Notices

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Disclaimer

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FlashCut CNC is not responsible for damage to any equipment or workpiece resulting from use of this product.

If you do not understand and agree with all of the above, please do not use this product.

Safety and usage guidelines

When running an automated machine tool, safety is of utmost importance. For proper and safe use of the FlashCut CNC program and your CNC machine, the following safety guidelines must be followed:

Never let the machine tool run unattended.

Require any person in the same room as a running machine tool to wear safety goggles, and to stay a safe distance from the machine.

Allow only trained operators to run the machine tool. Any operator must have:

- Knowledge of machine tool operation
- Knowledge of personal computer operation
- Knowledge of Microsoft Windows
- Good common sense

Place safety guards around the machine to prevent injury from flying objects. It is highly recommended that you build a safety shield around the entire tool envelope.

Never place any part of your body within the tool envelope while the machine has power, since unexpected machine movement can occur at any time.

Always keep the tool envelope tidy and free of any loose objects.

Be on alert for computer crashes at all times.

About this document

Certain of the screen captures in this document may differ in minor ways from the actual FlashCut application. Those differences are used to make sure what you see is clear and help you understand the descriptions.
Technical support

We provide expert technical support for all of our products. We have many resources dedicated to helping you resolve your problems quickly. Please use these resources in the following order:

Website

http://www.flashcutcnc.com/

Our website has product specifications, documentation, videos and support information.

Dealer support

If you purchased FlashCut CNC from a dealer or other machine tool manufacturer (OEM), please contact them as they will have the best knowledge of your complete system.

Email

support@flashcutcnc.com

Email is the most organized way to convey your issues to our support staff. In your e-mail, please state your problem completely. Include your FlashCut version, the processor and speed of your computer, your version of Windows and your signal generator serial number. Attach your Setup and Tooling files (usually found in a folder named c:\flashcut data) and, when appropriate, the G-code file with which you are having problems. Alternatively, you can attach a single FlashCut support file generated by the Build Support File command on the Error! Reference source not found. tab. The support file is in ZIP format and contains all relevant files needed by technical support to resolve your issue. Please see Build Support File for more details.

Phone/fax support

If email is unavailable to you, please call our telephone support number. We will normally respond to your call within 24 hours.

Phone: (847) 940-9305 (9:00 AM-5:00 PM, CST, M-F)
Fax: (847) 940-9315
**THC Kit Includes:** (Before you get started familiarize yourself with all the parts/cables)

1) THC Isolation Box  
2) Controller to THC Box Cable (DB 25 to Minifit)  
3) Torch to THC Box (DB 15 to 14 pin Circular Connector)  
4) Ohmic Sensing Cable  
5) Ohmic Return Cable  
6) Ohmic Return Clamp
Cable Pinouts:

Controller to THC

<table>
<thead>
<tr>
<th>Rectangular 18pin (Mini I/O Board)</th>
<th>Function</th>
<th>DB-25 (THC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>GND</td>
<td>19</td>
</tr>
<tr>
<td>6</td>
<td>Output 1 (-)</td>
<td>23</td>
</tr>
<tr>
<td>9</td>
<td>Shield</td>
<td>N/A</td>
</tr>
<tr>
<td>10</td>
<td>Input 19</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>Input 20</td>
<td>2</td>
</tr>
<tr>
<td>13</td>
<td>+5V</td>
<td>6</td>
</tr>
<tr>
<td>15</td>
<td>Output 1(+)</td>
<td>10</td>
</tr>
<tr>
<td>18</td>
<td>Analog Input 1</td>
<td>3</td>
</tr>
</tbody>
</table>

18 pin Minifit Jr. (front View)

DB-25 (front View)

Torch to THC Box

<table>
<thead>
<tr>
<th>DB-15 (THC)</th>
<th>Function</th>
<th>Circular 14 Pin (Torch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Varc (+)</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>Varc (-)</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>Start (+)</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>“OK to start” (+)</td>
<td>12</td>
</tr>
<tr>
<td>7</td>
<td>Ohmic Sensor</td>
<td>N/A</td>
</tr>
<tr>
<td>13</td>
<td>Start (-)</td>
<td>4</td>
</tr>
<tr>
<td>14</td>
<td>Arc Transfer</td>
<td>14</td>
</tr>
<tr>
<td>N/A</td>
<td>Shield</td>
<td>13</td>
</tr>
</tbody>
</table>

DB-15 (front View)

14 pin Circular Connector (front View)
Installation: (Please read through instructions carefully prior to installing the kit)

1) **Mount the THC Isolation Box:** The THC Isolation box can be mounted to the torch or to the machine by fastening it down from one of the bolt patterns.

