

OWNER'S GUIDE

M MACHINE AUTOMATIC TOOL CHANGER (ATC) RETROFIT FOR PCNC 770 SERIES 3

TECHNICAL DOCUMENT

1.1 PURPOSE

This document gives instructions on installing and using an Automatic Tool Changer (ATC) for PCNC 770 Series 3.



IMPORTANT! Install the Power Drawbar on your machine before installing the ATC. If you have a Power Drawbar button, don't install it: the button's functionality is replaced by the ATC.

1.2 PRODUCT INFORMATION

Product: Automatic Tool Changer (ATC) for PCNC 770 Series 3 (PN 39008)

The Automatic Tool Changer (ATC) holds up to 10 tools in a single tray. If your program requires more tools, the ATC changes tools automatically for all tools assigned to the tray, and pauses for a manual tool change for all tools not assigned to the tray.

Automatic Tool Changer (ATC) for 770M	
Quantity	Description
1	ATC Assembly
3	Fixed Standoff Assembly (PN 35832)
10	Plastic Screw (PN 32173)
1	Tilt Standoff Assembly (PN 35911)
M Machine ATC Retrofit for PCNC 770 Series 3 (PN 39006)	
Quantity	Description
3	5/16-18 x 3/4 Socket Head Cap Screw (PN 39010)
3	M8 x 1.25 - 20 Socket Head Cap Screw (PN 39307)
1	ATC Legacy Adapter Cable (PN 38661)
1	<u>Coolant Hose Bracket Kit for PCNC 770 (PN 37259)</u>
1	M Machine ATC Carousel Plate Spacer (PN 39005)



Note: If any of these items are missing, we can help. Email support@tormach.com to contact Tormach Technical Support for guidance on how to proceed.

1.3 REQUIRED TOOLS

This procedure requires the following tools. Collect them before you begin.

1.3.1 Required Tools for Installation

- 1-1/2 in. adjustable wrench
- Marker
- Metric hex wrench set
- Phillips screwdriver
- Small, flat-head screwdriver
- Snips
- Socket wrench, and a 13 mm socket

1.3.2 Required Tools for Verification

- Machinist's square, between 6 in. and 9 in. (152 mm and 229 mm)
- Straight rod (for Tormach Tooling System (TTS) tool holder), between 8 in. and 12 in. (203 mm and 305 mm)
- Tormach Tooling System (TTS) tool holder (for alignment rod)

1.4 AIR REQUIREMENTS

You must verify that the site conforms to the following air supply requirements.

- **Air Pressure** Between 90 psi and 120 psi (620 kPa to 825 kPa).
If the air supply is more than 120 psi (825 kPa), you must use a regulator.
- **Dry Air** We recommend using a compressed air dryer, desiccator, or filter between the air compressor and the machine.
- **Lubricated Air** You must lubricate the air with air tool oil. Use the FRL Filter-Regulator-Lubricator (PN 32457) or similar for this purpose.

2.1 SETUP

Complete the following steps in the order listed:

2.1.1 Update PathPilot	3
2.1.2 Prepare the Machine.....	4
2.1.3 Install the Automatic Tool Changer (ATC).....	4
2.1.4 Make Final Alignments to the Automatic Tool Changer (ATC).....	16

2.1.1 Update PathPilot

- Before using the ATC, you must verify that the PathPilot controller is updated to PathPilot v2.1.4 or higher. This version of PathPilot has settings required to use the ATC. Depending on the version you're using, do one of the following:
 - **v2.1.4 or Higher** Go to "Prepare the Machine" (on the next page).
 - **v2.1.3 or Lower** Either "Download and Install an Update File" (below) or "Install an Update File from a USB Drive" (below).

Download and Install an Update File



Note: Downloading and installing an update file requires an Internet connection. From the PathPilot interface, confirm that the Internet button LED light is on.

1. Confirm that the PathPilot controller is powered on and out of **Reset** mode.
2. From the PathPilot interface, on the **Status** tab, select **Update**.



Figure 2-1: Update button on the Status tab.

3. From the **Software Update** dialog box, select **Check Online**.

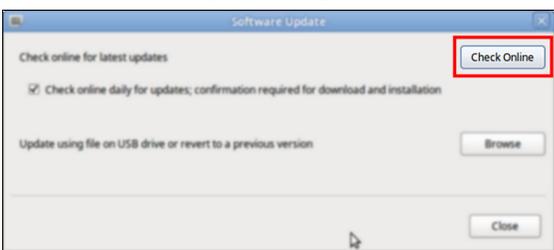


Figure 2-2: Software Update dialog box.

4. Select **Install**.

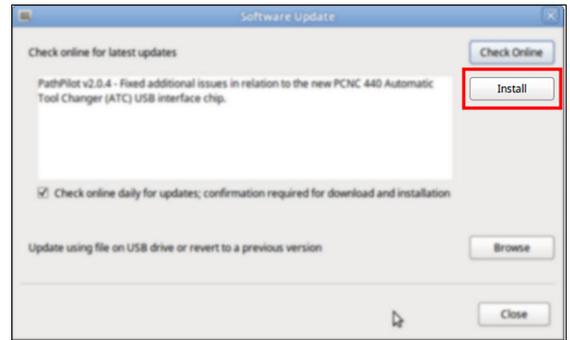


Figure 2-3: Install button on the Software Update dialog box.

The update file is downloaded, and a notification dialog box displays.

5. From the dialog box, select **OK**.

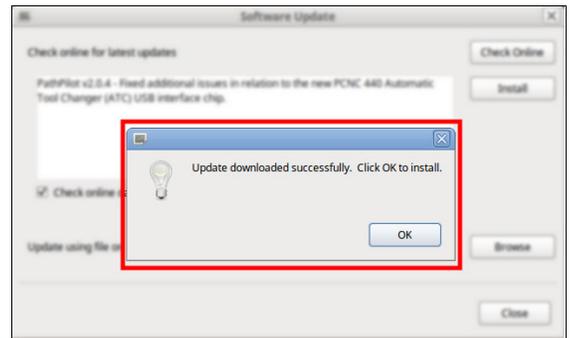


Figure 2-4: OK button on the dialog box.

The update file is installed on the PathPilot controller.

6. Follow the on-screen instructions to restart the PathPilot controller.

Install an Update File from a USB Drive

1. From tormach.com/pp-updates, download the most recent PathPilot update file.
2. Transfer the PathPilot update file to a USB drive.
3. Put the USB drive into the PathPilot controller.
4. Confirm that the PathPilot controller is powered on and out of **Reset** mode.

- From the PathPilot interface, on the **Status** tab, select **Update**.

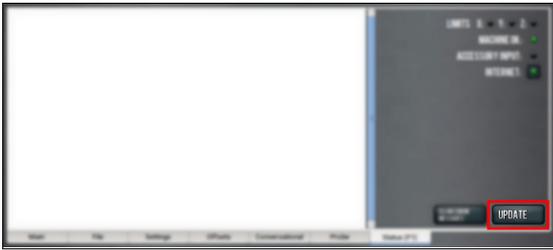


Figure 2-5: Update button on the Status tab.

- From the **Software Update** dialog box, select **Browse**.

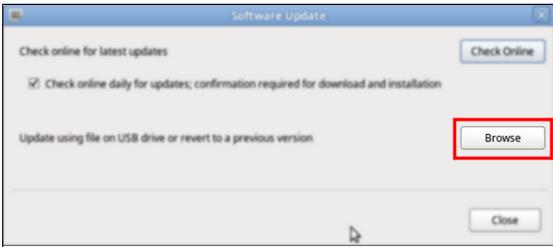


Figure 2-6: Software Update dialog box.

- From the **Browse** dialog box, select **USB**.



Figure 2-7: Browse dialog box.

- Select the desired update file, and then select **Update**.

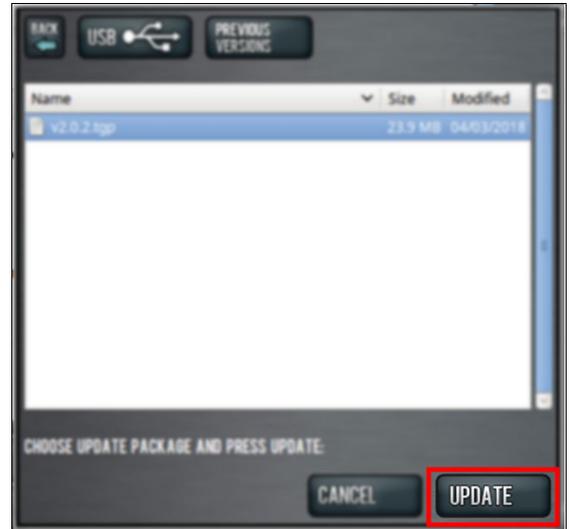


Figure 2-8: Update button.

The update file is installed on the PathPilot controller.

- Follow the on-screen instructions to restart the PathPilot controller.

