

TECHNICAL DOCUMENT

SmartCool™ Install

Product Identification: SmartCool Starter Kit (PN 37167)

Purpose: This document details installation and use of the SmartCool programmable coolant system on a PCNC 1100™, PCNC 770™, or PCNC 440™ mill with PathPilot®.

This document has 10 sections:

1. Install SmartCool Head Unit
2. Route Cables on a PCNC 1100 or PCNC 770
3. Route Cables on a PCNC 440
4. Relocate Flood Coolant Mounting Bracket
5. Make Coolant Connections
6. Make Control Module Connections
7. Calibrate with PathPilot
8. SmartCool MultiCoolant Module (PN 37168)
9. Programming
10. Troubleshooting

Qty.	SmartCool Starter Kit	PN
1	SmartCool Head Unit	—
1	Control Module	—
1	USB Cable	—
1	Tube	—
1	AC/DC Power Adapter	—
1	Mounting Bracket	—
2	M6 x 16 mm Socket Head Cap Screw	—
2	M6 x 10 mm Button Head Cap Screw	—
2	M6 Small Flat Washer	—
2	M6 Large Flat Washer	—
4	Zip Tie Mount	31460
4	Zip Tie	32791
1	M5 x 12 mm Socket Head Cap Screw	31353
1	Sheet Metal Screw	31718



NOTE: If any of these items are missing, contact Tormach Customer Service at (608) 849-8381 for a replacement.

Required Tools:

- Phillips screwdriver
- Metric hex wrench set
- Adjustable wrench
- Wire cutter
- M6 x 1 tap¹

¹PCNC 440 mills serial number 80075 and below require holes to be drilled and tapped to complete assembly.

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NOTE: If mill is not equipped with an automatic tool changer (ATC), an additional mounting bracket is required for SmartCool install. Refer to the table below for more details.

PN	Description
37258	PCNC Coolant 1100 Relocation Bracket
37259	PCNC Coolant 770 Relocation Bracket
37260	PCNC Coolant 440 Relocation Bracket

IMPORTANT! Download and install the latest version of PathPilot before proceeding. PathPilot v1.9.7 or later is required to use these instructions. For more information, refer to www.tormach.com/updates.

Install SmartCool Head Unit

1. Identify two pre-existing mounting holes behind spindle on head casting (see **Figure 1**).

NOTE: Holes may need to be cleaned of paint prior to use.

PCNC 440 mills serial number 80075 and below require two mounting holes to be drilled and tapped:

- Temporarily place Mounting Bracket behind spindle on head casting
- Mark hole locations (see **Figure 2**)
- Drill and tap marks for a M6 x 1 mm screw

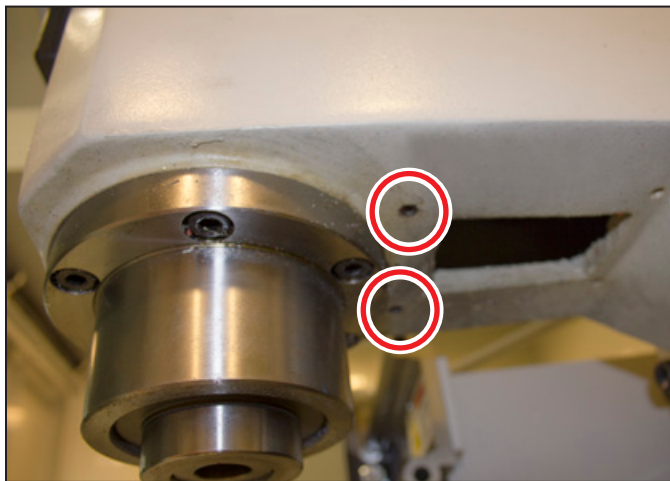


Figure 1

PCNC 440



Figure 2

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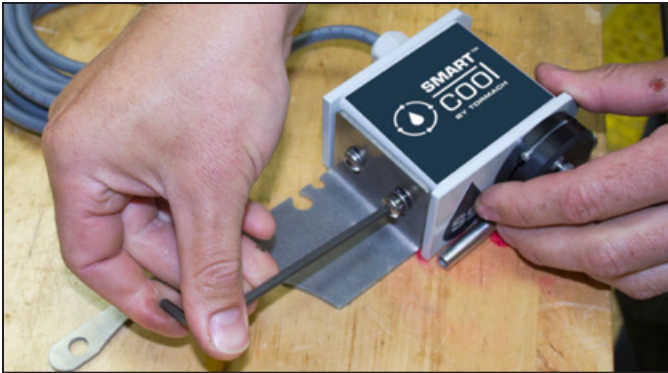


