



**The Techno CNC Plasma System is powered by 220 volt single phase power.**

This document will provide a quick guide to the set up and operating procedure of the Techno CNC Plasma Cutter.

## Safety Information!

1. **Before operating**, ensure proper ventilation.
2. **DO NOT** operate this machine without proper training.
3. **DO NOT** operate unattended.
4. **DO NOT** wear jewelry or loose clothing when operating machine.
5. **Wear proper eye protection.**
6. **Wear proper protective clothing.**
7. **Keep clothing and hair away from the Torch and hot metals.**
8. **Keep all areas around the Torch free of flammable materials**, including but not limited to wood, flammable material scraps, clothing, cleaning solvents, plastic and more.
9. **In case of emergency**, have fire extinguishing equipment available.
10. Make sure the **Ground Clamp (Work Lead) is connected** to material being cut.
11. **Before servicing**, disconnect **all** power sources.



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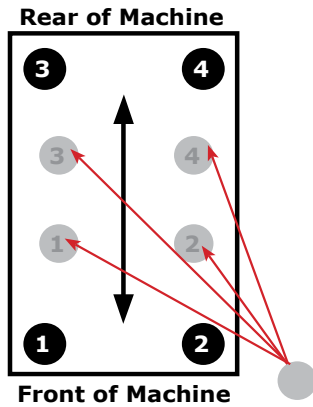
# PLASMA FORKLIFT GUIDE

**I. SAFETY WARNING: DO NOT LIFT OR MOVE MACHINE USING GANTRY**

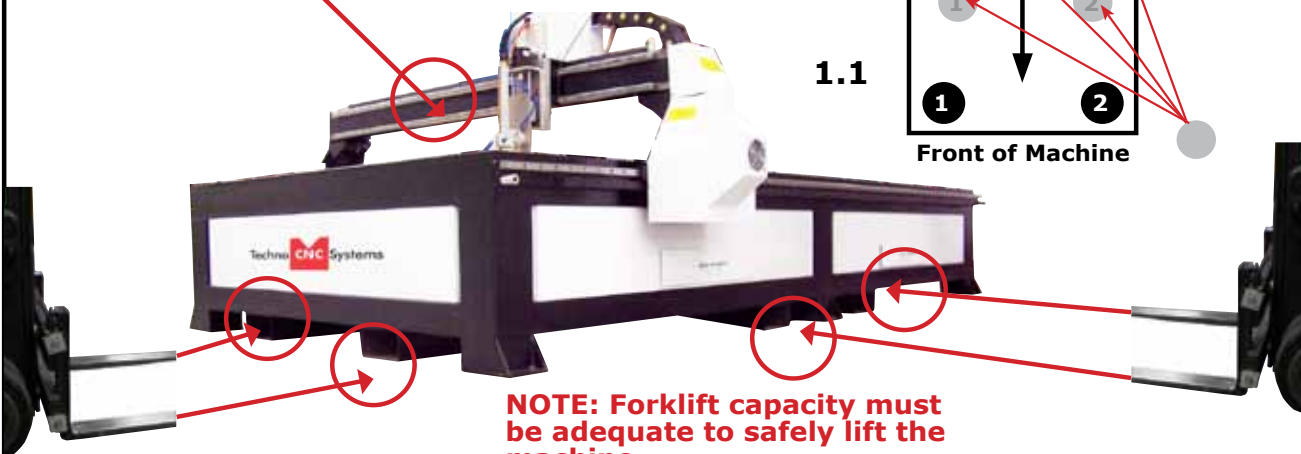


**Fig. 1.1**

- Please note the 4 Forklift Tubes on the front and rear of the machine.
- If required, there are 4 Forklift Tubes on the sides of the machine.



**1.1**

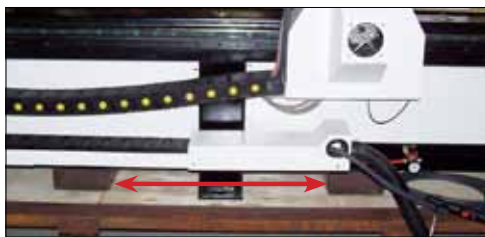


**NOTE: Forklift capacity must be adequate to safely lift the machine.**

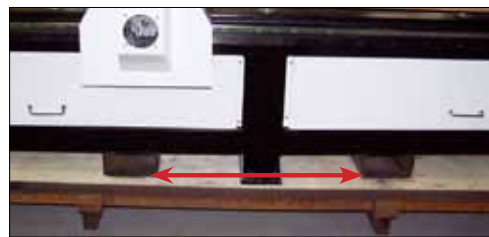
**For safety and to prevent damage to the machine and cables, Lift Machine Using Forklift Tubes ONLY**

## II. MEASURING FORKS AND FORKLIFTING MACHINE

**2.1** All Techno machines are shipped assembled and secured to a wooden pallet.



Left Side



Right Side

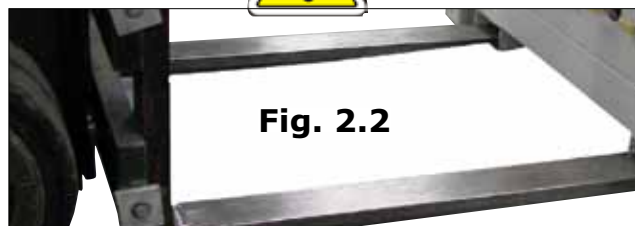
**Fig. 2.1**

Measuring the distance between the forks.  
(shown in Fig 2.1).

**2.2** Be very careful not to damage the wiring and/or the plumbing underneath the machine.

Take care not to damage the machine. Slowly move in close to the machine.

Forklift your machine up from the floor and remove the wooden pallet.



**Fig. 2.2**

It is recommended that you have professional riggers conclude the installation if you are uncomfortable with this method.



## **WARNING! READ, FOLLOW AND UNDERSTAND THE TORCH MANUAL BEFORE BEGINNING USE.**

- 1) *Use a welding screen when operating Plasma Torch.*
- 2) *Wear proper eye protection.*
- 3) *Wear proper protective clothing.*
- 4) *Disconnect all power before adjusting, loading, or replacing any materials or consumables on the machine table or torch.*
- 5) ***CUT MATERIAL AND MACHINE WILL REMAIN HOT FOR MANY MINUTES AFTER PLASMA TORCH HAS BEEN SHUT OFF. LET COOL ACCORDINGLY. ALWAYS USE GLOVES TO AVOID BURNS AND SHARP EDGES.***
- 6) *Disconnect all power before servicing the CNC machine or torch. The machine may have multiple power sources, disconnect all power sources.*
- 7) *Ensure proper ventilation is setup and used during operation of Plasma Torch.*
- 8) *Install Plasma Cutter on a non-flammable surface only.*
- 9) *Keep all areas around the Plasma Torch free of flammable materials, including but not limited to wood, flammable material scraps, clothing, cleaning solvents, plastic and more.*
- 10) *Keep clothing, hair, and jewelry away from the Plasma Torch and hot metals.*
- 11) *Do not operate unattended.*
- 12) *Have appropriate fire extinguishing equipment available in case of emergency.*
- 13) *Refer to MSDS for material being cut for material-specific safety instructions. Stainless steel can be particularly dangerous.*

# DANGER!

**MULTIPLE POWER SOURCES**  
Disconnect All Power  
Sources before Servicing

This Equipment has 2 Power Sources  
To Disconnect Power:  
Unplug power cord to this panel from receptacle.  
And Disconnect and lock out  
power to Plasma Torch.



The Techno CNC Plasma  
System is powered by 220 volt  
single phase power.

## WORK LEAD TERMINAL



Make sure the Ground Clamp  
(Work Lead) is connected to  
the material being cut.



Please make sure the CNC Plasma  
is properly grounded using the  
grounding lug provided on the rear  
leg of the machine.



Have a licensed electrician perform  
all electrical connections based on  
your electrical codes!

## II. Techno CNC Plasma Installation

### Machine and Controller Connections

**1.1** The Electronics are housed in the large controller box as shown in Figure 1.1. When unpacking the machine, avoid twisting the plastic conduit that guides the cables to the motors.

**1.4** Plug the labelled cables into their proper places. 2 labelled interface cables, 1 monitor and 2 USB for mouse and keyboard.

**Fig. 1.1**

**1.2** Open the front of the controller box



**1.3** Unpack the computer and monitor and mount them inside the controller. The PC fits on the bottom shelf and the LCD screen rests on its mounts.

**Fig. 1.4**



See PC and Controller Interface Connections on page 25.

**1.5** The terminal for the 220 volt connection is located at the bottom of the box. The hole on the left is for power to the PC and monitor. The middle hole is for the Hypertherm machine interface cable.