2) Plug in and screw down the DB-15 connector to the THC box.
3) Plug in the male quick connect on the blue “ohmic sensing cable” to the female quick connect on the blue wire from the DB 15 connector. Plug in the female quick connect to the ohmic clip on the torch.

4) Plug in the male quick connect of the white striped “ohmic return” cable into the female quick connect on the white/striped wire from the DB 15 connector. Plug in the female quick connect into the male quick connect on the table ohmic return clamp. Make sure the return clamp is clamped to the table or material securely, where it is out of the way of moving parts and successfully acts as the return line for the ohmic sensor.
5) Plug in and screw down the circular connector to the torch.

6) Install the “DB 25 to Minifit Connector Cable”. A “Mini Expansion Board” must be installed in your controller to use THC. The 18 pin rectangular Minifit connector plugs into the Mini Expansion Board, where it is labeled “Expansion Slot” on the back of the controller, and the DB 25 fastens to the THC box.

The LED turns on when it receives +5V from the control box

The Torch Height Control Part of your System should now be installed correctly.

Please verify that all the screws and connections are tight and reliable.
Preparing Plasma Table for Use

1) Verify that you meet all electrical power requirements, which are defined by the torch.
2) Verify that the air compressor is set up correctly.
   • Is it powerful enough for your needs?
   • Do you need an air filter or air dryer?
   • Does it keep pressure at the recommended range? If not, you may need an additional regulator.
3) Verify that everything is hooked up correctly to the power supply and to the torch.
4) Verify that the power supply settings are correct, which are material dependent. On many torches you can change the amperage, air pressure, and type of cut.
5) It is recommended that an initial test piece is cut when the torch is initially set up to verify that the torch is working properly with our software. The test cut consists of cutting a short line downhill along an incline to verify that the THC is working.

Example for Powermax

Verification Points:
- Make sure the torch is turned on
- Verify that your plasma torch settings are correct including amperage and air pressure
- Make sure the torch is set to “cut through material” setting
- Verify that there are no warning/issue lights displayed by the torch
- Verify that the air supply line is hooked up correctly to the torch

IMPORTANT: Research the torch that you are going to interface with. Some models of torches do not have a built-in voltage divider. A voltage divider will be required to get the system working properly. Contact the torch manufacturer for more information regarding voltage dividers.
Software Setup

1) Load proper setup file: Find your setup file, or configure your own in the “Configuration” tab. Your setup file contains all the information that your machine needs to run accurately and efficiently. Setup files can also be changed and customized to optimize your machine, and preferences.
   A. The setup file screen can be found by pressing the gear looking icon on the top right of the screen.
   B. You can use the default setup file and customize it, or open your specific setup file and save to the proper destination.

2) Define a “fabrication head” to configure torch height control options.
   A. In the configuration panel on the left side of the screen under the “Machine” category select “Fabrication Heads”.
   B. You can create a new fab head or select the default fab head. Double click the default Fab Head (Plasma 1 in example) to access the fabrication head configuration screen, or select “New Fab Head” to create a new one.
2.0) Fabrication head features screen

*The values in the screen are commonly used and recommended default settings for basic use*

<table>
<thead>
<tr>
<th>New Fab Head</th>
<th>Delete Fab Head</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID:</td>
<td>1</td>
</tr>
<tr>
<td>Model:</td>
<td>Powermax65</td>
</tr>
<tr>
<td>Name:</td>
<td>Powermax65</td>
</tr>
<tr>
<td>Offset:</td>
<td>X: 0 in Y: 0 in</td>
</tr>
<tr>
<td>Communication:</td>
<td>None RS-232/RS-485</td>
</tr>
<tr>
<td>Legacy Tool Number:</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>General Sensing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directions:</td>
</tr>
<tr>
<td>Feedrate:</td>
</tr>
<tr>
<td>Primary Sensor</td>
</tr>
<tr>
<td>Monitor Input Lines:</td>
</tr>
<tr>
<td>Sensor Offset:</td>
</tr>
<tr>
<td>Use Additional Sensor</td>
</tr>
<tr>
<td>Monitor Input Lines:</td>
</tr>
<tr>
<td>Sensor Offset:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Program Zero Sensing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use Program Zero Sensing:</td>
</tr>
<tr>
<td>Max Distance To Move:</td>
</tr>
<tr>
<td>Retract Distance:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Touch Off</th>
</tr>
</thead>
<tbody>
<tr>
<td>Touch Off At Start (G605):</td>
</tr>
<tr>
<td>Sensing Limit (Z Prog Coord):</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Advanced Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cut leadin when returning to toolpath:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Custom Charts Location</th>
<th>C:\Generic Data\Custom Cut Charts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copy Standard Charts To Folder</td>
<td></td>
</tr>
</tbody>
</table>