2.1.2 Prepare the Machine

- If there's a tool holder in the spindle, remove it.
- Remove any accessories or fixtures from the machine table.
- Center the machine table: from the PathPilot interface, in the **MDI Line DRO** field, type `G20 G53 G1 X7 Y-3.75 Z0 F20`. Then select the **Enter** key.

⚠ WARNING! Electrical Shock Hazard: You must power off the machine before making any electrical connections. If you don't, there's a risk of electrocution or shock.

- Power off the machine and the PathPilot controller.
 - Push in the Emergency Stop button on the operator panel, which removes power to motion control.
 - From the PathPilot interface, select **Exit**.
 - Turn the Main Disconnect switch to **OFF** on the side of the electrical cabinet.

2.1.3 Install the Automatic Tool Changer (ATC)

Complete the following steps in the order listed:

Disassemble the Coolant Hose	5
Install the Air Cylinder	5
Mount the Automatic Tool Changer (ATC) Bracket	6
Install the Main Assembly	6

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Level the Automatic Tool Changer (ATC).....	7
Make Air Connections.....	9
Make Electrical Connections.....	9
Verify the Installation.....	13
Adjust the Power Drawbar.....	14

Disassemble the Coolant Hose

Use the provided kit to disassemble and relocate the coolant hose.

To disassemble the coolant hose:

1. Find and read the machine serial number. Depending on your specific machine, do one of the following:
 - **Serial Number 80075 and Below** Go to Step 2.
 - **Serial Number 80076 and Above** Go to Step 4.
2. Use the relocation bracket as a template: put it behind the spindle — verifying that it's flush with the right edge of the spindle head — and then use a marker to mark the location of its holes.



Figure 2-9: Relocation bracket used as a template to mark the hole locations.

3. Drill and tap a hole for a 6 mm screw in the locations that you marked in Step 2.
4. Remove the 1/4-in. coolant hose and the coolant hose mount bracket from the side of the spindle head, and then set both aside.

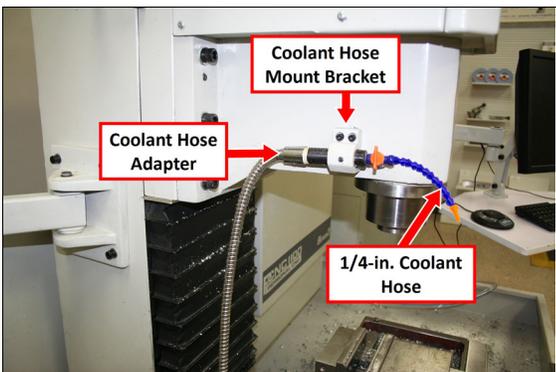


Figure 2-10: Flood coolant kit installed on the spindle head.

5. Attach the coolant hose mount bracket to the relocation bracket with the two screws from the coolant hose mount bracket.

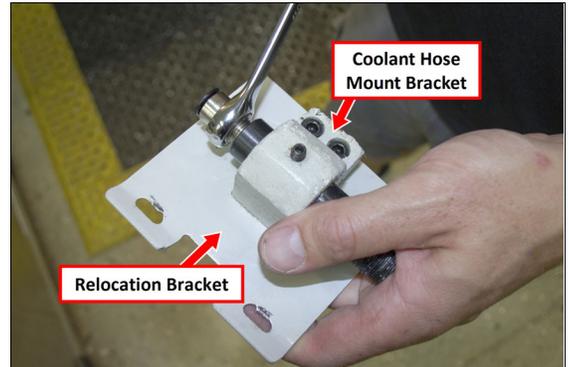


Figure 2-11: Coolant hose mount bracket attached to the relocation bracket.

6. Attach the relocation bracket below the spindle head.



Figure 2-12: Relocation bracket mounted below the spindle head.

Install the Air Cylinder

1. Attach the air cylinder on to the ATC main assembly.

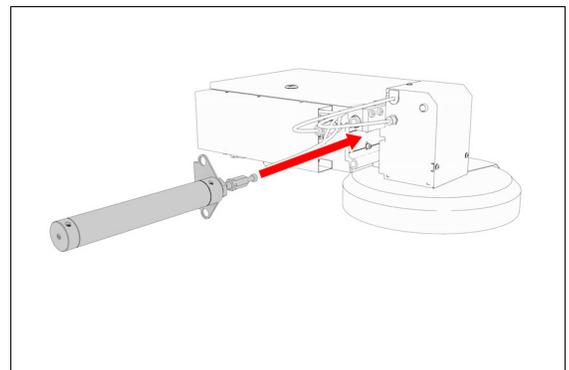


Figure 2-13: Putting the air cylinder into the ATC main assembly.

- Secure the air cylinder to the ATC main assembly with a 12 mm hex wrench (provided) and two M14 × 20 mm socket head cap screws.

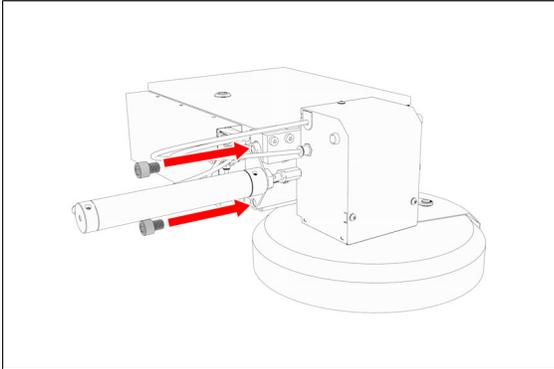


Figure 2-14: Putting the air cylinder hardware into the air cylinder.

- Connect the air lines from the ATC main assembly to the air cylinder as follows:
 - Connect the short air line to the front of the cylinder.
 - Connect the long air line to the back of the cylinder.

Mount the Automatic Tool Changer (ATC) Bracket

- Identify the four provided standoffs that are used to mount the ATC to the Z-column:
 - Three fixed standoffs
 - One tilt standoff
- Remove the flange nuts and the washers from the standoffs, and then set them aside.
- Identify and remove the four set screws on the Z-column with a flat-blade screwdriver.
- Install the four standoffs on the Z-column as shown in the following image.

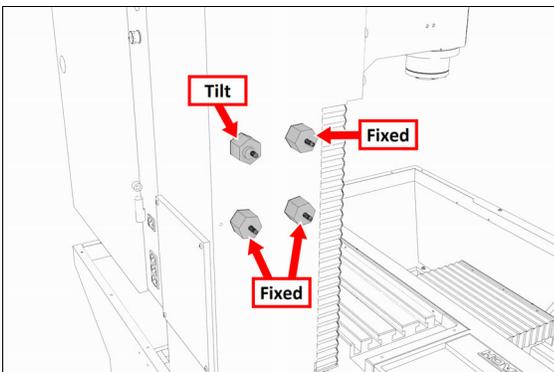


Figure 2-15: Four standoffs installed on the Z-column.

- Securely tighten the standoffs on the Z-column with a 1-1/2 in. adjustable wrench.

- Put the ATC mounting bracket on the standoff's threaded studs as shown in the following image.

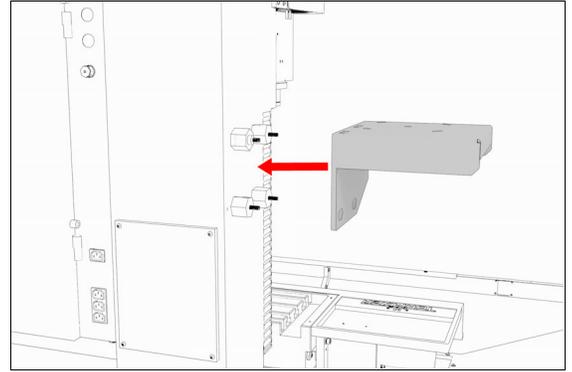


Figure 2-16: ATC mounting bracket moving on to the four standoffs.



Note: Verify that the tilt standoff's eccentric cam fits into the large slot on the ATC mounting bracket.

- Secure the bracket by reinstalling the washers and flange nuts that you removed in Step 2 with a 13 mm socket.
- Pull the bracket toward the front of the machine. You'll make adjustments to the location of the bracket later in this procedure, but we recommend starting with it moved forward.

Install the Main Assembly

- Remove the four preinstalled M8 × 1.25 - 16 mm socket head cap screws and washers from the bottom of the ATC electrical cabinet. Then, set all aside for later use.



CAUTION! Team Lift Required: You must have the aid of more than one person to lift and move the object. The object is heavy, and lifting it by yourself can cause serious injury.

- Lift the ATC main assembly on to the mounting bracket.

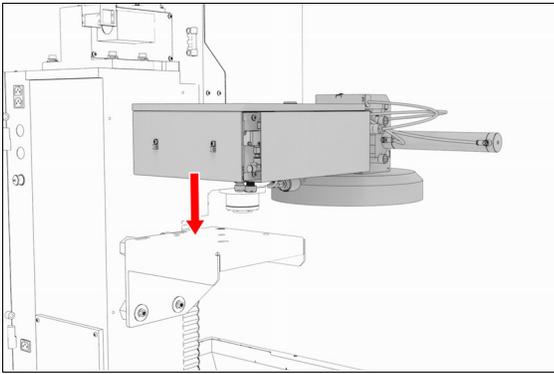


Figure 2-17: ATC main assembly positioned above the mounting bracket.

