Hypertherm®

Shape Cutting Control

Software Version 7.50
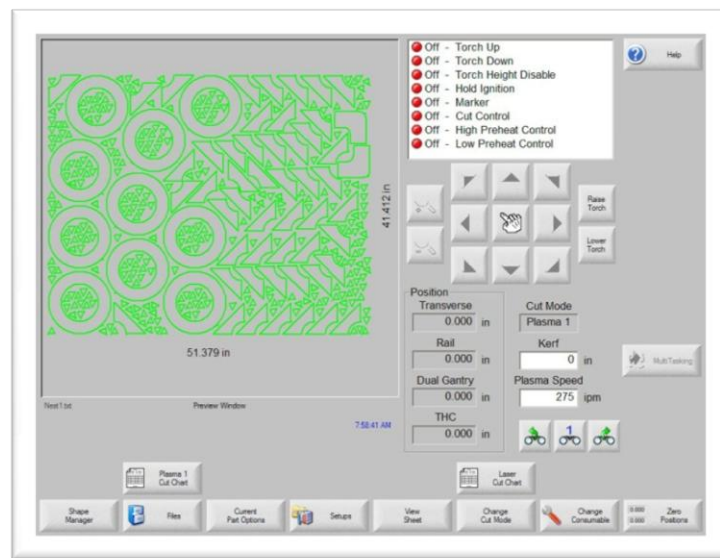
Making people and machines more productive through process *Automation*

Table of Contents

Safety

Read This Manual

Read and understand this instructional manual, the cutting machine manuals, and your employer's safety practices. *Note*: This product is not designed to be field serviceable. Please return to an authorized repair center for any required service.

Dangerous Machinery

Operation and maintenance of automated equipment involves potential hazards. Personnel should take precautions to avoid injury.

Injury and entanglement may occur if hands and limbs come in contact with moving machinery.

KEEP HANDS CLEAR of dangerous moving machinery. All control, including manual, can be effected using the touch screen, front panel keys or remote interface.

Loose fitting clothing or ties may become entangled in the machinery. These items should not be worn while operating or servicing the machine.

High Voltages

Electric shock can kill. Be sure this equipment is safely installed in accordance with enclosed procedures and specifications.

Avoid contact with electrical wires and cabling while power is on.

This equipment should only be opened by trained service personnel.

Please refer to the appropriate appendix in the Installation Guide provided with your control for details on safety certification for that product.

Product Listings

MicroEdge and Voyager III

Note: This product has been designed and manufactured in accordance with CE and UL Safety Standards.

UL has successfully tested and listed these products in accordance with the applicable U.S. and Canadian Safety Standards. File number E178333. Note: Suitable for pollution degree 2 environment only.

This appliance has been successfully tested and listed by CE under the following standards; EN 500081-2 1994, EN 61000-6-2 1999 and EN 55011:1998. Certificate number: Retlif R-3909N

Edge TI

Note: This product has been designed and manufactured in accordance with CE and UL Safety Standards.

UL has successfully tested and listed this products in accordance with the applicable U.S. and Canadian Safety Standards. File number E307226.

This appliance has been successfully tested and listed by CE under the following standards; EN 500081-2 1994, EN 61000-6-2 1999 and EN 55011:1998. Certificate number: Retlif R-3909N.

Please contact Hypertherm Automation for further information in safety listing information.

Overview

Introduction

This control is a multi-axis digital control system specifically designed for shape-cutting machines and is our latest effort in a long history of developing leading edge technology for the metal fabricating industry. At the forefront of our design efforts is a commitment *to ease-of-use.* Programmable soft-keys simplifies the front panel and put the most common functions at your fingertips. Developed around Microsoft Visual C++® and the Microsoft Foundation Classes®, this control brings a new generation of *man-machine-interfaces* to the most critical element in the shape cutting process, you, the user.

With the maturing of High Tolerance Plasma and the emergence of Laser into the area of shape cutting, you need a control that can accurately position the cutting device. *SoftMotion* brings the power and the accuracy of the Intel Pentium® microprocessor to your positioning table. With both a digital position loop and velocity loop running, you get smooth motion through the entire velocity range, and the comfort of knowing the cutting device is at the preprogrammed position. You can even verify this with a dynamic zoom function during cutting.

The control can be used with almost any two-dimensional shape-cutting table. Built-in logic is present for Plasma, Oxy-Fuel, Marking, Waterjet and Laser. Regardless of your application, we will make your shape cutting process more productive.

You can graphically key in part programs directly using *ShapeWizard*® on the front panel, without waiting for delivery, set-up, and alignment of templates. Or you can select any of 68 shapes from the parametric shape library. Using a host computer or CAD/CAM system, you can also download custom part programs easily. We even supply you at no-charge a communications package to tie the control to the rest of your management information. Whatever method is used, the control, with its advanced graphical user interface (GUI), shortens set-up time, speeds productivity and simplifies scheduling.

Our product is designed and developed around Microsoft Visual C++® and the Microsoft Foundation Classes®. The operating environment is completely compliant with the year 2000 dating.

ShapeWizard

Allows you to graphically create simple part programs and store them on the internal hard disk present in the control.

Teach/Trace

If configured with a tracing head, you can use the control to digitize almost any pattern, store it on the internal hard disk, and further customize the program with *ShapeWizard*. The control has both smart-arc and smart-line translators to provide you with optimum program resolution.

Shape Libraries

Graphically select the desired shape from the parts library. Then you simply add the dimensions you want, and the scaled part, with your entered dimensions, will be displayed. There is even a Help Icon to step you through the data entry.

Program Upload and Download

Communication is an integral part of today's fabricating shop. All part programs that have been entered in the control can be uploaded to a remote computer or file server with an integrated RS-232C/ RS-422 communications link. CAD generated programs can be downloaded at baud rates of up to 115K baud and visually previewed on the color LCD display. Visual representation of part programs, along with full alpha-numeric file name support, gives you the flexibility to manage your data as you see fit. Use of the optional Network Card allows us to bring the latest in communication technology for increased speed and productivity to your shape cutting controller. Additionally, built-in Control monitoring features allow current operational status to be displayed at the host Link screen.

SoftMotion

SoftMotion, a proprietary data buffer and interrupt structure that allows the control to generate all of its motion control algorithms from the main Pentium® Processor. This architecture allows S*oftMotion* to tightly couple the motion control and I/O logic to the operator interface.

Cutting Options

Flexibility in your cutting operation is the key to success. The control comes standard with the following cutting functions to help you optimize material and plate usage. These functions work on any program. After selecting one of these functions, the new part will be graphically displayed.

Mirror function
The mirror function can be used to create a mirror image of the part along either the X or Y-axis.

Rotate function
The rotate function can be used to rotate the current part.

Scale function
The scale function can be used to increase or decrease the current part by a programmed ratio.

Repeat function
The repeat function duplicates the part shape in either a straight, staggered or nested grid patterns.

Programming Features

English and Metric operation for worldwide use. Each axis can have its own encoder-to-unit edge rate.

Dynamic Kerf compensation with programmable kerf value.

Automatic Corner and Plate Alignment with programmable scrap clearance.

Shape Repeat with three grid patterns (straight, stagger, and nested) allows fast cutting of multiple pieces.

Part mirroring in both X and Y axes.

Part rotation.

Scaling allows quick part resizing to original size.

Virtually no limit to the number of program names or workfile folders that can be stored on the internal hard disk drive.

Punch or powder marker control with twelve programmable offsets.

Choice of industry-standard EIA RS-274D or ISO 6582 ESSI Part Programming Languages.

Manual Data Input (MDI)
Full screen ASCII text editor.

Allows writing, editing, and graphical review of part programs at the machine.

Communications Link
Preview Mode allows machine operator to graphically review and select programs for download.

Download part programs from CAD system, remote host computer, or other storage device via built-in RS-232C/ RS-422 port.

Can accept EIA RS-274D or ESSI part programs.

Baud Rates of up to 115K Baud. Communication baud rates of 230K are obtainable using the communication link software provided with the control.

Optional Network Card for connecting directly to a PC Network for part file allocation.

Graphical program display
Visually display any part program.

Display of real-time position and I/O information.

Display of actual cut path while cutting.

Built-in Parametric Shape Library
Contains 68 commonly used shapes.

Simple Graphical prompts for entering all part dimensions.

Teach/Trace
Smart-arc and Smart-Line algorithms for optimum program size and contouring smoothness.

Converts your existing optical tracer templates to EIA RS-274D programs, and stored on the internal hard disk drive.

Automatic part closure detection.

Allows multiple pierce points, lead-ins, lead-outs, and rapid traverse segments.

Upload taught part programs to CAD system, remote host computer, or other storage device.

Requires a separate optical tracer control system.

Performance Features

Digital servo positioning control for any cutting machine.   An optional SERCOS Interface™ allows expansion of motion axes and distributed I/O.

Control dynamic accuracy of 0.002 inch (0.051 mm) with 1000 edge/inch encoders.

Programmable cut speeds up to 3000 IPM (76,200 mmpm).

Variable segment length look ahead for optimum contouring performance.

Automatic corner slowdown and torch height disable for clean, sharp corners.

Speed Increase/Decrease buttons for optimizing machine cut speed.

Automatic Plate and Corner Alignment corrects for skewed plates.

Complete cut-loss recovery with backup and forward along path, off-path re-pierce and return-to-path, and move pattern functions.

Rip Mode for straight-line cutting. Jog control cutting.

Punch, powder or Plasma marker capability.

Manual jog control with position read-out for positioning torches.

Manual Nester™ and optional HyperNest® – CNC Automatic Nesting features for increased productivity and increased plate utilization.

Automated Torch Spacing feature to position torch station spacing automatically through the part program for standard and mirrored multi-torch cutting.

Rush Job Interrupt and Automated Power Loss Recovery features.

Installation and Setup Features

Selectable axis orientation for compatibility with all cutting machines.

Built in oxy-fuel interface with programmable pre-heat time, ignition, and creep speed.

Built in plasma interface with programmable purge time, ignition time, arc-off delay time, and arc-transferred feedback.

Built in Laser interface with programmable shutter time, power ramp time and pierce time.

Built in Water Jet interface with programmable abrasive output and pierce time.

Programmable servo gains, speeds, Watch Window, machine parameters, and communication parameters for flexible application.

Interfaces easily to most optical tracing systems for integrated control.

Complete built-in diagnostics for checkout and test.

Hardware Specifications

15" TFT Touch Screen with 1024 x 768 resolution.

≥60Gbyte hard disk

≥1.3 GHz Processor.

512 Mbytes of RAM.

Up to 96 lines of interface signals for cutting and motion logic (gas control, tracing system, markers, homing, etc.) depending on I/O configuration.   An optional SERCOS Interface™ allows expansion of I/O configuration.

Industrial grade enclosure and keypad designed to minimize RFI/EMI interference.

Surface mount printed circuit board technology.

Two axes optically isolated ±10VDC drive outputs and incremental encoder inputs which are expandable to 6 axes of motion. Up to twelve axes of motion and 1024 I/O available with optional SERCOS Interface™. Optional axes available for dual gantry, dual transverse, contoured bevel head, two rotate, two tilt angle and eight Sensor™ THC applications..
+5VDC single ended or differential encoder inputs.

Optically isolated serial ports with programmable baud rates to 115 K baud. Communication baud rates of 230K are obtainable using the communication link software provided with the control. Optional Network Card for connecting directly to a PC Network.

Universal power input (100-240 VAC; 47-63Hz). Individual models may vary. Refer to machine interface information for details.

Operating environment: 0 to 50°C (32 to 122°F); 95% relative humidity (non-condensing).

An optional Chiller for Mariner style controls is available.

Model Numbering System

The control is available with the following hardware and software configurations. Features and control configuration options in software are based on the I/O configuration of the control. Generally, the information presented in this guide is based on the I/O configuration as outlined below. Please refer to your control I/O configuration for available features and product information. The specific configuration is determined by the Model Number, as shown below:

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Axis Configuration
2 = 2 Servo Axes
3 = 3 Servo Axes
4 = 4 Servo Axes
5 = 5 Servo Axes
6 = 6 Servo Axes
7 = 7 Servo Axes
8 = 8 Servo Axes
9 = 9 Servo Axes
A = 10 Servo Axes
B = 11 Servo Axes
C = 12 Servo Axes
S = Sercos

I / O Configuration
B = Burny 3 / 5
M = MicroPath
P = PicoPath
V = Voyager
S = Sercos
D = Edge Ti - DC amps

Power Supplies
0 = Standard Logic Supply
2 = Standard Logic Supply & Auxiliary Supply with +5, +/-12 & +24 vdc

Pointing Device
0 = None
1 = Industrial Mouse

LCD Type
X = None
0 = 10.4" Dual Scan DSTN
1 = 10.4" Active Matrix TFT
2 = 15" Active Matrix TFT
3 = 15" Touch Screen
4 = 12.1" Active Matrix TFT

Memory
0 = 16 MBytes
1 = 32 MBytes
2 = 64 MBytes
3 = 128 MBytes
4 = 256 MBytes
5 = 512 MBytes

Operating System
0 = Windows 95 / 98
1 = Windows NT
2 = Windows XP

APC
0 = None
1 = Laser
2 = Plasma

THC
0 = None
1 = 1 THC
2 = 2 THC's

Speed Pots
0 = None
1 = 1 Speed Pot
2 = 2 Speed Pots

Joystick
0 = None
1 = Joystick

Backup Hard Drive
0 = None
1 = Installed

Processor
0 = 166 MHz
1 = 200 MHz
2 = 266 MHz
3 = 433 MHz
4 = 566 MHz
5 = 1.2 GHz
6 = 2.4 GHz
7 = 3.06 GHz
8 = 1.3 GHz M

Front Panel Layout

This software is designed specifically for 15" TFT Touch Screen operation with 1024 x 768 or higher resolution and is used on all CNC models. Individual man machine interface (MMI) and front panels may vary.

Power Switch

Hypertherm Automation controls are equipped with a momentary contact power switch. Press briefly and release for controlled power on and power off the control. Pressing the power switch for 10 seconds will force a hard system shutdown of Windows and the control. Generally, a hard shutdown is not recommended.

Touch Screen

The touch screen software interface allows direct key input on the screen through the use of check boxes, radial boxes, drop down selections and data input.   Data input boxes will automatically display a numeric or alphanumeric keypad depending on data type.

Front Panel (selected models)
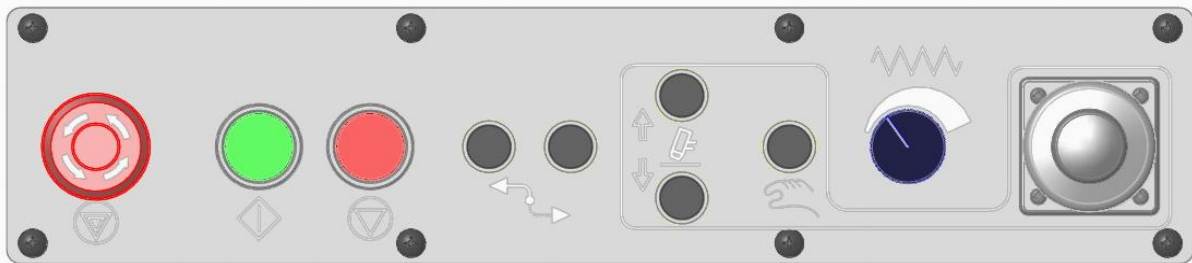
ICON Legend

Emergency Stop

Start

Stop

Forward and Backward on Path

Torch Up / Down

Manual

Speed Pot (Manual Feedrate)

Front Panel Keypad (Voyager III model)
The yellow key labeled with a question mark ? is for online documentation and help. Simply press this key at any time and this document will be displayed.

The keys to the lower right of the front panel comprise the alpha numeric keypad, which is used for entering data. To the far left are keys which control manual motion and cursor location during data input. These include the MANUAL key (for Manual Mode jogs) and the eight arrow keys (for jog and cursor direction).

The two keys in the center of the keypad are for program start and stop.

The two keys to the right of the yellow help key are for Forward on Path and Backup on Path while in the Pause screen.

Key Functions

The alpha–numeric keypad is used to enter numeric data or text. To enter a number, simply press the key. To enter a word, press and hold the matching colored shift key (up arrow) while pressing the desired letter key. The + (plus) and – (minus) keys are used to add and delete features at selection and check boxes.

An alternate (ALT) soft key indicates that more soft keys and features are available by pressing this soft key on screen.

When the alternate soft key is displayed, the purple shift can also be used to view additional soft keys.

These keys activate jogging using the arrow keys when in the manual mode. Manual key functions (indicated in green) are available at the Manual, Pause and Align Screens. This keypad is also used for navigating through a multi-variable dialog box (indicated in yellow).

The Prev/Next buttons are used to move through the field boxes, Page Up/Down is used to scroll and the arrow keys are used to select items in a dialog box.

Pressing the space key inserts a space into the current data entry field. The space key is also used to toggle between fixed logic settings (i.e. setups - preheat sense input open/closed). The space key may also be used to add and delete features at selection and check boxes.

Deletes the current character in the data entry field and backs up one position in the field. Located above the Back Space key are the * and ? characters which are used as wild cards to search for files.

Can be pressed at any time (except during cut) to return to the previous menu without saving any changes. Located above the Cancel key are the \ and : characters which are used for mapping network drives.

Causes the last number entered/toggled to be accepted. Located above the enter key are the < and > characters which are used for mapping network drives.

PC Keyboard Layout

Available as standard on selected models but may be added to all controls.
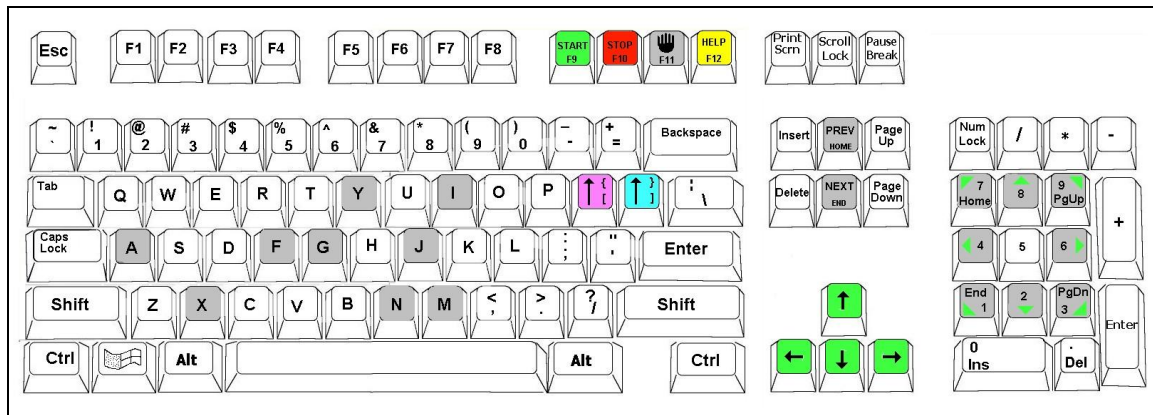
Keyboard Functions
Function Keys F1-F8 are equivalent to the soft keys on the display screen.
Function Key F9 is equivalent to the START key.
Function Key F10 and Pause Key are equivalent to the STOP key.
Function Key F11 is equivalent to the MANUAL MODE key.
Function Key F12 is equivalent to the HELP key.
Arrow direction keys are used for manual motion.
The HOME key is equivalent to the PREV field key.
The END key is equivalent to the NEXT field key.
The [key is equivalent to the purple arrow shift key.
The] key is equivalent to the blue arrow shift key.
The Esc key is equivalent to the CANCEL key.
To exit the control software press Alt F4. Warning: This will terminate the current application.
To switch between applications press Alt Tab. Warning: The selected application window to be on top of the desktop and may cover or hide the control software application window.