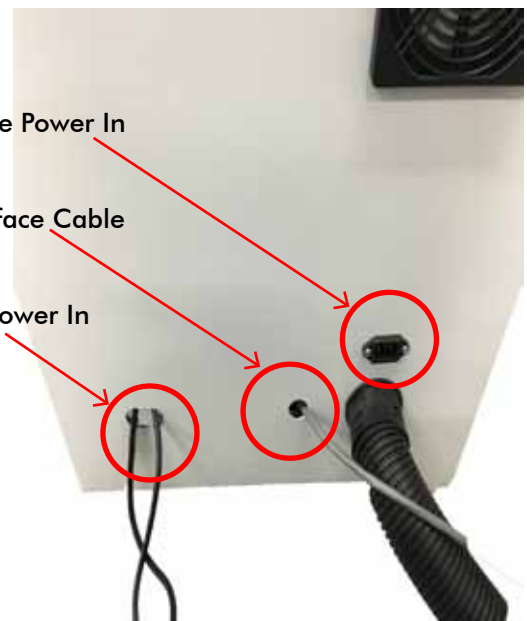
**Fig. 1.3**



220V Single Phase Power In

Hypertherm Interface Cable

PC and Monitor Power In







**WARNING:** Read this setup thoroughly before running the machine. Have a licensed electrician perform all electrical connections based on your local codes!

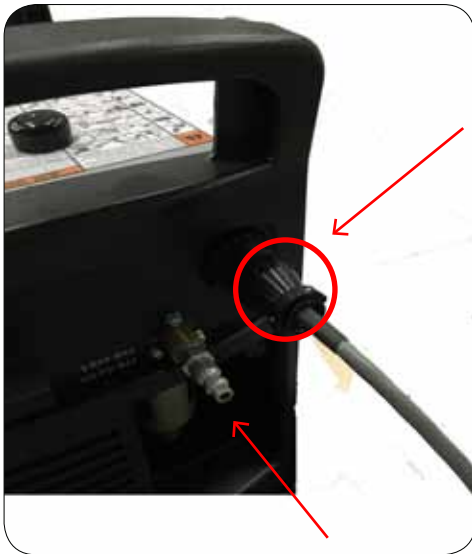
## Iib. Plasma Torch Connections

When hooking up the plasma torch, be sure to use appropriate power. See Hypertherm documentation or refer to quote for details.

Please read and understand the Hypertherm torch manual before operating the machine.



Make sure the torch and grounding clamp are plugged in.



Hypertherm Machine Interface Cable from Controller box

Both the Hypertherm torch and the plasma machine need compressed air to operate. If there is no air going to the plasma machine, you will receive an error saying "E-STOP". You will NOT be able to move both the x and y axis until compressed air is connected to the machine.

The error "E-STOP" will also appear when the torch is not in its correct position. This acts as an e-stop if the torch knocks into something while in motion.

Compressed air is required to operate



## III. Controller Functionality

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### Machine Controls



**Emergency Stop** - Cuts off the power to the machine.

**Power Button** - Turns the machine on and off when the machine has power and the power breaker is in the on position.

**Power Indicator Light** - Light on indicates power to the machine.

### Power Breaker

The power breaker is used as a safety feature. The machine will only power up when the breaker is in the vertical "ON" position. Spin the selector clockwise from "OFF" to "ON" in order to enable the machine and lock out access to the high powered electronics inside the controller cabinet.

**"OFF" Position**



**"ON" Position**





## IV. Controller Screen Layout

### Main Layout Controls and Description

The screenshot displays the WinCNC Controller software interface. At the top, there is a menu bar with options: File, Configuration, Settings, View, Options, Units, Transit, Jog, and Help. Below the menu bar is a **Tool Bar** containing various icons for file operations and navigation.

The main interface is divided into several functional areas:

- Command Box and History Viewer:** A large white rectangular area on the left side of the interface.
- Axis Window:** A panel in the top right showing current axis positions and limits.
 

Axis	Position	Limit
X	1.050	300
Y	2.062	300
Z	1.423	100
- WinCNC Controller Logo:** A logo in the top right corner with the text "WinCNC Controller" and "PC Based Motion Control".
- Custom Functions:** A central panel with buttons for "Seek Limits", "Go Home", "Set XY", "Set Z", "Touch Top", "Clear", and "Calculator".
- THC Configuration Window:** A panel on the right side containing settings for "TEST", "THC" (set to Auto), "Target Voltage" (128.0), and "Arc Voltage" (0.0). It also includes a "Torch" indicator.
- Pen Mod Selection:** A panel below the THC configuration showing "Pen Mode OFF".
- Status Indicators:** A panel at the bottom right showing "Arc Present" (off) and "EStop" (on, indicated by a green light).
- Jog / Transit Direction, Speed, Step Size Buttons:** A central joystick-like control with directional buttons (X, Y, Z) and speed buttons (Fast, Med, Slow). Below it are step size buttons (.001, .01, .1, 1) and a "P1" dropdown menu with "Edit" and "Go" buttons.
- Live View and Toolpath Viewer:** A large grid area on the bottom left showing a red dot representing the current tool position. Below the grid, coordinates are displayed: "X:78.8272 in., Y:106.2026 in. [5 in.]".

The status bar at the bottom of the window shows the file path "C:\USERS\TECHNO PLASMA\DESKTOP" and the current program "G00 G90".

## V. Controller Button Functions

### Tool Bar

The tool bar is a collection of shortcut buttons that perform specific actions.

**START**  
Execute command line or job

**RESTART / SKIP**  
Restarts a job at a given line number

**SINGLE STEP MODE**  
Allows you to execute single lines of a g-code file at a time.

**STOP / ABORT** Stops a running command or job

**PAUSE**  
Pauses a running command or job

**OPEN**  
Opens Explorer to open a job file

**VIEW HISTORY**  
Opens Job history browser

**SOFT LIMITS**  
Enables/Disables soft limit features

**VIEW**  
Displays the current job in the viewer window

**EDIT**  
Opens Notepad to edit a job file

**SIMULATE**  
Simulates a file to check for errors and run time

### Axis Window

The axis window is the primary display for current information about each axis on your machine. The current positions and velocities for each axis are displayed in the text boxes.

**Machine Status**  
Displays current units, active modes and current feed rate override percentage

**Red Triangle**  
Indicates a triggered limit switch (left low, right high)

**Green Box**  
Indicates an origin offset is applied

**Blue Box**  
Indicates a workspace offset is applied

**Slider Bar**  
Controls feed rate override

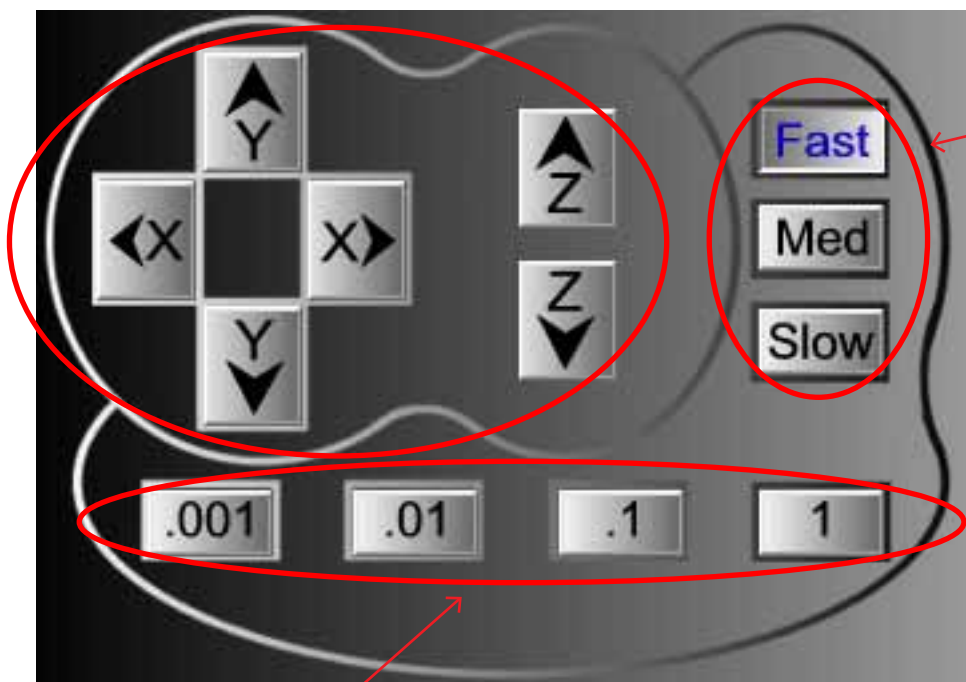
Axis	Position	Limit
X	0.000	300
Y	0.000	300
Z	0.000	100

## Jog and Incremental Buttons

These buttons are what allow you to initiate a manual jog or incremental movement. In jog mode, holding the button down will continuously move the machine. In incremental mode, each time a button is pressed the machine will move according to the jog increment that has been selected. Holding the button down in incremental mode will move the machine only once.

### Movement Direction Buttons

When pressed, these buttons allow the machine to move in selected direction in the selected mode.  
(Jog or Incremental)



### Jog Speed Buttons

When pressed, these buttons allow the machine to move at predetermined continuous speeds.