- Align the locating pin on the ATC main assembly with the matching hole in the mounting bracket.
- Secure the ATC main assembly to the mounting bracket with the four M8 × 1.25 - 16 mm socket head cap screws and washers that you set aside in Step 1.

Level the Automatic Tool Changer (ATC)

This section gives instructions to roughly level the ATC on the machine by using a long, straight rod. More adjustments are made later in the installation procedure.

NOTICE! After the initial installation, you must level the ATC. If you don't, there's a risk of machine damage.

Complete the following steps in the order listed:

Prepare the Machine.....	7
Examine Perpendicularity in the Y Direction.....	7
Examine Perpendicularity in the X Direction.....	8
Examine the Alignment of the Carousel Door Opening.....	8

Prepare the Machine

- Push the tool tray toward the spindle.

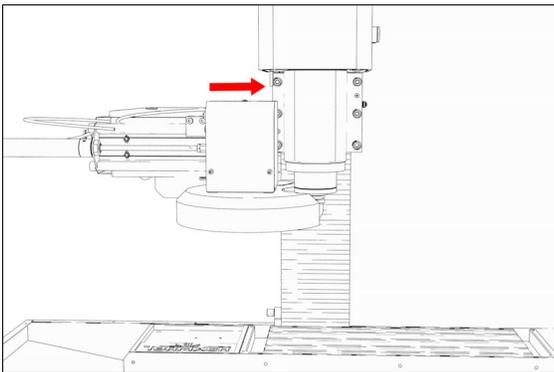


Figure 2-18: Tool tray moved in toward the spindle.

- Verify that the linear bearing on the ATC is flush with the ATC main assembly.

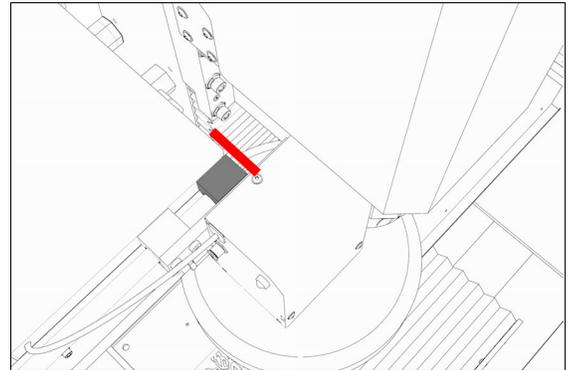


Figure 2-19: Linear bearing flush with the ATC main assembly.

- Find a straight rod between 8 in. and 12 in. (203 mm and 305 mm) long. Verify that it's straight: roll it on a known flat surface (like a granite surface plate).



Note: You'll use the rod to verify that the ATC is correctly installed on the mill, so it must be straight.

- Put the alignment rod into a tool holder.
- Put the tool holder into the fork so that the groove in the tool holder slides into the fork. Don't rest the tool holder on top of the fork.

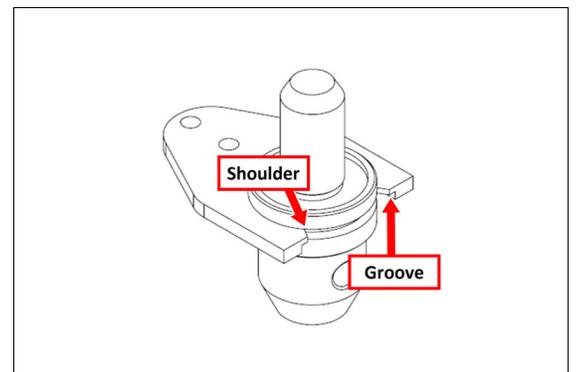


Figure 2-20: Groove on a Tormach Tooling System (TTS) aligned with the shoulder of an ATC fork.

- Put a machinist's square on the machine table.

Examine Perpendicularity in the Y Direction

- Verify that the rod is perpendicular to the machine table in the Y direction: compare the rod's position to the vertical edge of the machinist's square.

- If the rod is perpendicular to the vertical edge of the machinist's square, go to "Examine Perpendicularity in the X Direction" (below).
 - If the rod must be adjusted, go to Step 2.
2. Loosen the flange nuts on the standoffs.
 3. Turn the tilt standoff with an adjustable wrench, and slowly pivot the ATC until the rod is perpendicular to the vertical edge of the machinist's square.

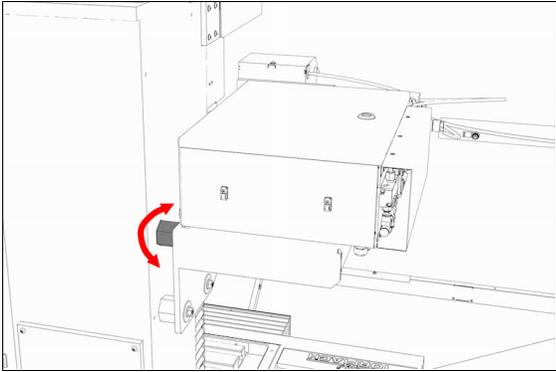


Figure 2-21: Tilt standoff.

4. Tighten the flange nuts with a 13 mm socket.
5. Reexamine the alignment of the ATC in the Y direction. If the rod isn't perpendicular to the vertical edge of the machinist's square, repeat Steps 2 through 5.

Examine Perpendicularity in the X Direction

1. Verify that the rod is perpendicular to the machine table in the X direction: compare the rod's position to the vertical edge of the machinist's square.
 - If the rod is perpendicular to the vertical edge of the machinist's square, go to "Examine the Alignment of the Carousel Door Opening" (below).
 - If the rod must be adjusted, go to Step 2.
2. Loosen the two socket head cap screws on the linear rails.

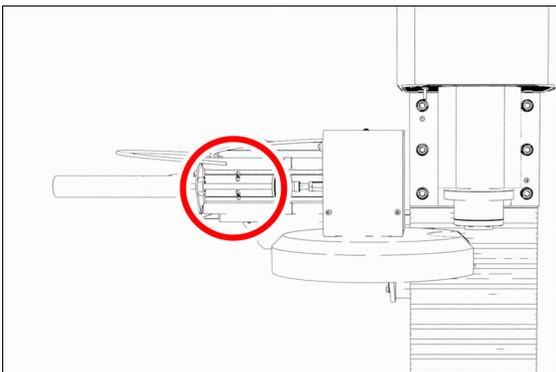


Figure 2-22: Socket head cap screws on the linear rails.

3. Slowly pivot the linear rails up or down until the rod is perpendicular to the vertical edge of the machinist's square.
4. Tighten the socket head cap screws.
5. Reexamine the alignment of the ATC in the X direction. If the rod isn't perpendicular to the vertical edge of the machinist's square, repeat Steps 2 through 5.

Examine the Alignment of the Carousel Door Opening

1. Remove the tool holder from the fork, and set it aside.



Note: You'll need this tool later in the installation procedure to make further alignments.

2. Power on the machine and the PathPilot controller.
 - a. Turn the Main Disconnect switch to **ON** on the side of the electrical cabinet.
 - b. Twist out the Emergency Stop button on the operator panel, which enables movement to the machine axes and the spindle.
 - c. Press the Reset button on the operator panel.
 - d. Bring the machine out of reset and reference it.
3. Verify that the ATC is all the way forward (toward the spindle), and then slowly move the Z-axis down (-Z) to examine the clearance of the carousel door opening.
4. Verify that the carousel door opening is approximately equal to the front back and left of the spindle mounting flange:
 - If the carousel door opening is approximately equal, go to Step 8.

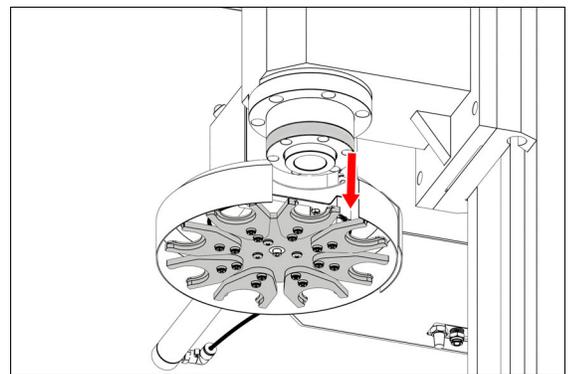


Figure 2-23: Distance between the carousel door opening and the spindle mounting flange.

- If the carousel door opening must be adjusted, go to Step 5.

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- Loosen the four socket head cap screws that secure the ATC main assembly to the mounting bracket with a 6 mm hex wrench.