Operation Summary
The programming and operation of the control is menu-driven. The following diagram shows the
Screen Hierarchy for the menu structure.

The menu that appears in the display when the unit is first turned on is referred to throughout this
manual as the Main Menu. All other menus and functions are accessed at some level under Main
Menu, or else appear as part of a special operational sequence, such as when the cutting process is
interrupted during the middle of a part.

The OK and CANCEL keys have special functions in relation to the menu structure. The OK soft key
returns to the menu from which the present selection was entered and retains any changes that were
made. The CANCEL key returns to the menu from which it was entered and deletes/discards any
changes that were made. There are, however, some operations during which CANCEL is not active.

Screen Hierarchy

Main Screen

- Files
  - Load from Disk
  - Save to Disk
    - Save Log to Disk
  - Download from Host
  - Upload to Host

- Cut Chart
  - Change Consumable
    - Manual Options
  - Manual
    - Manual Options
    - Home Axes

- Part Options
  - Repeat
  - Align
    - Manual Options

- Cut
  - Pause
    - Change Consumable
      - Manual Options

Setups

- Cut Types
  - Oxy Fuel
    - Timing Diagram
  - Water Jet
    - Timing Diagram
  - Plasma
    - Timing Diagram
    - Cut Chart
  - Marker
    - Timing Diagram
    - Cut Chart
  - Laser
    - Timing Diagram
    - Cut Chart
      - Process Monitoring

- Diagnostics
  - Control Information
  - I / O
    - Inputs
    - Outputs
    - Analog Inputs
  - Oscilloscope
  - Serial Port
  - Drives and Motors
  - Plasma System
    - Inputs
    - Outputs
    - Supply Information

- Password 1
  - Machine
  - Speeds
  - Link
  - I/O
  - Sercos
  - Axes
    - Transverse
    - Rail
    - Dual Gantry
    - CBH
    - Tilt
    - Rotate
    - THC
    - Lens

- Cutting
  - Watch
  - Password 3
    - Station Configuration
  - Password 2
    - System Tools
      - Backup Hard Drive
      - Scan Hard Disk
      - Defrag Hard Disk
      - Format Floppy Disk
      - Network Tools
      - Remote Assistant

Shape Manager

- Shape Library
  - Simple Shape
    - View Text
    - Part Options
      - Repeat
      - Align
        - Manual Options

- Nester
  - Nester Setups
  - Load from Disk
  - Download from Host
  - Shape Library
    - Simple Shape

- Shape Wizard
  - Part Options
    - Repeat
    - Align
      - Manual Options

- Text Editor
- Teach Trace
- HyperCAD
- HyperNest

Key & Menu Functions

The following is a short form description of all menu functions in the control. This is only a brief description of each function. Please consult the subsequent manual sections for more complete information on operational usage of specific keys. **Note:** Screens and features will vary depending on interface selection of Beginner, Intermediate or Advanced. For convenience, information provided here is in Advanced Mode showing all options.

Screen Navigation

The eight keys located directly at the bottom of the display act as programmable soft keys. Soft keys allow many different functions to be included without an excessive number of separate keys. It also provides complete flexibility for future software features and enhancements.
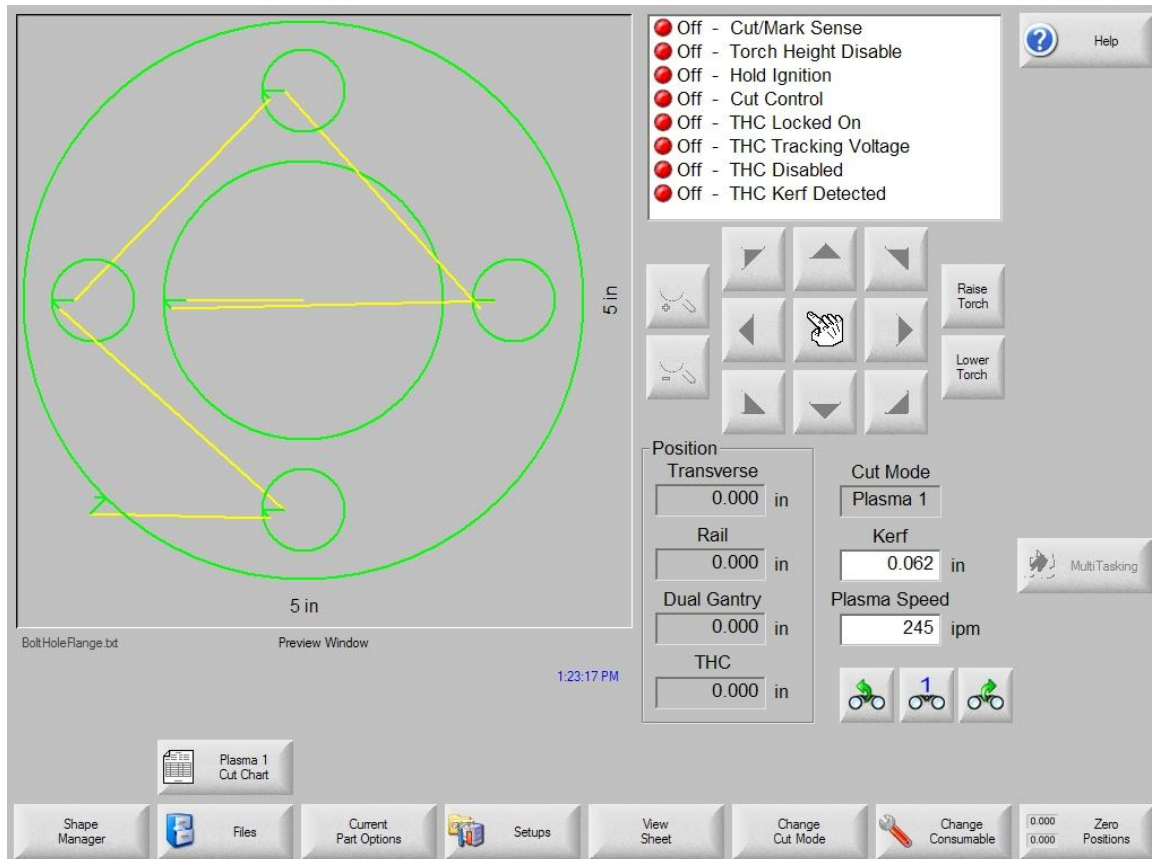
Soft keys to accept (OK) and reject (Cancel) changes.

An alternate (ALT) ICON at the left or right edge of the soft keys indicates that that more soft keys and features are available by pressing this softkey.

The touch screen software interface allows direct key input on the screen through the use of check boxes, radial boxes, drop down selections and data input.

Pull Down Box (note arrow at left)
Press the arrow box to pull down and view selections.

Radial Button
Press the round box to select.
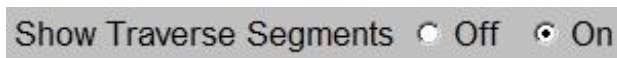
Check Box
Press the square box to enable.

Data Input
Data input boxes will automatically display a numeric or alphanumeric keypad depending on data type. Double click on the field to enter data.

Alpha Numeric Keypad

Edge

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | - | = | Backspace |

| Q | W | E | R | T | Y | U | I | O | P | [|] | \ |

| A | S | D | F | G | H | J | K | L | ; | ' | Enter |

| Shift | Z | X | C | V | B | N | M | , | . | / | Shift |

| Space |

Password

[   ]

❌ Cancel   ❓ Help   ✅ OK

Numeric Keypad

Edge

| (|) | Backspace |

| 7 | 8 | 9 | / |

| 4 | 5 | 6 | * |

| 1 | 2 | 3 | - |

| 0 | . | + |

Plasma Speed

New [180]

Old [180]

❌ Cancel   ❓ Help   ✅ OK
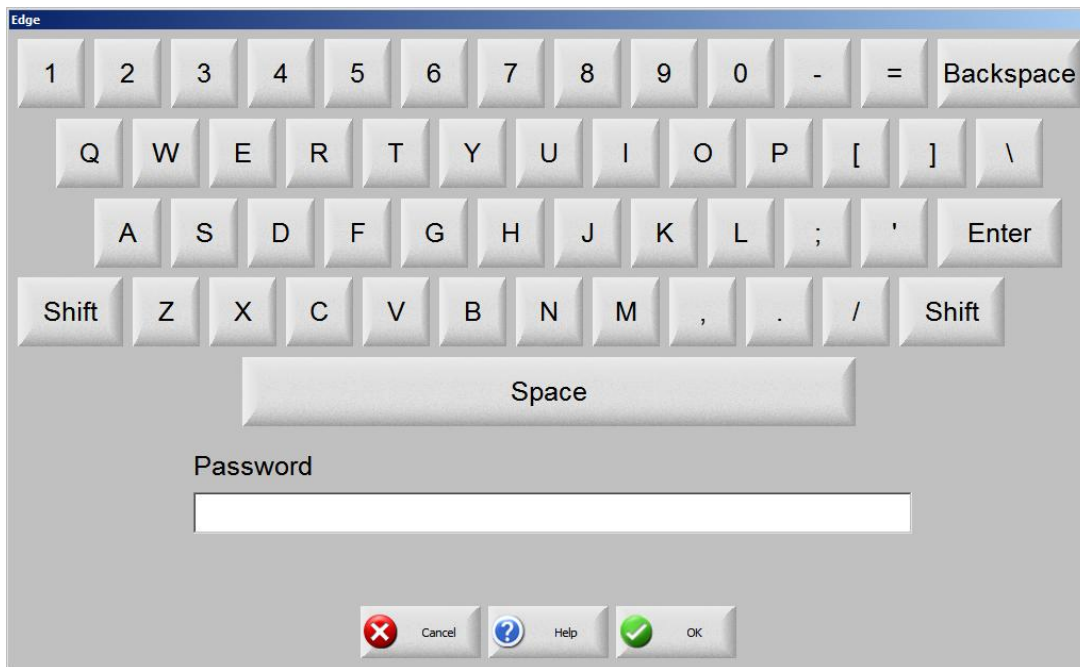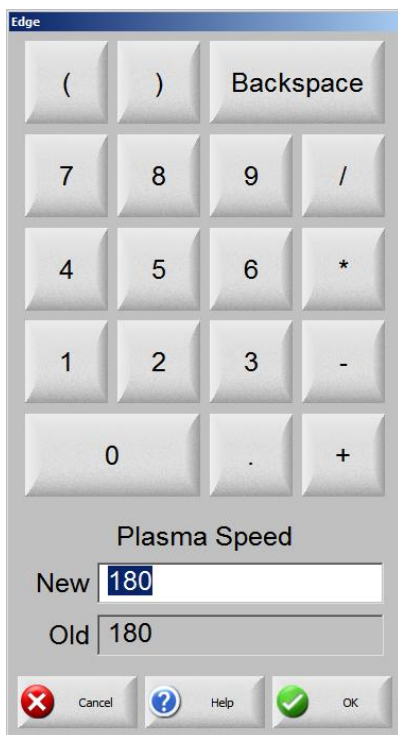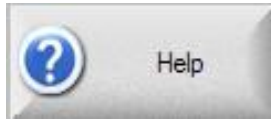
Help Screen

This controller is equipped with an easy to follow help screen function. To access the internal help screens press the Help soft key. Help information for the screen currently being accessed will be displayed. Pressing the OK soft key will exit the help screens and return you to the last control screen accessed.
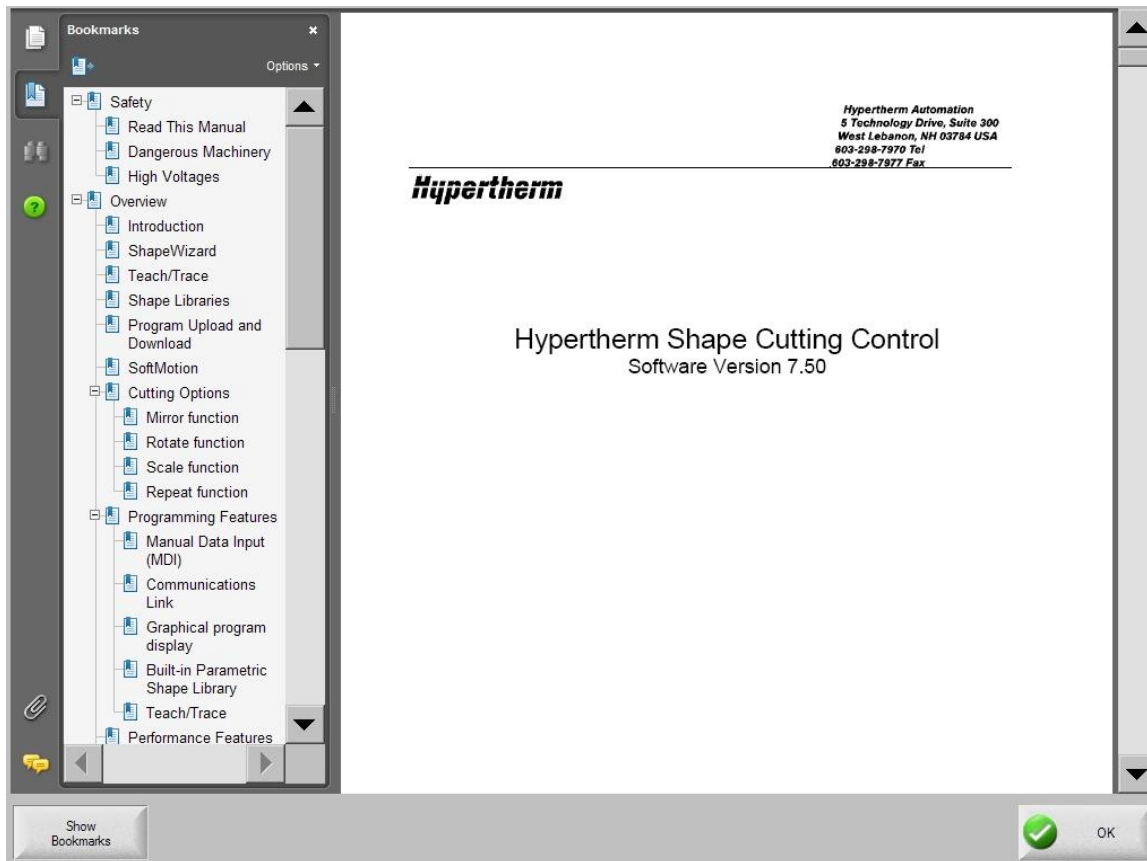
Show Bookmarks
While at the help screen, the table of contents (bookmarks) may be turned on and off by pressing the Show Bookmarks soft key. Click on the selected topic for additional information.

Main Screen

This is the top most screen and the first available screen at power up.
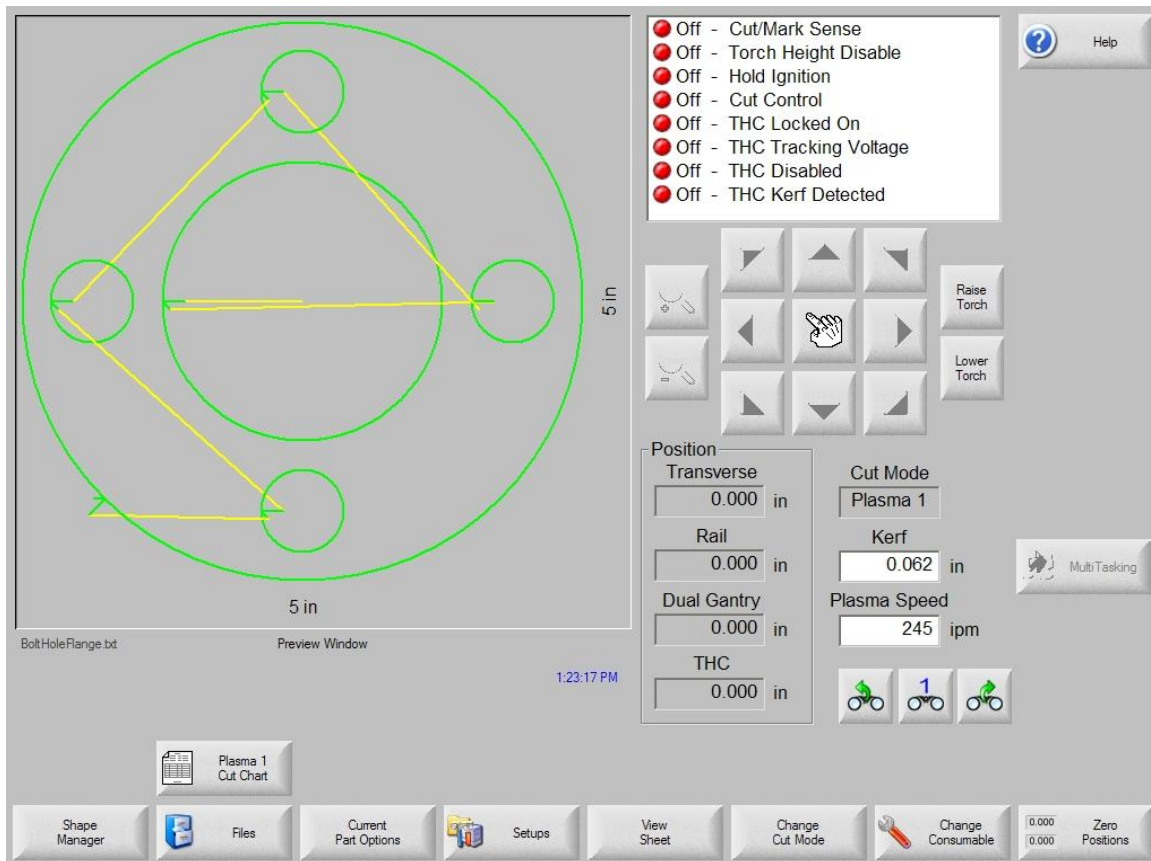
Preview Window
This window displays the current part in memory with the overall dimensions for that part.

Watch Window
This is the right part of the screen where such things as the speedometer, positions, cut mode and time are displayed. This part of the screen is configurable through the setups. Up to 10 different Watch Windows are available for viewing during use.

Shape Manager
This soft key takes you to the Shape Manager screen where you can load a simple shape, edit a part using the text editor or shape wizard or teach trace a part.

Files
This soft key takes you to the Files screen where you can load, save, download or upload part files.

Part Options
This soft key takes you to the Part Options screen where the current part can be scaled, rotated, mirrored and/or repeated.

Setups
This soft key takes you to the setup screens.

View Part/View Sheet
View Part allows the viewing of the entire current part in the Preview Window.

View Sheet allows the viewing of a part as it would appear on the plate. After pressing the View Sheet soft key, the display window zooms out to show the part in relationship to the entire plate.