### Jog Increment Buttons

When pressed, these buttons allow the machine to move in steps of the selected increment.

## Viewer

WinCNC contains a built in viewer window that will allow you to display the output of G-Code files before the job is actually run. By default, the viewer can also display a G-Code file line by line as it is run.

G0 rapid moves are shown as a black dashed line. G1 feedrate moves are displayed as a solid blue line.

To view a file before you run it, open the file in the command line and then press the viewer button on the toolbar.

Once the object is loaded into the viewer the following controls can be used:

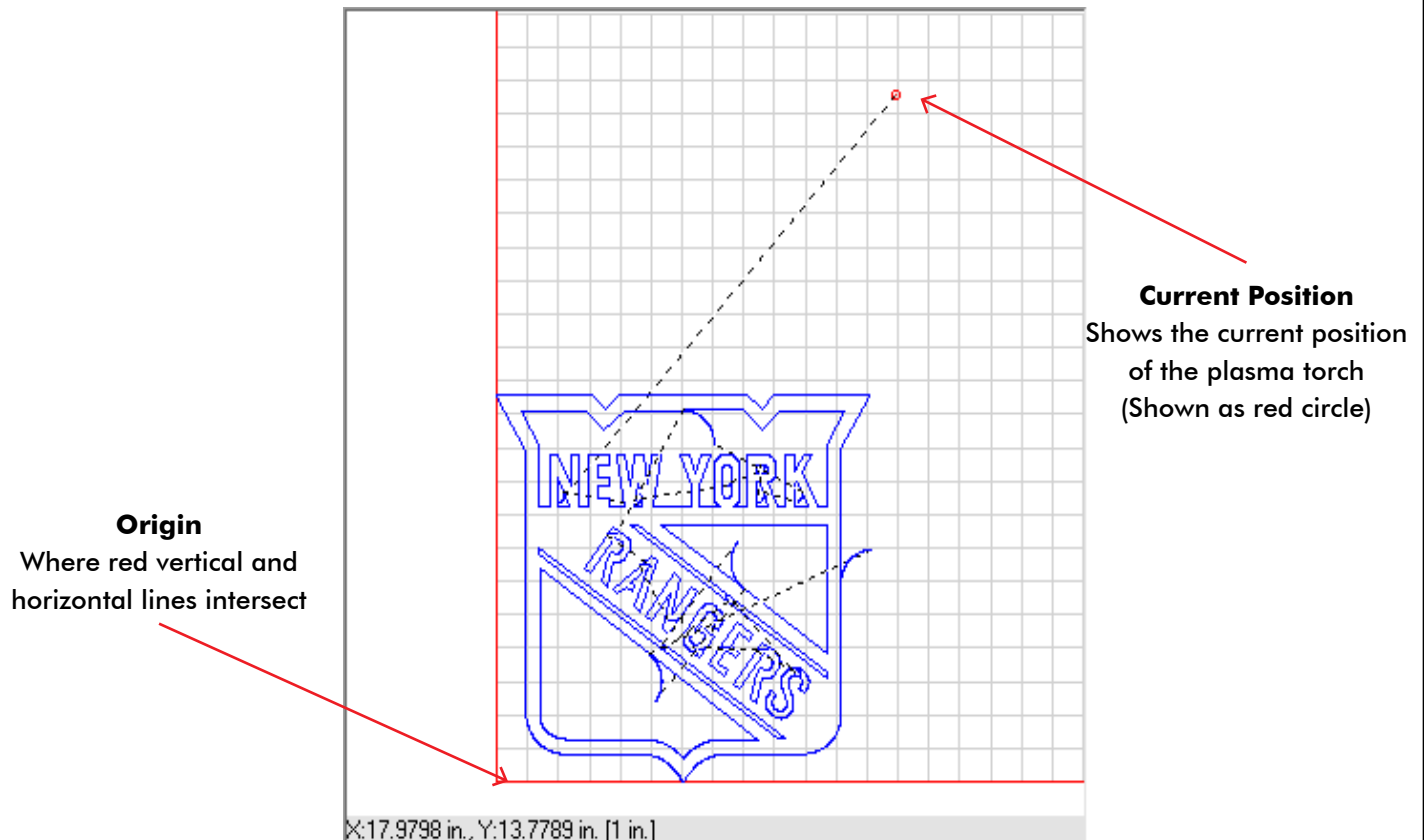
**Zoom In** - click the left mouse button.

**Zoom Out** - click the right mouse button.

**Selected Zoom** - hold down the left mouse button and drag the box around the area to zoom in on.

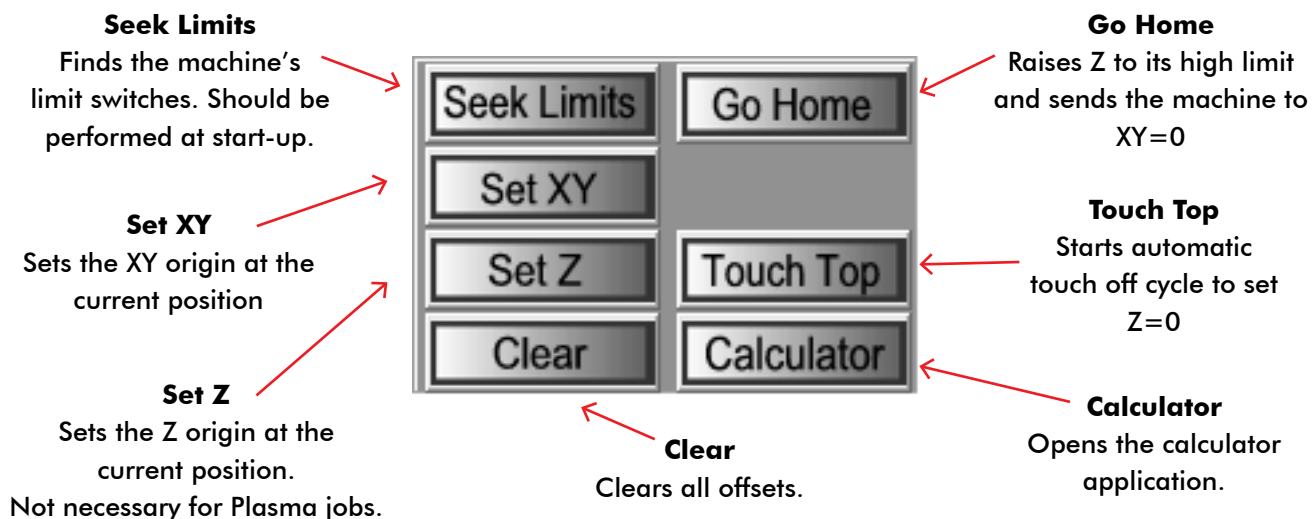
**Pan or Re-Center Object** - hold CTRL and click either mouse button.

**Reset Image** - hold shift and click either mouse button



## Function Buttons

These buttons perform preset functions. They are used as shortcuts for many G-code operations.



Pen Mode is unique to the CNC Plasma. It is a mode that allows the machine to use a pen to draw the given job onto the material. Click to turn on and off. Button shows current mode

Pen mode:

Disables Touch-Off

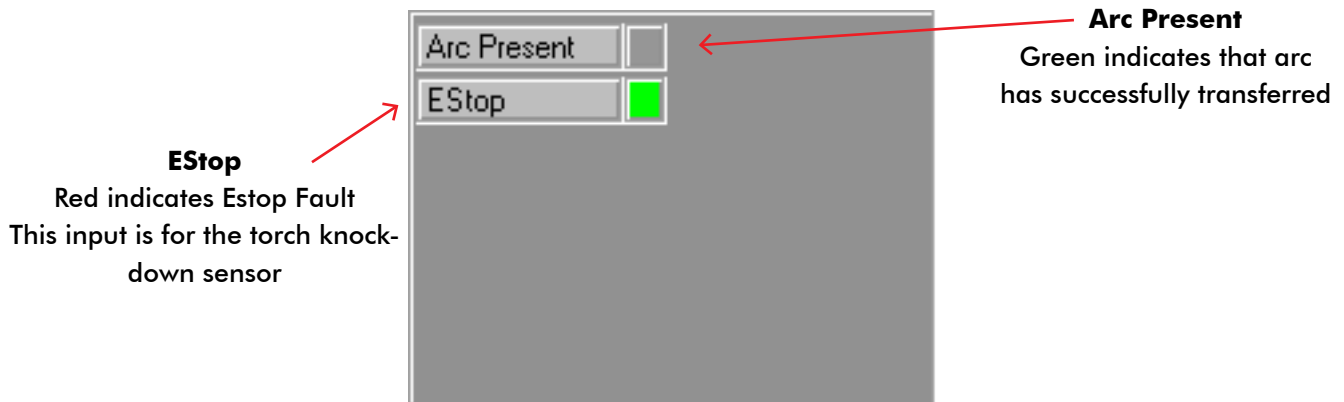
Disables Torch On

Applies Pen Offset (Blue Box on Y-axis Coordinates)