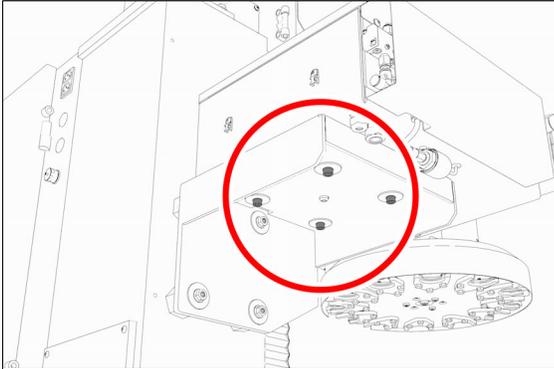


Figure 2-24: Socket head cap screws securing the ATC main assembly to the mounting bracket.

- Adjust the carousel door opening as required:
 - If the Carousel Door Opening is Contacting the Front**
Pivot the ATC around the locating pin on the bottom of the mounting bracket toward the front of the machine (closer to you).
 - If the Carousel Door Opening is Contacting the Back**
Pivot the ATC around the locating pin on the bottom of the mounting bracket toward the back of the machine (closer to the machine column).
 - If the Carousel Door Opening is Contacting the Left**
Loosen the four flange nuts that attach the mounting bracket to the column to move the bracket forward or backward.

Note: Moving the ATC mounting bracket could change the position of the tilt standoff (on the Z-column). If you move it, you must verify that the ATC is still correctly installed; go to "Examine Perpendicularity in the Y Direction" (page 7).

Repeat this step as needed.

- Tighten the socket head cap screws and the flange nuts (if you loosened them in Step 5).
- Move the tool tray to its retracted position.
- Center the machine table: from the PathPilot interface, in the **MDI Line** DRO field, type G20 G53 G1 X7 Y-3.75 Z0 F20. Then select the **Enter** key.
- Power off the machine and the PathPilot controller.

- Push in the Emergency Stop button on the operator panel, which removes power to motion control.
- From the PathPilot interface, select **Exit**.
- Turn the Main Disconnect switch to **OFF** on the side of the electrical cabinet.

Make Air Connections

- Cut the cable tie that secures the ATC cables and plastic tubes together with snips.
- Route the loose ends of the two 1/4 in. plastic tubes connected to the ATC main assembly through the enclosure knockout, up the energy chain, and toward the Power Drawbar.

WARNING! Crush Hazard: If the ATC isn't completely retracted, it could move once the air is reconnected. When you reconnect the air, you must keep your hands away from the ATC.

- Connect the loose ends of the 1/4 in. plastic tubes in the following order:
 - Connect the Retract (PDB Bottom) airline to the bottom push-to-connect elbow on the Power Drawbar.
 - Connect the Advance (PDB Top) airline to the top push-to-connect elbow on the Power Drawbar
 - Connect the air supply line from the FRL to the air in port in the ATC main assembly, as shown in the following image.

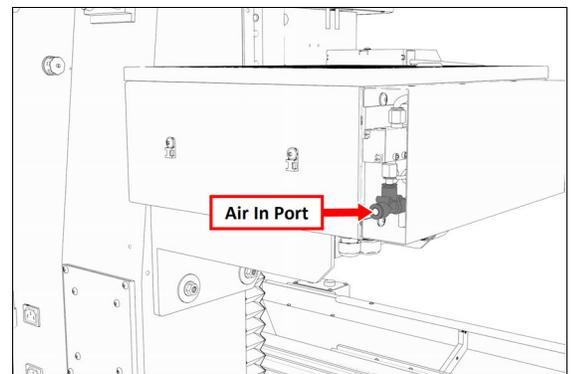


Figure 2-25: Air in port in the ATC main assembly.

- If you haven't already done so, connect your shop's air supply to the FRL.

Make Electrical Connections

Complete the following steps in the order listed:

Rewire the Power Drawbar Board 10

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Connect the ATC Legacy Adapter Cable.....	10
Rewire the ATC Board.....	13

Rewire the Power Drawbar Board

If you previously installed the Power Drawbar board, you must rewire it.

To rewire the Power Drawbar board:

WARNING! Electrical Shock Hazard: You must power off the machine before making any electrical connections. If you don't, there's a risk of electrocution or shock.

1. Power off the machine and the PathPilot controller.
 - a. Push in the Emergency Stop button on the operator panel, which removes power to motion control.
 - b. From the PathPilot interface, select **Exit**.
 - c. Turn the Main Disconnect switch to **OFF** on the side of the electrical cabinet.
2. Open the electrical cabinet door.
3. Locate blue wires 105 and 105A on the terminal block in the electrical cabinet.

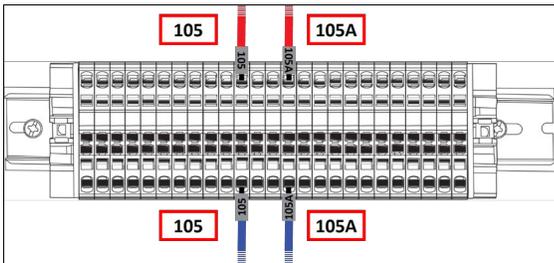


Figure 2-26: Current wire configuration on the terminal block.

4. Remove blue wires 105 and 105A.
5. Locate red wire 105A on the terminal block. Then, remove it.



Note: During the original procedure to install the Power Drawbar, wire 105 was given a new label, making it wire 105A.

6. Connect red wire 105A to the slot opposite red wire 105 on the terminal block.

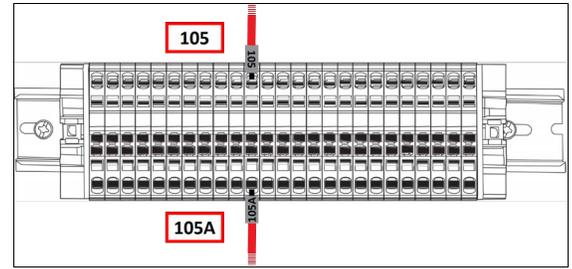


Figure 2-27: New wire configuration on the terminal block.

7. In the Power Drawbar control assembly box, locate the blue spindle door interlock wires on the Power Drawbar board. Then, unplug them.

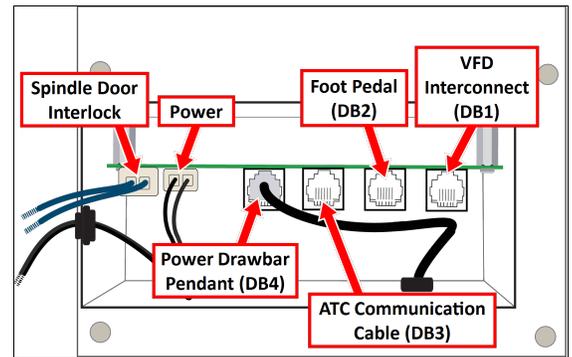


Figure 2-28: Current wire configuration on the Power Drawbar board.

8. Pull the loose blue spindle door interlock wires from the Power Drawbar control assembly box, through the Z column, and out of the machine. Then, discard them.
9. In the Power Drawbar control assembly box, locate the power wire connector on the Power Drawbar board. Then, unplug it.
10. Pull the loose power wire from the Power Drawbar control assembly box and out of the machine. Then, discard it.
11. In the Power Drawbar control assembly box, locate the VFD interconnect cable (from DB1) on the Power Drawbar board. Then, unplug it.

Connect the ATC Legacy Adapter Cable

1. Connect the ATC Legacy Adapter Cable to the ATC power cable on the main assembly.
2. Route the loose wires from the ATC Legacy Adapter Cable out of the enclosure and toward the electrical cabinet on the back of the machine.

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3. Use any open access hole in the bottom of the electrical cabinet to route the loose wires into the electrical cabinet.

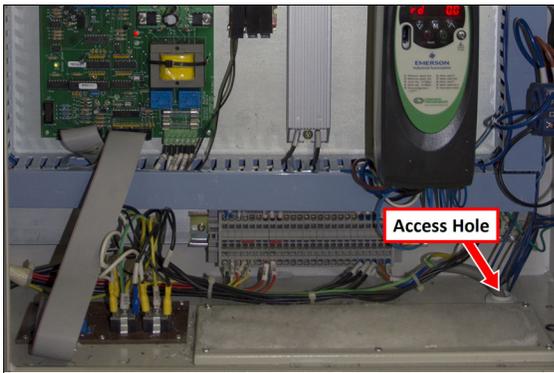


Figure 2-29: Access hole in the bottom of the electrical cabinet.

4. Remove the wire trough covers in the electrical cabinet.
5. Identify wires T1 and B5 on the ATC Legacy Adapter Cable. Then, route them through the wire troughs toward the variable frequency drive (VFD).