Figure 3

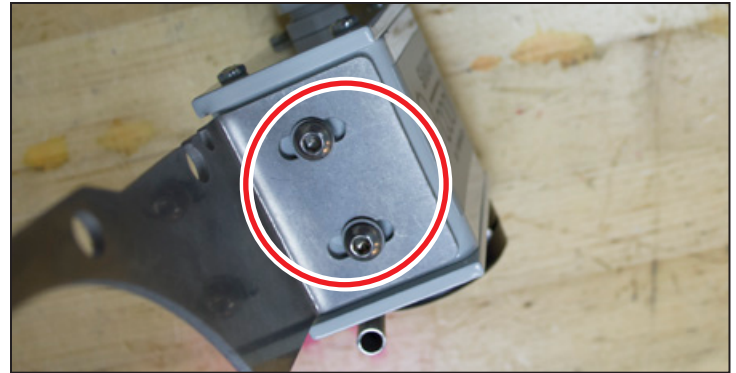


Figure 4

2. Using two M6 x 1 mm Button Head Cap Screws and two M6 Small Flat Washers, loosely attach SmartCool Head Unit to Mounting Bracket as shown in **Figure 3**.
3. Position SmartCool Head Unit roughly in center of slots on Mounting Bracket (see **Figure 4**). Final adjustments will be made after installation is complete to ensure coolant stream is correctly positioned.
4. Using two M6 x 1 mm Socket Head Cap Screws and two M6 Large Flat Washers, loosely attach Mounting Bracket to two mounting holes (see **Figure 5**).
5. Weave control cable from SmartCool Head Unit through Mounting Bracket and underneath head casting (see **Figure 6**).

NOTE: Cable routing for PCNC 1100/PCNC 770 and PCNC 440 varies; see related section.

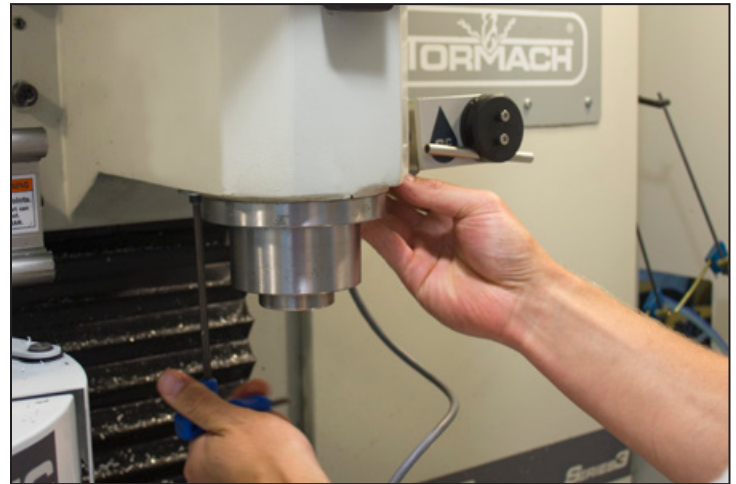


Figure 5

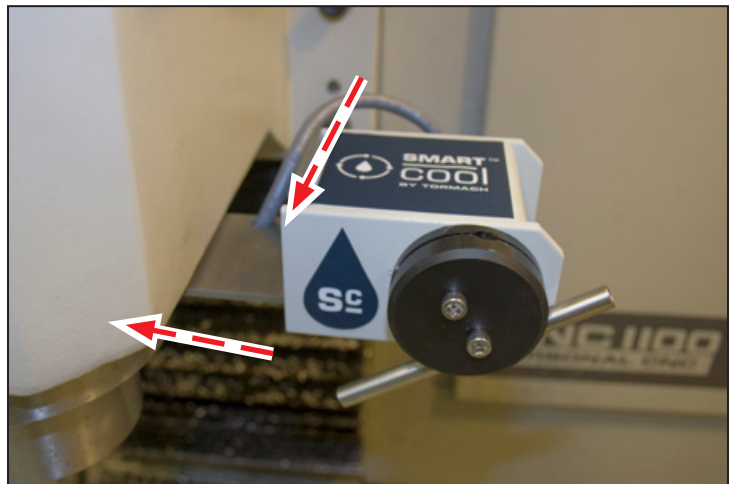


Figure 6

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Route Cables on a PCNC 1100 or PCNC 770

NOTE: This section shows SmartCool install on a PCNC 1100 mill; installation on a PCNC 770 mill is similar.

1. Open spindle motor cabinet door.
2. Route control cable from SmartCool Head Unit up spindle column and through inside of spindle motor cabinet (see **Figure 7**).
3. Using two zip ties and two zip tie mounts, secure control cable from SmartCool Head Unit to mill in locations A and B as shown in **Figure 8**.
4. Route control cable from SmartCool Head Unit to back of mill based your specific mill configuration:
 - If power drawbar (optional) is installed: Route through power drawbar's cable carrier and out to back of mill (see **Figure 9**).
 - If no power drawbar is installed: Holding control cable from SmartCool Head Unit in location C as shown in **Figure 10**, slowly run spindle head up and down to ensure clearance through full range of motion in Z direction. Loosen center screw on Z-axis motor mount plate; using one zip tie and one zip tie mount, attach control cable from SmartCool Head Unit (see **Figure 10**).
5. Slowly run spindle head up and down to ensure control cable cannot get caught in any part of mill.

