

TACTILE FOOT

**AN OPERATION SUPPLEMENT MANUAL FOR
CINCINNATI CNC LASER SYSTEMS**

CINCINNATI

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TACTILE FOOT

The Tactile Foot option allows the Laser System to cut materials such as wood, plastic, fabric and light gauge metals with the noncontact cutting head. This option uses the CINCINNATI INCORPORATED Height Sensing System (HSS).

The CINCINNATI INCORPORATED Height Sensing System is a capacitive sensor. A capacitive sensor has two electrodes with an AC signal across them. One electrode (the workpiece) is at neutral and the other electrode (the nozzle tip) has a charge. The sensor measures the charge and converts it into a voltage. If the distance between the electrodes changes, the voltage changes to accurately indicate the nozzle tip height above the workpiece surface. The Z-axis CNC responds to the voltage change and moves the nozzle tip up or down to maintain the target standoff.

When cutting with the tactile foot, the follower ring is the neutral electrode of the sensor. The sensor measures the capacitance between the follower ring and the nozzle tip. Since the follower ring rides on the workpiece surface, if the elevation of the workpiece surface changes, the follower ring moves up or down, changing the capacitance. The sensor measures the capacitance change and the CNC compensates the Z-axis position to maintain the target nozzle tip standoff. In addition, the follower ring applies a downward force to help keep the material flat on the pallet and prevent the flutter that sometimes occurs when cutting thin materials.

Note: Figure 2 includes C. I. part numbers for the original tactile foot design. Later designs may use different part numbers. Before ordering parts, contact CINCINNATI INCORPORATED to determine the correct replacement part number for your laser system.