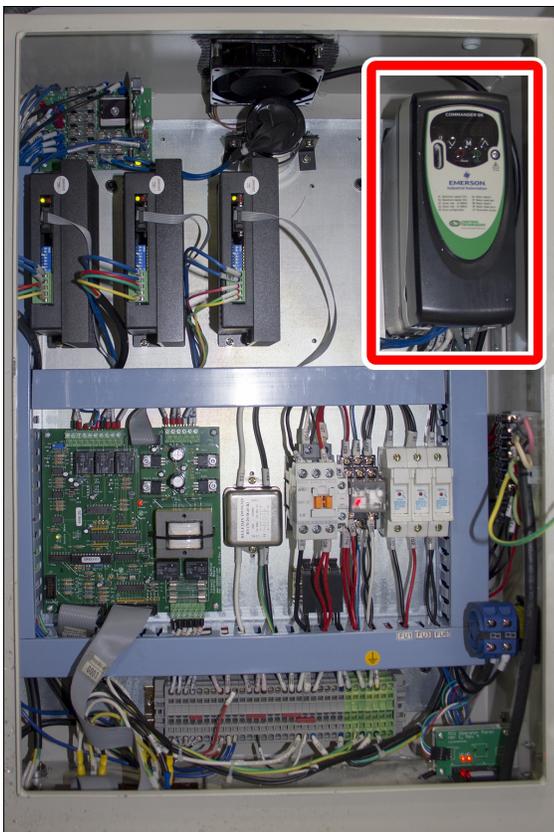


Figure 2-30: VFD in the electrical cabinet.

6. Use a Phillips screwdriver to remove the cross-head screw on the VFD, and then remove the VFD faceplate.



Figure 2-31: Removing the faceplate from the VFD.

7. If you previously installed the Power Drawbar board, you must remove the VFD interconnect cable. Identify it on the VFD and remove it. Then, pull the loose cable out of the machine, and discard it.



Figure 2-32: VFD interconnect cable connected to the VFD.

8. Identify slots T1 and B5 on the VFD. You'll make connections in both slots to connect the ATC Legacy Adapter Cable.

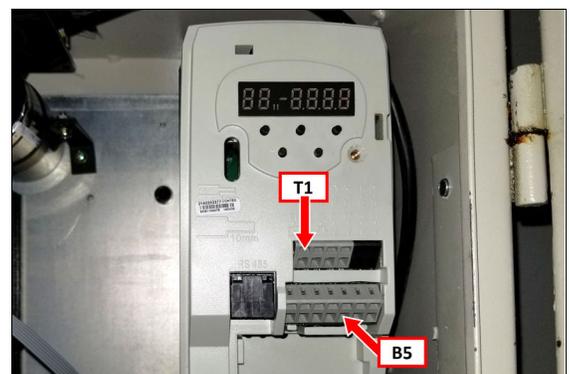


Figure 2-33: Slot identification on the VFD.

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- Remove wire T1 from the VFD, and then insert it in to the open slot in the T1 lever nut on the ATC Legacy Adapter Cable.



Note: If you have an (optional) load meter, your VFD has an extra wire in slot T1. Remove it from the VFD, and then insert it into the remaining open slot in the T1 lever nut on the ATC Legacy Adapter Cable.

- Completely push the lever down on the T1 lever nut to latch the wire. Verify that the lever is latched.
- Connect the loose wire from the T1 lever nut in to slot T1 on the VFD.

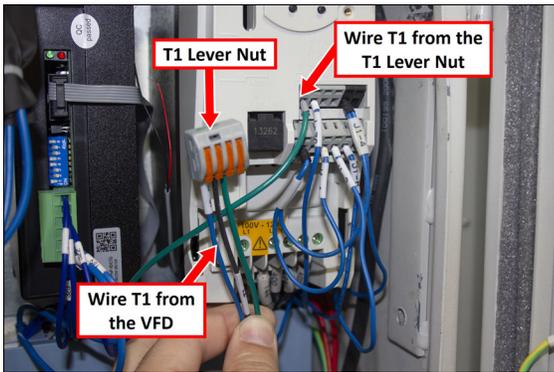


Figure 2-34: T1 lever nut connected to slot T1 on the VFD.

- Remove wire B5 from the VFD, and then insert it in to the B3/B5 lever nut on the ATC Legacy Adapter Cable. Push the lever down on the B3/B5 lever nut to latch the wire. Then, connect the loose wire from the B3/B5 lever nut in to slot B5 on the VFD.
- Replace the VFD faceplate.
- Identify the green and yellow ground wire on the ATC Legacy Adapter Cable. Then, route it through the wire troughs toward the ground terminal block.



Figure 2-35: Terminal block in the electrical cabinet.

- Connect the ground wire in to any open slot on the ground terminal block.

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16. Identify wires 503 and 504 on the ATC Legacy Adapter Cable. Then, route them through the wire troughs toward the DC-BUS board.



Figure 2-36: DC-BUS board in the electrical cabinet.

17. Connect wire 503 to the TC+ terminal on the DC-BUS board.
18. Connect wire 504 to the TC- terminal on the DC-BUS board.

Rewire the ATC Board

1. Unlock and open the lid on the ATC main assembly with a large, flat-blade screwdriver.
2. Identify the J10 connector on the ATC board, and then unplug it from the board.

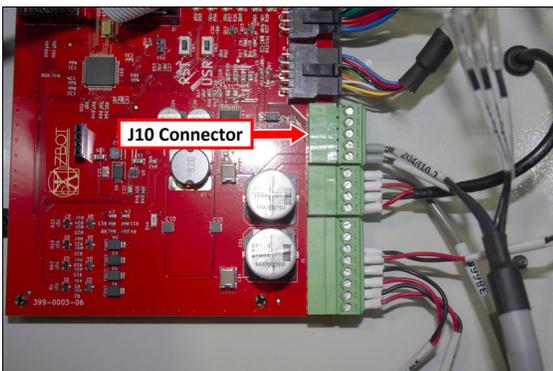


Figure 2-37: J10 connector on the ATC board.

3. Identify the loose ends of wires 403, 408, and GND.

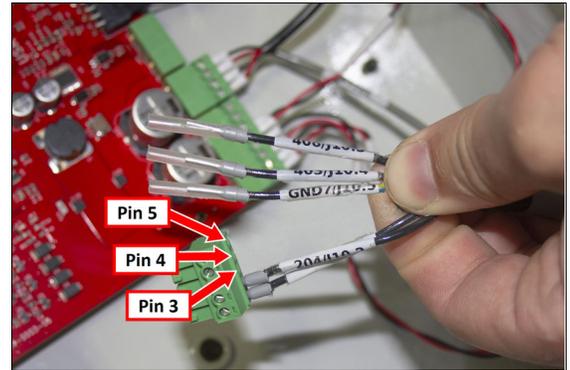


Figure 2-38: Loose wires on the J10 connector from the ATC board.

4. Remove the plastic wire protectors from the ferrule ends.
5. Use a small, flat-blade screwdriver to connect the following wires to the J10 connector:
 - Wire 408 to pin 3
 - Wire 403 to pin 4
 - Wire GND to pin 5
6. Plug the J10 connector back in the ATC board.
7. Close the lid on the ATC main assembly and lock it.

Verify the Installation

1. Power on the machine and the PathPilot controller.
 - a. Turn the Main Disconnect switch to **ON** on the side of the electrical cabinet.
 - b. Twist out the Emergency Stop button on the operator panel, which enables movement to the machine axes and the spindle.
 - c. Press the Reset button on the operator panel.
 - d. Bring the machine out of reset and reference it.
2. If you have not yet done so, you must make sure that the PathPilot controller is updated to the latest version of PathPilot.
For information, see "Update PathPilot" (page 3).

- From the PathPilot interface, on the **Settings** tab, select the **ATC** radio button.

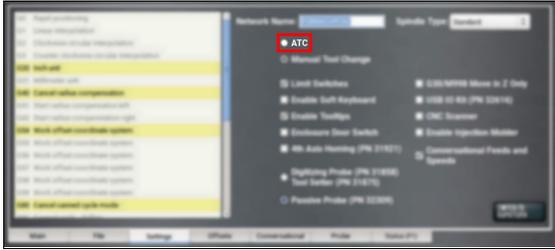


Figure 2-39: ATC radio button on the Settings tab.

The **ATC** tab appears in the PathPilot interface.



Note: If prompted, you may need to update the firmware for the ATC. Follow the on-screen instructions.

- Load a tool into the spindle:
 - Push and hold the collet open button on the side of the ATC.



Figure 2-40: Collet open button on the side of the ATC.

The collet opens.

- Load a tool into the spindle.
 - Release the button.
The collet closes.
- From the PathPilot interface, on the **Main** tab, in the **RPM** DRO field, type 1000. Then select the **Enter** key.
 - Select **FWD**.
The spindle starts.
 - From the **Status** tab, make sure that the **VFD Running** green light comes on.

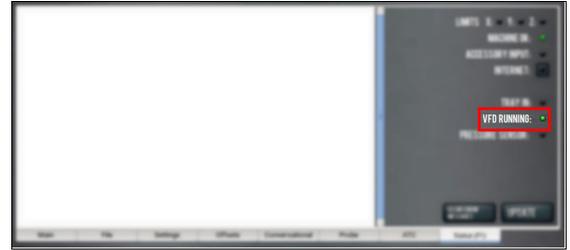


Figure 2-41: VFD Running light on the Status tab.