2.1) Define fabrication head

**ID:** Reference number of fab head  
**Model:** Select from various models supported  
**Name:** Edit and change name of torch  
**Offset:** Used to define the offset of a secondary fab head to the primary fab head.  
**Communication:** Allows the user to control certain aspects of the torch from the software.  
**Legacy Tool Number:** To change the torch using traditional tool change commands.
2.2) Torch Control

Torch Control

M50: Torch On
M51: Torch Off

2.3) Automatic Execution Mode

Automatic Execution Mode

M80: Start ATHC
M81: Stop ATHC

2.4) Torch Height Control

Torch Height Control

Use THC Checkbox: Click the checkbox to enable THC.
Arc Voltage Divisor: The amount that the raw voltage is divided by the plasma controller. (For example 25:1)
Lock Out Factor: % of programmed feedrate which turns off THC. This feature may improve cuts around corners.
Lock Out Hysteresis: After THC has been locked out, this is the amount (feed rate) that needs to change before THC is initiated again.
Set Point Offset: Changes the voltage display. This is for visual purposes only.
Sensitivity: Parameter that change how quickly the Z-Axis lifter adjusts to height change of material. Default = 16. Quickier response = lower number: Slower response = higher number.
Use Kerf Crossing Detection: Enables a feature to detect and safely cross Kerf or a gap that may potentially cause problems otherwise.
2.5) General Sensing

<table>
<thead>
<tr>
<th>General Sensing</th>
<th>Direction:</th>
<th>Positive</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Feedrate:</td>
<td>10</td>
<td>in/min</td>
</tr>
<tr>
<td>Primary Sensor</td>
<td>Monitor Input Line:</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>Sensor Offset:</td>
<td>0</td>
<td>in</td>
<td></td>
</tr>
<tr>
<td>Use Additional Sensor:</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Direction:** Direction of sensing movement  
**Feedrate:** The federate at which the axis senses  
**Primary Sensor:** This is the first sensor to be used  
**Monitor Input Line:** The input line used for primary sensing  
**Sensor Offset:** Offset of sensor (If switch has an offset)  
**Use Additional Sensor:** Can use as a secondary sensor in addition to the primary sensor.  
**Monitor Input Line:** Input line used for secondary sensor

2.6) Program Zero Sensing

<table>
<thead>
<tr>
<th>Program Zero Sensing</th>
<th>Use Program Zero Sensing:</th>
<th>Max Distance To Move:</th>
<th>Retract Distance:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>6 in</td>
<td>0.25 in</td>
</tr>
</tbody>
</table>

**Use Program Zero Sensing:** Enables program zero sensing  
**Max Distance to Move:** The max distance before the axis stops moving in the direction of the material. The value should be positive.  
**Retract distance:** The distance that the axis retracts program zero directly after sensing program zero.
2.7) Touch Off

Touch Off

- **Touch Off At Start (G605):**
  - [ ]

- **Sensing Limit (Z Prog Coord):** -1 in

**Touch Off at Start (G605):** Before the torch fires at the start of each cut in the G-Code, the material is sensed and referenced to achieve a consistent Pierce and cut height.

**Sensing Limit (Prog Coord):** The distance that the Axis will actively sense the material until it stops.

2.8) Advanced Control

Advanced Control

- **Cut leadin when returning to toolpath:** [ ]

**Cut Leadin**
Check box to enable the “cut leadin” feature.
This feature automatically starts cutting a lead in from your current position. The feature is commonly used after the torch has stopped in middle of a cut and you need to start where you left off without damaging the part.