Zoom +/- soft keys are available to change zoom level.
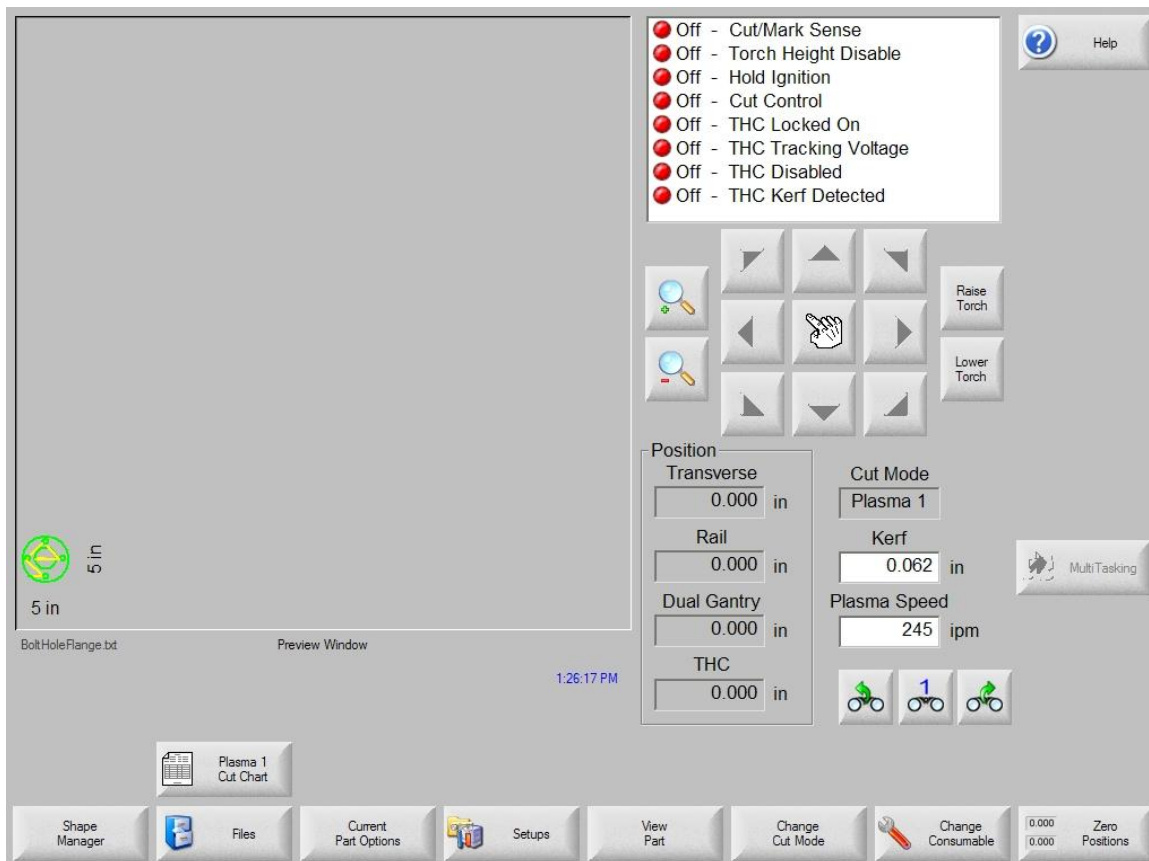
After zooming out, the display can be zoomed in again by pressing the **+** key, which causes horizontal and vertical scroll bars to be displayed. Pressing the **-** key will zoom back out.
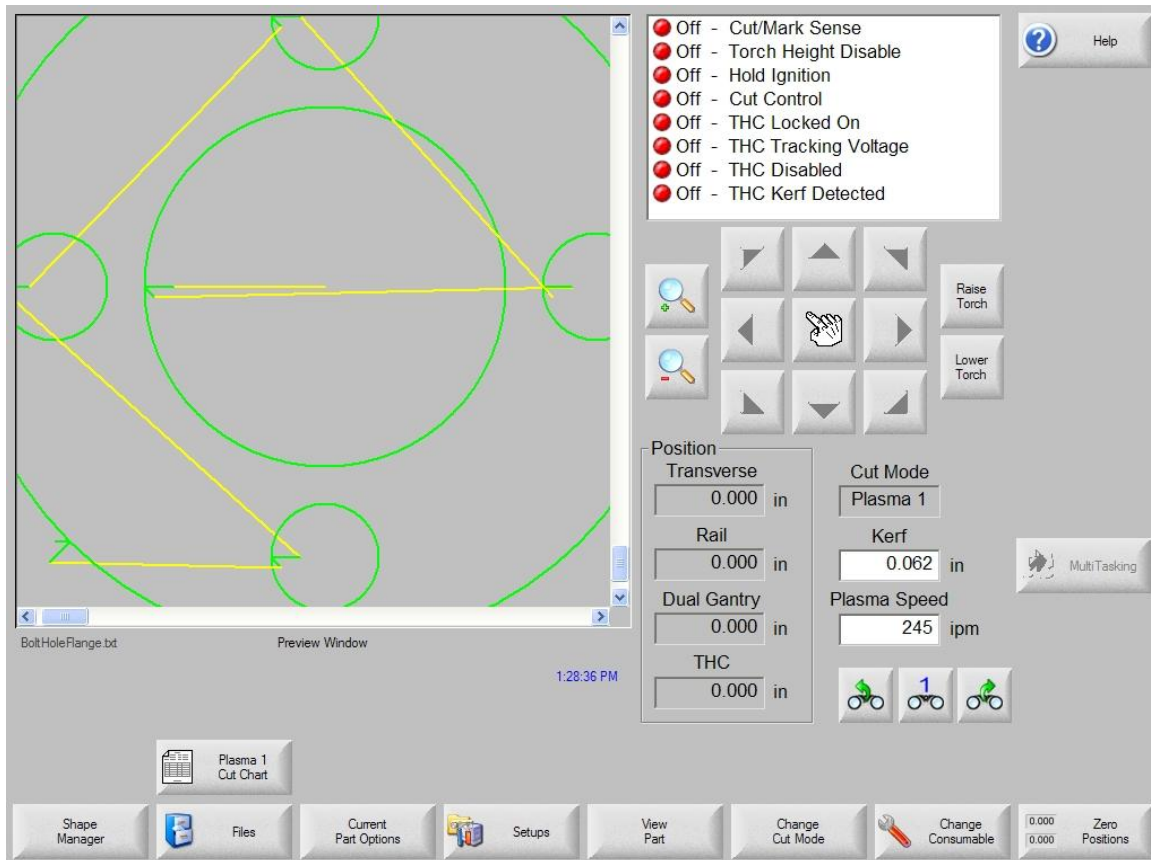
While the scroll bars are displayed and the control is not cutting, the view of the plate can be shifted horizontally and vertically by pressing and moving the scroll bar or by holding down a shift key and pressing the arrow keys on the keypad. While the control is cutting, the view will automatically be shifted as the cut path reaches one of the edges of the view. This mode is useful in normal cutting to closely follow the cut-path while in zoom.

View Sheet is more useful when proper Plate Size values have been entered in Cutting Setups.

Change Cut Mode
Allows selection of Trial, Oxy Fuel, Plasma, Waterjet and Laser cutting modes, depending on the setup configuration.

Change Consumable
This soft key takes you to the Change Consumable screen.

Zero Positions
This soft key zeros the current positions on the Transverse and Rail axes as well as the Dual Gantry axis if used.

Shape Manager Screen

The Shape Manager screen is used to retrieve a part from the Shape Library and edit part files.

Shape Library
Brings up the built-in library of 68 simple shapes.

Text Editor
Enters the full screen ASCII text editor. The current part in memory is loaded, allowing direct editing of the selected part program.

Shape Wizard
Enters into the *ShapeWizard*® a graphical editor window. *ShapeWizard*® allows direct editing of the selected part program using an easy to use graphical interface to view changes as they are made.

Teach Trace
Enters the trace-teach menu, where with an *optional* tracing system, you can digitize a template.

Nester

Nester™ is a proprietary part nesting program which allows the operator to manually group or nest selected parts together as one part program to conserve raw materials and maximize machine utilization.

An *optional* Automatic Nesting feature is available as an add-on item to Nester™. This true shape, single station, automatic nesting package allows quick and simple nesting of profiles on to selected material sizes. This feature is offered as a limited use trial version. Please contact your control vendor for information on adding this feature.

HyperCAD
The optional HyperCAD® feature is an easy to use 2D drawing application specifically designed for shape cutting. The software's powerful CAD utilities let users import DXF and CNC files or draw from scratch. Files can be converted to graphical parts for editing and saving or go directly to cutting.

HyperNEST
The optional HyperNEST® feature is a full featured, automatic true shape application designed to allow quick and simple nesting of profiles onto standard material sizes. With its advanced Graphical User Interface, HyperNEST® greatly improves the output of any shape cutting operation.

Evaluation Timer
Trail version software will prompt the user with a notification of the number of "uses" left at each launch. To enable unlimited use, a password would be provided by the control vendor.

To launch the trial software, select the Evaluation Version.

Example:
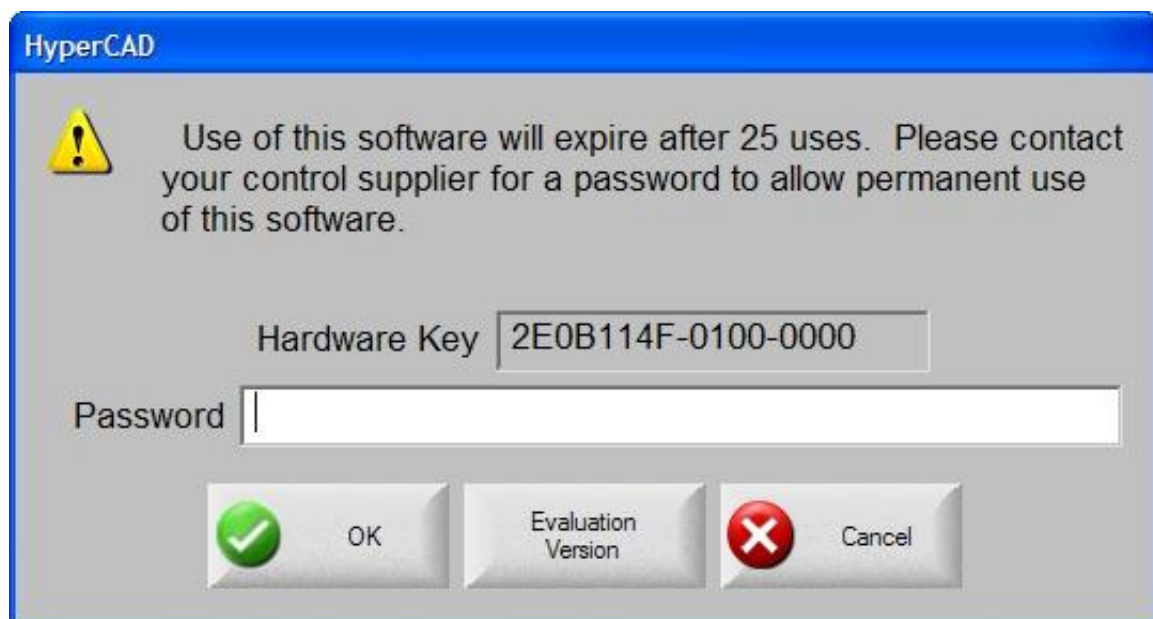
Files

From the Files screen the user may load or save parts on the control or an external location.
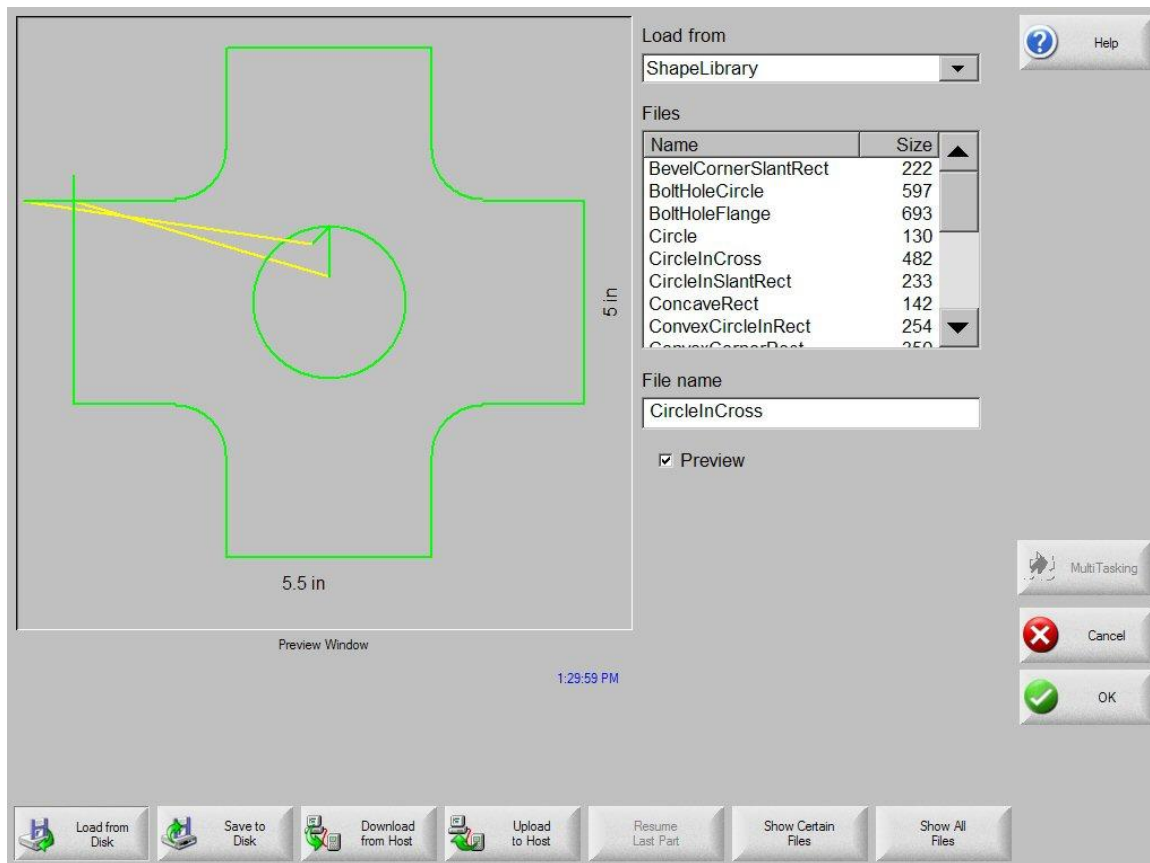
Load from Disk
Allows programs to be loaded from the internal disk drives, USB memory stick or external mapped drives (network option) into working memory.

Save to Disk
Allows the current program in memory to be saved to the internal disk drives or external mapped drives (network option). This also accesses the Save Key Logging File screen.

Download from Host
Allows programs to be downloaded from a host computer to the internal disk drives over the selected RS-232C/ RS-422 serial port.

Upload to Host
Allows programs from the internal disk drives to be uploaded to a host computer via the selected RS-232C/RS-422 serial port.

Resume Last Part
The Resume Last Part soft key will be visible when the Rush Job Interrupt or Automated Power Loss Recovery feature is in use. These features allow the user to pause the current part program and retain the part and current position information. This then allows the user to load and execute another part program and return to the original part using the Resume Last Part soft key.

Note: Controllers with SERCOS interface will save position information every minute to the hard drive. Some motion on path may be required for power or position loss recovery.

Show Certain Files
This soft key allows the operator to show only certain files from the selected directory. Both the asterisk and question mark may be used in defining the files to show.

Keypad operation: The asterisk is generated by holding down the left shift key and pressing the backspace key. The question mark is generated by holding down the right shift key and pressing the backspace key.

Show All Files
This soft key allows the operator to undo the Show Certain Files from above.

Note: An optional Network Card for connecting directly to a PC Network for part file allocation is available.

Setups Screen

The Setups Screen is used to configure the control for use.

Cutting
Allows programming of the different cutting parameters and dwell times.

Process
Enters the cut type menu, which allows editing of gas control sequencing variables for oxy-fuel and plasma cutting.

Disable Control
Pressing the Disable Control soft key disables the motion command from the control to the drive system. While disabled, I/O points and encoder feedback are still active.

Watch
Allows programming of the user definable Watch Window.

Password
Enter a password to get to the supervisor password protected setup menu.

Diagnostics
Enters the diagnostics menu.

Change to Metric Units/English Units
Changes all parameters over to metric units or English units.

Change Consumable

The Change Consumable Screen is used to track and record consumable life in a database. If the New Torch Tip or New Electrode soft key is pressed every time a torch tip or electrode is changed, the last information for the corresponding consumable will be added to a database. This database will show the date a consumable was changed and how long it lasted in minutes, pierces, inches / mm of travel and Arc Errors. Torch Tip and Electrode data can be recorded for up to twelve Oxy torches and up to eight plasma torches. A special feature allows the user to add an additional wear factor (in minutes) to compensate the database for the additional wear during piercing. Additionally, a Change Consumable Output will be activated when the specified limit has been reached. This output may be tied to an indicator lamp or alarm to prompt the operator to change the consumable.

New Torch Tip
This soft key tells the control that a new torch tip had been installed on the cutting machine.

New Nozzle
This soft key tells the control that a new nozzle had been installed on the cutting machine.

New Electrode
This soft key tells the control that a new electrode had been installed on the cutting machine.

Reset Database
This soft key is used to reset the database on the control to have no torch tip or electrode information.

Setups
Pressing the Setups soft key accesses the control setups for adjustment of the cut process.

Upload Database
This soft key is used to upload the current database to a host computer running our link.

Save Database
This soft key is used to save the current database to the Diskette or USB memory stick.

Setups

Cutting

When entering the Setup menu the operator can adjust the following run-time parameters for Trial Mode (no cutting), Oxy-Fuel, Plasma, Waterjet and Laser cutting.

Cut Mode
Specifies the current cut mode. Trial mode allows the operator to dry-run the current part program without cutting.

Kerf
Specifies the amount of kerf (cutter compensation) that will be applied to the current part program. Care should be taken when selecting a kerf value as this parameter can cause invalid geometries to be generated. For example, adding a kerf of 0.5" to an arc with a radius of 0.25". After entering a kerf value, the kerf compensated cut path can be viewed by pressing the Kerf soft key under the Part Options menu.

Kerf Variable / Kerf Value
The Kerf Variable / Kerf Value parameter is used to create a Kerf Variable table which assigns a reference number (variable) to a Kerf value. Up to 200 variables may be entered to create a reference table.

This Kerf Variable can then be used within a part program to define the kerf value when cutting. The advantage to this is that as torch parts wear, the kerf value changes. If the Kerf Variable value is updated as the consumable wears and changes, the new value will be called by the Kerf Variable command with all programs loaded that use the variable.

The EIA-274D part code for left kerf variable is the G43 code.

Example: G43 D1 X0.06

Kerf Variable Setting

Kerf Variable
    A number from 1-200 may be used

Kerf Data
    The selected kerf value
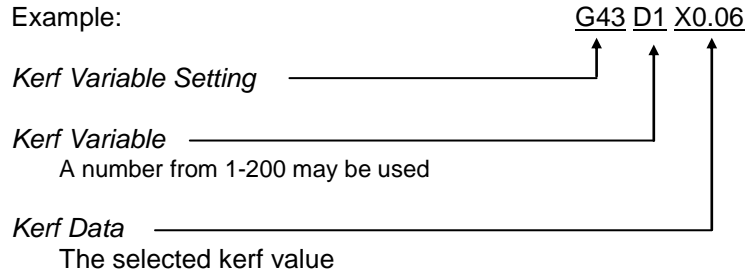
Trial/Cut Speed
Specifies the speed for the current cut mode. These speeds are saved independently for trialing and cutting. Both speeds will be limited to the maximum machine speed. Cut and Trial speeds may be executed at the embedded F-code speed within a part program.

Marker 1 / Marker 2 Speed
Specifies the speed for the selected Marker. These speeds are saved independently for each Marker and are executed through the marker tool selection within a part program. Marker 1 is activated by EIA RS-274D M09 and M10, or an ESSI 9 and 10. Marker 2 is activated by EIA RS-274D M013 and M14, or an ESSI 13 and 14.

Plate Size
Specifies the dimensions of the current plate being cut. This dimension is used when loading a part to determine if it will fit on the plate. It is also used for viewing the part in Screen View.

Vent Controls 1 - 50
Enter in values for up to fifty programmable zones for fume extraction damper control. Based on the machine position the vent control outputs to activate dampers at the selected zone for increased performance.

Marker Offsets 1 - 12
Enter in values for up to twelve programmable marker offsets. The machine is offset by this amount at maximum speed when the appropriate marker code is detected.