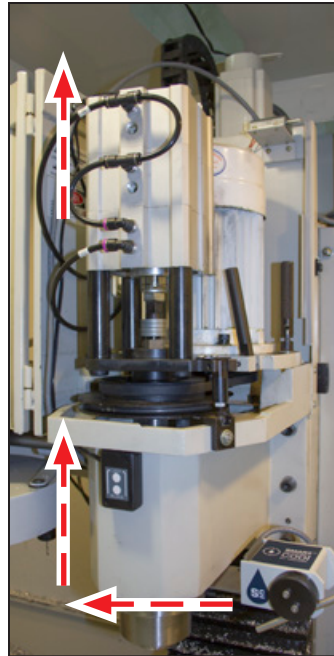


Figure 7

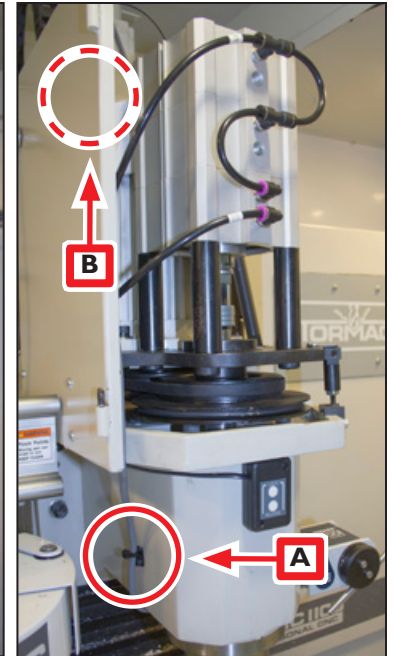


Figure 8

Power Drawbar Installed

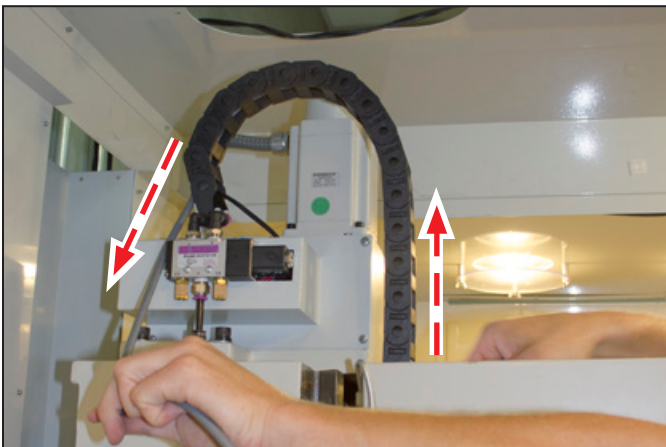


Figure 9

No Power Drawbar Installed

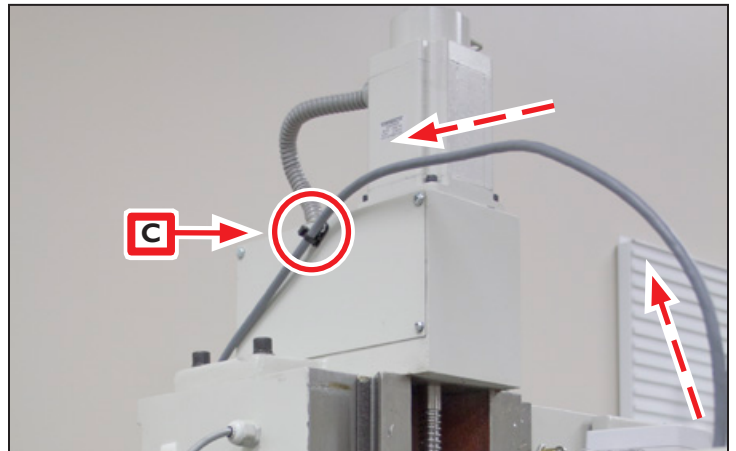


Figure 10

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Figure 11

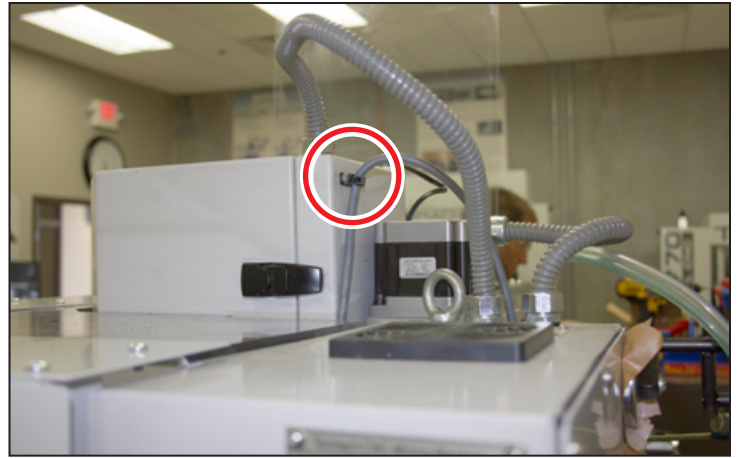


Figure 12

Route Cables on a PCNC 440

1. Route control cable from SmartCool Head Unit up spindle column; secure using two cable mounts and two zip ties as shown in **Figure 11** and **Figure 12**.
2. Slowly run spindle head up and down to ensure control cable cannot get caught in any part of mill.

Relocate Flood Coolant Mounting Bracket

If your mill is equipped with an optional ATC, Coolant Hose Mount Bracket is already relocated. Skip to Step 5 later in this section.

1. If mill is equipped with flood coolant kit, remove 1/4" Coolant Hose and Coolant Hose Mount Bracket (see **Figure 13**); set aside.