User must set Z using "set Z" for pen on material

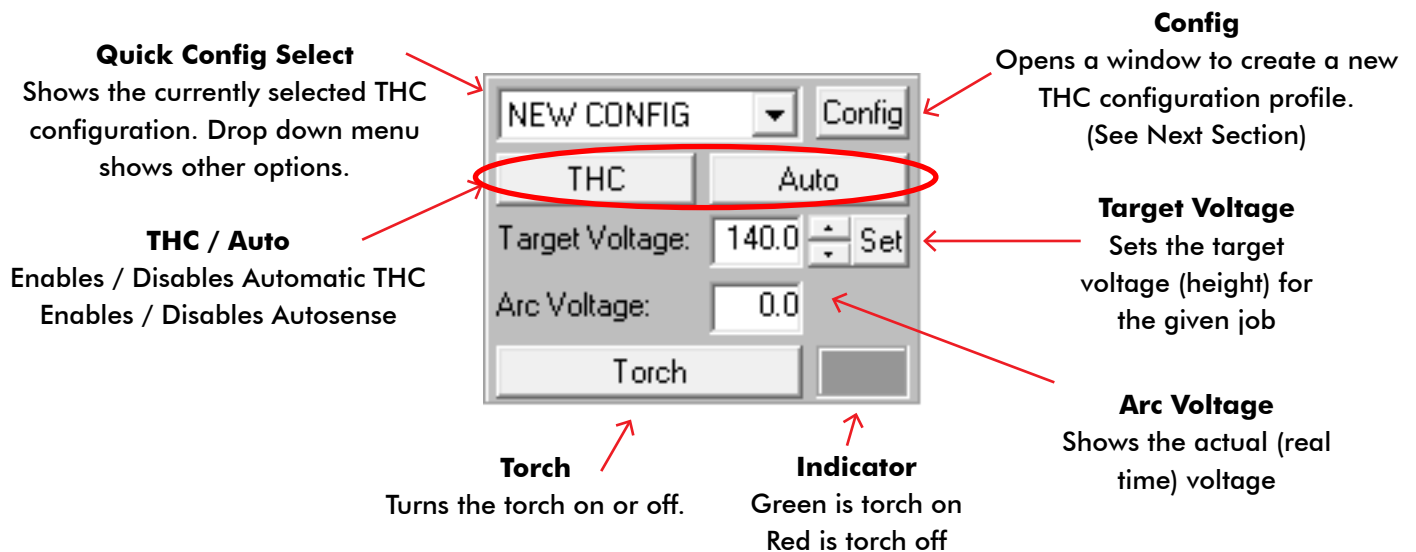
## Status Indicators

This window shows certain machine inputs and outputs.



## Torch Height Control (THC) Quick View

This window allows the user to select preconfigured THC modes as well as perform basic commands.





## THC Configuration Window

This window allows the user to save THC profiles for future usage. We recommend saving a new configuration profile for each material type and thickness used.

The highlighted variables should always be used. All values are taken directly from the Hyperthem Manual's Cut Charts.

See section V to learn how to set these values

**Material Name**  
Configuration name

**Torch Amps**

**Feed Rate**

**Target Voltage**

**Pierce Delay**

**Piercing Height**

**THC Mode**  
3 Options

**Config List**  
Shows a list of THC profiles. Select one to edit it.

**Cutting Height**

Disabled - No THC, maintains a fixed height

Automatic - THC On, maintains a fixed height above the material based on voltage (recommended)

Auto Sense - Uses voltage from initial touch off as fixed height

## VI. Using the Cut Charts

### Setting the Plasma Cut Parameters:

Please refer to your Hypertherm Powermax Manual's cut chart to ensure proper settings. Maximum cut speeds are the fastest speeds possible to cut material without regard to cut quality. Recommended cut speeds are a good starting point for finding the best quality cut. You will need to adjust the speeds for your application and your table to obtain the desired cut quality.

Arc current (amps)	Material thickness	Torch-to-work distance (in)	Initial pierce height		Pierce time delay (sec)	Recommended		Maximum	
						Cut Speed (ipm)	Voltage (V)	Cut Speed (ipm)	Voltage (V)
30	0.018 in (26 Ga)	0.06	0.15 in	250%	0.0	360	117	400*	118
	0.030 in (22 Ga)					340	116	400*	117
	0.036 in (20 Ga)					320	115	400*	117
	0.060 in (16 Ga)				0.2	225	111	280	115
	0.036 in (20 Ga)				0.0	380	115	400*	112
	0.060 in (16 Ga)				0.0	350	116	400*	115
45	0.075 in (14 Ga)	0.06	0.15 in	250%	0.1	280	117	380	115
	0.105 in (12 Ga)				0.3	190	117	240	115
	0.135 in (10 Ga)				0.4	140	117	175	115
	0.188 in (3/16 in)				0.5	85	118	110	115
	0.250 in (1/4 in)				0.6	60	120	75	116
	0.375 in (3/8 in)				0.9	32	122	40	116
	0.500 in (1/2 in)	Edge start recommended				20	132	25	125
	0.625 in (5/8 in)					11	138	14	127
	0.750 in (3/4 in)					8	140	10	131
	1.000 in (1 in)					4	146	5	142

**The cut chart on the previous page is being used as an example. It is from the Hypertherm PowerMax manual. It represents the cut chart for shielded consumables on Mild Steel with English Units.**

In this example, we will be cutting 16 Ga mild steel and we will use the recommended settings. These are merely recommended settings, you will need to adjust accordingly.

We will use the cut chart from left to right.

First, we need to open the WinCNC controller and open the THC config window.

Name the Material "16 Ga - 45 amps"

We will start with "Torch Amps". For our given setup, we will be using 45 amps. Input 45 into the "Torch Amps" box and make sure the Hypertherm torch is set to 45 using the front knob.

Next, we choose our material thickness. In this example, we will be using 16 Ga.

As we move from left to right, we can use and set various parameters.

Torch-to-work distance is our "Cutting Height" value. Enable "Cutting Height" and set the value to .06"

Initial Pierce Height is our "Piercing Height" value. Enable "Piercing Height" and set the value to .15"

Now we will set our Pierce delay, under "Pierce Delay" enter 0.0.

For the best cut results, we will use the "Recommended" settings for feed rate and voltage.

Our cut speed will be 350 inches per minute. Put 350 in the spot marked "Feed Rate"

Our voltage will be 116. Put 116 in the spot marked "Target Volts"

Finally, choose a THC mode. In cases of flat sheet material, you can choose "disabled". If there may be any chance of variation of material thickness or height or the material may be warped, choose "Automatic"

Click "Save" to save the profile and "Done" to exit

## VII. Plasma Quick Start Guide

This guide will assume all machine, controller, plasma and PC connections have been made and that you are ready to run a file.

### Step 1 - Power Up

Turn on power to the machine, plasma torch and PC. Ensure the torch and machine have an adequate air supply and the ground clamp is properly on the material being cut.



### Step 2 - Seek Limits

Once powered up, please choose "Seek Limits" from the controller screen. This will ensure proper positioning.

**WARNING:** Before seeking limits, ensure that the plasma table is free from obstruction.



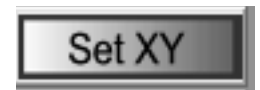
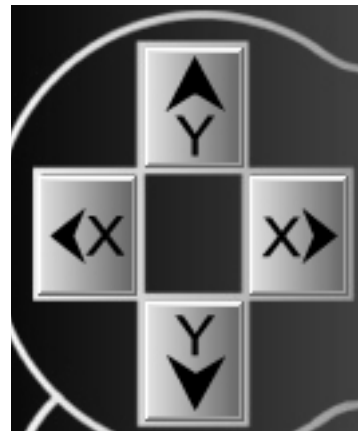
### Step 3 - Setting the Origin

Jog the machine to the desired X/Y start position by pressing the X and Y directional keys.

Once located, press "Set XY".

The display should now show X and Y coordinate values of 0.000 with green boxes as indicators that the origin has been set.

Z may have a non zero number.



IN G55 G92		100%	
X	0.000	<span style="color: green;">■</span>	300
Y	0.000	<span style="color: green;">■</span>	300
Z	0.000	<span style="color: blue;">■</span>	100

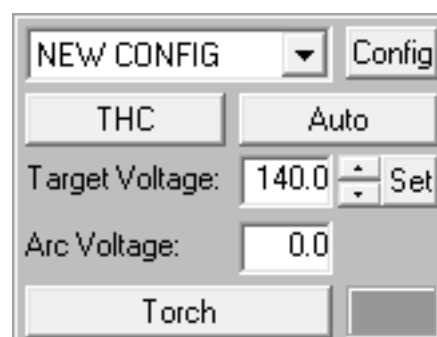
#### Step 4 - Testing the Touch Off

Before running a file, we want to test the torch touch off. Make sure the material is under the torch for this test and the work lead is attached to the raw stock. Press "Touch Top" button. The torch should lower to the material, touch off, and retract.