Dwell Time
Specifies the amount of dwell (delay) to be inserted into the current part program when an appropriate RS-274D program block is reached. This time can be overridden in the part program. For example in EIA programming a G04 X3 will cause a three second dwell to be inserted at the current program block. A G04 with no X-code will insert a dwell with the current Dwell Time parameter.

Arc Radial Error
Specifies the arc error tolerance to be used when checking the current segment for dimensional accuracy. All ESSI or EIA programs are comprised of lines, arcs, and circles. Arc Radial Error is used to make sure that the starting and ending radial vectors are within tolerance to describe a valid geometry.

Dwell Override
When this parameter is enabled, embedded dwell G04 Xvalue codes in an RS-274D program will override the operator entered dwell time.

Optional Program Stop
Allows overriding of the optional program stop code M01 in the current part program. If enabled, an M01 code operates identically to M00. If disabled, the M01 code is ignored.

EIA I & J Codes
Selects Absolute or Incremental RS-274D programming mode. In Incremental mode, all offsets for X, Y, I and J relative to the current block. In absolute, mode all X, Y, I and J are relative to an absolute reference point unless changed by using a G92 program code.

EIA F-Code Override
When this parameter is enabled, embedded F-codes in an RS-274D program will override any operator entered Cut Speed.

Speed +/- Affects F-Codes
When this parameter is enabled, the control will apply the speed increase/decrease percentage to all embedded F-codes encountered in the part program

EIA Decimal Shift
Some programming styles are structured so that the decimal point in the EIA positioning affecting part sizing is assumed. The EIA decimal shift parameter allows the operator to select the location of the decimal point when translating parts by selecting normal or single for correct translation. The selection should be set to Normal unless your part programs have only a single digit to the right of the decimal point.

Process Select Override
When enabled, this feature will allow the part program to override the process select input.

Station Select Override
When enabled, this feature will allow the part program to override the currently selected station select input.

Auto Torch Spacing Override
When enabled, this feature will allow the part program to override the manually selected Torch Spacing inputs.

G97 Loop Count Prompt
When Enabled this feature will post a message on the screen to enter the number of loops or repeats to be selected when an EIA G97 code without a "T" value is encountered in the part program.

ESAB Multi Torch Support
When enabled this feature allows ESAB style ESSI part programs to map codes to specific station selects.

ESSI CODE	Mapped EIA CODE	Description
7	M37 T1	Select Station 1
8	M38 T1	Deselect Station 1
13	M37 T2	Select Station 2
14	M37 T2	Deselect Station 2
15	M37 T3	Select Station 3
16	M38 T3	Deselect Station 3

Force G40 Kerf Disable
In a part program Kerf is enabled and disabled using EIA G41/ G42 and G40 codes. Standard operation is to disable Kerf at the cut off even if the G40 Kerf Disable is not in a program. With this parameter, you can select to turn off the "forced" G40 Kerf Disable if no G40 is used in the program by setting the parameter to a "Disable" state.

G40 Used in Simple Shapes
Used in conjunction with the Force Kerf Disable parameter this allows the G40 code normally inserted in to a Simple Shape from the control Shape library to be omitted by setting the parameter to a "Disable" state.

Auto Start after APA
Used with the Automatic Plate Alignment feature, this allows the user to select to automatically begin cutting after completion of the Automatic Plate Alignment.

EIA Code 2 Decimal Shift
Some programming styles are structured so that the decimal point in the EIA positioning affecting part sizing is assumed. The EIA Code 2 Decimal Shift parameter allows the operator to select the location of the decimal point when translating parts by selecting normal or single for correct translation. The selection should be set to Normal unless your part programs require two decimal shift to the right of the decimal point.

M17, M18 Used as Cut Codes
This allows the EIA-274D M17 and M18 codes to be used for cut on and off commands when enabled.

M76 Rotary Shortest Path
When enabled, this allows the EIA-274D M76 Rotate go to Home command to select shortest path. When disabled it allows motion by longest path when homing.   This is advantageous for some bevel head designs.

Show Traverse Segments
Allows traverse segment lines (displayed in yellow) to be turned OFF or ON during all part preview displays.

Retain Skew Adjustment
The Retain Skew Adjustment feature is used to retain the last calculated plate skew for all subsequent parts that are loaded. If disabled, any new part that is loaded will remove any previously calculated plate skew.

THC Voltage Offset
The THC Voltage Offset parameter is used to offset the individual Sensor THC™ Arc Voltages from the master set Arc Voltage. This allows the individual THCs to be adjusted to compensate for consumable wear and obtain optimum cut quality.

Process

Your shape cutting control comes standard with several styles of built-in cut process logic which allows the cut process timing to be configured for optimum performance. Selection will vary due to control configuration.

Example:

In the Plasma Cut Type example provided above, various process timing adjustments may be made to tune the process to the Plasma System and material being cut for the desired performance. Pressing the Timing Diagram softkey or the space key on a keyboard allows the user to view a graphical diagram of the process logic

Additionally, each cut type has the ability to save and load the process setups in a file on the hard drive or to a floppy Diskette or USB memory stick. Pressing the ALT key allows the Save Data and Load Data functions to be available.

Oxy Fuel

The control comes with the following built-in control logic for Oxy Fuel cutting. When Oxy Fuel is selected, the following parameters are available to customize the logic for the particular metal being cut. As these parameters are changed, the timing diagram below will change to show the new timing parameters. This screen is located under the Cut Types soft key in the Setups.

Note: Pressing the Start key twice will bypass all timers and begin the cut.

Press the Timing Diagram soft key to view the timing diagram from setups.

Ignition Time
Specifies the length of time that the oxy fuel igniter is held on at each ignition of the flame.

Low Preheat
For those cutting systems that are equipped with a Low Preheat feature, this parameter allows the operator to input a timing delay to activate the Low Preheat output prior to the High Preheat.

High Preheat
Specifies the length of time to wait at each pierce position for preheating the piece prior to piercing. During the run-time, the operator may use the SET, EXTEND, or RELEASE soft keys to customize the preheat length for the particular metal being cut.

Pierce Time
Specifies the amount of delay after the cutting gas is turned on before lowering the torch to the cut position.

Moving Pierce Time
The Moving Pierce Time parameter specifies the amount of time that the Pierce Output remains on while piercing with motion.

Creep Time
Specifies the amount of time after piercing the part that the torch travels at Creep Speed. Creep Speed is determined by a setup parameter at the Speeds setup screen and is a percentage of the programmed cut speed. After the Creep Time is completed, the control accelerates to full cut speed. This parameter is helpful in allowing the operator to bring the cutting surface up to temperature and completely pierce the metal before cutting at full speed.

Primary Torch Up Time
Specifies the amount of time used for torch lift after completing each cut. This is normally used to provide torch head clearance and return the torch to its predefined rest position.

Primary Torch Down Time
Specifies the amount of time used to lower the torch at the beginning of each new cut. This is usually longer than the Pierce Torch Down Time as it involves lowering the torch from its predefined rest position.

Pierce Torch Up Time
Specifies the amount of time used for torch lift during piercing. This parameter is used to provide distance between the torch tip and metal surface for cutting.

Pierce Torch Down Time
Specifies the amount of time used for torch lowering during piercing.

Cut Off Time
The Cut Off delay parameter species the amount of time the cut on output will remain on at the end of a cut.

Bleedoff Time
Specifies the amount of time that the cut torch will pause to purge the oxygen at the end of a cut segment before traversing to the next cut segment.

Igniters
When "No" is selected, this feature will turn the Preheat on between cut segments. This is to keep the torch lit for those cutting systems that do not have automatic torch igniters. For those cutting systems which have automatic torch igniters or that control the torch gases outside of the control, set this parameter to "Yes". This tells the control not to turn on the Preheat between cut segments.

Preheat During Cut
Specifies whether the Preheat will be left on while cutting.

Staged Pierce
This unique feature works with selected outputs to perform the pierce in a staged progression of gas pressures.

Plasma

The control comes with the following built in control logic for Plasma cutting. When Plasma is selected, the following parameters are available to customize the logic for the particular metal being cut. As these parameters are changed, the timing diagram below will change to show the new timing parameters.

Torch Down Time	0	sec	Arc On Feedback	○ Off ⊙ On
Purge Time	0	sec	Partial Raise	○ Off ⊙ On
Pierce Time	0.5	sec	Torch Down During Cut	⊙ Off ○ On
Creep Time	0	sec	Torch Down Between Cuts	⊙ Off ○ On
Cut Off Time	0	sec	Ignition	⊙ Off ○ On
Retract Delay	0	sec		
Full Torch Up Time	0	sec		
Partial Torch Up Time	0	sec		
Stop Time	0	sec		
Arc Off Time	0	sec		
Retry on Transfer Fail	0	times		
Transfer Time	0	sec		
Set Arc Current	100	amps		
Corner Current Percent	100	%		

Help

Cancel

OK

1:41:52 PM

Save Data   Load Data

Oxy Fuel   Plasma 1   Plasma 2   Marker 1   Marker 2   Water Jet   Laser   Timing Diagram

Press the Timing Diagram soft key to view the timing diagram from setups.
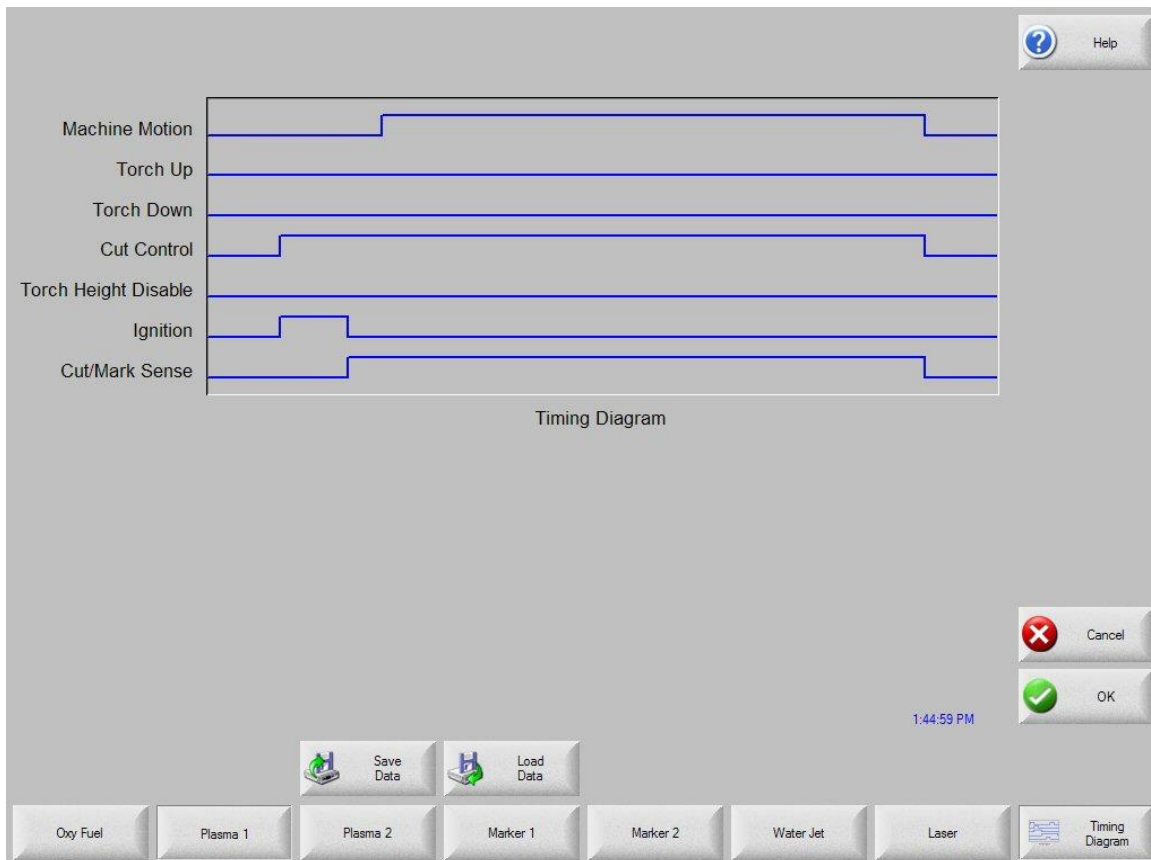
Purge Time
Specifies the time delay from torch ignition until motion is enabled if Arc On Feedback is OFF. Purge Time should be set to zero if Arc On Feedback is ON.

Pierce Time
Specifies the time delay from when the torch completes lowering until motion is initiated at Creep Speed. Used to allow the plasma torch to completely pierce the material before moving.

Creep Time
Specifies the amount of time after piercing the part that the torch travels at Creep Speed. Creep Speed is determined by a setup parameter at the Speeds setup screen and is a percentage of the programmed cut speed. After the Creep Time is completed, the control accelerates to full cut speed.

Cut Off Time
The Cut Off delay parameter species the amount of time the cut on output will remain on at the end of a cut. A negative Cut Off time up to one second may be used to terminate the cut output prior to the end of the cut segment. This is used to compensate for response delays of the cut gases that will maintain the cut arc and widen the cut path at the end of the cut segment.

Full Torch Up Time
Specifies the length of time to raise the torch at the beginning and end of each cut to provide clearance over the cut pieces. If you are using an automatic height control system, set Torch Up Time to zero.

Partial Torch Up Time
Specifies the length of time for a partial raise of the torch at the beginning and end of each cut to provide clearance over the cut pieces. If you are using an automatic height control system, set Torch Up Time to zero. Note: The Partial Raise parameter must be enabled.

Torch Down Time
Specifies the length of time to lower the torch at the beginning of each cutting cycle. If you are using an automatic height control system, set Torch Down Time to zero.

Arc Off Time
Specifies the amount of delay to allow prior to indicating a lost cut signal. This can be useful in helping to minimize nuisance trips when traveling over previously cut paths in complex nested parts.

Stop Time
Specifies the amount of time that X/Y motion will pause at the end of a cut. This pause is advantageous for allowing the torch to completely raise and clear any cut irregularities before continuing to the next cut segment.

Retract Delay
Retract Delay specifies the amount of time X/Y and lifter motion will pause at the end of a cut. This allows the cut process to finish before lifting the torch and moving to the next pierce.

Set Arc Current
The Set Arc Current feature allows the user to set the arc current at the plasma supply. This feature uses the "Set Current BCD" output from the control to activate the BCD inputs at the plasma supply. The Set Arc Current parameter is also available for the HD4070® via the serial link. EIA RS-274D part program code G59 V*value* F*value* for setting current is supported.

Corner Current Percent
The Corner Current Percent feature allows the operator to select a reduced current setting to be executed when cutting corners to improve cut quality. This value is a percentage of the Set Current (above) and is active when the Torch Height Disable Output is on. The Corner Current parameter is also available for the HD4070® via the serial link.

Retry Transfer Fail
The Retry On Transfer Fail feature is used to specify the number of times the control will attempt to fire the torch in the event that the torch fails to ignite.

Transfer Time
The Transfer Time parameter specifies the amount of time used to attempt ignition of the torch. The ignition is confirmed by the Arc Sense Input (Arc on Feedback) to the control.

Arc on Feedback
Specifies whether an arc-on (also called Plasma Go, Current Sense, Arc Transferred) signal from the plasma system to the control is used. With Arc On Feedback ON, the control waits for Cut Sense input to activate before initiating machine motion.

Ignition
Enables use of the Ignition output for use in igniting the plasma torch. If your plasma system requires a separate ignition signal, toggle Ignition to ON. If not, leave Ignition OFF.

Dual Grid/THC
The Dual Grid parameter enables use of the Torch Height Disable output. This output is used to disable an automatic torch height sensor or reduce the plasma current in a switchable current plasma system when machine speed is less than Plasma Hi/Lo Speed.

Dual Grid/THC Start
If Dual Grid is ON, the start mode can be configured to start (HI) or (LOW) at ignition time. For switchable plasma systems, this usually means that in low mode the plasma system will only deliver 50% of the maximum output power.

Partial Raise
Enabling the Partial Raise feature will execute a tool raise at the end of the cut segment within a nest for the time specified in the Partial Up Time parameter. Full raise will be executed at the end of the final cut segment.

Torch Down During Cut
Turning on the Torch Down During Cut feature forces the torch down output to remain on throughout the cut process. This is advantageous for pneumatic style torch lifters that require a constant output.

Torch Down Between Cuts
Turning on the Torch Down Between Cuts feature forces the Torch Down Output to remain on while traversing between cut segments.

Marker

The control comes with the following built in marker control logic for marking. When marking is selected, the following parameters are available to customize the logic for the particular metal being marked. As these parameters are changed, the timing diagram below will change to show the new timing parameters. This screen is located under the Cut Types soft key in Setups.

Marker Interface

The Marking feature from the control is operated through the use of existing I/O points for cutting torches on the control I/O connector. These I/O points may be switched from the cutting torch to the marking tool by use of an external relay(s) activated by the Marker Output or the Marker Output may be used to activate the marking tool.

Please refer to the Machine Interface section of this guide for exact I/O pinout information.

Field	Value		Field	Off	On
Marker Down Time	0 sec		Ignition	○ Off	⊙ On
Ignition Time	0 sec		Arc On Feedback	○ Off	⊙ On
Marker On Time	0 sec		Partial Raise	○ Off	⊙ On
Marker Off Time	0 sec		Down On During Mark	○ Off	⊙ On
Marker Up Time	0 sec		Down On Between Marks	⊙ Off	○ On
Marker Partial Up Time	0 sec		Cut Control Used for Marking	○ Off	⊙ On
Arc Off Time	0 sec		Marker Down/Up with Each Marker On/Off	⊙ Off	○ On
Set Arc Current	7 amps				
Corner Current Percent	100 %				

Help   Cancel   OK   2:11:08 PM

Save Data   Load Data

Oxy Fuel   Plasma 1   Plasma 2   Marker 1   Marker 2   Water Jet   Laser   Timing Diagram

Press the Timing Diagram soft key to view the timing diagram from setups.
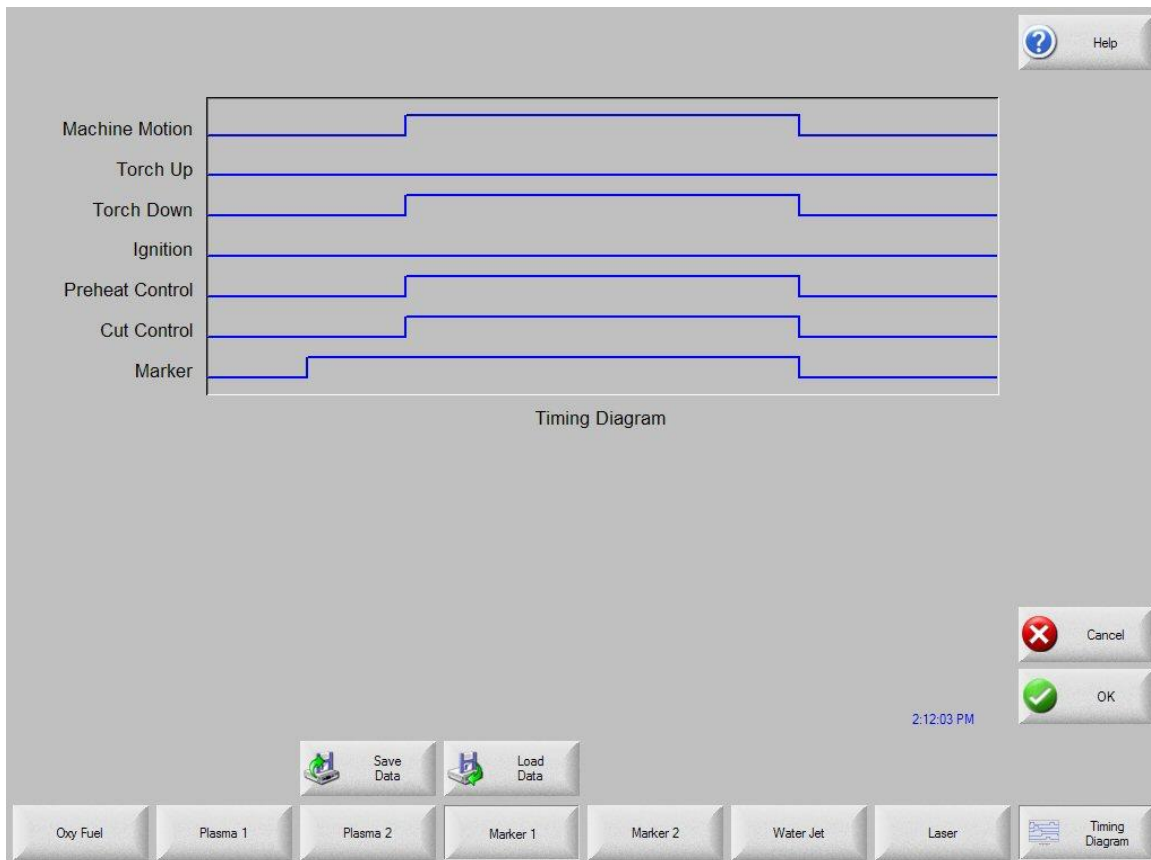
Ignition Time
(Ignition Output) Specifies the length of time that the ignition output is held on at each ignition point.