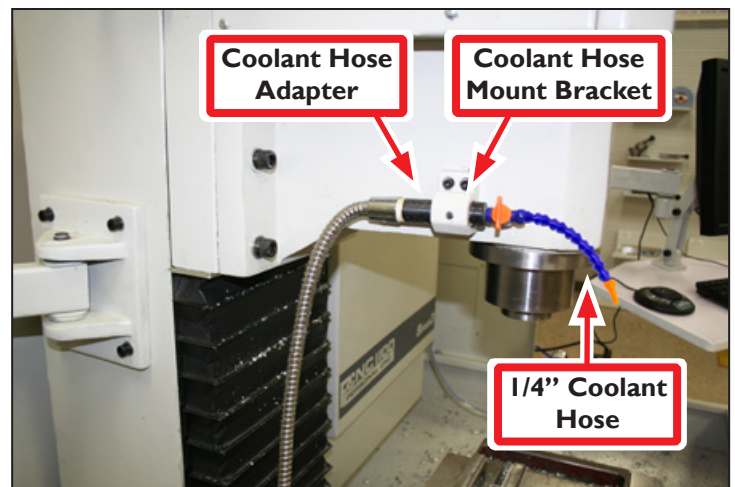


Figure 13

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PCNC 1100 / PCNC 770

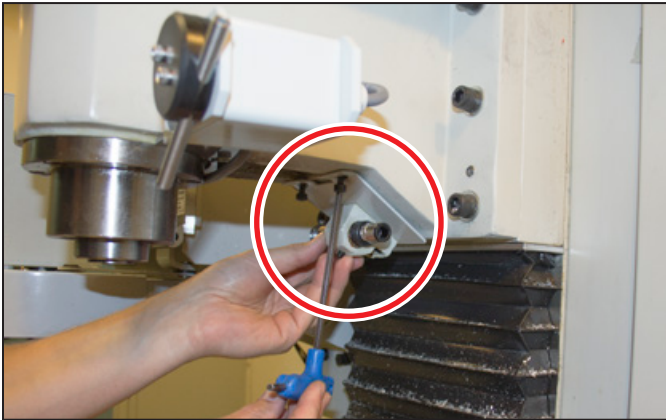


Figure 14

2. Identify mill-specific location for mounting bracket (see **Figure 14** and **Figure 15**).

NOTE: PCNC 440 mills serial number 80075 and below require one hole to be drilled and tapped behind SmartCool's Mounting Bracket. Temporarily place Relocation Bracket on spindle column flush with right edge of spindle head casting as shown in **Figure 15**; mark hole locations. Drill and tap these marks for a 6 mm screw.

3. Using two screws from Coolant Hose Mount Bracket, attach Coolant Hose Mount Bracket and Coolant Hose Adapter to Relocation Bracket (see **Figure 16**).

PCNC 440



Figure 15

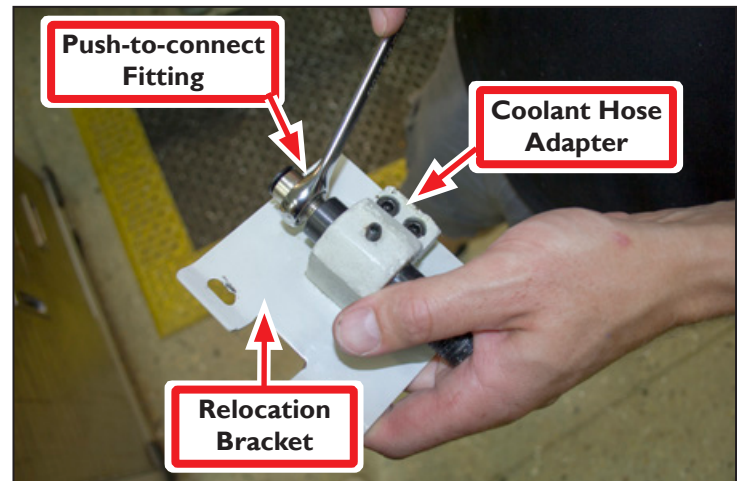


Figure 16

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4. Attach Relocation Bracket to head casting in location identified in step 2.
5. Remove Push-to-connect Fitting from Tube (see **Figure 17**); install on Coolant Hose Adapter using adjustable wrench (see **Figure 16**).

Make Coolant Connections

SmartCool units are pre-configured for use with flood coolant, but can be configured to use mist coolant as the primary coolant source.

NOTE: An optional MultiCoolant Module (PN 37168) allows the SmartCool to use flood coolant and mist coolant simultaneously – along with several other configurations. For more information, refer to SmartCool MultiCoolant Module section later in this document.

Flood Coolant

Connect Tube to Push-to-connect Fitting on Relocation Bracket and route to SmartCool Head Unit (see **Figure 18**).