2.9) Cut Charts

- **Use Standard Cut Charts**
- **Use Custom Cut Charts**

**Custom Cut Charts Location:** C:\Generic Data\Custom Cut Charts

- **Copy Standard Charts To Folder**

**Standard Cut Charts:** Predefined cut charts that the software references. Cut charts help optimize your torch cutting quality to a variety of variables contain important values such as material type, material thickness, federates, torch types, and amperage to name a few.

**Custom Cut Charts:** Create your own cut chart and enter in the file location. *Contact us about cut chart requirements*
3) M-Code Definition

*Software configuration settings in this manual are set to default settings*

The default settings define the Torch On/Torch Off output line M-Codes and the Start ATHC/Stop ATHC Macro M-Codes.

The default Macros includes the torch touching off the material, turn on the torch, wait for arc-transfer signal, pierce delay, and enable ATHC.

**M-80 Macro (ATHC ON)**

```
IF #1sDryRun = FALSE THEN
G605
M50
M101 I20
G04 X#PierceDelay
G601
ENDIF
```

**M-81 Macro (ATHC Off)**

```
IF #1sDryRun = FALSE THEN
G600
M51
ENDIF
```

*These macros can be modified for additional functionality listed below. For example, you may want to “feed hold” the system when there is a “loss of arc-transfer”.*
3.1) M-Codes

Output Line M-Codes

- M-50 (Torch On)
- M-51 (Torch Off)

Macro M-Codes

- M-80 (Start ATHC)
- M-81 (Stop ATHC)

Other M-Codes

- M-101 (Wait for Arc Transfer Signal)
- M-102 (Feed Hold When Loss of Arc Transfer)
- M103 I20 (Disable Feed Hold When Loss of Arc Transfer)

Associated G-Codes

- G600 (Turn Off THC)
- G601 (Turn On THC)
- G602 (Disable THC)
- G603 (Enable THC)
- G605 (Touch-Off)

3.2) Example M-Codes

Example M80 Macro (With Feed Hold on Arc Transfer)
(Start ATHC Macro)
G605 (Touch Off)
M50 (Torch On)
M101 I20 (Wait for Arc Transfer Signal)
M102 I20 S0 (Feed Hold When Loss of Arc Transfer)
G04 X#PierceDelay (Pierce Delay)
G601 (THC On)

Example M81 Macro (With Disable Feed Hold When Loss of Arc Transfer)
(Stop ATHC Macro)
G600 (THC Off)
M103 I20 (Disable Feed Hold When Loss of Arc Transfer)
M51 (Torch Off)

M102: Enable feed hold input line*

Syntax
M102 li Ss
i = input line number
s = 0 to trigger feed hold on untripped state, 1 to trigger feed hold on tripped state
**M103: Cancel activation of feed hold input line**

Syntax
M103 li
l = input line number

*The following input line types may not be used: limit, home/limit, safety.
The temporary feed hold is only active while running the G-Code file that enabled it. It is not active during jog, point move, homing, etc.
Resetting the G-Code file, or loading a new file, clears any temporary feed hold lines that have been enabled.

3.3) M-Code Execution

*Default settings are shown in the red boxes below

The default settings are set to automatically use torch height control (if enabled) and turn on the torch during any federate move. Any other code will automatically shut off torch height control and turn off the torch. After an error including “limit/safety/spindle” error the torch will be turned off.
4) Input Lines:
*(These are the default settings)*

The two main input lines used for ATHC are Input 19, and Input 20 from the Mini I/O Board (Reference Pinout)

A) **Input 19** is used for the ohmic sensor. This is a “Control” line and should be set to Normally Closed “N.C.”

B) **Input 20** is used for the “Ok to Start” function. This is a “Control” line and should be set to Normally Open “N.O.”