Note: If the VFD Running light did not come on in the previous step, we can help. Email support@tormach.com to contact Tormach Technical Support for guidance on how to proceed.

- Select **Stop**.
The spindle stops.

Adjust the Power Drawbar

If you have not yet done so, you must adjust the Power Drawbar. Complete the following steps in the order listed:

Adjust the Drawbar Tension	14
About Drawbar Tension	15
Adjust the Initial Setup	15

Adjust the Drawbar Tension

This adjustment sets the highest possible drawbar tension while still allowing the Power Drawbar cylinder to release the tool. For information, see "About Drawbar Tension" (on the next page).

NOTICE! After the initial installation, you must examine the drawbar tension weekly. During periods of heavy use, examine the drawbar tension more frequently. If you don't, there's a risk of tool pull-out.

To adjust the drawbar tension:

- Put an empty Tormach Tooling System (TTS) tool holder into the collet.
- While using one hand to support the tool holder, use the other to push the Release Tool button.

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- Depending on whether the tool holder releases or not, do one of the following:
 - If the Tool Holder Releases** Tighten the Power Drawbar in quarter-turn increments with two adjustable wrenches. After each turn, push the Release Tool button. Stop when the tool holder does not release. Then, loosen the Power Drawbar one quarter-turn with two adjustable wrenches.
 - If the Tool Holder Doesn't Release** Loosen the Power Drawbar in quarter-turn increments with two adjustable wrenches while pushing the Release Tool button. Stop when the tool holder releases.
- Make a visual reference to help you set or adjust the drawbar tension in the future: use a paint pen to make a witness mark on both the head of the drawbar and the end of the spindle.

About Drawbar Tension

While machining, the Tormach Tooling System (TTS) collet holds a Tormach Tooling System (TTS) tool holder in the spindle by applying a clamping force to both the shank and the shoulder of the tool. The tension force that is applied to the drawbar pulls the Tormach Tooling System (TTS) collet into the spindle taper, which then applies the clamping force to the Tormach Tooling System (TTS) tool.

The force on the drawbar — known as drawbar tension — is applied differently depending on the tool changing method:

- Automatic (using the Power Drawbar)** Tension is applied by the compressed spring washers.
- Manual** Tension is applied when you tighten the drawbar into the collet using a wrench.

Adjust the Initial Setup

In this adjustment, you'll verify that there's enough clearance between the end of the drawbar and the Power Drawbar cylinder.

NOTICE! If you don't do this adjustment, there's a risk that the drawbar can loosen, or that operations can be louder than normal.

- Examine the space between the hex head screw on the Power Drawbar cylinder's rod and the top of the drawbar.

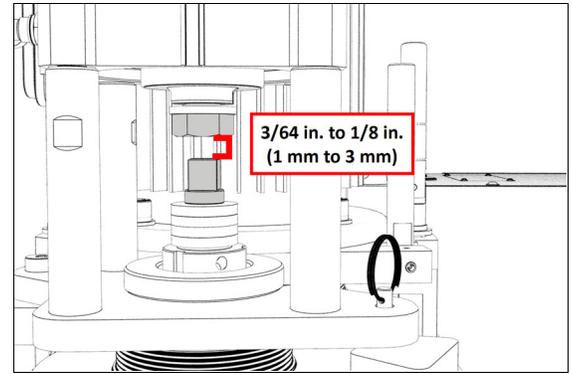


Figure 2-42: Correctly spaced drawbar and Power Drawbar cylinder.

- Verify that the gap is between 3/64 in. and 1/8 in. (1 mm and 3 mm). Depending on the size of the gap, do one of the following:
 - Between 3/64 in. and 1/8 in. (1 mm and 3 mm)** You have completed adjusting the initial setup. Go to Operation.
 - Less Than 3/64 in. (1 mm)** Go to Step 3.
- Disconnect the shop's air supply from the Power Drawbar button.
- Pull out the quick-release pin.
- Pivot the Power Drawbar cylinder assembly to the left so that you can access the Power Drawbar cylinder's rod.

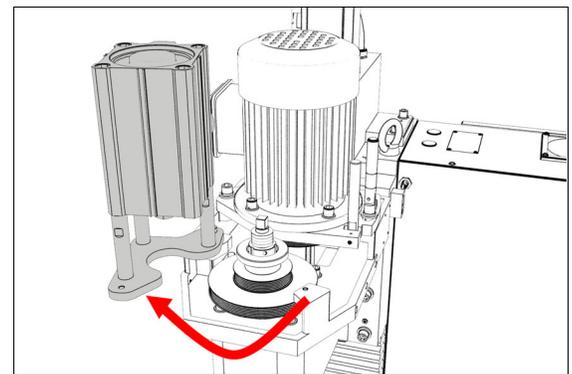


Figure 2-43: Power Drawbar cylinder pivoted to the left.

- Remove the hex head screw on the Power Drawbar cylinder's rod with an adjustable wrench, and set it aside.

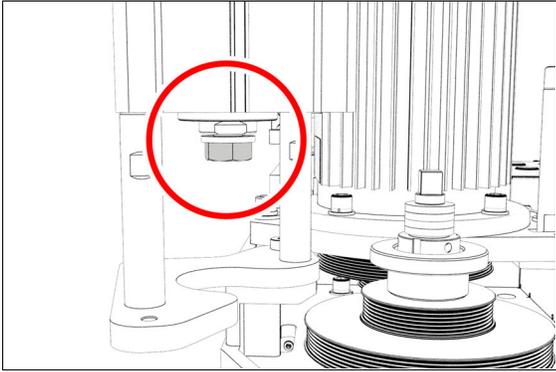


Figure 2-44: Hex head screw on the Power Drawbar cylinder's rod.

- Remove the M16 washer from the Power Drawbar cylinder's rod, and set it aside.

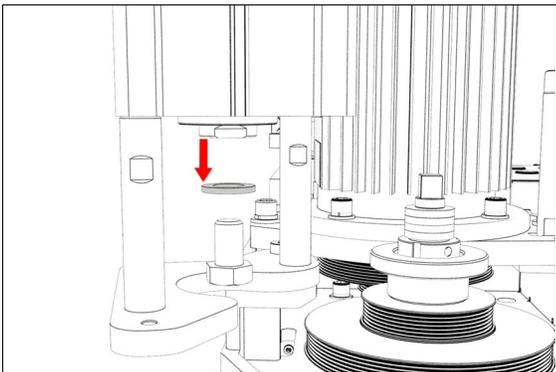


Figure 2-45: M16 washer removed from the Power Drawbar cylinder's rod.

- Put the hex head screw back in, and then tighten it completely with an adjustable wrench.
- Pivot the Power Drawbar cylinder to the original location.
- Push in the quick-release pin.
- Reconnect the shop's air supply to the Power Drawbar button.
- Examine the space between the hex head screw on the Power Drawbar cylinder's rod and the top of the drawbar.
- Verify that the gap is between 3/64 in. and 1/8 in. (1 mm and 3 mm). Depending on the size of the gap, do one of the following:
 - Between 3/64 in. and 1/8 in. (1 mm and 3 mm)** You have completed adjusting the initial setup. Go to Operation.
 - Less Than 1/8 in. (1 mm)** Go to Step 14.
- Find the three provided M14 flat washers.

- Put one M14 flat washer under each mounting post on the Power Drawbar cylinder.

2.1.4 Make Final Alignments to the Automatic Tool Changer (ATC)

Complete the following steps in the order listed:

Adjust the Tool Tray Load Position	16
Verify the Alignment	17
Set the Tool Change Height	17
Adjust for Rotational Play	17

Adjust the Tool Tray Load Position

- Verify that there's no tool in the spindle.
- From the PathPilot interface, on the ATC tab, select **Ref Tool Tray**.

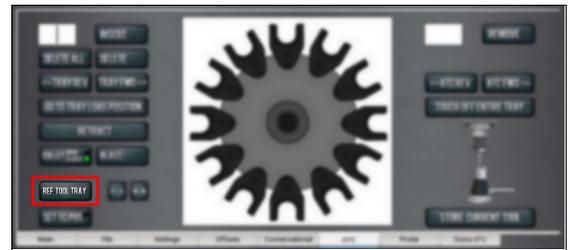


Figure 2-46: Ref Tool Tray button on the ATC tab.

The tool tray spins.



Note: You're only required to reference the tool tray once, unlike the mill axes' referencing procedure.

- Select **Go to Tray Load Position**.

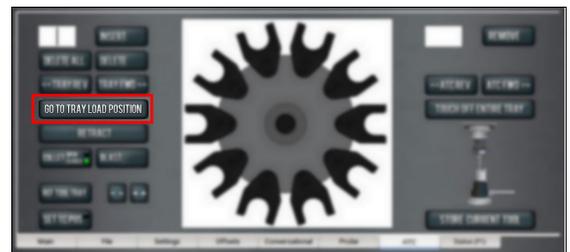


Figure 2-47: Go to Tray Load Position button on the ATC tab.