Mist Coolant

1. Identify Hub on SmartCool Head Unit (see **Figure 19**).

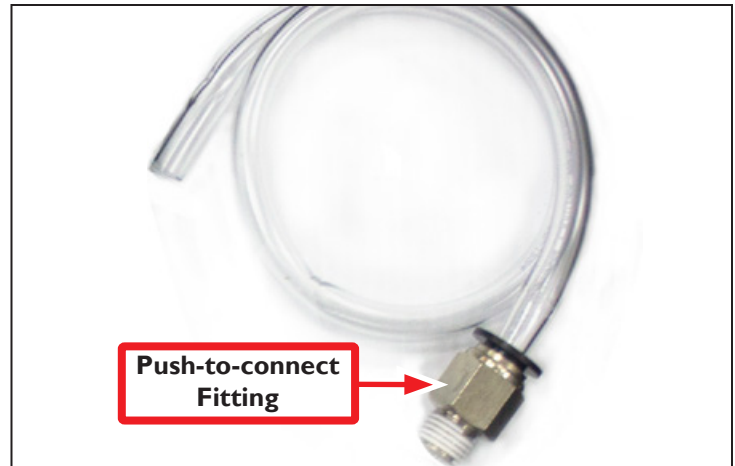


Figure 17

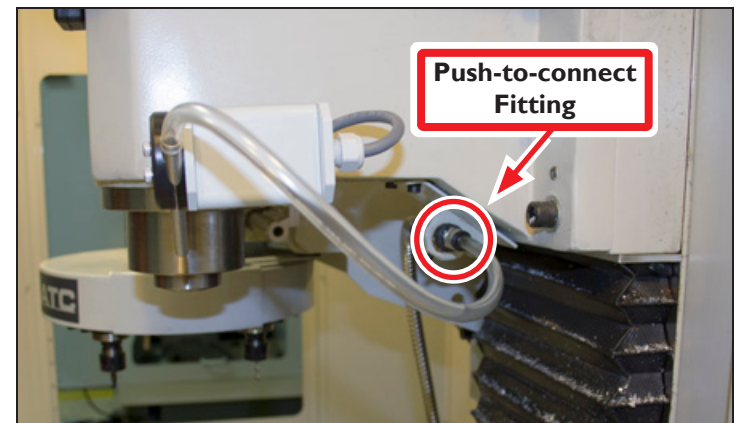


Figure 18

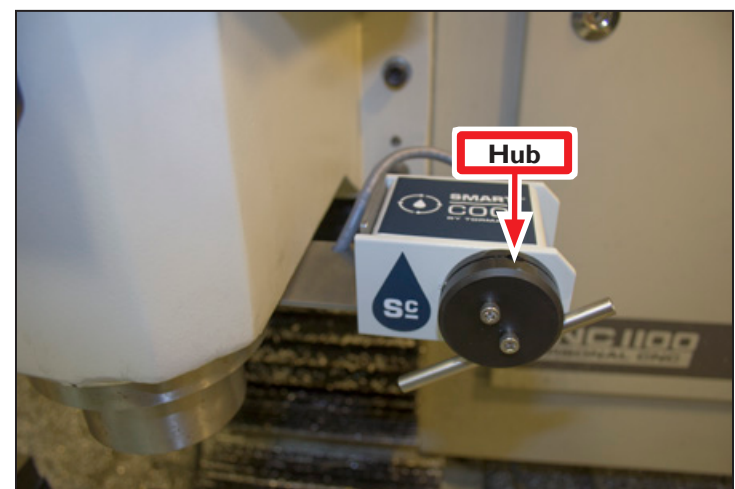


Figure 19

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2. Remove cap from Hub; identify two slots for flood and mist coolant (see **Figure 20**) and set aside.

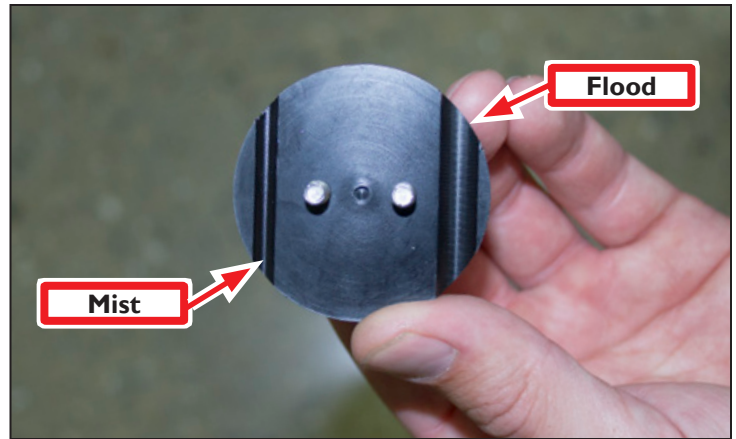


Figure 20

3. Remove Hub's mounting plate from front of SmartCool Head Unit (see **Figure 21**); identify two slots for flood and mist coolant. Hub mounting plate follows same pattern as hub cap.
4. Re-install hub mounting plate with mist slot on bottom; tighten screws finger-tight.



Figure 21

5. Re-install hub cap set aside earlier with mist slot on bottom. Insert two hoses into slots as shown in **Figure 22**; tighten screws finger-tight.