HARDWARE

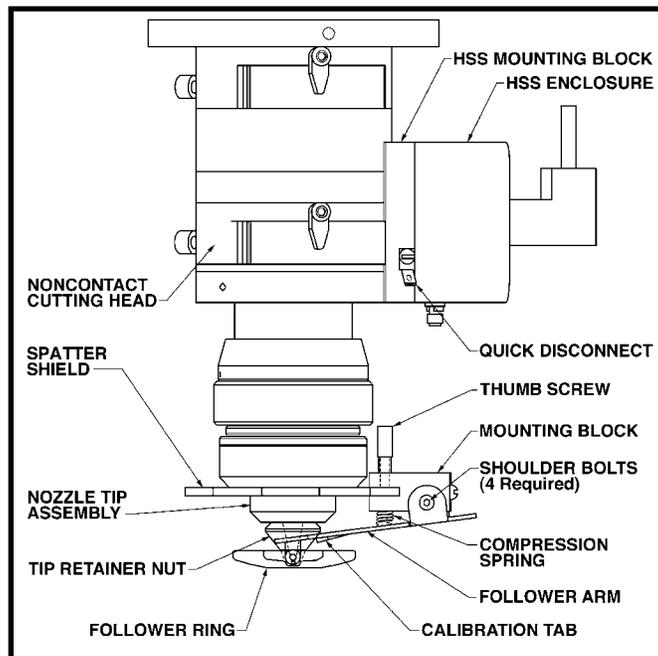


FIGURE 1 Noncontact Cutting Head with Tactile Foot

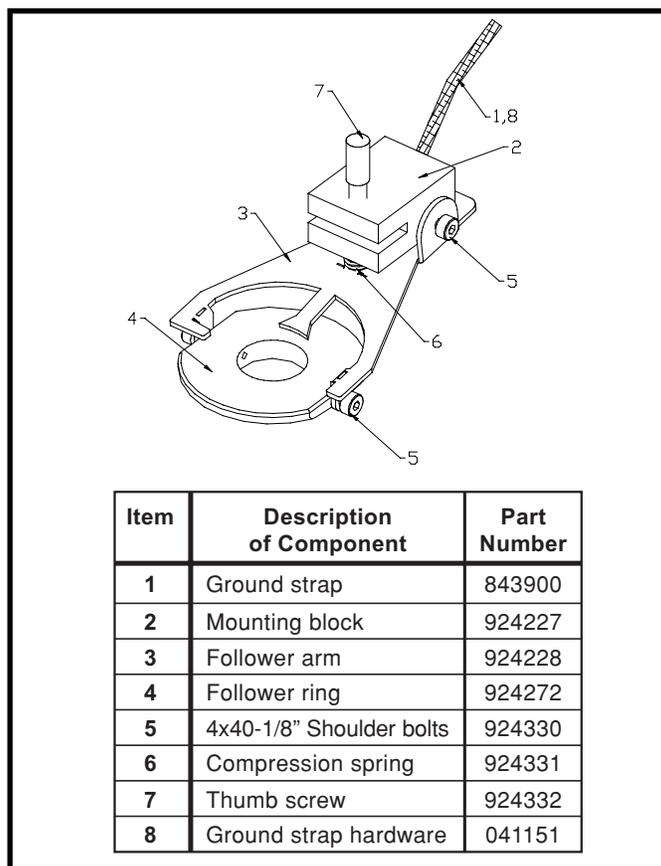


FIGURE 2 Tactile Foot Assembly

MECHANICAL SETUP

TACTILE FOOT MOUNTING

The tactile foot is removable for storage and cleaning. To install, slide the mounting block onto the noncontact cutting head's spatter shield. Center the follower ring on the nozzle tip. Secure the assembly to the spatter shield by tightening the knurled thumbscrew. Attach the ground strap to the quick disconnect on the HSS mounting block. (The ground strap is absolutely necessary when cutting nonconductive materials). Push the follower ring up against the nozzle tip and hold for 1 second, then release. The message "Nozzle Tip Touch" should appear on the CNC window. If no message appears, refer to the TROUBLESHOOTING section. Make sure the safety cables are attached to the cutting head.

After installing or removing the tactile foot assembly, always perform a Standoff Calibration.

TIP TOUCH POSITION

This procedure ensures that the "Nozzle Tip Touch" message occurs when the nozzle tip either touches the material surface or is just slightly above it (0.001 to 0.002-inch). Located on the follower arm is a calibration tab that extends from the follower arm body out towards the center of the follower ring (between the forks.) The tab is bent down slightly. This tab creates an electrical short between the machine ground and nozzle tip when the follower ring moves toward the nozzle tip. The angle of the bend determines when the short occurs with respect to the position of the follower ring and nozzle tip. When the angle of the bend is correct, the short occurs when the workpiece side of the follower ring and the nozzle tip are in the same plane.

It is sometimes necessary to adjust the angle of the bend for a different nozzle tip length. To adjust the angle of the bend, remove the cutting head from the laser center. Turn the cutting head upside down and rest it on the flange. With a straight edge, push the follower ring down while keeping it perpendicular to the beam path (parallel to the workpiece surface). Adjust the bend angle so the calibration tab touches the tip retainer nut when the straight edge either contacts the nozzle tip or is slightly above it. See Figure 3.

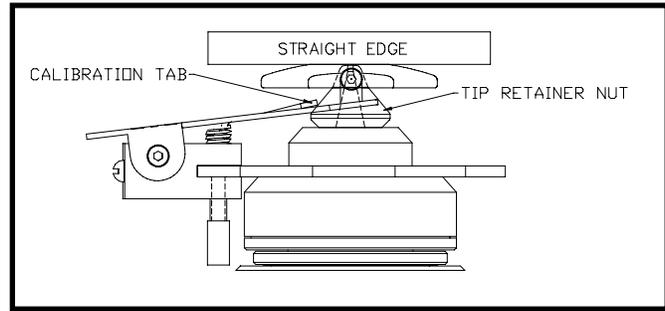


FIGURE 3 Tip Touch Position

STANDOFF CALIBRATION

Before performing Standoff Calibration, verify that the tactile foot is installed as specified in the Tactile Foot Mounting section. Jog the cutting head so the tactile foot is above the workpiece.