### Input Line Standard Use List

<table>
<thead>
<tr>
<th>Input Line</th>
<th>Function</th>
<th>NO/NC Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Input Line</td>
<td>N.C.</td>
</tr>
<tr>
<td>2</td>
<td>Input Line</td>
<td>N.C.</td>
</tr>
<tr>
<td>3</td>
<td>Input Line</td>
<td>N.C.</td>
</tr>
<tr>
<td>4</td>
<td>Input Line</td>
<td>N.C.</td>
</tr>
<tr>
<td>5</td>
<td>Input Line</td>
<td>N.C.</td>
</tr>
<tr>
<td>6</td>
<td>Input Line</td>
<td>N.C.</td>
</tr>
<tr>
<td>7</td>
<td>Magnetic Breakaway</td>
<td>N.C.</td>
</tr>
<tr>
<td>8</td>
<td>Secondary Touch Off</td>
<td>N.C.</td>
</tr>
<tr>
<td>19</td>
<td>Ohmic Sensor</td>
<td>N.C.</td>
</tr>
<tr>
<td>20</td>
<td>OK to Start</td>
<td><strong>N.O.</strong></td>
</tr>
</tbody>
</table>
Z-AXIS LIFTER SETUP

*Remember to unscrew the two shipping screws used to lock down the breakaway

Please familiarize yourself with the Z-Axis lifter features and functionality

### Parts Needed for Wiring

<table>
<thead>
<tr>
<th>Connectors/Contacts</th>
<th>Functions</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female Quick Connects (0.187” width)</td>
<td>Breakaway, Roller Switches</td>
<td>71F-187-20-NBL</td>
</tr>
<tr>
<td>Male Minifit Jr. Pins</td>
<td>Laser Pointer</td>
<td>0039000041</td>
</tr>
<tr>
<td>2 Position Minifit Jr. Connector</td>
<td>Laser Pointer</td>
<td>0039013029</td>
</tr>
</tbody>
</table>

Connections for the magnetic breakaway, and/or laser pointer

Magnetic breakaway attached to the spring-loaded lifter

Removable magnetic breakaway mounting screws.

*OK to remove
**Connections**

**Magnetic Breakaway**
The magnetic breakaway is used as a safety mechanism to prevent damage to you and the torch. You can configure the magnetic breakaway as a “Feed Hold” function in the software which will “feed hold” the machine when tripped. Wire it by connecting an input line to the male quick connects on the blue and white wires. The magnetic breakaway should be set to “Normally Closed”.

**Example of defining the magnetic breakaway in the input configuration careen as “feed hold” in input line 6**

<table>
<thead>
<tr>
<th></th>
<th>Feed Hold</th>
<th>Feed hold</th>
<th>N/A</th>
<th>N/A</th>
<th>N/A</th>
<th>0.001</th>
<th>N.O.</th>
<th>N.C.</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Magnetic Breakaway Adjustment**
Adjust the strength of the magnetic breakaway by changing the distance of the alignment cone set screws on the breakaway. Hollow set screws installed to lock down the adjustment on the cone set screw. Try breaking off the magnetic breakaway to verify correct strength of the magnets.
**Laser Pointer**

The Laser Pointer is an optional accessory and is extremely useful for setting program zero accurately, visualizing “dry runs” and determining if the material is in the proper location. Configure the laser pointer as a fabrication head and wire it to a defined output line using a M-Code.

**Define Laser Fab Head**

<table>
<thead>
<tr>
<th>Type: Laser Pointer</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID#: 1</td>
</tr>
<tr>
<td>Name: Laser Pointer</td>
</tr>
<tr>
<td>Offset: X: 0 in</td>
</tr>
<tr>
<td>Y: 0 in</td>
</tr>
</tbody>
</table>

**Laser Control**

- Laser On: M20
- Laser Off: M21

**Automatic Execution Mode**

- Start Of Cut: M20
- End Of Cut: M21

<table>
<thead>
<tr>
<th>Type: Select Laser Pointer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offset: The offset from the laser pointer to the torch.</td>
</tr>
</tbody>
</table>

**Laser Control:** Define an M-code to turn on/off the output line of the laser pointer.

**Automatic Execution Mode:** Select the same M-Code as “Laser Control”.

**Define M-Code for Laser Pointer**

M20 turns the laser pointer “On”. M21 turns the laser pointer “Off”. Refer to the picture below for standard configuration.

<table>
<thead>
<tr>
<th>M20 Laser ON (On)</th>
<th>0</th>
<th>3</th>
<th>On</th>
</tr>
</thead>
<tbody>
<tr>
<td>M21 Laser OFF (Off)</td>
<td>0</td>
<td>3</td>
<td>Off</td>
</tr>
</tbody>
</table>
Limit/Roller Switches

There are two roller switches located on the Z-Axis Lifter. Use the roller switch fixed to the mounting bracket on the upper left corner as the Z-Axis “limit switch”. Use the roller switch located on the spring-loaded lifter as a secondary “touch off” mechanism. Input lines for limit switches are usually wired to inputs 1-6. Secondary touch off is wired to input line 8. A limit switch cable and female quick connects are needed for connection to the switches.
THC Verifications

Simple THC Setup Verification

Simple Verifications

1) **Ohmic sensor:** Touch the white blue wire to the blue wire to see the ohmic sensor activate in the software.
2) **Force the torch on:** Using the torch button in the software.