#### Step 5 - Choosing the THC profile

Choose a THC config from the Quick Config menu. Ensure all settings are consistent with Hypertherm Cut Charts.



#### Step 6 - Load and Simulate G-Code file

Press "Open" and navigate to and select the file you would like to run. Once selected, choose "Simulate" to check for errors. You may also choose "View" to show the tool paths in the Viewer window.



**OPEN**



**SIMULATE**



**VIEW**

#### Step 7 - Start the File

Press play.

The machine will automatically touch off and set the height for cutting then proceed to execute the G-code program.



**PLAY**

## VIII. Pen Quick Start Guide

This guide will assume all machine, controller, plasma and PC connections have been made and that you are ready to run a file.

### Step 1 - Power Up

Turn on power to the machine, plasma torch and PC. Ensure the torch and machine have an adequate air supply and the ground clamp is properly on the material being cut.



### Step 2 - Seek Limits

Once powered up, please choose "Seek Limits" from the controller screen. This will ensure proper positioning.



**WARNING:** Before seeking limits, ensure that the plasma table is free from obstruction.

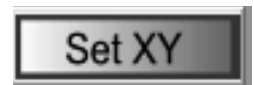
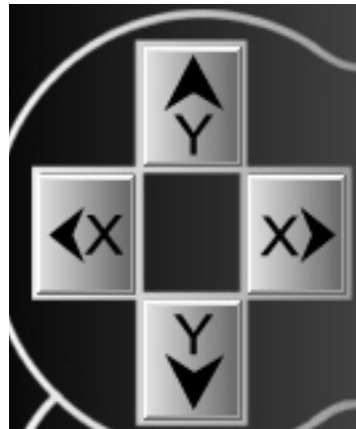
### Step 3 - Setting XY=0

Jog the machine to the desired X/Y start position by pressing the X and Y directional keys.

Once located, press "Set XY".

The display should now show X and Y coordinate values of 0.000 with green boxes as indicators that the origin has been set.

Z may have a non zero number.

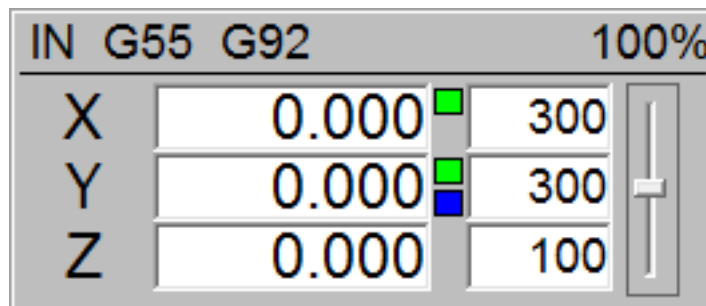


### Step 4 - Setting Pen Mode

Press the "Pen Mode" button. It should now say "ON" and the Y axis should move and have a blue box next to its position.

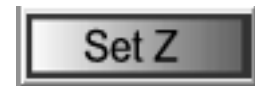






### Step 5 - Setting Z=0

Place the Pen in the pen holder. Carefully lower the Pen down using the Z down button. Once the tip is touching the material, press "Set Z".



### Step 6 - Load and Simulate G-Code file

Press "Open" and navigate and select the file you would like to run. Once selected, choose "Simulate" to check for errors. You may also choose "View" to show the tool paths in the Viewer window.



**OPEN**



**SIMULATE**



**VIEW**

### Step 7 - Start the File

Press play.



**PLAY**

The machine will proceed to execute the G-code program.

## IX. Supported Code

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G-Code	Description	Usage
G0	Rapid Movement	G0 X# Y#
G1	Feed Movement	G1 X# Y# F#
G2	Clockwise Movement at Feed (IJ or R)	G2 X# Y# I# J# / G2 X# Y# R#
G3	Counter Clockwise Movement at Feed (IJ or R)	G3 X# Y# I# J# / G3 X# Y# R#
G4	Dwell	G4 m (m is time in seconds)
G20	Units are in inches	
G21	Units are in centimeters	
G22	Units are in millimeters	
G28	Return to machine zero (all axes if none specified)	G28 Z / G28 XY / G28
G90	Absolute mode	
G91	Relative mode	

L-Code	Description	Usage
L36	Torch Height Control On	
L36.1	Auto Voltage Set Mode On	
L36.2	Reset Auto Voltage Set Status	
L37	Torch Height Control Off	
L37.1	Auto Voltage Set Mode Off	

## X. Error Codes

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Error	Description
Line Too Long	Input line longer than 256 characters
Unsupported G Code	G Code in input line not support / recognized
Unsupported L Code	L Code in input line not support / recognized
Unsupported M Code	M Code in input line not support / recognized
Multiple Commands	Input line contains more than one command
Command or File Not Found	Non-supported Code / Invalid File Name Entered
Arc Radius	Distance from start point to center is not equal to distance from end point to center. Check G2 vs G3 and G91 vs G90
Soft Limit Exceeded	Specified move would result in exceeding soft limits
Boundary Exceeded	Specified move would result in exceeding workspace
Acceleration Out of Bounds	Acceleration exceeds maximum resolution
Illegal Value	The specified value is invalid
Unknown Position Specified	The specified position is invalid
Subprogram Nesting Too Deep	Too many nested subprogram calls
L10 in Subprogram	L10 command not allowed in subprograms
File Not Found	The specified file name cannot be found
Parameter Not Specified	A required parameter is missing
Unknown	Unknown error has occurred
Memory Error	Insufficient or bad memory
Parameter Out of Range	Specified Parameter is out of range
Arc Too Small	Specified Arc is below resolution
Could Not Open File	File cannot be opened. May be used by another device
Limit Switches	Limit Switch encountered while running
Aborted by User	E-Stop or Escape used by user
Error Reading File	File may be corrupted

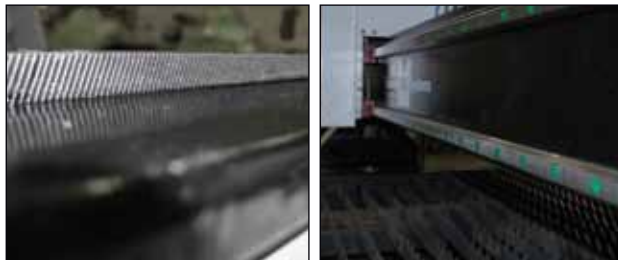
## XI. Machine Lubrication.

### Lubricating the X-Y Rack and Pinion.

Lubrication is important with rack and pinion gearing systems. A thin film of grease should always be present on the contacting tooth flanks to minimize metal to metal contact.

Lithium grease lubrication is recommend over oil, as the oil lubrication will flow away from tooth flanks.

The grease should be applied to the rails at regular intervals, depending on the usage of the machine. Use a small brush to coat both rails on the side of the Y-axis and the single rail across the X-axis.



### Lubricating Z Ballscrew

The Z axis uses a ballscrew and ballnut instead of a Rack and Pinion. You must apply oil directly to the ballscrew to properly lubricate the mechanism.

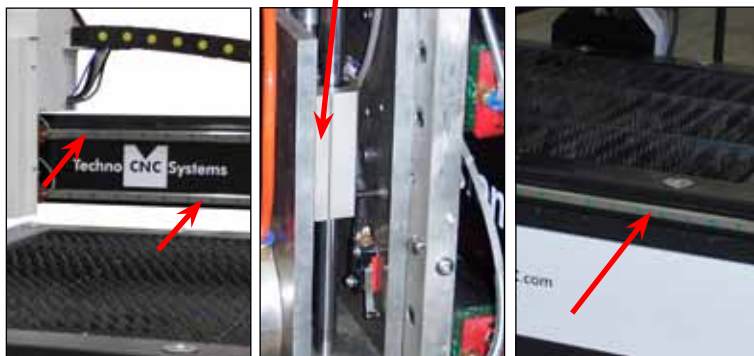


Lithium grease is pumped into the lubrication point with the application gun.



### Lubricating the X-Y-Z Rails

The rail carriage bearings are sealed and protected with wipers. The rails should be lightly oiled to allow smooth operation. Avoid a build up of debris on the rails by blowing them off with air, or wiping them down with a rag. The rails do not need to be lubricated as often as the rack, once a month should be sufficient.