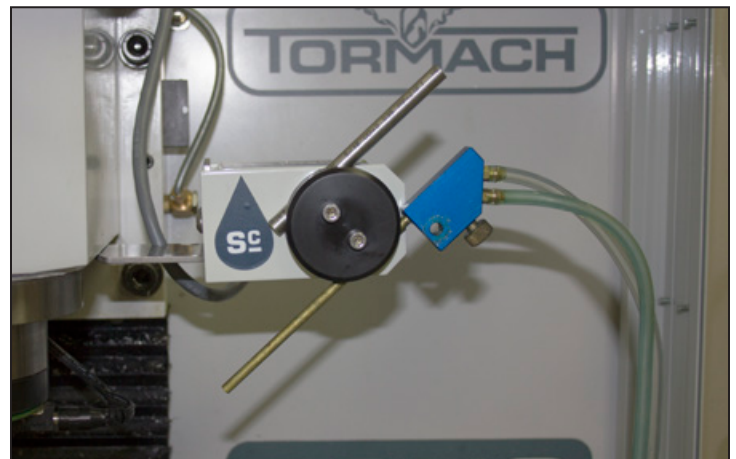


Figure 22

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Make Control Module Connections

1. Connect the Control Module as follows:
 - Connect AC/DC Power Adapter to Power port (see **Figure 23**)
 - Connect USB Cable to USB port (see **Figure 23**)
 - Connect Control Cable from SmartCool Head Unit (see **Figure 23**)

NOTE: If equipped with optional MultiCoolant Module (PN 37168), wait to make M07 Auxiliary Solenoid connection until SmartCool MultiCoolant Module section later in this document.

Control Module

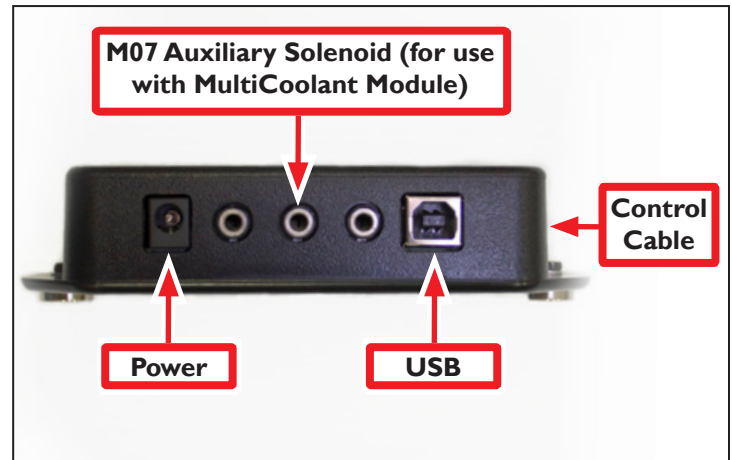


Figure 23

2. Control Module is magnetic; attach to back of mill as shown in **Figure 24**.
3. Route USB Cable to controller; connect to any available USB connector.
4. Route AC/DC Power Adapter to power outlet.

NOTE: SmartCool can be plugged in and used at any time; mill does not need to power cycle for PathPilot to recognize SmartCool.



Figure 24

Calibrate with PathPilot

Using a tool of a known length, calibrate the height of the coolant flow from SmartCool by issuing a M08 or M07 command in PathPilot and mechanically adjusting assembly installation on spindle head casting.

1. To calibrate SmartCool, insert a measured tool into spindle and activate length offset. For more information, refer to mill *Operator Manual*.
2. In MDI line, type *M8 P0* to turn on flood coolant and aim stream at tip of tool (for more information, refer to *Programming Guide* section later in this document).
3. Observe coolant stream; if necessary, adjust SmartCool Head Unit within Mounting Bracket (see **Figure 25**) to visually correct for uneven mounting. Adjust until coolant stream is in line with tool tip.
4. Tighten down screws securing SmartCool Head Unit to Mounting Bracket.
5. If necessary, coolant stream can be further adjusted in PathPilot to position on tool tip as shown in **Figure 26**. Type *ADMIN SMARTCOOL_OFFSET* to raise or lower the coolant stream; positive values move the coolant stream up, negative values move the coolant stream down (for more information, refer to *Programming Guide* section later in this document).

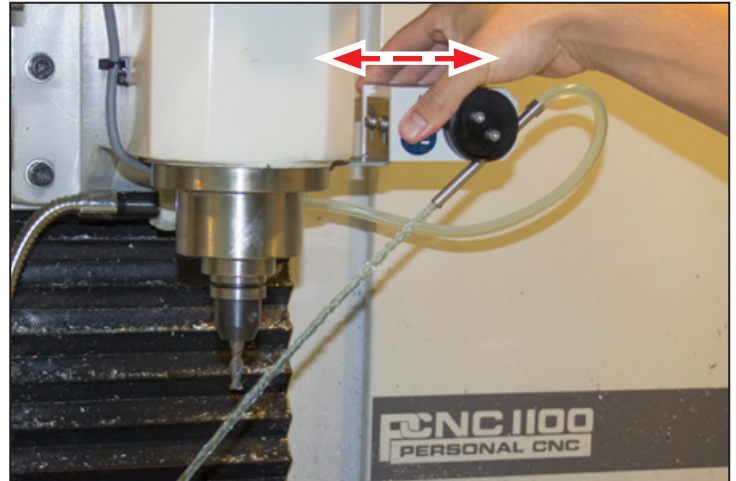


Figure 25



Figure 26

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SmartCool MultiCoolant Module

The optional MultiCoolant Module (PN 37168) allows you to add a second source of coolant to your SmartCool Head Unit using an auxiliary solenoid.