Marker On Time
(Time Delay) This parameter allows the operator to insert a time delay, which allows the marker to prepare for operation prior to the start of Marker motion.

Marker Off Time
(Time Delay) This parameter allows the operator to insert a time delay, which allows the marker to prepare for operation prior to the end of Marker motion.

Marker Up Time
(Torch Up Output) Specifies the length of time to raise the marker at the beginning and end of each mark.

Marker Partial Up Time
(Torch Up Output) Specifies the length of time for partial raise of the marker at the beginning and end of each mark.   Note: The Partial Raise parameter must be enabled.

Marker Down Time
(Torch Down Output) Specifies the length of time to lower the marker at the beginning of each marking cycle.

Set Arc Current
The Set Arc Current feature allows the user to set the arc current at the Plasma Marking supply. This feature uses the "Set Current BCD" output from the control to activate the BCD inputs at the Plasma Marking supply. EIA RS-274D part program code G59 V*value* F*value* for setting current is supported.

Corner Current Percent
The Corner Current Percent feature allows the operator to select a reduced current setting to be executed when cutting corners to improve marking quality. This value is a percentage of the Set Current (above) and is active when the Torch Height Disable Output is on.

Ignition
(Ignition Output Enable) The Ignition Off/On selection allows the operator to use the Ignition Output when marking if set to On.

Cut Control Used for Marking
This parameter is used to determine if the Cut Control output is to be used for activating the Marking tool. If set to no, the Marking Output would be used.

Marker Down/Up With Each Marker On/Off
The Marker Down/Up With Each Marker On/Off will command the send the appropriate Up/Down Output commands at each Mark On/ Off.

Arc On Feedback
Specifies whether an arc-on signal from a plasma marking system to the control is used. With Arc On Feedback ON, the control waits for Cut/Mark Sense input to activate before initiating machine motion.

Partial Raise
Enabling the Partial Raise feature will execute a tool raise at the end of the Mark within a nest for the time specified in the Partial Up Time parameter. Full raise will be executed at the end of the final Mark segment.

Down On During Mark
Turning on the Down On During Mark feature forces the torch down output to remain on throughout the Marking process. This is advantageous for pneumatic style torch lifters that require a constant output.

Down On Between Marks
Turning on the Down On Between Marks feature forces the Torch Down Output to remain on while traversing between marking segments.

Note: Please refer to the Program Codes section of this guide for information on the Marker Font Generator feature.

Laser Overview

The Mariner ™ Controls offers a unique Laser process screen directly integrates to Hypertherm's *FAST* Laser™ head. This feature has the ability to improve Laser setup and operational accuracy while having the flexibility to fine tune the process specific to the operator's needs.

FAST Laser™ (Flow Accelerated Screen Technology), utilizes an innovative patent-pending design to create a dual flow zone allowing significantly higher oxygen assist gas pressures in the tightly defined cut zone established by the beam geometry, without the uncontrolled burning in the surrounding zone normally induced by increased assist gas pressures. This accelerated high-velocity oxygen flow along the beam path not only increases cut speed by fueling the exothermic reaction, but also reduces *sensitivity* to common plate fabricating conditions and variables, most notably plate chemistry and condition.

With this technology, Hypertherm has introduced a line of laser cutting heads that utilize the *FAST* Laser™ process to deliver up to a 20% increase in cut speed over standard CO_2 laser heads on plate steel while also significantly expanding the capacity and quality range of plate laser cutting systems. These combined benefits produce substantial gains in productivity and unattended operation potential for dedicated plate lasers (4 to 6 kW) – whether integrated or retrofitted – while also offering expanded capacity range and cost performance for shared-duty systems (2 to 3 kW). The Hypertherm LH2100 head offers two different focal lengths: 7.5 and 10.0 inches; the LH2125 adds a 12.5-inch focal length option for thicker plate. The Hypertherm LH2125/2100 series is used on laser systems with 1.5" or 2.0" optics. The Hypertherm LH1575 head offers two different focal lengths: 5.0 and 7.5 inches for 1.5 inch optics.

Integrated with Hypertherm Automation's Mariner™ CNC controller, on-board *FAST* Laser™ process intelligence coupled to process monitoring optics standard on LH-series cutting heads, achieves improved overall control of the cutting process with fewer system faults and reduced operator involvement. Dynamic Pierce Control senses and initiates each cut once the pierce is complete. These combined capabilities maximize uptime while minimizing total cycle time.

Note: Refer to Laser Information provided with the *FAST* Laser™ head for proper operation.

Laser

Purge Time	1	sec	Height Control	○ Manual ⊙ Automatic	Help
New Gas Purge Time	2	sec	IHS in Manual	○ Off ⊙ On	
Shutter Time	0.5	sec	Retract	○ Full ⊙ Partial	
Power Ramp Time	0.1	sec	Partial Retract Distance	0.5 in	
Pierce Time	9.999	sec	Start IHS Distance	2.4 in	
Pulse On Time	0.003	sec	Skip IHS Within	0 in	
Pulse Off Time	0	sec	Preflow During IHS	○ Off ⊙ On	
Creep Time	0.5	sec	Nozzle Contact IHS	○ Off ⊙ On	
Beam Off Time	0	sec	Nozzle Contact During Cut	⊙ Off ○ On	
Postflow Time	1	sec	Pierce Control	○ Manual ⊙ Automatic	
Cut Height	0.039	in	Pierce Mode	⊙ Pulse ○ Blast	
Pierce Height	400 %	0.156 in	Pierce Complete	4 volts	
Lens Cut Position	0.315	in	Next Pulse	0.3 volts	
Lens Pierce Position	1	in	Pulse Laser Time	0 sec	
			Pulse Laser Power	0 watts	

Cancel

OK

2:14:40 PM

Save Data   Load Data   Calibrate Lens   Calibrate CHS   Test Lifter

Oxy Fuel   Plasma 1   Plasma 2   Marker 1   Marker 2   Water Jet   Laser   Timing Diagram

Test Lifter
Pressing the Test Lifter soft key will command the laser head THC1 lifter to lower to the plate, sense the plate and retract to the pierce height.

Press the Timing Diagram soft key to view the timing diagram from setups.
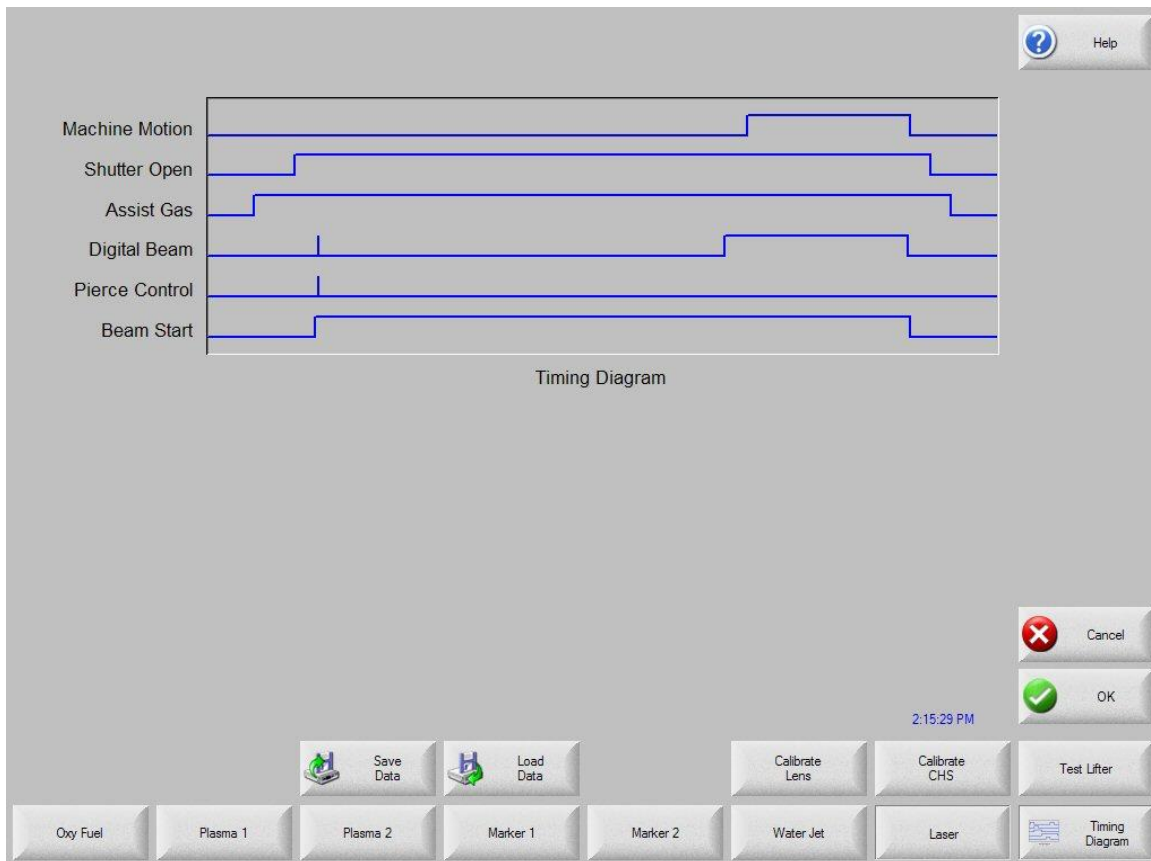
Purge Time
Specifies the time delay for cutting gas purge before start of the laser cut motion is enabled.

New Gas Purge Time
Specifies the Gas Purge Time for switching from one cutting gas to another cutting gas.

Shutter Time
The Shutter Time parameter is used to specify the amount of time to open the shutter prior to the laser beam on.

Power Ramp Time
The Power Ramp Time parameter is used to specify the amount of time to ramp up the laser power prior to the laser pierce.

Pierce Time
Specifies the time delay from when laser head completes lowering until motion is initiated at creep speed for cutting.
When Manual Pierce Control is selected, this is the total pierce time allowed.
With Automatic Pierce Control is selected, this time is an additional delay after pierce is complete.

Pulse On Time
When Automatic Pulse Mode is selected for pierce control the user can select Pulse On and Off Time to adjust duty cycle response of the sensor pulses from the laser cutting head.

Pulse Off Time
When Automatic Pulse Mode is selected for pierce control the user can select Pulse On and Off Time to adjust duty cycle response of the sensor pulses from the laser cutting head.

Creep Time
Specifies the amount of time after piercing the material that the laser head travels at Creep Speed for cutting. Creep Speed is determined by a setup parameter in the Speed Setup Screen and is a percentage of the programmed cut speed. After the Creep Time is completed, the control accelerates to full cut speed.

Beam Off Time
The Beam Off Time parameter specifies the amount of time the beam output will be turned off prior to he stop of motion. This feature can be used to tab parts for attachment to the skeleton.

Postflow Time
Specifies the amount of time that the cutting gas remains on after the cut is complete.

Cut Height
The Cut Height setup parameter is used to select the desired cut distance above the plate. This will set the initial cut height before the laser cut motion is activated. Cut Height is derived from the CHS signal and the calibration curve and represents cut distance from nozzle tip to the plate.

Pierce Height
The Pierce Height setup parameter is used to select the desired Pierce Height above the plate. This can be entered as a multiplication factor that is calculated times the Cut Height or an actual Pierce Height distance.

Lens Cut Position
Sets the focal lens position in the laser head for cutting.

Lens Pierce Position
Sets the focal lens pierce position in the laser head for cutting.

Pulse Laser Time
Sets the Laser Pulse Time duration for a one shot beam alignment.

Pulse Laser Power
Sets the Laser Pulse Power for a one shot beam alignment.

Height Control Manual/Automatic
Allows the user to either select a Manual or Automatic Height control for the laser head.

IHS in Manual
The IHS in Manual setup parameter allows the operator to select whether or not to use the Initial Height Sense feature when operating the Z axis lifter (THC1) in manual mode.

Retract Full/Partial
Selects the retract distance to be set at Full or Partial. In the Full retract mode, the laser head will retract to the Z-Axis Home position. In Partial retract mode, the laser head will retract to the set retract distance.

Partial Retract Distance
This setup parameter is used to select the THC 1 Retract Distance when configured for partial retract mode.

Start IHS Distance
The Start IHS Distance specifies the distance of travel for the THC 1 to move the laser head at high speed before switching to low speed and beginning Initial Height Sense. Caution should be taken when selecting this distance so that the laser head does not crash into the plate.

Preflow During IHS
Selecting ON will activate Preflow gases during the IHS cycle.

Nozzle Contact IHS
This parameter would be set to ON to select the THC 1 to use Contact Sense to detect the plate during the IHS cycle.

Nozzle Contact During Cut
Nozzle Contact During Cut allows the CNC to detect contact with the plate and generates a fault if this condition occurs.

Pierce Control Manual/Automatic
Allows the user to select Manual or Automatic Pierce control. Automatic control uses sensors in the Laser head to detect when the pierce is complete. Manual mode uses a preset pierce time and preset laser program. Automatic mode dynamically controls laser duty cycle.

Pierce Mode Pulse/Blast
When Automatic Pierce is selected the user can select to use a definable pulse output or a single Blast.

Pierce Complete
The Automatic Pierce monitors the voltage of sensors in the laser head and compares them to the value set by this parameter to detect the completion of the pierce.

Next Pulse
Based on sensors in the laser head, the system can determine when the next Laser Pulse is delivered during Automatic Pierce control. The voltage is derived from the feedback of the sensors in the laser cutting head.

Cut Chart
A cut chart database allows the user to select factory recommended settings or amend the database for personalized settings. The Cut Chart information can be saved or loaded via the hard drive, floppy drive or USB memory stick. The Cut Chart files contain the factory recommended settings that are available from Hypertherm®.

Notes:
- Please refer to the *FAST* Laser™ operators manual for complete information on the operation and setup of the *FAST* Laser™ head.
- The *FAST* Laser™ Laser parameters must first be enabled in the password protected Station Configuration screen to allow use of the Cut Chart Information
- Specific Material, Process Power, Assist Gases, Material Thickness, Focal Length and Nozzle data fields allow new values to be added. Double click on the field to enter an new value or press the Plus key "+" to add or "-" to delete on the keypad.

Laser Cut Chart

The Cut Chart Database (cut process parameters) transmitted to configure the laser head are based on the following process variables. All values are user definable.

Material Type
The Material Type, such as Mild Steel, Stainless Steel or Aluminum, may be selected.

Specific Material
This is a user defined value to allow the user to create a custom database based on unique characteristics of the material type. Double click on the field or press the Plus key "+" to enter an new material name or "-" to delete on the keypad.

Process Power
The appropriate process power (Wattage) for the material thickness and material type for the desired process.

Assist Gas
The appropriate Assist Gas for the desired process.

Material Thickness
The material thickness for the selected material type.

Focal Length
Specific Focal Length lens that needs to be installed in the laser head for the desired process.

Nozzle
Diameter and type of nozzle that needs to be installed for the desired process.

Test Gas
Pressing the Test Gas soft key performs the Test Gas feature of the cutting assist gas delivery system.

The following are the Cut Process parameters within the database, which are then available to configure the specific process.

Set Power
The Set Power parameter allows the user set the power (watts) to be used during the cut process. This value can be less than the process power.

Cut Speed
Specifies the Cut Speed for the selected material process.

Kerf
Specifies the amount of kerf (cutter compensation) that will be applied to the current part program.

Cut Height
The Cut Height setup parameter is used to select the desired cut distance from the nozzle tip to the plate. Cut Height is derived from the CHS signal and the calibration curve.

Pierce Height
The Pierce Height setup parameter is used to select the desired Pierce Height.   This may be entered as a multiple factor that is calculated value of the Cut Height or an actual Pierce Height distance.

Lens Cut Position
Sets the focal lens position in the laser head for cutting.

Lens Pierce Position
Sets the focal lens pierce position in the laser head for cutting.

Resonator On Time
During automated power up this allows a specific time for the resonator to power up.

Purge Time
Specifies the time delay from switching from one cutting gas type to another cutting gas type.

Pierce Time
Specifies the time delay from when laser head completes lowering until motion is initiated at creep speed for cutting.
When Manual Pierce Control is selected, this is the total pierce time allowed.
With Automatic Pierce Control is selected, this time is an additional delay after pierce is complete.

Pulse On Time
When Automatic Pulse Mode is selected for pierce control the user can select Pulse on time to adjust the pulse.

Pulse Off Time
When Automatic Pulse Mode is selected for pierce control the user can select Pulse on and off time to adjust the pulse. The Off Time starts when the sensor signal falls below the next pulse threshold.

Creep Time
Specifies the period after pierce complete that the laser head travels at Creep Speed. Creep Speed is determined by a setup parameter in the Speeds setup screen and is a percentage of the programmed cut speed. After Creep Time is complete, the control accelerates to full cut speed.

Pierce Complete
The Automatic Pierce monitors voltage of sensors in the laser head to detect completion of the pierce. This is used in conjunction with Pulse On Time, Pulse Off Time and next pulse.

Next Pulse
Based on sensors in the laser head, the system can determine when the next pulse occurs. The Next Pulse will be delivered when the voltage drops below the Next Pulse setting.

Start Corner Power
The Start Corner Power allows the user to define a speed where the corner power analog signal will be used to start to decrease laser power. This is defined as a percentage of cut speed.
See Corner Power graph, where the example shows this set to 80%.

Minimum Corner Power
This parameter defines the minimum laser resonator power to switch when the cut speed reduces to zero in a corner. This is defined as a percentage of selected power (watts). See Corner Power graph, where the example shows 30%.