- When prompted, select **OK**.
The tool tray moves forward.
- Put the tool holder with the rod into the fork.
- From the PathPilot interface, slowly jog the Z-axis down (-Z) to bring the spindle nose toward the tool in the tool tray.
- Make sure that the tool's shank is aligned concentrically with the collet in the spindle.

8. If the tool's shank isn't aligned, do the following:
 - **Adjust the Alignment of the Tool in the Y Direction (toward or away from the Z column)** Determine if the tray must move clockwise or counterclockwise. From the PathPilot interface, in the **ATC** tab, either select -- to step the tool tray counterclockwise or ++ to step the tool tray clockwise.

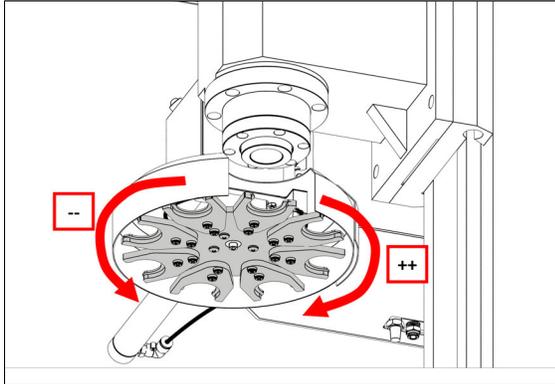


Figure 2-48: Moving the tool tray clockwise or counterclockwise.

- **Adjust the Alignment of the Tool in the X Direction (left or right)** Determine if the tray must move left or right. Use two wrenches to loosen the jam nut on the end of the cylinder rod, making sure that you don't spin the rod end when adjusting the jam nut. Then, either turn the rod end one-half turn further on to the cylinder rod to move the tool tray to the left, or turn it one-half turn off of the cylinder rod to move the tool tray to the right. Once finished, tighten the jam nut.

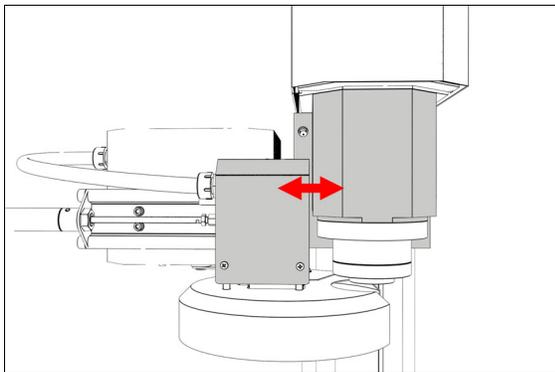


Figure 2-49: Moving the tool tray left or right.

Repeat adjustments until the tool's shank is concentric with the collet in the spindle.

9. From the PathPilot interface, on the **ATC** tab, select **Retract**.

Verify the Alignment

1. From the PathPilot interface, select **Go to Tray Load Position**.
2. Slowly jog the Z-axis down (-Z) over the tool's shank.
3. Verify that the tool's shank moves freely into the collet.
4. Depending on the tool's shank movement, do one of the following:
 - **Moves Freely** Go to "Set the Tool Change Height" (page 20).
 - **Doesn't Move Freely** This indicates that the ATC is misaligned and you must realign it. Go to "Adjust the Tool Tray Load Position" (on the previous page).

Set the Tool Change Height

1. From the PathPilot interface, slowly jog the Z-axis down (-Z) over the tool. Stop jogging when the spindle nose just makes contact with the shoulder of the tool holder.
2. On the **ATC** tab, select **Set TC POS**.

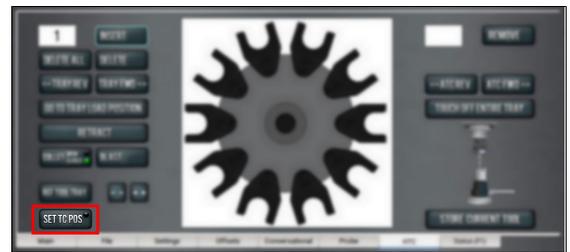


Figure 2-50: Set TC POS button on the ATC tab.

The tool change position is set.

Adjust for Rotational Play

There's a small amount of rotational play built into the Automatic Tool Changer (ATC) carousel. This play allows for some misalignment during tool changes, and you must adjust for it in both directions. The taper on the tool shank also helps align the tool during a tool change.

To adjust for rotational play:

1. From the PathPilot interface, on the **ATC** tab, select **Tray Fwd** to rotate the tray clockwise (forward) one full tool slot.



Figure 2-51: Tray FWD and Tray REV buttons on the ATC tab.

2. Select **Tray Rev** to rotate the tray counterclockwise (backward) one full tool slot.
3. Verify that the tool's shank is aligned with the collet in the spindle.
4. Depending on the alignment, do one of the following:
 - **Aligned** You have completed aligning the ATC. Remove the tool from the fork. Go to "Operation" (page 19).
 - **Not Aligned** You must readjust the tool tray rotation. Go to "Adjust the Tool Tray Load Position" (page 16).

3.1 OPERATION

Note: Make sure that there's always a tool holder in the collet while the machine is not in use. Retracting the Power Drawbar to the clamped position with no tool holder in the collet will eventually fatigue the collet, and may shorten its service life. For more information, refer to the Power Drawbar documentation.

Read the following sections to understand how to operate the ATC:

- 3.1.1 Assign Tool Numbers 19
- 3.1.2 Automatically Load a Tool into the Tool Tray 19
- 3.1.3 Automatically Unload a Tool From the Tool Tray 19
- 3.1.4 Load a Tool into the Spindle 19
- 3.1.5 Manually Load a Tool Into the Tool Tray 20
- 3.1.6 Manually Unload a Tool From the Tool Tray 20
- 3.1.7 Retrieve a Tool From the Tool Tray 20
- 3.1.8 Set the Tool Change Height 20
- 3.1.9 Switch to Manual Tool Changes 21

3.1.1 Assign Tool Numbers

- Use any tool number, from 1-1000, to assign a position in the tool tray.

3.1.2 Automatically Load a Tool into the Tool Tray

1. Load a tool into the spindle.
2. From the PathPilot interface, on the **ATC** tab, type the tool number in the **Tool DRO** field. Then select the **Enter** key.
3. Select **Store Current Tool**.

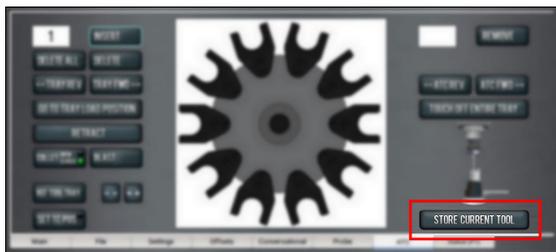


Figure 3-1: Store Current Tool button on the ATC tab.

The tool is assigned to the nearest open slot. The ATC fetches the tool from the spindle and stores the tool in the tray. When stored, the tool number displays on the tray image in the center of the screen.

4. Click **Retract**.

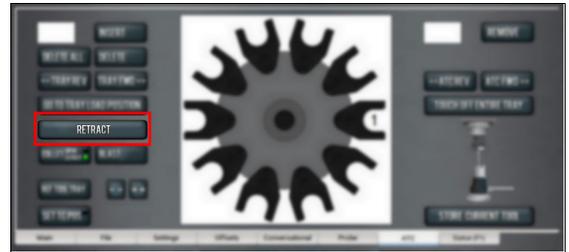


Figure 3-2: Retract button on the ATC tab.

The tray returns to the machining position.

3.1.3 Automatically Unload a Tool From the Tool Tray

Note: Typing a new tool number in the **Tool DRO** field doesn't remove the tool from its tray assignment.

1. From the PathPilot interface, on the **ATC** tab, type the tool number in the **Remove DRO** field. Then select the **Enter** key.

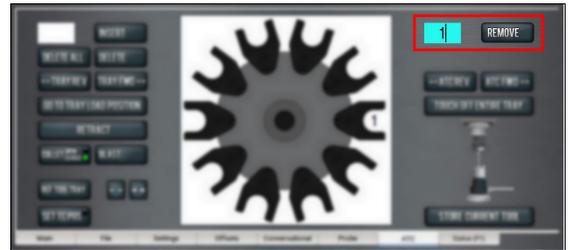


Figure 3-3: Remove DRO field on the ATC tab.

2. Select **Remove**.
The ATC fetches the tool from the tray.
3. Unload the tool from the spindle.
4. From the **ATC** tab, select **ATC FWD** or **ATC REV**.

