new persistent screen button or by CTRL F11.

Setting up the Tool Changer

Variables

Start Mach3 and open the MRT Tool Changer page by either clicking on the button at the top of the page or doing a CTRL-F11. There are several variables we need to set before we can setup the Tool Changer. Looking at the figure below enter the values shown in the DRO boxes. These variables are used in the following setup and operation of the Tool Changer. Their use will be discussed in detail later. Enter the value of the thickness of your Zero plate in the Touch Plate DRO. The values are shown for the imperial units of inches and inches/minute. For Metric users convert the figures to metric. The following is a brief explanation of the variables used in the operation of the MRT Automatic Tool Changer

This is the amount of distance the Tool Changer will travel above the top surface of the Tool Pallet when it picks up a Tool Holder. This value is added to the value in the Set Tool Pallet Zero DRO and after the Tool Changer blows off the Too Holder, drops to this height to pick up the Tool Holder.

This is the amount of distance the Tool Changer will travel above or below the top surface of the Tool Pallet when it is replacing a tool. Adjust this value if necessary so the Tool Changer replaces the Tool Holder above the center line of the spring pins. When the Tool Changer releases the Tool Holder the Tool Holder will be forced down a bit till the Tool Changer rises. Inserting the Tool Holder above the center line will keep it from being forced out the bottom of the Tool Bay when the drawbar actuates.

This is the distance the Tool Changer will be positioned in front of (+X) the Tool Bay when replacing the old Tool Holder or picking up a new one.

This is the speed the Tool Changer will move when replacing a Tool Holder and dropping down over a Tool Holder about to be picked up. It is recommended that this be set to a low value till you are confident that the Tool Changer is setup correctly and functioning properly. Then adjust to a comfortable speed.

This is the speed the Tool Changer will move when doing a probing routine either when finding the center of the Tool Holder or when finding the Z zero height with the zero plate. It is recommended this be kept at a low value to reduce over travel and wear and tear on the machine due to the sudden stops.

Clearance +0.7000 This is the distance the probe will travel past the Tool Holder approximate center when probing during the Tool Holder Center macro. This value should be increased if using a probe larger than ¼ò

Lift +0.1250 This is the distance the probe will raise above the top of the Tool Holder when probing during the Tool Holder Center macro. It is recommended that this value not be decreased.

Probe Depth -0.7000 This is the distance the probe will lower when probing during the Tool Holder Center macro. It is recommended that this value not be changed or be changed with care as another value could result in none accurate Tool Holder Center locations.

Z Up Height -1.0000 This is the machine value the Tool Changer will raise to when making X, Y moves during setup and during a Tool Change. Time can be minimized by making this value smaller but the risk of hitting the upper Z travel limit increases with the longer tools and larger tool offsets.

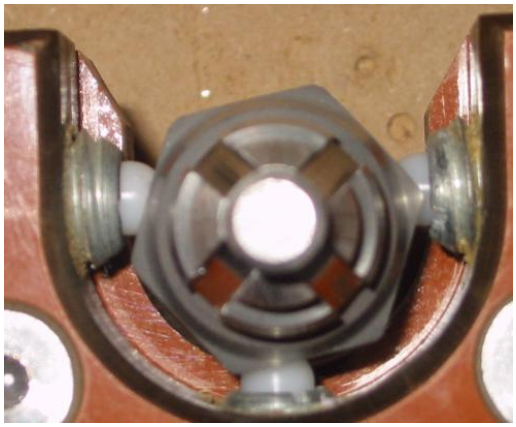
Blank +0.0000 Not used at this time.

Tool Pallet Zero

Home the system to its Machine Zero on all three axes. Do not reset any DROôs at this time. Remove any Tool Holders in the 3rd, 4th, 5th, and 6th bay in the Tool Pallet and remove any Tool Holder in the router. Place the zero plate on top of the Tool Pallet between the 4th and 5th tool bay. Position the router above the zero plate approximately ¼òabove the Zero Plate. Click the Set Tool Pallet Z Zero button on the lower left. The router will lower and touch the zero plate. The location of the top of the Tool Pallet with respect to machine Z zero will be saved in the DRO just below the Set Tool Pallet Z Zero button. This value will be used in all the other setup routines and all tool change routines. This dimension lets the software know where the Tools are located.