Simple Test Runs

3) Test run on a flat piece (sampling on)
4) Test run on a flat piece (sampling off)

Inclined Test Run

5) Test run on an inclined piece. The test cut should be made on an inclined piece of metal with the torch moving to the lower side so the torch doesn’t crash if the THC is not working as expected.

Common problems:

1) No voltage divider (the reported voltage is always between 4 and 9 volts when cutting)
2) Wrong voltage divider setting (the voltage when cutting doesn’t closely match the cut charts)
3) Isolation box not connected with no green light on it. Reported arc voltage = 0V at idle.

Troubleshooting:

1) Verify that all connections are fully plugged in and/or screwed on. Incorrect cable fastening is one of the largest contributors to problems.
2) If there’s a problem “re-connect” all cables and try again. Sometimes, although rare, a cable may become improperly fastened over time. (This can happen from rust, water, dust, slippage, vibration, etc.)
3) Verify that all cables are installed correctly, and connections, especially the torch ground clamp and the ohmic clamp, are secured correctly to the table. It may be helpful to make a checklist by your machine.
Advanced Torch Height Control Testing, Verification, and Diagnosis

Before You Begin:

1. **Does your torch have a 50:1 voltage divider?**
2. **Verify that your Torch Height Control Configuration is correct.** Make sure that the z-axis feedrate is sufficient.
3. **Is the reported ARC voltage on the CNC panel between 4 and 9 volts when the system is idle?**
4. **Does the ohmic sensor function?**
   A. observe the state of input 19 on the diagnostic panel.
   B. with the blue wire (ohmic input) disconnected from the table and ohmic return (white-blue wire) is the input dark?
   C. with the blue wire connected to the table and the ohmic return, is the input illuminated?
   D. manually fire the torch
      i. From the CNC panel, press the gray torch button on the upper left of the screen.
      ii. A dialog box will appear stating that "The system is about to turn output line 1 on. Do you with to continue?"
      iii. Click "OK".
      iv. The torch should turn on.
      v. Click the blue Torch button on the upper left of the screen.
      vi. The torch should turn off.
5. **Verify the machine geometry**
   A. from the CNC panel, make a 1" incremental move for the x-axis.
      i. Did the machine move exactly 1" in the x direction?
   B. from the CNC panel, make a 1" incremental move for the y-axis.
      i. Did the machine move exactly 1" in the y direction?
   C. from the CNC panel, make a 1" incremental move for the z-axis.
      i. Did the machine move exactly 1" in the z direction?
   D. Verify magnetic breakaway operation
      i. Remove the 2 bolts used to secure the breakaway during shipping.
      ii. Adjust the holding force.
         a. Tighten the (4) set screws used to orient the breakaway.
            Keep in mind there is a jam set screw installed on top of the conical set screw used to prevent the conical set screw from backing out. Rotate the jam set screw counterclockwise until the wrench is now able to engage both set screws and tighten them, thus lifting the aluminum plate away from the steel plate.
         b. Once the conical set screws are in the proper position lock them in place by only tightening the jam set screw.
         c. You should be able to adjust the set screws until the 2 plates no longer hold together, however if the holding force is still too high you can remove magnets from the back of the aluminum plate. Start with the smaller magnets and eventually move to the larger magnets.
      iii. Wire the breakaway wires to an input line. The white wire will go to the ground connection on the input connector and blue wire will go to the input connection on the input connector. This input should be defined in the software as a safety input. This way any time the 2
plates separate all motion will be stopped. After this switch is wired to the controller you can test the functionality by going to Controller, Input Line Status and remove the aluminum plate from the steel plate and you will see the input line change state in the software.

Verifying Torch Height Control Operation:

1. **Create a simple part and prepare to machine it.**
   A. Draw a simple part on the CAD panel and go to the CAM panel.
   B. Change the plasma settings so that they match the material being cut and the torch being used.
      If using a non-listed torch, edit the settings so that they match the cut charts provided by the torch manufacturer. It is highly recommended that for initial testing a flat plate is used.
   C. Submit to CNC by pressing the Machine button.