EXAMPLE of Corner Power Graph
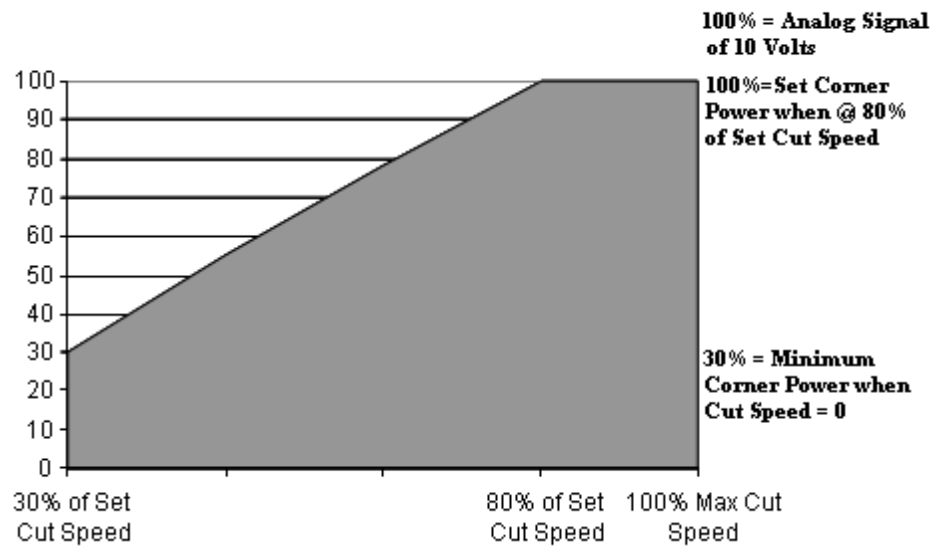
Save Process
Pressing the Save Process soft key allows the user to save the current process settings to the Hard drive creating a custom user database based on the eight process variables selected.

Rest Process
Pressing the Reset Process soft key allows the user to reset the current settings to factory recommend factory defaults based on the eight process variables selected.

Save Cut Charts
Pressing the Save Cut Charts soft key allows the user to save the current User and Factory databases to Diskette or USB memory stick. User files are designated with a .usr file extension and the factory files are designated with a .fac file extension

Load Cut Charts
Pressing the load Cut Charts soft key allows the user to the factory default database files which are supplied by Hypertherm in a Text file (.txt), user files (.usr) or factory files (.fac) from Diskette or USB memory stick.

Pulse Laser Time
Sets the Laser Pulse Time duration for a one shot beam alignment.

Pulse Laser Power
Sets the Laser Pulse Power for a one shot beam alignment.

Height Control Manual/Automatic
Allows the user to either select a Manual or Automatic Height control for the laser head.

IHS in Manual
The IHS in Manual setup parameter allows the operator to select whether or not to use the Initial Height Sense feature when operating the Z axis lifter (THC1) in manual mode.

Retract Full/Partial
Selects the retract distance to be set at Full or Partial. In the Full retract mode, the laser head will retract to the Z-Axis Home position. In Partial retract mode, the laser head will retract to the set retract distance.

Partial Retract Distance
This setup parameter is used to select the THC Retract Distance when configured for partial retract mode.

Start IHS Distance
The Start IHS Distance specifies the distance of travel for the THC to move the laser head at high speed before switching to low speed and beginning Initial Height Sense. Caution should be taken when selecting this distance so that the laser head does not crash into the plate.

Preflow During IHS
Selecting ON will activate Preflow gas during the IHS cycle.

Nozzle Contact IHS
This parameter would be set to ON to select the THC to use Contact Sense to detect the plate during the IHS cycle.

Nozzle Contact During Cut
Nozzle Contact During Cut allows the CNC to detect contact with the plate and fault.

Pierce Control Manual/Automatic
Allows the user to select Manual or Automatic Pierce control. Automatic control uses sensors in the Laser head to detect when the pierce is complete

Pierce Mode Pulse/Blast
When Automatic Pierce is selected the user can select to use a definable pulse output or a single Blast.

Pierce Complete
The Automatic Pierce monitors voltage of sensors in the laser head to detect completion of the pierce.

Next Pulse
Based on sensors in the laser head, the system can determine when the next Pulse Pierce occurs during Automatic Pierce control. The voltage is derived from the feedback of the sensors.

Cut Chart
A cut chart database allows the user to select factory recommended settings or amend the database for personalized settings. The Cut Chart information can be saved or loaded via the hard drive, floppy drive or USB memory stick. The Cut Chart files contain the factory recommended settings that are available from Hypertherm®.

Notes:
- Please refer to the *FAST* Laser™ operators manual for complete information on the operation and setup of the *FAST* Laser™ head.
- The *FAST* Laser™ Laser parameters must first be enabled in the password protected Station Configuration screen to allow use of the Cut Chart Information
- Specific Material, Process Power, Assist Gases, Material Thickness, Focal Length and Nozzle data fields allow new values to be added. Double click on the field to enter an new value or press the Plus key "+" to add or "-" to delete on the keypad.

Water Jet

Purge Time	0	sec
Pierce Time	0	sec
Creep Time	0	sec
Abrasive Off Time	0	sec

Abrasive Charging ⦿ Off   ○ On

Help

Cancel

OK

2:17:35 PM

Save Data   Load Data

| Oxy Fuel | Plasma 1 | Plasma 2 | Marker 1 | Marker 2 | Water Jet | Laser | Timing Diagram |

Press the Timing Diagram soft key to view the timing diagram from setups.
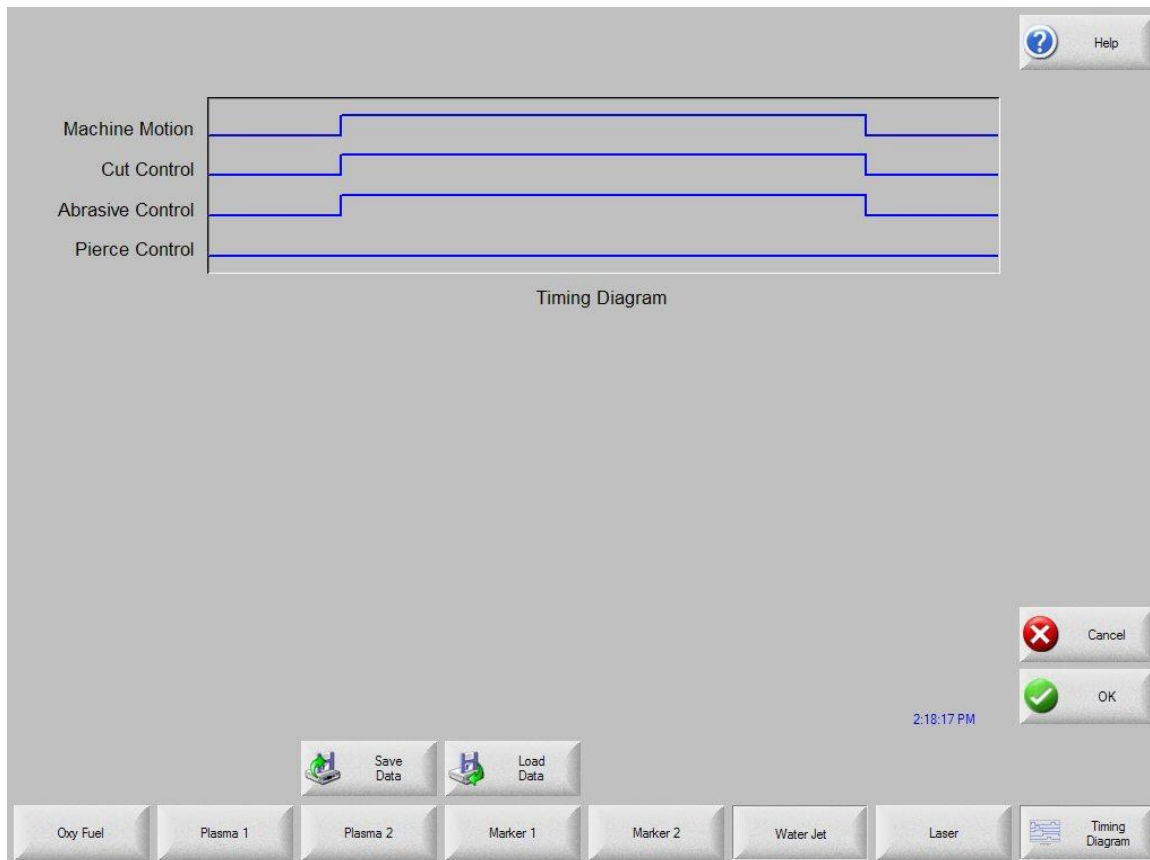
Purge Time
Specifies the time delay from torch ignition until motion is enabled.

Pierce Time
Specifies the time delay from when cutting tool completes lowering until motion is initiated at Creep Speed. Used to allow the cutting tool to completely pierce the material before moving.

Creep Time
Specifies the amount of time after piercing the part that the torch travels at Creep Speed. Creep Speed is determined by a setup parameter at the Speeds setup screen and is a percentage of the programmed cut speed. After the Creep Time is completed, the control accelerates to full cut speed.

Abrasive Off Time
The Abrasive Off delay parameter species the amount of time the abrasive will remain on at the end of a cut.

Abrasive Charging
When selected, the Abrasive Charging feature will charge or fill the abrasive into the cutting system for use while cutting.

Watch

The control comes with a unique function for watching critical process related parameters during cutting. The Watch window allows the operator to customize a certain portion of the screen to display functions that are critical for your particular cutting operation. Whether it is Current Speed, Position, I/O status, or torch consumable life, you now have the flexibility to display the information that you want to see.

As these parameters are turned ON or OFF, the Watch window will be updated with the new graphical widget. Widget is a GUI programmer's term for defining icons which graphically display information.
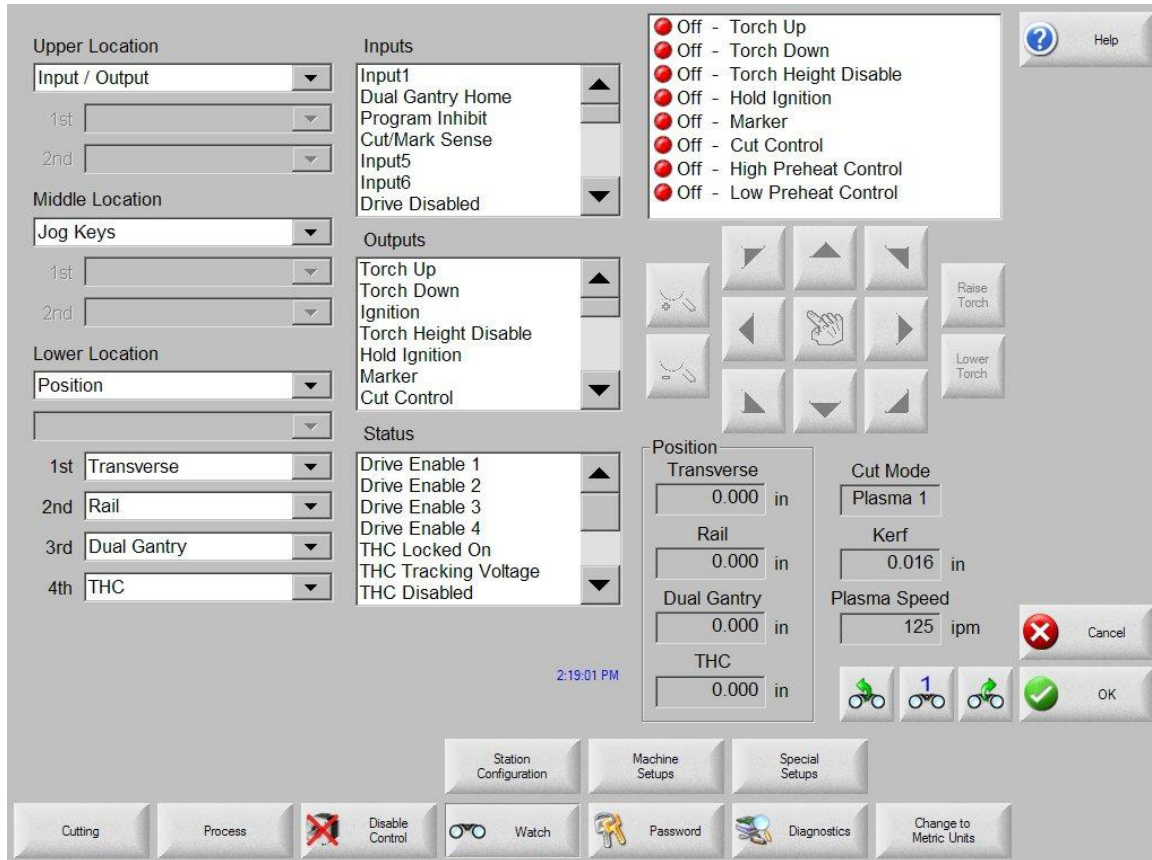
Several options are available to personalize the Watch window and not all options can be viewed at one time. The options are grouped into two sizes of widgets or icons. Large widgets may be placed into the upper position at the top of the Watch window or in the middle of the Watch window. Small widgets are positioned in the lower left corner of the Watch Window next to the cut information and clock. The cut information and clock at the lower right may not be edited.

Selections in the Watch window will change slightly based on the control I/O configuration and machine option selections that have been enabled.

The Watch positions will allow for the following selections.

None
Selecting None will leave the selected position blank.

Input/Output
Allows current state of selected Input, Outputs or Status information to be displayed during cutting. This can be especially useful in debugging gas control sequencing problems. To add or delete a desired Input, Output or Status point to the Input/Output list box, Double click the disired item or highlight the desired item and + (add) or − (delete) keys on the alpha-numeric keypad.

Position
Allows the position for the selected axis to be displayed. Only two axes may be displayed at the Upper or Middle locations. The Lower location will allow up to four axes to be displayed.

Following Error
Allows the Following Error to be displayed. Following Error is the distance between the position the control has calculated and the actual position of the torch. A large Following Error may indicate that the cut speed selected may be beyond the capability of the cutting system. Only two axes may be displayed at the Upper or Middle locations. The Lower location will allow up to four axes to be displayed.

Command Voltage
Allows the user to view directional motion command voltage being sent to the amplifier for velocity type drives. This displayed voltage also equates to current being commanded for motion in current type drives. Peak voltage can be displayed for a specified amount of time.

Temperature
Selecting to add the Temperature information to the Watch window will display the current temperature inside the control in Fahrenheit or Celsius (selected at the Special Setups screen). **Note:** Specific control hardware required.

Speedometer
Allows cut speed, maximum machine speed and current machine speed to be graphically displayed while cutting.

Oxy Fuel Torch Tip
Allows the selected oxy fuel torch tip (1- 12) consumable life to be graphically displayed while cutting. This is especially useful in helping to determine when the torch tip should be replaced and keeping track of torch tip data for statistical process control (SPC).

Plasma Torch Tip
Allows the selected plasma torch tip (1- 8) consumable life to be graphically displayed while cutting. This is especially useful in helping to determine when the torch tip should be replaced and keeping track of torch tip data for statistical process control (SPC).

Plasma Electrode
Allows the selected plasma electrode (1- 8) consumable life to be graphically displayed while cutting. This is especially useful in helping to determine when the electrode should be replaced and keeping track of electrode data for statistical process control (SPC).

Jog Keys
Selecting the jog keys option allows a directional keypad to be added to the watch window for manual motion directly from the touch screen. The operator can press the hand ICON in the middle of the navigation pad to enable manual mode.   Select the desired move speed and press the corresponding arrow for manual motion in the desired direction.

Process Data
The Process Data option allows the user to view up to four selected items for a selected cut or marking process. Process timers and status items for Oxy Fuel, Plasma, Marker, Waterjet and Laser may be selected.   Note: The process data will only be displayed during the current cut process. Example: Plasma 1 process parameters will only be displayed in the Watch window at the main cut screen while cutting in Plasma 1 Mode.

Laser Nozzle
Laser Nozzle consumable life to be graphically displayed while cutting. This is especially useful in helping to determine when the nozzle should be replaced and keeping track of nozzle data for statistical process control (SPC).

HPR Power Supply
Allows the user to view status for inputs, outputs and gas pressures for the HPR autogas console. Up to four power supplies may be monitored.   This is generally used for service diagnostics only.

Multiple Watch Windows
Up to ten different Watch windows may be configured on the control for quick selection and viewing of the Watch icons.

To configure different Watch windows for viewing, first access the Watch setup screen. Press the number ICON to enter a number or the Left/Right arrows to move up and down through the selections.   The different Watch windows can be selected and viewed during operation using the same selection process.

Shape Manager

Shape Library

The control contains a built-in Shape Library with more than 68 commonly used shapes. These shapes are *parametric.* Parametric shapes are shapes that are not fixed in size or geometry.

The Shape Library consists of more than 68 shapes as shown below. The screen is defined in colors, from the easiest (green) to the hardest (black).
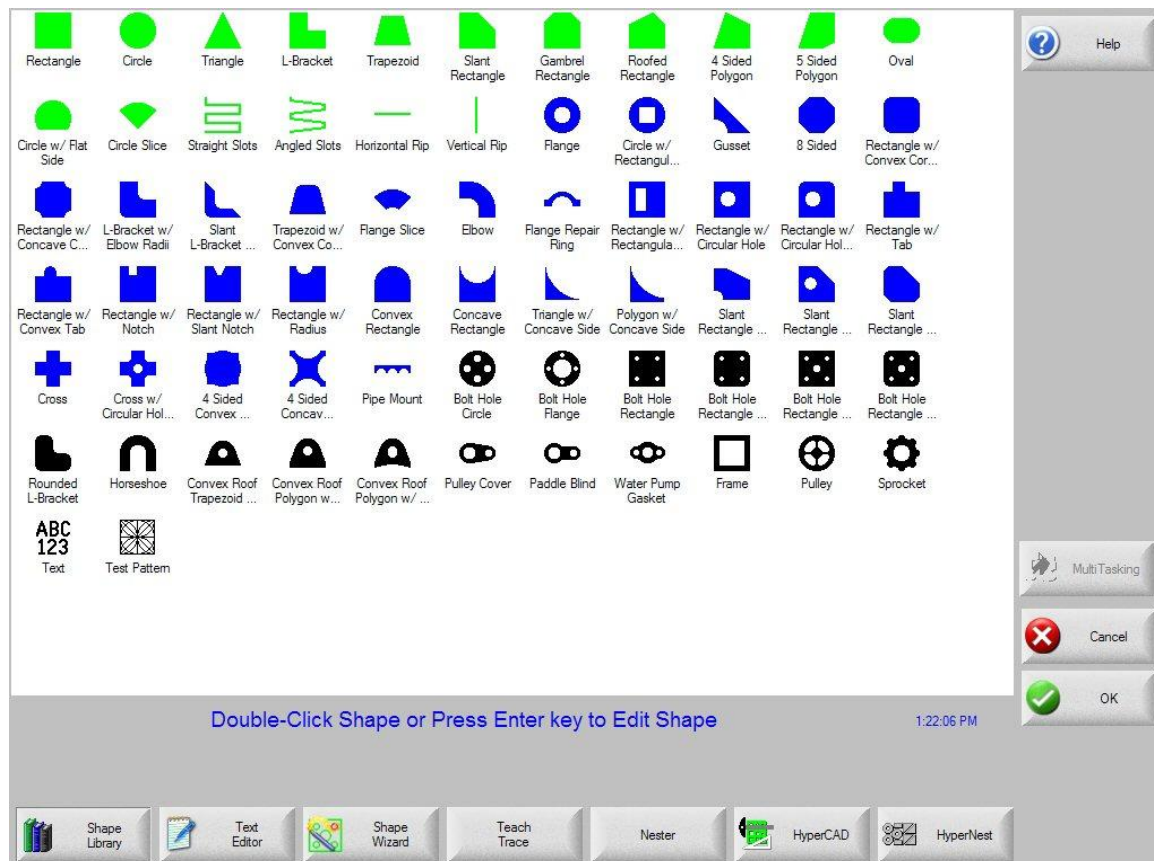
Selecting a Simple Shape
After pressing Shape Library from the Main Menu, the control display shows the Shape Library as shown above. Double click the desired shape you wish to cut and press OK. If the selection is incorrect, press CANCEL and re-select the shape.

Keypad operation: Use the arrow keys to navigate to the desired shape you wish to cut and press ENTER.