X Axis

Z Axis

Y Axis

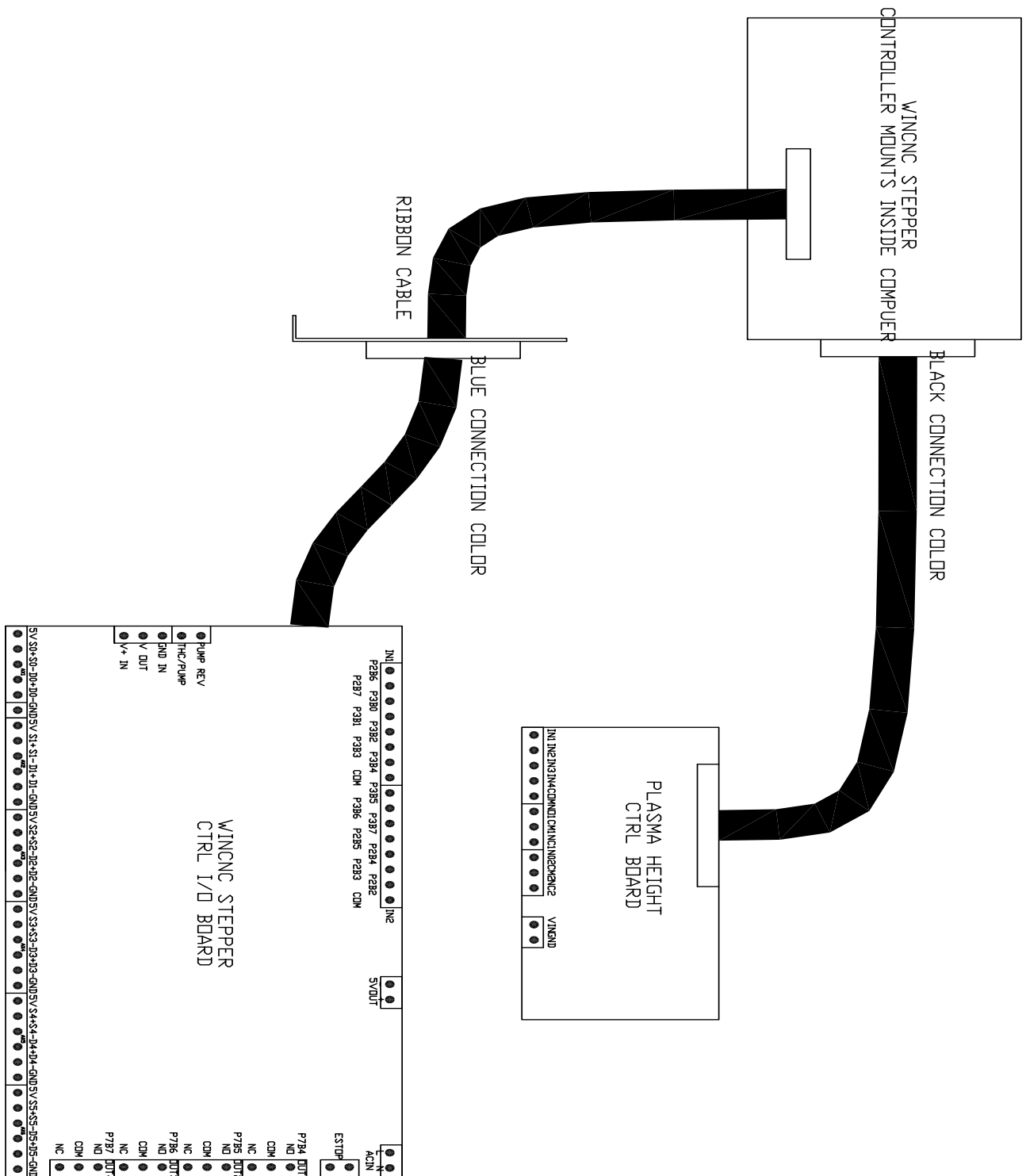
### Recommended Lubricants.

Lithium Based Grease:  
Alvania Grease No. 2(Shell)  
or Equivalent.  
Techno Part No.  
H90Z00-8670T8

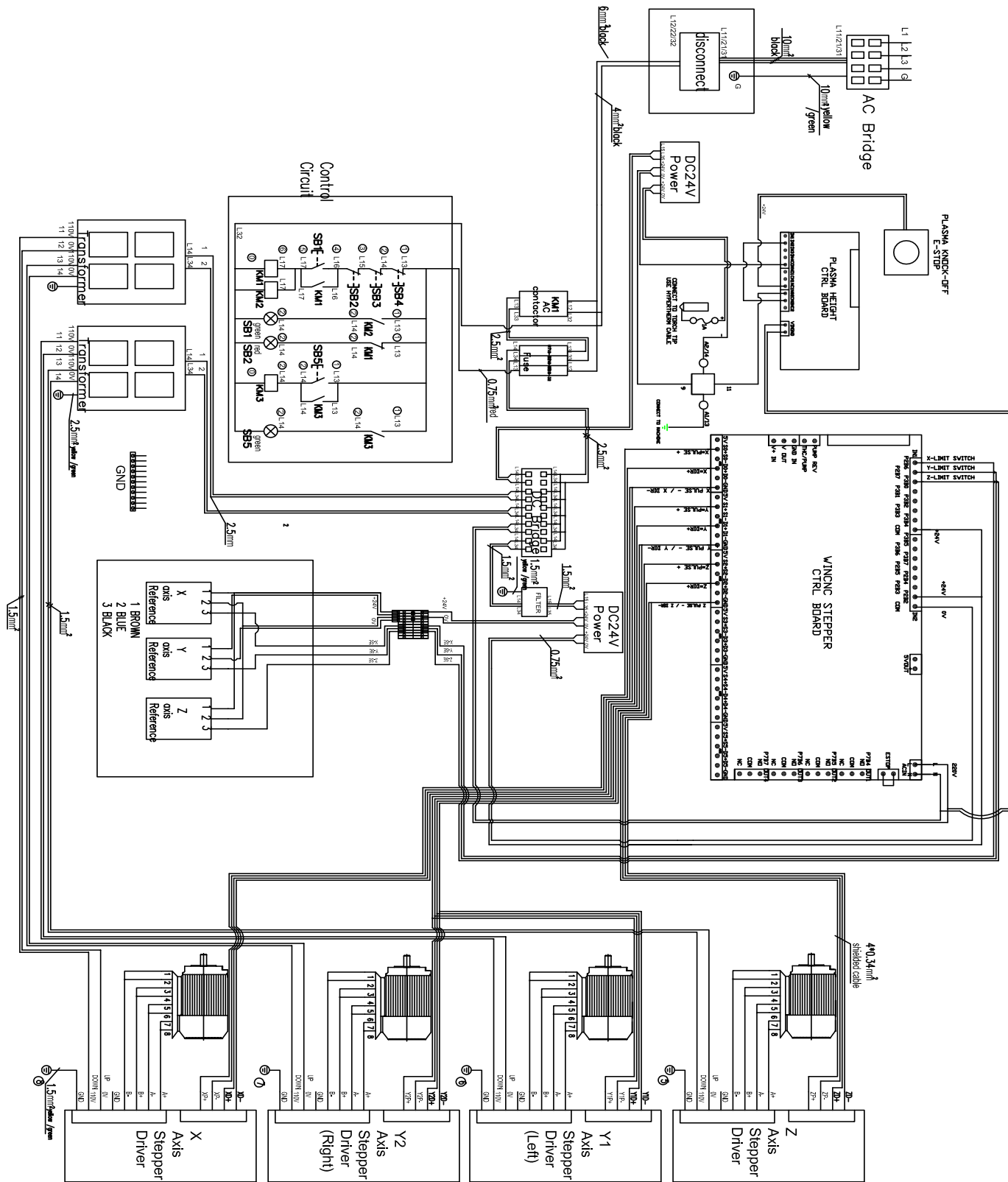
**NOTE: AVOID A BUILD UP OF DEBRIS ON MOVING PARTS. CLEAN OFF ANY DEBRIS TO AVOID DAMAGING THE MACHINE.**

## XII. Diagrams

### PC and Controller Interface Connections



Machine Diagram





## XIII. Cut Quality

### Reading the cut

There are four basic measurements used to determine good cut quality:

- Bevel angle
- Dross levels
- Appearance of cut
- Lag lines  
(Mild steel – O<sub>2</sub> cutting only)

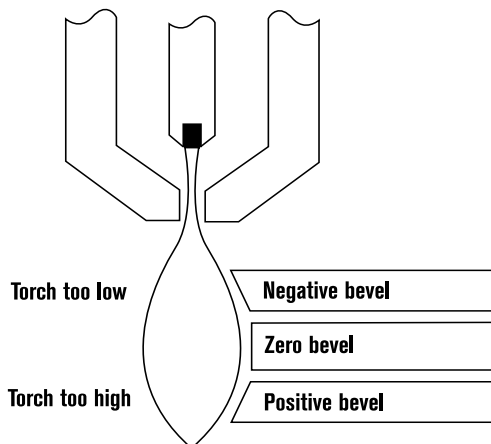
The adjustments that the operator can make to improve these qualities are:

- Torch height or arc voltage
- Cut speed

Remember: the cut charts are the place to start, but cut speed and torch height may need to be adjusted on some materials.

### Bevel angle

- By increasing or decreasing the height of the torch, the bevel angle can be changed.
- This is done by adjusting the Arc Voltage setting on plasma systems with arc voltage torch height control (THC). If the plasma system is not equipped with THC, then it must be manually adjusted.
- If the angle is not equal on all sides of a cut part, then the torch may not be square to the plate and will need to be adjusted.