2. **Verify machine motion**
   A. Click on the THC icon on the CNC panel so that it is gray. This disables THC while still allowing a proper motion in the z-axis for piercing.
   B. Locate the torch where appropriate
   C. Zero the program coordinates (x and y)
   D. Perform a "sense z zero"
   E. Uncheck the enable check box next to the torch on the CNC panel - this will disable the torch from firing
   F. Press the play button
   G. The torch should move to the configured safe-z height and perform the x-y motion that would cut the part as drawn (if the torch turned on).

3. **Cut a part with THC disabled**
   A. Re-zero the machine
   B. Reset the g-code
   C. Verify that the THC icon on the CNC panel is gray
   D. Check the enable check box next to the torch on the CNC panel - this will enable the torch.
   E. Be prepared to watch the arc voltage reported on the CNC panel during the cut
   F. Press the play button
   G. Observe the following operation:
      i. The machine performs a touch-off
      ii. The machine moves to pierce height
      iii. The torch fires
      iv. The system waits until the arc transfer signal becomes active
      v. The system waits for the pierce delay timer to expire
      vi. The machine starts motion - during the start of motion, the torch will move from pierce to cut height
      vii. The machine cuts the part as drawn
      viii. The machine turns off the torch
      ix. The machine moves to the safe z-height
   H. Did the arc voltage closely match the recommended cut voltage as called out in the manufacturer's cut chart?
   I. Was the part cut as drawn? Does it's size match?

4. **Cut a part with THC enabled and Sampling Enabled**
   A. Re-zero the machine
   B. Reset the g-code
C. verify that the THC icon on the CNC panel is blue
D. verify that the Use Sampling Voltage checkbox is checked.
E. press the play button
F. observe the following operation:
   i. the machine performs a touch-off
   ii. the machine moves to pierce height
   iii. the torch fires
   iv. the system waits until the arc transfer signal becomes active
   v. the system waits for the pierce delay timer to expire
   vi. the machine starts motion - during the start of motion, the torch will move from pierce to cut height. **For the first portion of travel (typically < 1/4") the arc voltage is sampled and averaged. This sampled value is used as the target arc voltage for the remainder of the cut.**
   vii. the machine cuts the part as drawn adjusting the height of the torch above the plate so that the arc voltage closely matches the sampled value.
   viii. the machine turns off the torch
   ix. the machine moves to the safe z-height
   x. the software updated the set point voltage to that used during the cut.
G. Does the set point voltage closely match the cut voltage as specified in the torch manufacturer’s cut chart?
H. Cut a part with THC enabled and Sampling Disabled re-zero the machine
   i. reset the g-code
   ii. verify that THC icon on the CNC panel is blue
   iii. verify that the Use Sampling checkbox is unchecked
   iv. verify that the Set Point voltage on the CNC Panel matches the material being cut
   v. press play
   vi. observe the following operations
      a. the machine performs a touch-off
      b. the machine moves to pierce height
      c. the torch fires
      d. the system waits until the arc transfer signal becomes active
      e. the system waits for the pierce delay timer to expire
      f. the machine starts motion - during the start of motion, the torch will move from pierce to cut height.
      g. Torch Height Control will use the programmed Set Point voltage for the cut.
      h. the machine cuts the part as drawn adjusting the height of the torch above the plate so that the arc voltage closely matches the Set Point voltage.
      i. the machine turns off the torch
      j. the machine moves to the safe z-height
      vii. Did the torch closely follow the material?
Advanced

1. Verify Cut Height
   A. Perform test 2.D. again and press the stop button during the cut. Using a feeler gauge, measure the height of the torch above the workpiece.
   B. Compare the height recorded to the cut height recommended in the torch manufacturer's cut chart.
   C. Perform test 2.E. again and press the stop button during the cut. Using a feeler gauge, measure the height of the torch above the workpiece.
   D. Compare the height recorded to the cut height recommended in the torch manufacturer's cut chart.

2. Verify THC operation on an inclined plane
   A. Raise one side of the workpiece so that the torch would be cutting down the slope (We want to cut down the slope in order to minimize the chance of the torch contacting the workpiece.)
   B. Perform test 2.E. again
   C. Did the torch follow the plane of the material?

Revision History

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