The SmartCool Head Unit has two slots for coolant sources (see **Figure 27**):

- Primary coolant source (like flood coolant) is controlled with an M08 command in PathPilot, and aims the bottom slot of the hub.
- Secondary coolant source (like air or mist coolant) is controlled with an M07 command in PathPilot, and aims the top slot of the hub.

Typical system configurations are:

- Flood (M08) and air (M07)
- Flood (M08) and Fog Buster (M07)
- Fog Buster (M08) and air (M07)

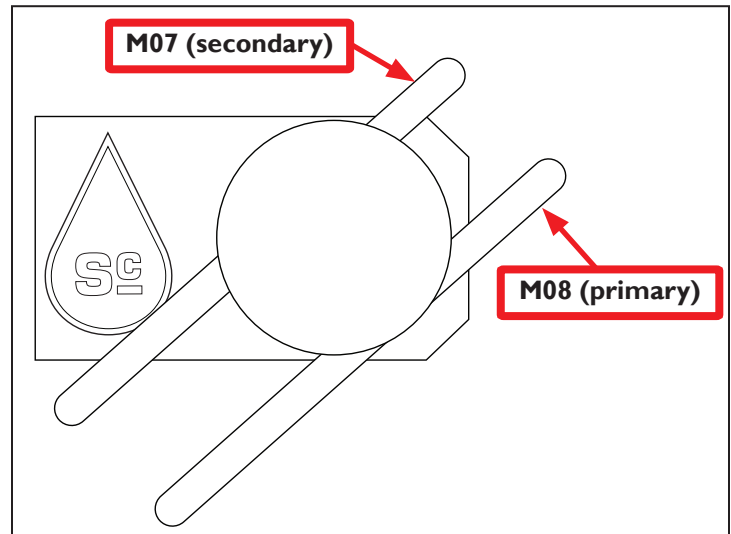


Figure 27

Installation

1. Determine your primary and secondary coolant sources.

NOTE: If you are using a Fog Buster as the secondary coolant source, skip to *Other Configurations* section later in this document.

2. MultiCoolant Module's plate is magnetic. Place on mill near Control Module (see **Figure 28**).
3. Connect MultiCoolant Module to middle 3.5 mm jack on Control Module (see **Figure 28**).
4. Ensure primary coolant source is installed in bottom slot of SmartCool Head Unit's hub (see **Figure 27**).
5. Route secondary coolant source to SmartCool Head Unit; install in top slot of hub.
6. Route 1/4" Black Tube from MultiCoolant Module to air line; splice into the T-connector.

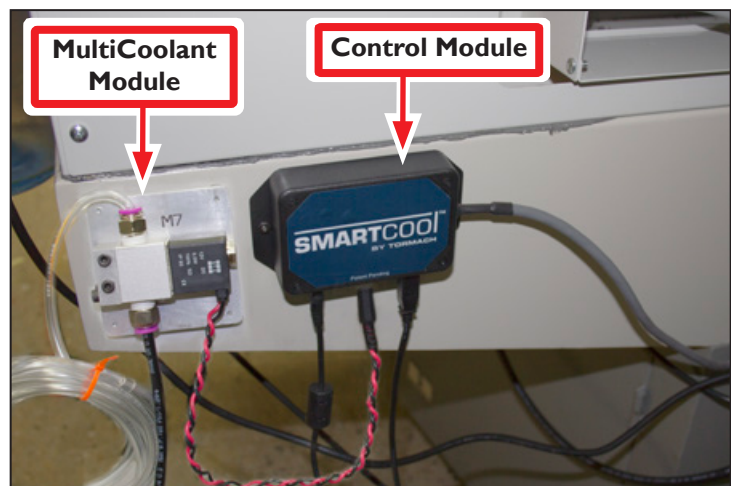


Figure 28

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Other Configurations

Using a Fog Buster as a secondary coolant source requires removing the auxiliary solenoid from the MultiCoolant Module and installing it on the Fog Buster. In this configuration, power is supplied to the Fog Buster through the SmartCool's Control Module.

1. Unplug Fog Buster.
2. Remove solenoid and power cord from Fog Buster (see **Figure 29**) and set aside; keep for future use.



Figure 29

3. Remove auxiliary solenoid from MultiCoolant Module (see **Figure 30**); set aside remaining parts from MultiCoolant Module and keep for future use.
4. Install MultiCoolant's auxiliary solenoid in place of solenoid and power cord removed from Fog Buster in Step 2 (see **Figure 31**).
5. Connect MultiCoolant Module to middle 3.5 mm jack on Control Module (see **Figure 28**).

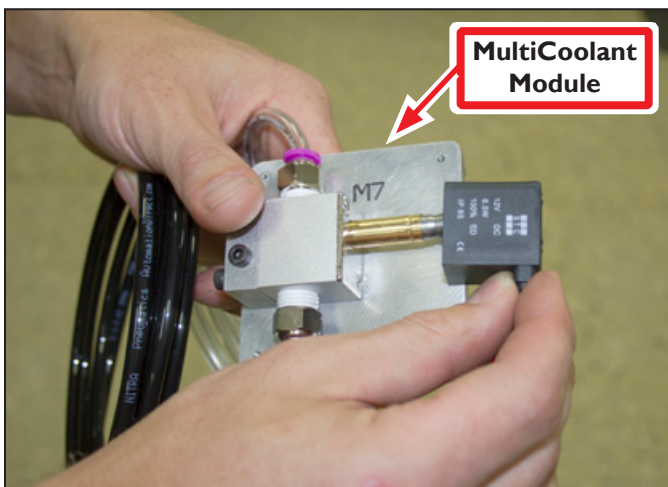


Figure 30



Figure 31

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Programming

SmartCool has three programming modes:

1. Z0 Mode (default): Aims coolant stream at a Z0 plane or programmed distance from the Z0 plane.
2. Tool Tip Mode (M08 P~): Aims coolant stream at the tool tip or a programmed distance from the tool tip.
3. Wiggle Mode (M08 R~): Oscillates coolant stream between two programmed positions.