**EFFECTS OF TORCH HEIGHT**

### Decreasing dross (slag)

#### Top dross

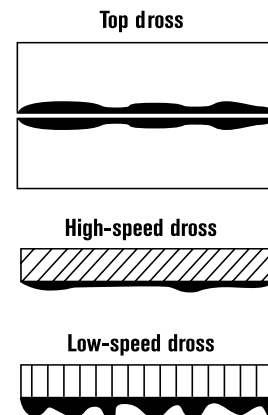
Splatter appears on the top edge of both pieces of the plate. Lower the voltage in increments of 5 volts (maximum) until top dross disappears. Usually only seen with air plasma.

#### High-speed dross

Fine, roll-over dross that welds to bottom edge. Cleaning requires chipping or grinding. Reduce cut speed to decrease high-speed dross.

#### Low-speed dross

Globular dross that forms in large deposits. Comes off very easily, in large pieces. Increase cut speed to decrease low-speed dross.



### More on dross

- Some types of metal inherently cut with more dross than others. Some of the more difficult plates and treatments are:
  - High carbon content
  - Clean metal surfaces
  - Shot-blasted plate
  - Aluminum
  - Hot-rolled steel
  - Warm or hot metal
  - High silicon steel
- Some of the easier types are:
  - Cold-rolled steel
  - Oil-pickled steel
- If plate has an oily, scaly or rusty surface, cut with this side down.
- A water muffler or underwater cutting will tend to increase dross levels.

### Appearance of cut

- When cutting metals besides mild steel with O<sub>2</sub>, lag lines are not a good indicator of cut speed.
- Bevel angle, dross levels and appearance of the cut must be factored together. The smoothness or roughness of the face and the dross levels will determine correct speed.
- Concave cut face is due to torch-to-work distance being too low or consumables are worn.
- Convex cut face is due to torch-to-work being too high or consumables are worn.



Good quality stainless steel cut

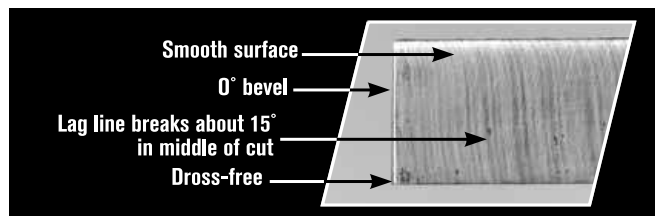


Good quality aluminum cut

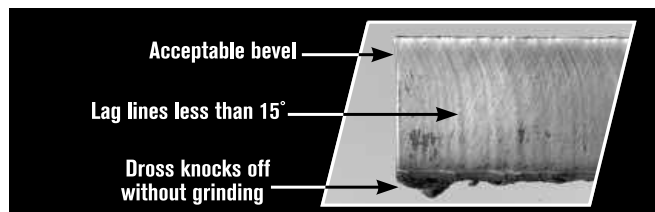
### Reading lag lines

#### Mild Steel, O<sub>2</sub> cutting only

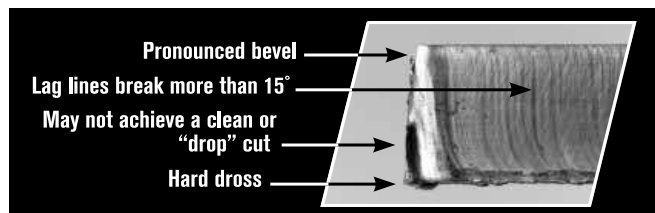
- Using the lag lines of a cut are an excellent way to determine proper cut speeds.
- The lines should generally trail the cut by approximately 10–15 degrees.
- When the lines are more vertical, the speed is too low.
- When the lines are more trailing, the speed is too high.



Correct speed



Too slow



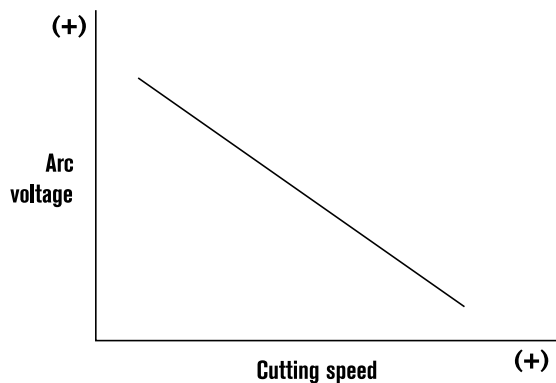
Too fast

## Effects of cutting speed on arc voltage

- As cutting speed *increases*, arc voltage *decreases* and vice versa.
- Cutting speed changes:
  - When going in and out of corners\*
  - At beginning and end of a cut\*
  - When cutting circles and contours\*
- Reaction of THC
  - Torch will dive as speed decreases\*\*
  - Torch will rise as speed increases\*\*

\* This will cause dross in corners and contours.

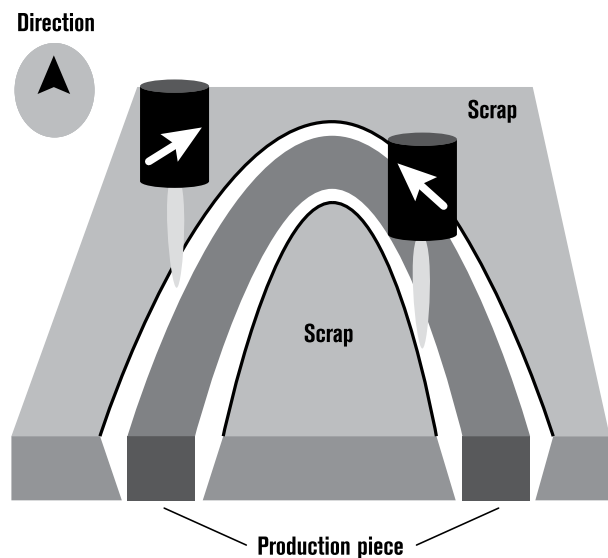
\*\* THC must be turned off or "Locked Out" when speed decreases.



Note: Graph is independent of system and metal thickness.

## Cutting direction

- Due to the swirling action of the plasma gas, one side of the cut will always have a bevel angle. This is called the "bad side" of the cut.
- In order to get the minimum amount of bevel on your production pieces, the torch must travel in the proper direction. The "good side" is on the right as the torch is traveling away from you. Refer to picture.
- The swirl direction can be reversed, by using different swirl rings on some models, to achieve the opposite results (Used for cutting mirror image parts).



## What drives cut quality?

The cut sample can be an excellent way to visually represent the capabilities of metal cutting equipment. By evaluating the smoothness of the cut, bevel angle and cross levels an accurate depiction of the potential success of this process can be observed. However, the cut sample cannot and should not be the sole determining factor in the purchasing decision. Many parameters directly impact the quality of the cut part. An understanding of all the factors that contribute to a successful cut is critical before a purchasing decision should be made.

The plasma cutting process is directly influenced by four primary factors:

- Cutting machine (XY table, punch press, etc.)
- Motion control device (CNC)
- Process variables (gas purity, travel speed, material variability, etc.)
- Plasma cutting system (power supply, torch, etc.)

There are numerous manufacturers of metal cutting systems in the marketplace today producing a variety of different types of machines. Consequently, results may vary. Cut samples provided by Hypertherm represent cut quality attainable on **one type** of cutting machine and in no way indicate expected results on other cutting equipment.

Hypertherm strongly recommends that you obtain a cut sample that has been made on equipment representative of the cutting machine being considered. Only then can a more accurate determination of expected results be possible.

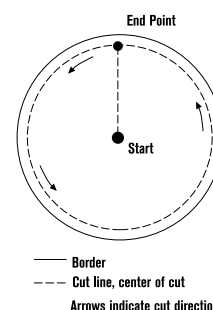
## Cutting holes

- Cutting internal holes can be very difficult with plasma. The minimum hole sizes, assuming excellent motion control characteristics are:

- HyPerformance/HyDefinition (O<sub>2</sub> on mild steel)
  - 1/8" (3 mm) plate and less: 3/16" (4.7 mm)
  - Above 1/8" (3 mm): 1.5 times material thickness
- Conventional (O<sub>2</sub> on mild steel)
  - 1/8" to 1/2" (3 – 13 mm) plate: 2 times material thickness
  - Above 1/2" (13 mm): 1.5 times material thickness

- For best results:
  - Turn THC off.
  - Reduce speed.
  - Make lead-in perpendicular to side.
  - Minimize lead-out. Only enough for part to drop out.

PLATE WITH INTERNAL HOLE



## Operator troubleshooting

### Status LEDs

The green or amber lights on the front of the power supply are good indicators of common problems. If the LEDs are green then they should be on; if they are amber they should be off. Check your Instruction Manual to see how to troubleshoot with these LEDs.

### Note

- HyPerformance plasma has no indicator lights on the power supply.