At this point, the shape is displayed with the default parameters, or the parameters from the last edit session of this shape. Detailed information on the available shapes can be found in the following section.

Text Editor

This screen is for manually inputting or editing of a part program in either ESSI or EIA format. The current part that is in memory will be displayed upon entering this screen. The OK soft key will save any changes to the current part in memory. If you want to save the changes to the hard drive, go to the Files Save to Disk screen. If you do not want to save any changes that were made, press Cancel on the keyboard.

Changes can be made by pressing on the desired line of code. An alphanumeric keypad will be displayed to initiate changes.

```
M07
G01 X1.5 Y0
G03 X0.5 Y0.5 I0 J0.5
G01 X0 Y1
G01 X2 Y0
G01 X0 Y-1
G03 X0.5 Y-0.5 I0.5 J0
G01 X1 Y0
G01 X0 Y-2
G01 X-1 Y0
G03 X-0.5 Y-0.5 I0 J-0.5
G01 X0 Y-1
G01 X-2 Y0
G01 X0 Y1
G03 X-0.5 Y0.5 I-0.5 J0
G01 X-1 Y0
G01 X0 Y2.25
M08
G40
M02
```

Help

MultiTasking

Cancel

OK

Double-Click Line of Text to Edit   2:21:35 PM

Show Original Text   Delete Part
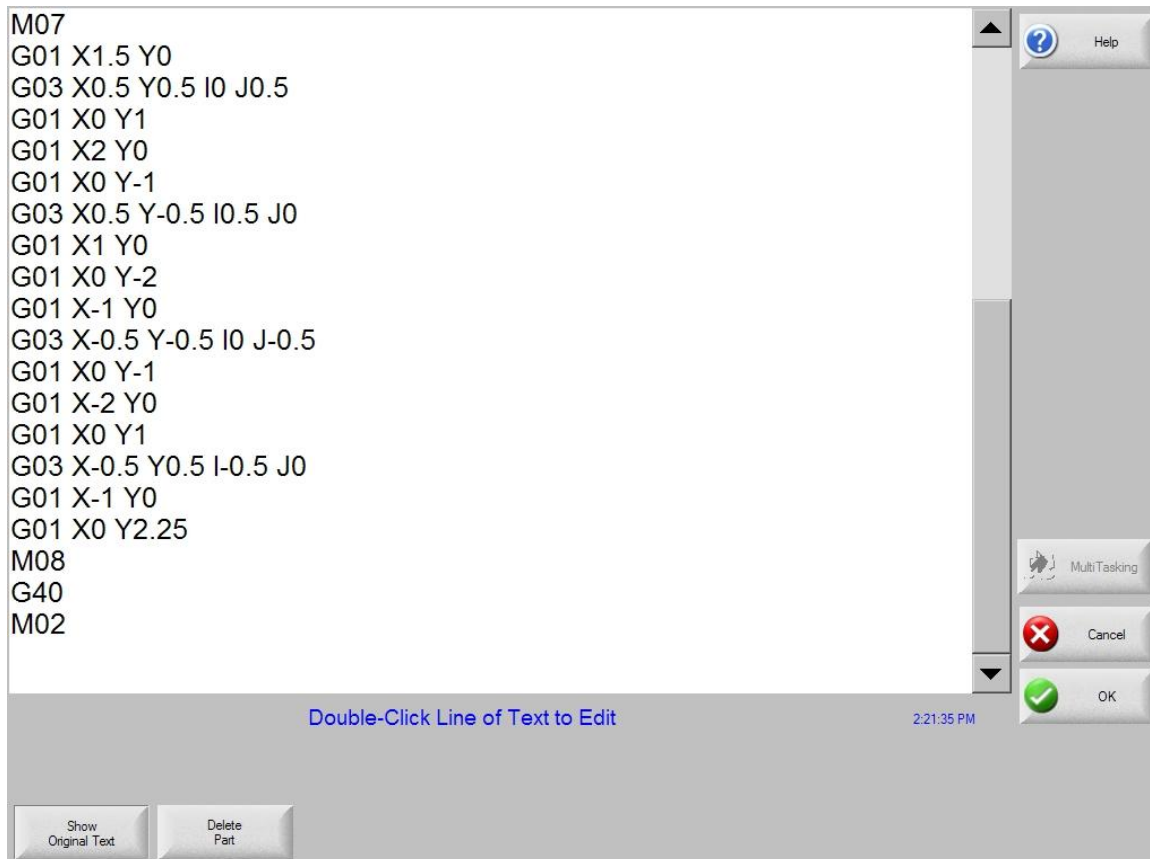
Show Original Text
Pressing the Show Original Text button allows the user to view and edit the part program in the original format in which it was written.

Delete Part
The Delete Part button will delete the current part from the Text Editor so that a new part can be constructed.

Shape Wizard

ShapeWizard®, a proprietary graphical part editor, provides a user-friendly, graphical method of editing part programs.

ShapeWizard® allows a user to graphically view not only the segment that is being edited, but also any changes that are made, when they happen. EIA RS-274D codes can be inserted directly as ASCII text into a part program or, alternatively, segments can be created by specifying phrases in the user's native language as a step-by-step process. EIA RS-274D codes need not be known. *ShapeWizard*® is accessed from the Shape Library menu.
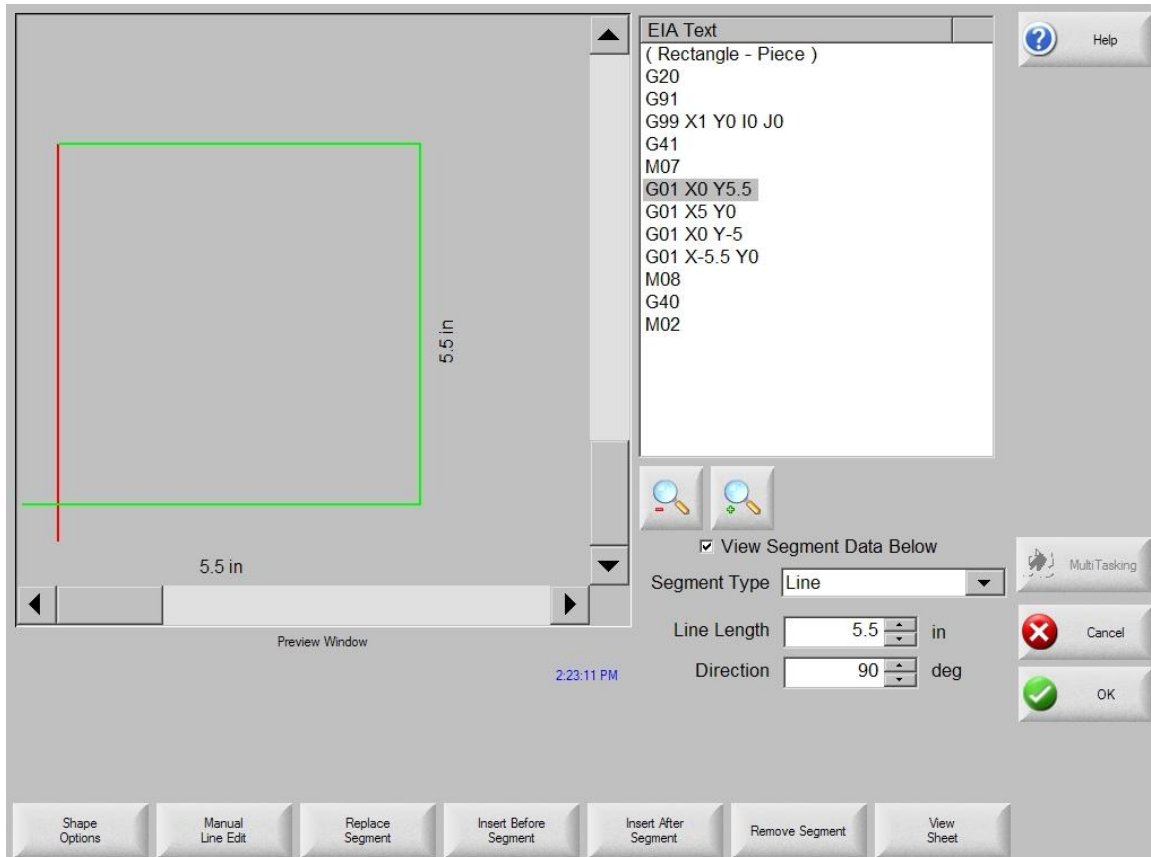
Manual Line Edit
Pressing Manual Line Edit allows editing the highlighted line in the Text Editor window. The ASCII text entered must be valid EIA RS-274D codes or an error message will result. The alphanumeric keypad will be displayed for line edits. Below is a Text Editor line as it appears immediately after the Manual Line Edit is pressed:

```
EIA Text
( Rectangle - Piece )
G20
G91
G99 X1 Y0 I0 J0
G41
M07
G01 X0 Y5.5
G01 X5 Y0
G01 X0 Y-5
G01 X-5.5 Y0
M08
G40
M02
```
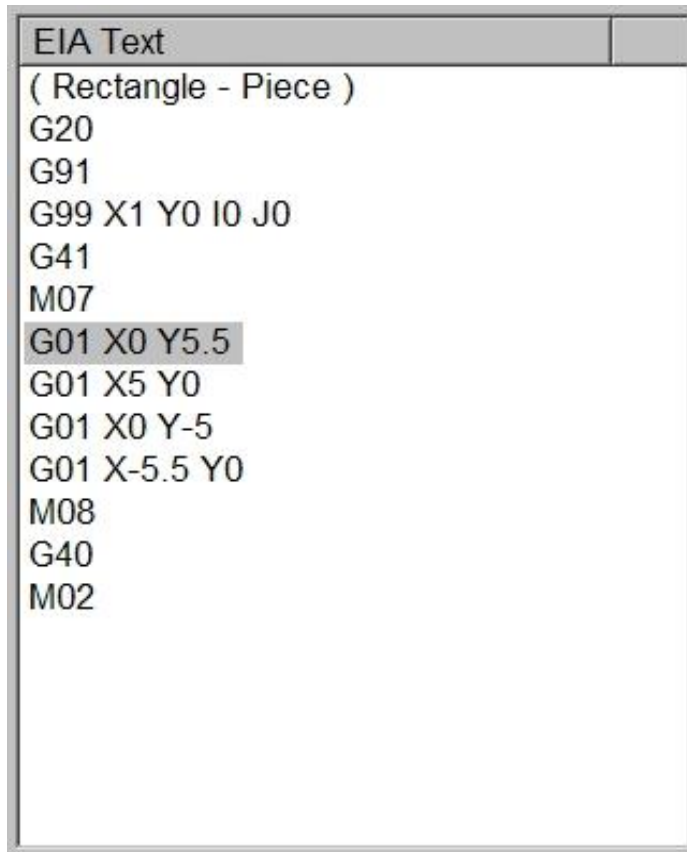
Simply typing right over the line can erase the highlighted text.

While a text line is highlighted in blue, a new segment type can be selected and inserted into the program using soft keys. Additionally, a graphic representation of the part program in the Preview window is updated so that the corresponding segment is highlighted in red or blue, depending on whether it is a cut segment or a traverse.

The Segment Type pop-up window is pictured below:

```
☑ View Segment Data Below

Segment Type   Line                    ▼

    Line Length          5.5  ⬍   in

     Direction            90  ⬍   deg
```
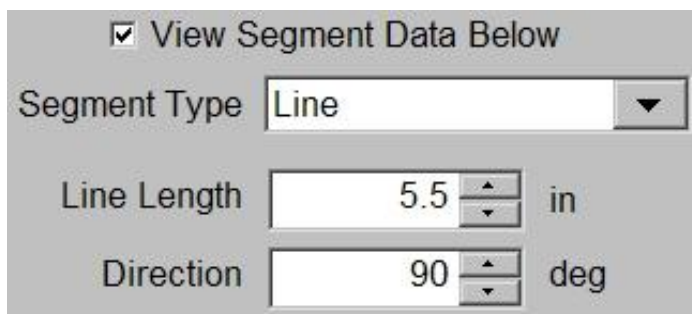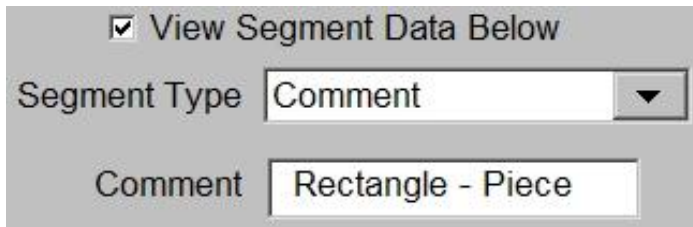
Parameters associated with the segment type will also be displayed and can be edited.

Replace Segment
Replaces the segment highlighted in gray in the Text Editor window with the segment selected from the Segment Type window as pictured below:

Insert Before Segment
Pressing this soft key causes the segment selected from the Segment Type window to be inserted before the segment highlighted in gray in the Text Editor window.

Insert After Segment
Pressing this soft key causes the segment selected from the Segment Type window to be inserted after the segment highlighted in gray in the Text Editor window.

Remove Segment
The segment highlighted in gray or blue in the Text Editor window is removed from the part program when the Remove Segment soft key is pressed.

Teach Trace

The Teach Trace function of the control allows parts to be taught rather than programmed. The position information from the taught part will remain as a part program that can be saved to disk for future use.

The Teach Trace algorithms present in the control can recognize both arcs and lines. This will reduce the overall memory required to store these parts and will improve the smoothness of the cut. The taught part in memory is in EIA format and can be cut, saved or manipulated using any of the part options.

The Teach Trace function must be used in conjunction with an optional stand-alone optical tracing system.
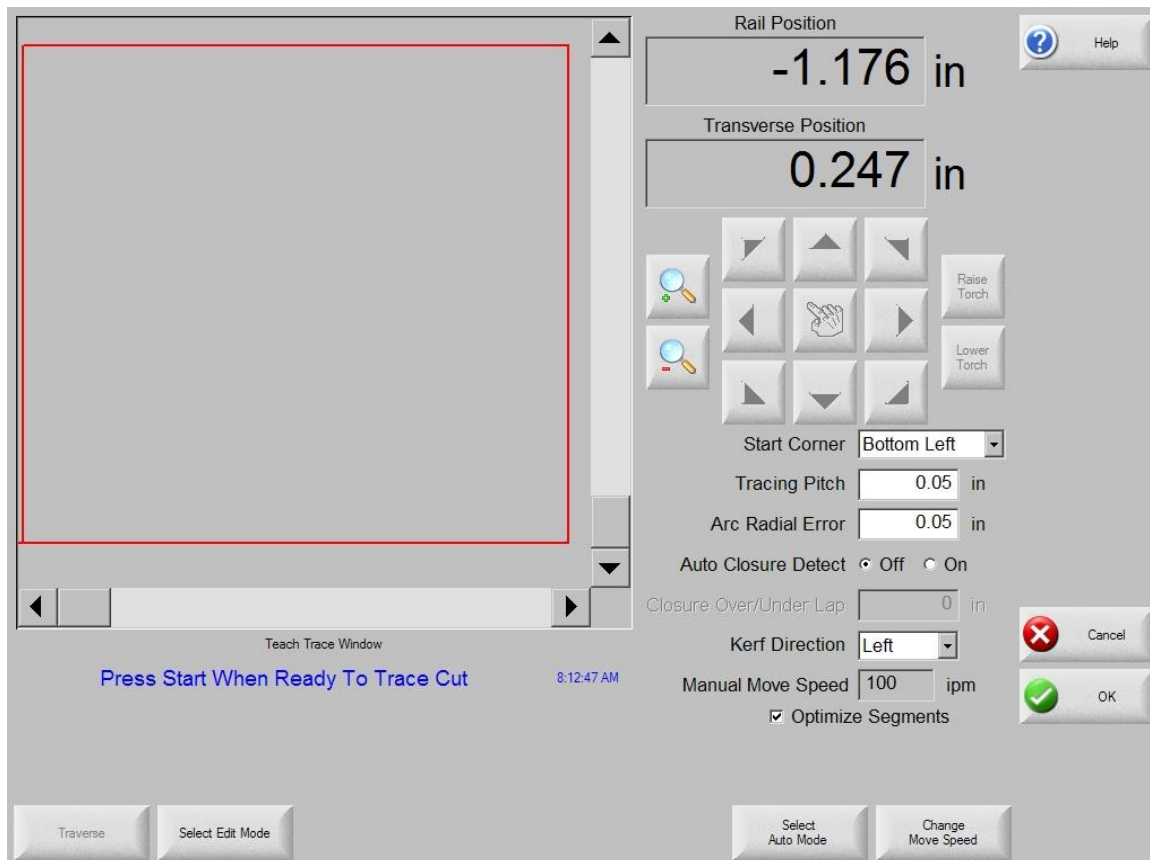
Start Corner
The Start Corner setup parameter allows the user to select where the taught part will begin for proper viewing on the screen.

Tracing Pitch
This determines how precisely to learn a part. The Tracing Pitch can be adjusted to trade off resolution versus size of the taught part. This value does not affect the actual position resolution of the part.

A good starting point for most tracing systems is 0.01".

Arc Radial Error
Specifies the arc error tolerance to be used when checking the current segment for dimensional accuracy. All ESSI or EIA programs are comprised of lines, arcs and circles. Arc Radial Error is used to ensure that the starting and ending radial vectors are within tolerance to describe a valid geometry.

Auto Closure Detect
This parameter is used to allow the control to detect that it has returned to the starting point. With this feature ON, the control stops the motion of the tracer when the part is complete allowing a lead-out to be programmed.

Closure Over/Under Lap
By specifying a positive value for this parameter, the control does not stop the tracer until it has gone past the start point by the amount of this parameter. By specifying a negative value, the tracer stops as soon as the tracing head position is within this parameter's distance of the starting point. This is only available if the Auto Closure Detect is ON.

Kerf Direction
Selects the desired kerf for cut segments.

Traverse/Pierce Switches between the traverse and cut segments of the part as it is taught.

Tracing a part
To trace a part while at the Teach Trace screen, select Auto mode, then select traverse or pierce. You may switch between traverse and pierce during the tracing procedure. Position the optical sensor near the part drawing and press Start. Use the sensor positioning controls to direct the sensor towards the part. Once the sensor has located the part, the tracing system will follow the part outline until completion. When completed, press OK. The part file can now be cut, saved or edited.

Please refer to the instructions provided with your Optical tracing system for further details.

Plate Remnant Trace
The Teach /Trace feature also supports the ability to trace in the outline of a plate remnant for use by a part programmer to create new nests of parts to be cut on the remnant.

The user manually moves the torch (or a pointer) around the plate to define the outline of the material which remains. When the path is completed (it doesn't have to be a closed path), the operator presses the OK key and the recorded axis motions are written to a standard part program format with moves recorded as incremental routing moves. The movements will also display on the control's screen in the same manner as displayed during manual motion commands.