1. Open the "Standoff Calibration" window under the "Maintenance" menu item. The text field inside the calibration window will be the color yellow and read "Press CYCLE START to move nozzle into calibration position". See Figure 4.
2. Select the option button "Re-calibrate". To calibrate for a different standoff position, edit the target standoff value in the calibration window.



FIGURE 4 Standoff Calibration Window

3. Press the CYCLE START pushbutton.
4. The Z-axis retracts to the home position, pauses for 1 second and then moves in the Z-down direction. The yellow text field inside the calibration window reads, "Moving to calibration position". The Z-axis continues in the down direction until a tip touch occurs. At that point, the Z-axis stops and then moves up to 0.260-inch above the workpiece surface. The control automatically collects the calibration data and then the Z-axis moves to the target standoff position. To stop the calibration routine, press the CYCLE STOP pushbutton. To restart, press CYCLE START.

5. The calibration window displays the actual sensor standoff as the "Standoff at last calibration" value. If standoff accuracy is acceptable, the text field inside the calibration window changes color from yellow to green and reads, "Nozzle is in calibration position".
6. If the actual standoff does not meet the accuracy specification, the software displays a warning message. If this occurs, select "Cancel" to close the message box and press CYCLE START to repeat the calibration. If the warning message repeats, refer to the TROUBLESHOOTING section.
7. To check the nozzle tip standoff, follow the same procedure except select the option button "Check standoff" in Step 2.

PROGRAMMING

When using the tactile foot, the CNC program uses the same G and M codes as the non-contact cutting head. See the programming manual (EM-423) for details.

- ◆ G84 moves the cutting head (Z-axis) to the pierce/cut position and starts the cutting process.
- ◆ G89 P filename.lib specifies target standoffs (pierce and cut) with a material library file.
- ◆ G102 Sxxx Zxxx specifies target standoffs without using a material library file.
- ◆ M41 moves the cutting head to the nozzle standoff specified by the CNC program or the last standoff calibration.

- ◆ M42 raises the cutting head to the Z-home position.
- ◆ M47 raises the cutting head to the partial Z-up position.
- ◆ M130 disables the Z-axis anti-dive function.
- ◆ M131 cancels M130, to restore Z-axis anti-dive.

Before using the tactile foot, the programmer should consider the stability of the parts as the tactile foot rides on the material surface. Hooking the follower ring on a part can disconnect the cutting head and stop the process. Leaving small tabs to connect parts to the sheet can help keep parts from tipping and "hooking" on the follower ring. The programmer should also consider how part location can affect the stability of parts supported by the pallet grids.

CLEANING

When cutting nonferrous material, debris can build up on the nozzle tip assembly and tactile foot follower ring. It is very important to keep the nozzle tip assembly and tactile foot assembly clean and as free of debris as possible. Remove the tactile foot and clean it daily. Always keep the calibration tab and retainer nut free of any material that would prevent an electrical short from occurring between them.

TROUBLESHOOTING

PROBLEM	POSSIBLE CAUSE	RECOMMENDED RESOLUTION
Calibration out of specification.	Incorrect tip touch position.	Follow tip touch setting procedure.
Z-axis hard over-travel during calibration.	Tip touch electrical short not occurring.	Check to see that electrical short occurs when calibration tab touches nozzle tip retainer nut.
Electrical Sensor Fault message. Message will not clear.	<ul style="list-style-type: none"> • HSS Interface cable is disconnected. • Tactile foot was removed from cutting head. 	<ul style="list-style-type: none"> • Reconnect HSS interface cable. • Disconnect the sensor interface cable, wait 10 seconds and then reconnect.
Intermittent nozzle tip touch when cutting.	The workpiece might be pushing up on the follower ring and causing an actual tip touch.	Consider Programming methods to improve part stability.
No nozzle tip touch message when expected.	<ul style="list-style-type: none"> • The ground strap is not connected. • No electrical short. • Broken SMA connection. • Wiring problem from HSS to CNC. 	<ul style="list-style-type: none"> • Reconnect ground strap. • Remove debris between nozzle tip retainer nut and calibration tab. • Replace SMA cable. • Check signals.



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