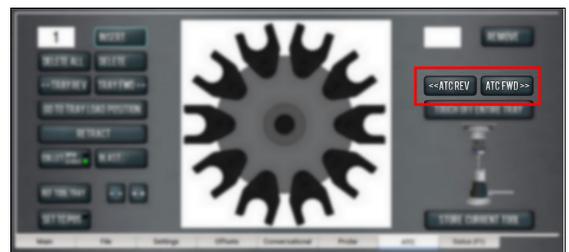


Figure 3-4: ATC REV and ATC FWD buttons on the ATC tab.

The tray moves to the next location and fetches another tool.

5. Select **Retract**.
The tray returns to the machining position.

3.1.4 Load a Tool into the Spindle

Load a tool into the spindle:

1. Push and hold the collet open button on the side of the ATC.



Figure 3-5: Collet open button on the side of the ATC.

The collet opens.

2. Load a tool into the spindle.
3. Release the button.
The collet closes.



Note: If installed, the Power Drawbar button's functionality is replaced by the button on the ATC.

3.1.5 Manually Load a Tool Into the Tool Tray

1. From the PathPilot interface, on the **ATC** tab, select **Go To Tray Load Position**.

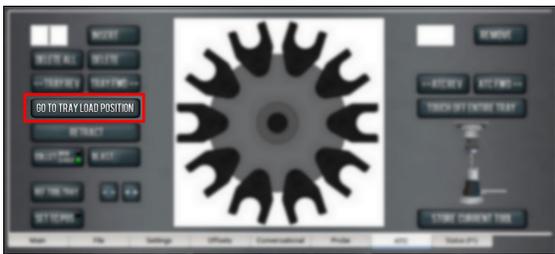


Figure 3-6: Go to Tray Load Position button on the ATC tab.

The spindle head moves up and the ATC moves into the door open position.

2. Load a tool into an open fork on the tray.
3. From the **ATC** tab, type the tool number into the **Insert DRO** field. Then select the **Enter** key.
4. Select **Insert**.
The tool is assigned to the exposed tray slot.
5. Select **Tray FWD** or **Tray REV**.
The tray moves to the next slot location.
6. Select **Retract**.
The tray returns to the machining position.

3.1.6 Manually Unload a Tool From the Tool Tray

1. From the PathPilot interface, on the **ATC** tab, in the **Insert DRO** field, type the tool number. Then select the **Enter** key.
2. Select **Go To Tray Load Position**.
The spindle head moves up and the ATC moves into the door open position.
3. Select **Delete**.

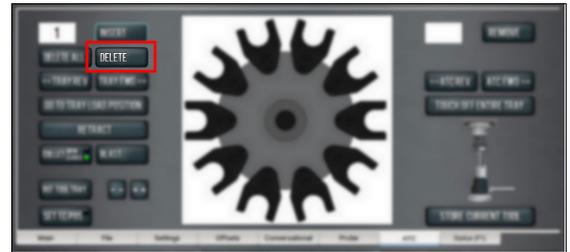


Figure 3-7: Delete button on the ATC tab.

The tool is unassigned from the tray and the tray moves to that tool.

4. Select **Tray FWD** or **Tray REV**.
The tray moves to the next slot location.
5. Select **Retract**.
The tray returns to the machining position.

3.1.7 Retrieve a Tool From the Tool Tray

- Depending on your workflow, do one of the following from the PathPilot interface:
 - Type the command directly into the **MDI Line DRO** field using the following format: **T[TOOL NUMBER] M06**
For example, T1 M06
 - Type the tool number in the **Tool DRO** field. Then select the **Enter** key.

3.1.8 Set the Tool Change Height

1. From the PathPilot interface, slowly jog the Z-axis down (-Z) over the tool. Stop jogging when the spindle nose just makes contact with the shoulder of the tool holder.

2. On the **ATC** tab, select **Set TC POS**.

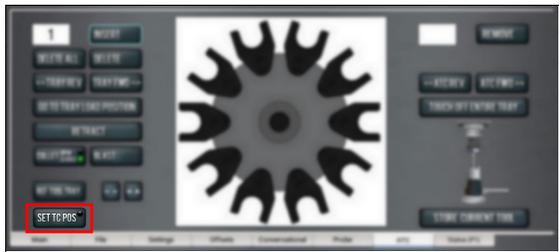


Figure 3-8: Set TC POS button on the ATC tab.

The tool change position is set.

3.1.9 Switch to Manual Tool Changes

- From the PathPilot interface, on the **Settings** tab, select the **Manual Tool Change** radio button.
The Automatic Tool Changer (ATC) is prevented from making tool changes.

4.1 TROUBLESHOOTING

If you're having issues with the ATC, read the following sections:

4.1.1 Lubricate the Linear Rails	22
4.1.2 Replace the Plastic Screws on a Fork	22
4.1.3 Install the ATC Carousel Plate Spacer	22
4.1.4 Turn Over the Tool Forks	22

If the ATC is mounted too high on the machine column for the spindle nose to clear the Tormach Tooling System (TTS) shank after completing the alignment procedures in the owner's guide, you may need to make adjustments to lower the tool in the ATC carousel. First "Install the ATC Carousel Plate Spacer" (below), and then, if necessary, "Turn Over the Tool Forks" (below).

4.1.1 Lubricate the Linear Rails

The linear rails are self-lubricating, so you don't need to lubricate them. If, after initial installation, you hear chatter from the linear rails, apply a thin layer of way oil to the linear rails.

4.1.2 Replace the Plastic Screws on a Fork

The plastic screws that hold the fork to the tool tray are designed to fail under greater-than-normal loads: when a tool crashes, the plastic screws snap to prevent damage to the Automatic Tool Changer (ATC). If the plastic screws that hold the fork to the tool tray break, you can replace them.

To replace the plastic screws on a fork:

1. Remove the broken screws from the fork.
2. Secure the fork to the tool tray with two of the included plastic screws. Make sure that the groove on the fork faces the machine table.

NOTICE! Don't use metal screws to replace broken screws on an ATC fork. If you do, it could cause machine damage.

3. You must adjust the tool tray rotation again: go to "Adjust the Tool Tray Load Position" (page 16).

4.1.3 Install the ATC Carousel Plate Spacer

To lower the tool height in the ATC, you can install the provided ATC Carousel Plate Spacer between the ATC carousel and the tool carousel plate.

To install the ATC Carousel Plate Spacer:

1. Remove the three bolts that secure the tool carousel plate to the ATC carousel and set them aside. Then, set aside the tool carousel plate.



Note: There are two sets of three bolts provided with this kit. You'll use one set to replace the original bolts securing the tool carousel plate to the ATC carousel.

2. Determine which set of bolts is correct for your specific machine:
 - a. Find both sets of bolts provided with this kit.
 - b. Compare the provided bolts to the original bolts that you removed in Step 1.
The correct replacement bolts should match the original bolts.
3. Discard the extra set of bolts and the original bolts that you removed in Step 1.
4. Align the ATC Carousel Plate Spacer on the ATC carousel, and then align the tool carousel plate with the ATC Carousel Plate Spacer.

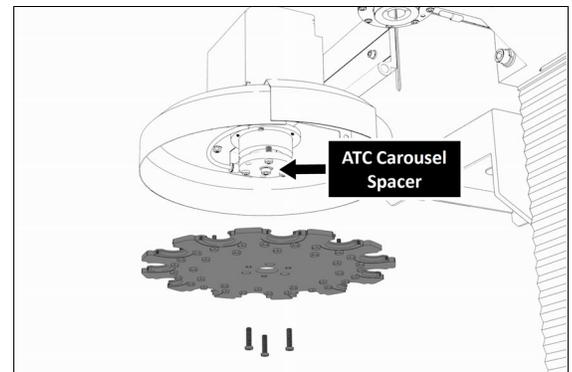


Figure 4-1: Location to install the ATC Carousel Plate Spacer.

5. Secure the tool carousel plate to the ATC carousel with three provided bolts that you determined in Step 2.

4.1.4 Turn Over the Tool Forks

If the tool height is still too high after you completed the steps in "Install the ATC Carousel Plate Spacer" (above), you can turn over the tool forks on the ATC carousel.

To turn over the tool forks:

TECHNICAL DOCUMENT

1. Remove the screws from the fork and set them aside.
2. Remove the fork from the ATC carousel, and then turn it over as shown in the following image.

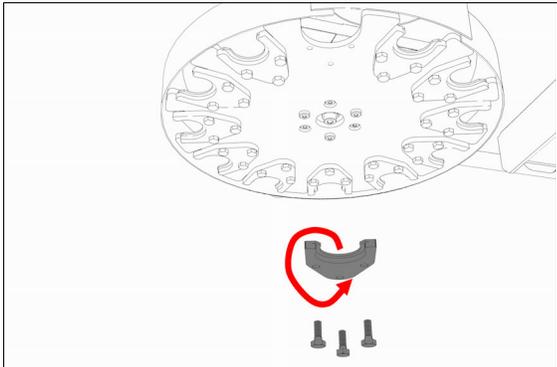


Figure 4-2: Turning over a tool fork from the ATC carousel.

3. Replace the fork on the ATC carousel using the screws that you set aside in Step 1.