Program SmartCool using P~, R~, or E~ words to modify the standard coolant M-codes:

M-code	Description
M07	Mist coolant or air on (secondary)
M08	Flood coolant on (primary)
M09	Coolant off

Word	Definition
E~	Adjusts the Z position when using Z0 mode to aim target point of coolant stream.
P~	Defines the target point of coolant stream. The P word is optional; if the P word is omitted, the target point of the coolant stream is the Z0.
R~	Enables oscillating coolant stream (wiggle mode).
Q~	Enables pulsing of M07 or M08 solenoid in seconds. Requires SmartCool MultiCoolant Module (PN 37168).

- To turn on flood coolant, program M08 P~ R~ E~
- To turn on mist coolant or air, program M07 P~ R~ E~
- To turn all coolant off, program M09
- P, R, and E are always optional

If the top of the workpiece is not at Z0, use an E word argument to maintain the coolant stream at the desired Z location.

When using an E or P word argument, units are defined by the active unit length as specified by G20 (inches) or G21 (millimeters).

To specify the time period between air blasts using the MultiCoolant Module, use a Q word argument. Q is always in whole seconds. The Q word affects aiming; during the blast period, only M07 aiming is in effect.

The SmartCool Head Unit aims coolant using the top slot on the hub when only M07 is in effect; when M08 is in effect, aiming priority is switched to the bottom slot on the hub. M07 and M08 may be used simultaneously.

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Examples

Description	Example Code
Turn on flood coolant, maintain stream at Z0	M08
Turn on flood coolant, maintain stream at 1 unit above Z0	M08 E1
Turn on flood coolant, aim stream at tool tip	M08 P0
Turn on flood coolant, aim stream at 1 unit above tool tip	M08 P1
Turn on flood coolant, aim stream at 3 units below tool tip	M08 P-3
Turn on flood coolant, aim stream at tool tip and oscillate between tool tip and 3 units above tool tip	M08 P0 R3
Turn on flood coolant, maintain stream at Z0 and oscillate between Z0 and 3 units above Z0	M08 R3
Turn on mist coolant or air, aim stream at Z0	M07
Turn off all coolant	M09

Keyboard Shortcuts

Key Code	Description
Alt + U	Manually override PathPilot coolant control to point nozzle up ¹
Alt + D	Manually override PathPilot coolant control to point nozzle down ¹
Alt + C	Cancel manual override of PathPilot coolant control; reverts to automatic control
Alt + M	Toggle auxiliary solenoid on and off (requires SmartCool MultiCoolant Module, PN 37168)

¹Cancel manual override with Alt + C or any subsequent M-code command.

ADMIN Commands

The aiming of the SmartCool Head Unit can be fine-tuned to compensate for installation variance or a sagging coolant stream (non-linear).

ADMIN Command	Description
ADMIN SMARTCOOL_OFFSET	Offset SmartCool Head Unit up or down as appropriate. Positive values move the stream up, negative values move the stream down.

For example, *ADMIN SMARTCOOL_OFFSET 1.0* moves the coolant stream one unit higher.

NOTE: This offset applies to every pointing operation, and is retained by the controller; it is not affected by PathPilot software upgrades.

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Troubleshooting

Problem: SmartCool does not respond to commands

Possible Cause	Probability	Action to Identify Cause of Problem	Discussion
Unplugged or defective USB cable	High	Verify that USB device is detected on PathPilot's <i>Status</i> tab.	Check USB cable connections; if plugged in to the controller, switch to any other open USB port. If PathPilot does not detect a USB device on the <i>Status</i> tab, replace the USB cable.
Loose pins on control cable	High	Check that all three pins at control module end of control cable are seated.	If any pins are not seated, click into place. If pins do not hold, replace control cable.
Over-tightened hub	High	Listen for a sound from the SmartCool Head Unit that indicates it is working. Verify that the SmartCool Head Unit does not move.	Remove the cap from the hub on the front of the SmartCool Head Unit. Loosen the mounting screws on the hub (see Figure 21) and replace the cap.
Power supply is defective	Medium	Remove cover from control module and inspect LEDs on control board.	If LEDs are not illuminated, replace 12V power supply. If new 12V power supply does not illuminate LEDs, replace control module.
Loose wires from SmartCool Head Unit to control cable	Medium	Remove back cover from SmartCool Head Unit and inspect wiring to control cable.	Check connections and ensure they are firmly seated.
Control cable is defective	Low	Inspect connection at control module end of control cable	Check all three pins at control module end of control cable. If pins are damaged, replace control cable.