### Tips

- System shuts off during cut or when trying to cut: Hold down on the Start button to see which LED “flickers”. This may be the one causing the system to shut down.
- Constant bevel: Check for the proper direction of cut, torch height, cut speed, condition of consumables and torch alignment (perpendicular to plate). If all appear to be correctly set and in good condition, have maintenance check for any leak or restriction. If no other problems are found, it may be necessary to replace the torch.

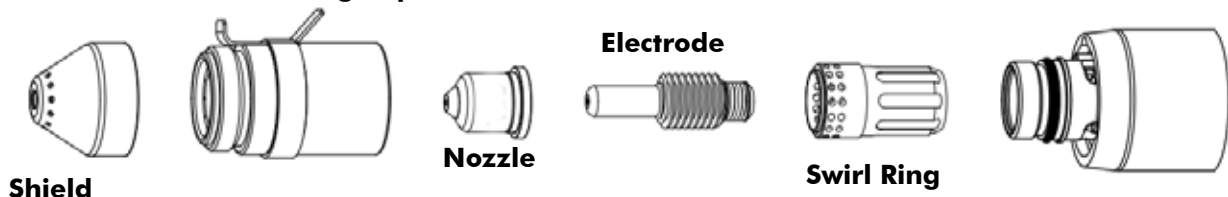
## XIII. Consumable Information

### Troubleshooting consumables

Learning how to evaluate consumables will allow the experienced operator to quickly evaluate the operation of his system and find any problem that may arise. The chart below shows common problems and solutions:




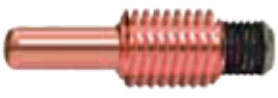
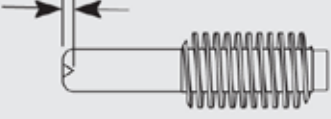


<b>Problem</b>	<b>Possible cause</b>	<b>Solution</b>	<b>Notes</b>
<b>Electrode quickly erodes</b>	Gas restriction, low gas flow	1. Verify proper flow setting and supply pressure/flow	Torch will dive if equipped with THC
		2. Verify proper consumables are installed	This problem could also cause misfiring
		3. Check swirl ring for blockage and proper amount of lubrication	
		4. Check for hose blockage or kink	
		5. Check for malfunctioning valve	
	High coolant temperature or low coolant flow	1. Verify proper temperature if equipped with external chiller	
		2. Perform coolant flow test	
	Excessive errors	Make programming changes to allow system to ramp up/down properly	
<b>Electrode pit wearing is non-concentric</b>	Blocked or defective swirl ring	Replace swirl ring	Excessive lubricant can block swirl rings
	Defective torch	Replace torch main body	
<b>Nozzle orifice wears out of round or orifice wears from the outside in</b>	Excessive pilot arcing	1. Verify proper pierce height	
		2. Check work cable connection	Excess slag on table can cause this problem
		3. Shorted torch	Measure resistance of torch
		4. Pilot arc relay is staying closed	
<b>Nozzle erodes on the inside</b>	Contamination	Check gas supply or check for leak	A leak when cutting with O <sub>2</sub> can cause contaminates to enter the plasma gas line
	Double arcing	Verify proper pierce height	Electrode and nozzle will be black. Torch will rise if equipped w/THC

#### Ohmic Retaining Cap



**Troubleshooting**  
Consumable wear



Part	Condition	Action
<b>Nozzle</b> Check center hole 	Good 	No action required.
	Worn 	If out of round, replace
<b>Electrode</b> Examine center surface 	Maximum 1 mm 	Replace
<b>Swirl ring</b> Examine external surfaces 	Damage or debris	Replace
Examine gas holes 	Blocked holes	Replace

**Troubleshooting**  
Cut quality

**Optimum cut**

**What to look for**

1. Well defined lag lines with an angle of 10° - 15°
2. Minimal dross
3. Square edges
4. No top splatter
5. No discoloration



Lagline

**Excess bevel angle**

**Possible cause**

1. Torch not square
2. Amperage too low
3. Speed too fast
4. Worn nozzle

**Solution**

1. Square torch to workpiece
2. Increase amperage
3. Decrease speed
4. Replace nozzle



Lagline

**Hardened dross**

**Possible cause**

1. Speed too fast
2. Amperage too low

**Solution**

1. Decrease speed
2. Increase amperage



Lagline

	<b>PowerMax 45</b>	<b>PowerMax 65</b>	<b>PowerMax 85</b>	<b>PowerMax 105</b>
<b>45 Nozzle</b>	H25XHY-220671	H25XHY-220941	H25XHY-220941	H25XHY-220941
<b>65 Nozzle</b>		H25XHY-220819	H25XHY-220819	H25XHY-220819
<b>85 Nozzle</b>			H25XHY-220816	H25XHY-220816
<b>105 Nozzle</b>				H25XHY-220990
<b>Electrode</b>	H25XHY-220669	H25XHY-220842	H25XHY-220842	H25XHY-220842
<b>Shield</b>	H25XHY-220674	H25XHY-220817	H25XHY-220817	H25XHY-220817 (45, 65, 85) H25XHY-220993 (105)
<b>Retaining Cap</b>	H25XHY-220719	H25XHY-220953	H25XHY-220953	H25XHY-220953
<b>Swirl Ring</b>	H25XHY-220670	H25XHY-220857	H25XHY-220857	H25XHY-220994



## Techno CNC Systems, LLC., Terms and Conditions For Limited Warranty and Repairs Warranty

### WARRANTY

All Techno CNC Systems, LLC., mechanical components are warranted against manufacturer's defects in material and workmanship for a period of one (1) year from the time of shipment from Techno CNC Systems, LLC., facilities. All Techno CNC Systems, LLC., electrical components are similarly warranted for a period of one (1) year from the time of shipment from Techno CNC Systems, LLC., facilities. Techno CNC Systems, LLC.,'s sole obligation under this warranty is limited to repairing the product or, at its option, replacing the product without additional charge, provided the item is properly returned to Techno CNC Systems, LLC., for repair as described below. The provisions of this warranty shall not apply to any product that has been subjected to tampering, abuse, improper setup or operating conditions, misuse, lack of proper maintenance, or unauthorized user adjustment. Techno CNC Systems, LLC., makes no warranty that its products are fit for any use or purpose to which they may be put by the customer, whether or not such use or purpose has been disclosed to Techno CNC Systems, LLC., in specifications or drawings previously or subsequently provided, and whether or not Techno CNC Systems, LLC.,'s products are specifically designed and/or manufactured for such a purpose. NOTE: Drive motors (servo or stepper) are considered "mechanical components".

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### LIMITATION OF REMEDY

In no event shall Techno CNC Systems, LLC., be liable for any incidental, consequential, or special damages of any kind or nature whatsoever. Techno CNC Systems, LLC., is in no way liable for any lost profits arising from or connected to this agreement or items sold under this agreement, whether alleged to arise from breach of contract, expressed or implied warranty, or in tort, including, without limitation, negligence, failure to warn, or strict liability.

### RETURN PROCEDURE

Before returning any equipment in or out of warranty, the customer must first obtain a return authorization number and packing instructions from Techno CNC Systems, LLC.,. No claim will be allowed nor credit given for products returned without such authorization. Proper packaging and insurance for transportation is solely the customer's responsibility. After approval from Techno CNC Systems, LLC., the product should be returned with a statement of the problem and transportation prepaid. If, upon examination, warranted defects exist, the product will be repaired or replaced at no charge, and shipped prepaid back to the customer. Return shipment will be by common carrier (i.e., UPS). If rapid delivery is requested by customer, then such transport is at the customer's expense. If an out-of-warranty situation exists, the customer will be notified of the repair costs immediately. At such time, the customer must issue a purchase order to cover the cost of the repair or authorize the product to be shipped back as is, at the customer's expense. In any case, a restocking charge of 20% will be charged on all items returned to stock.

### FIELD SERVICE

Repairs are ordinarily done at Techno CNC Systems, LLC.,'s Ronkonkoma, New York facility, where all necessary instrumentation is available. This instrumentation is difficult to transport, so field service is severely limited, and will only be supplied at Techno CNC Systems, LLC.,'s discretion. If field service is required and is performed at Techno CNC Systems, LLC.,'s sole discretion, all relevant expenses, including transportation, travel time, subsistence costs, and the prevailing cost per hour (eight hour minimum) are the responsibility of the customer.

### UNFORESEEN CIRCUMSTANCES

Techno CNC Systems, LLC., is not liable for delay or failure to perform any obligations hereunder by reason of circumstances beyond its reasonable control. These circumstances include, but are not limited to, accidents, acts of God, strikes or labor disputes, laws, rules, or regulations of any government or government agency, fires, floods, delays or failures in delivery of carriers or suppliers, shortages of materials, and any other event beyond Techno CNC Systems, LLC.,'s control.

### ENTIRE AGREEMENT/GOVERNING LAW

The terms and conditions contained herein shall constitute the entire agreement concerning the terms and conditions for the limited warranty described hereunder. No oral or other representations are in effect. This Agreement shall be governed in all respects by the laws of New York State. No legal action may be taken by any party more than one (1) year after the date of purchase.

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