Tool Holder Centers

Next, the centers of the Tool Bays need to be determined. The Find TH Center button runs a macro to find this information and enter it into the proper DROs. To use this macro, the Zero Plate must be functioning and illuminate the LED next to Auto Tool Zero button when the zero plate makes contact with the collet chuck on the router. Insert a ¼òdowel pin or something similar in a Tool Holder leaving ¾òto 1òof the dowel extending past the end of the Tool Holder. Using the manual button on the solenoid, install this Tool Holder into the router. Insert a Tool Holder in tool bay #1 with the anti-rotation slots positioned a 45° per the picture shown at the left. The macro will probe the 4 sides of the Tool Holder to find the center. Attach



the Tool Holder in bay 1 to the grounding plate using the lead with alligator clips attached. Position the router so the dowel pin is approximately above the center of the pull stud and is about ¼ò above the Tool Holder. Press the Find TH Center button under the Tool #1 column. The dowel will probe the 4 sides of the Tool Holder and store the X and Y values of the Tool Holder center in the DROôs below the Find TH Center with the x value in the upper DRO. Move the Tool Holder to tool bay #2 and repeat the process till all the tool holder centers have been recorded.

Tool Offsets

There are several methods of accounting for tool length differences. The method explained below uses the bottom edge of the router collet chuck with no Tool Holder installed as the reference plane. All the tool offsets will be set in reference to this location. Load the tools you will use into Tool Holders and load them in the Tool Bays. Place the zero plate in front of the Tool Bay for the Tool Holder for which you need to find the Z offset for. Lower the router till the collet chuck is ~0.25ò above the plate. Click the Set Z Offset button for the tool you need the offset for. The router will lower at Probe Speed till it contacts the Zero Plate. It then picks up the Tool Holder and raises to Z Up Height -1.0000 . It moves to the same location over the Zero Plate and lowers at Probe Speed till contact is made with the Zero Plate. The Tool Offset number is stored in the DRO just below the Set Z Offset and is also stored in the ToolTable. The router will move to the same location over the zero plate and the ToolTable will be opened. The value in the DRO just set should be the same as the value in column 2 for the Tool just measured. Click Apply and Ok to store the ToolTable. To view this table through Mach3, click Config>ToolTable. The tool offset is stored in the column labeled Height(H). Move the grounding plate in front of the next Tool Bay. Continue this process till tool offsets for all the Tool Holders has been completed. Doing the tool offsets individually allows you to get the offset for an individual tool if it breaks or if a different tool is required. Depending on your setup this will get values which are close to what you will need. Some adjustment may be necessary. If this is the case **DO THE TOOL OFFSET MODIFICATIONS IN THE TOOLTABLE** then go back and change the values on the MRT Tool Change page as they are not dynamically linked either way. That means a change to either one does not affect the value of the other. The machine will use the value in the ToolTable for the offset.

Get Tool Buttons

Make sure there is no Tool Holder in the router before using this button. The buttons at the bottom of each tool column will pick up the tool and set the offset for that tool. This is done by recording the current X, Y, Z position, picking up the required tool and returning to this position with tool offset in the ToolTable which corresponds to the tool.

Programming a Tool Change

Since this method uses the collet chuck as the reference for the tool offsets, it must be zeroed to the zero reference in the program (usually either the material surface or the table top). Place the zero plate on this reference and lower the router (with no Tool Holder installed) and hit the Auto Tool Zero button. This will

zero the bottom of the collet chuck to the material zero. Since all the tool offsets are referenced to this location, adding the offset for each tool to the Z height will place the end of the tool right where the bottom of the collet chuck was. Before running a program make sure the number in the 

section of the page matches the Tool Holder currently in the router. If there is no Tool Holder in the router, this number must be zero otherwise the Tool Changer will try to put a tool back into the location shown for the Loaded Tool and knock the Tool Holder in that location out of the Tool Bay. When a tool change is required in your part program the following code must be added:

M06 T0# G43 H# where # is Tool Holder you wish to use.

When this command is called, the Tool Changer will replace the Tool currently in the router into the bay shown in the 

DRO. It then moves up to the clearance height shown in the variable 

and move to the bay indicated by the T0# and picks up the Tool Holder in that position and sets the corresponding tool offset from the ToolTable. The Tool Changer than moves back to the X and Y location where the M06 command was called. Machining proceeds till the next tool change is called. At the end of the program you can put the current Tool Holder back in its bay (recommended practice) by issuing the following command.

M06 T00 G49

This will replace the Tool Holder and cancel any tool offset which might be active.