Once recorded, the part program can be uploaded via the serial link, or written to the floppy disk or USB memory, so that the programming department can use it to update their database to reflect the remaining material.
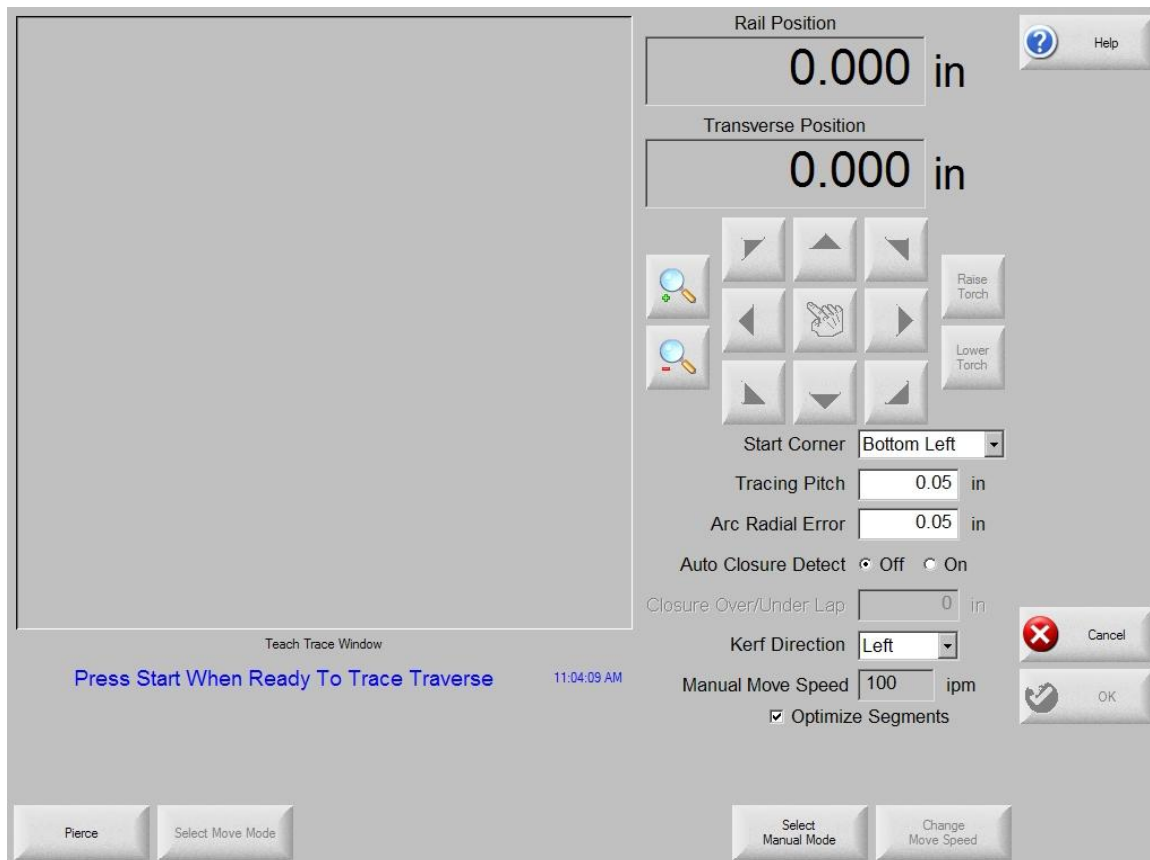
When first opened the system defaults to the automatic Teach/Trace mode which is used in conjunction with an optical head for program generation. In order to use the manual function, simply select the soft key to choose manual mode.

This will place the control in the manual control mode and also enables the Change Move Speed button to alter the manual move speed. Pressing the Change Move Speed button repeatedly will cycle through the programmed manual jog rate settings.
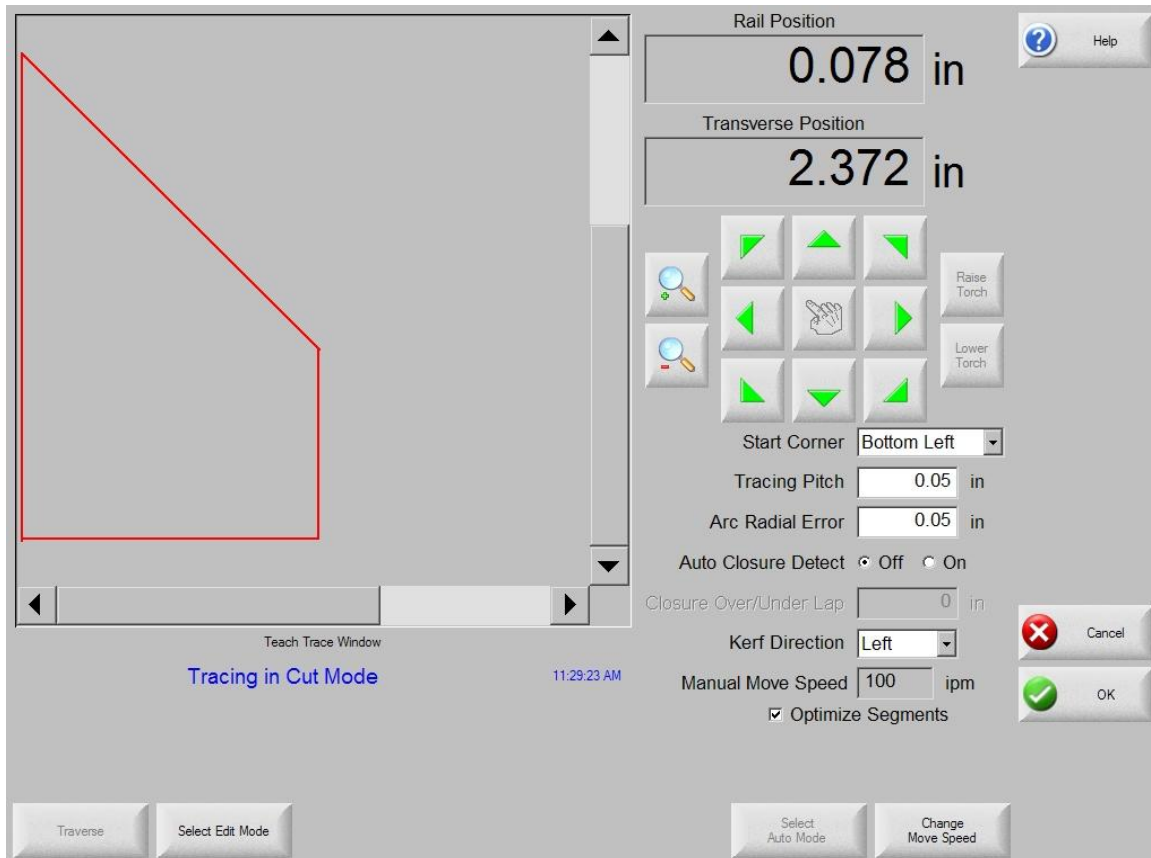
The operator should position the pointer or torch to the plate location where recording of the path is to begin. Once at the start point, press the "Start" button to begin recording positions. The manual motion buttons may now be used to trace out an arbitrary contour which defines the remaining plate area. When finished, press the OK soft key to record the motions to the "current" part program.

The program may now be saved to the disk, or uploaded in the normal manner.

Nester

Nester™ is a proprietary part nesting program, which allows the operator to manually group or nest selected parts together as one part program to conserve raw materials and maximize machine utilization. This nesting program is designed to maximize the control features of graphical user interface, simplified keypad operation and advanced communications software to provide quick, simple and logical programming.

Additionally, an optional Automatic Nesting feature may be enabled to perform true shape, single station, automatic nesting. With its advanced Graphical User Interface, ease of use and advanced profile positioning algorithms, this Automatic Nesting feature can greatly improve the output of your shape cutting operation by reducing overall process time and increasing plate utilization. Please contact your control vendor for details on enabling this Automatic Nesting feature.

Manual Nesting

Main Screen Layout
The main viewing area is the largest area of the screen and is located in the upper left corner. The edge of the plate is displayed in dark green. The plate size displayed is based on plate information that has been selected at the main setup screen.

The upper right corner of the main screen displays the part program list for the nest in order of cut sequence. In the lower right, part position and orientation information for the selected part program is displayed and can be manipulated for use as new parts are added.
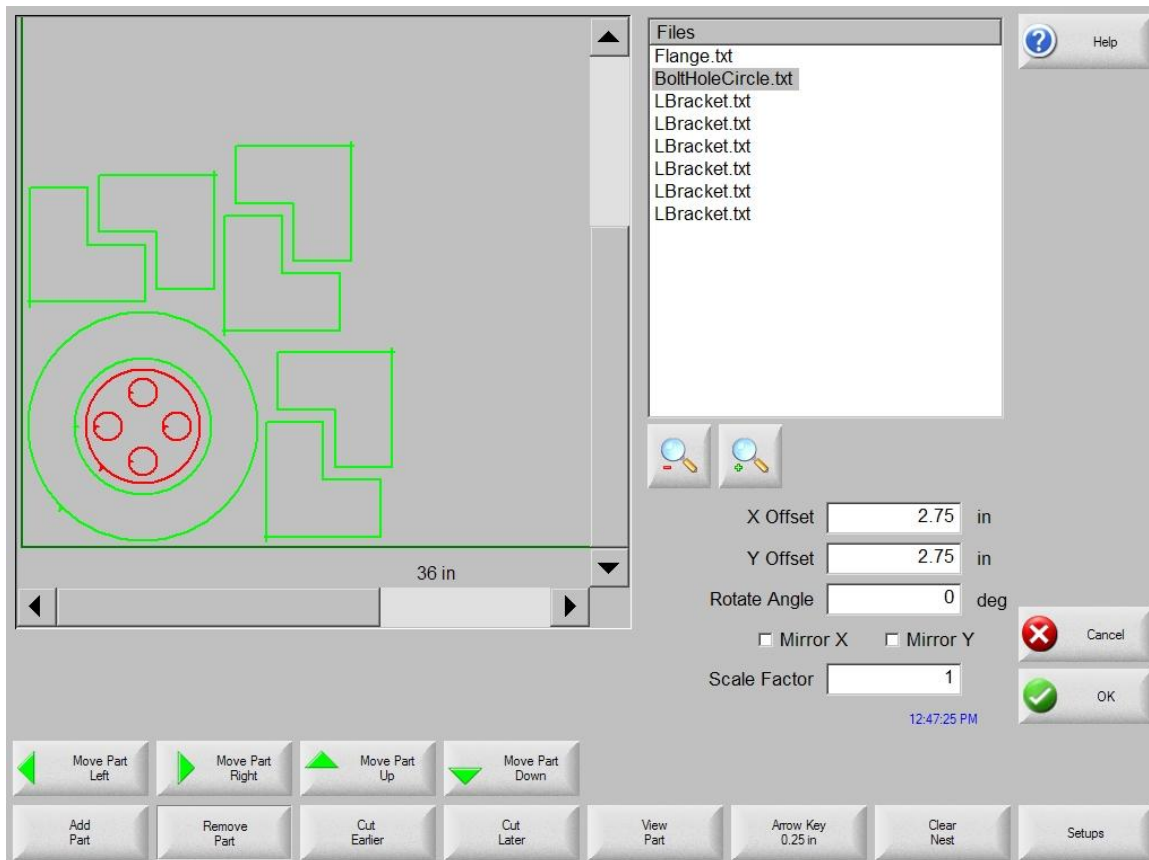
Add Part
Pressing the Add Part soft key accesses the screen, which allows the user to select a part program from a selected source.

Remove Part
This soft key is used to remove the selected part from the nest parts list.

Cut Earlier
Pressing the Cut Earlier soft key will move the selected part program to an earlier position in the part cut list. The sequence in which the parts are cut are changed, but not the selected part location in the nest.

Cut Later
Pressing the Cut Later soft key will move the selected part program to a later position in the part cut list. The sequence in which the parts are cut are changed, but not the selected part location in the nest.

View Sheet / View Part
View Sheet allows the viewing of a part as it would appear on the plate. After pressing the View Sheet soft key, the display window zooms out to show the part in relationship to the entire plate.

After zooming out, the display can be zoomed in again by pressing the **+** key, which causes horizontal and vertical scroll bars to be displayed. Pressing the **-** key will zoom back out.

More information on use of this feature is provided in the Manual cutting section.

Arrow Key (Distance)
The Arrow Key allows the user to select one of five different preset move distances when the arrow keys are pressed to locate parts in the nest. These five distances are definable and are selected in the Nester™ Setup screen.

Clear Nest
Clear Nest will delete all the parts located in the nested parts list from temporary memory.

Setup
Pressing the Setup soft key accesses the Nester™ Setup screen for configuring the variable parameters when using Nester™.

Nester Setup

The following Setup parameters are used to configure the manual nesting process for use.

Arrow Motion
At this screen, the user can select different move increment dimensions. These dimensions are used as move distance references when the control arrow keys are pressed to place parts in position on the plate.

Autoposition
Autoposition is an automated feature of the Nester™ software to search for the next available location to place a part that is being added to the nested part list. Autoposition compares the overall block dimensions of the selected part and searches for the next available block on the plate that is large enough to accommodate the part being loaded. Values can be input for the Search Increment and Scrap Clearance parameters that are used when searching for the next available part location.

Autoposition will not allow parts to be placed on top of other parts or inside other parts. This feature is enabled or disabled by using the space key at the enable box.

Using Nester

To begin, first select the plate size requirements for the nest at the Main Setup screen. This information is used to display the plate size and plate orientation at the main view screen to place parts on the plate. The plate information is retained with the nested part program when saved.

Press the Nester™ soft key from the Shape Manager screen then enter the Nester™ Setup Screen to configure the nesting software for use. Press OK to return to the Nester™ Main Screen to begin placing parts in the nest.

Adding Parts
At the Nester™ Main Screen, press the Add Part soft key to add a new part to the nesting part list. The first screen viewed will allow the user to select a part from the Simple Shape Library, from a disk or from the host computer via link communications.
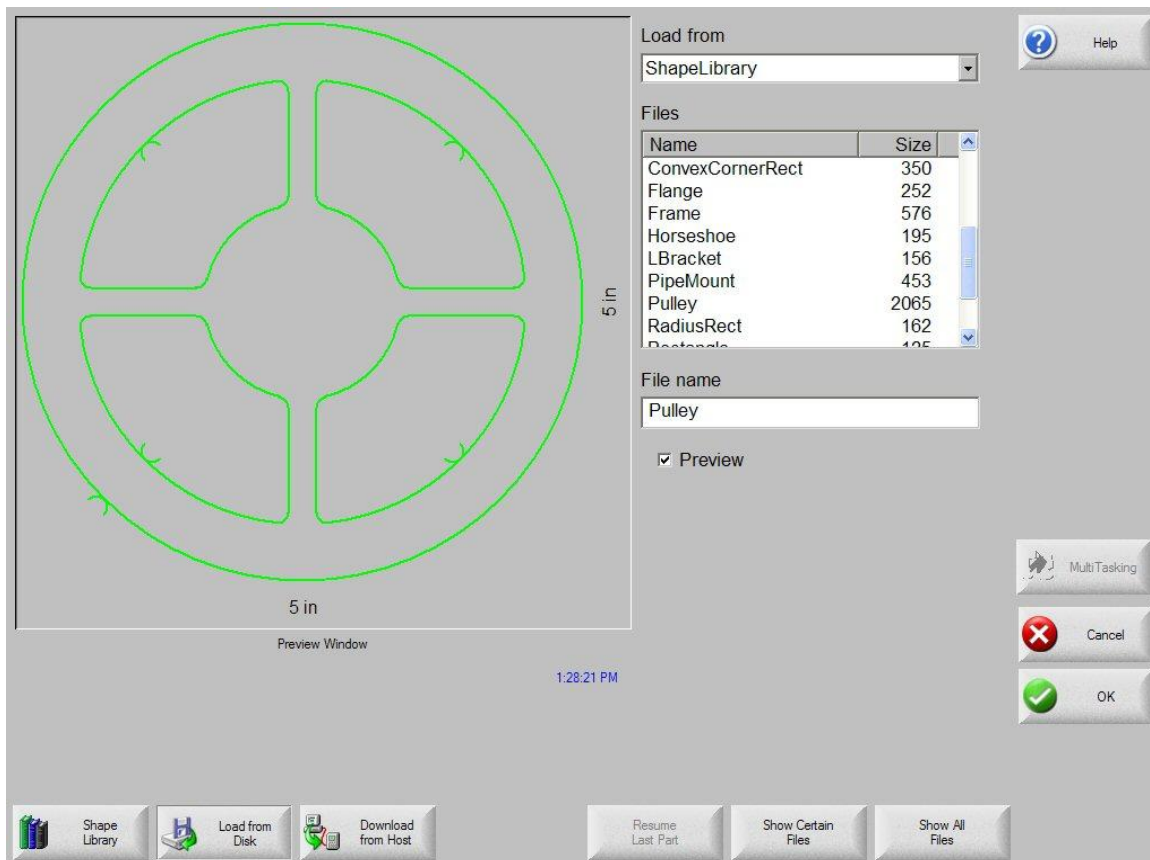
Once a part has been selected from either location, the user will be prompted to select the number of pieces desired.

As new parts are added, they will be displayed on the selected plate in preparation for final placement.
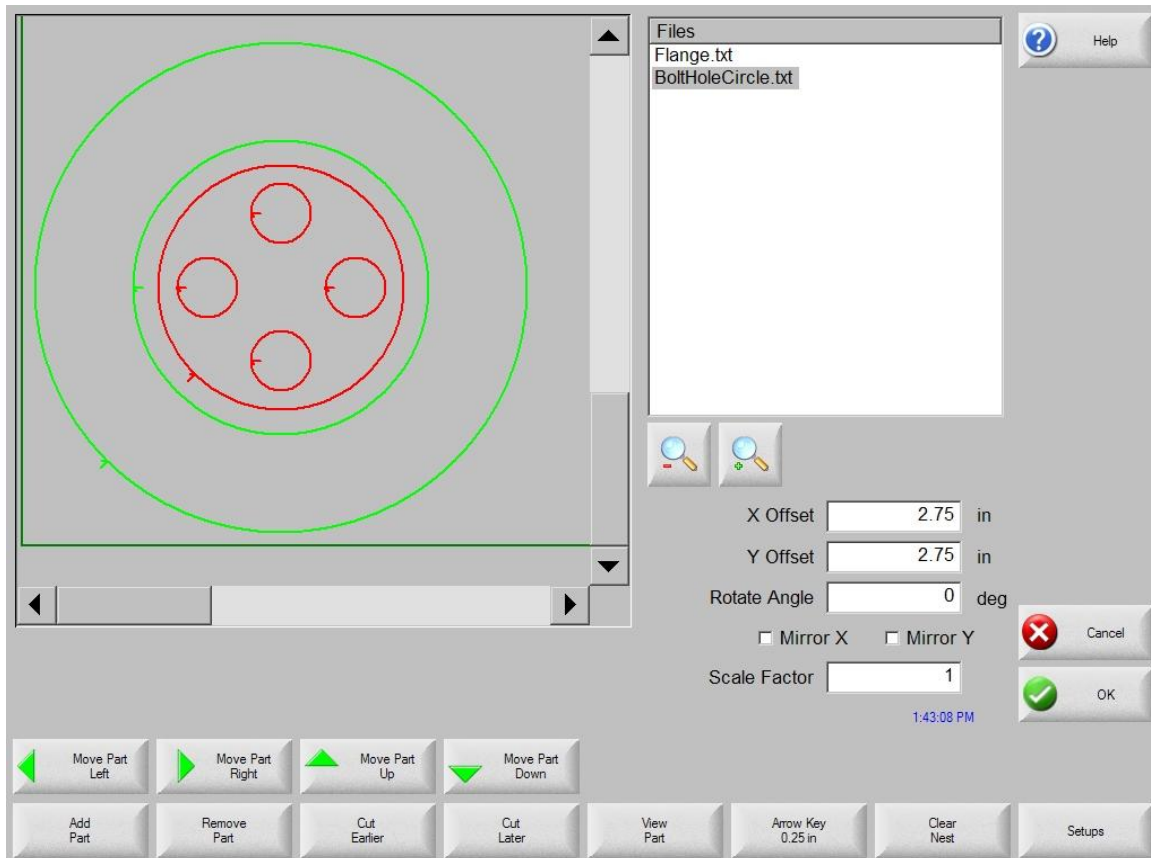
At this screen, the part can be oriented, scaled and moved to final position. This is done by moving to the Nester™ Part List and highlighting the file name. Then select the desired field to manually offset, rotate, mirror and scale the part.

To position the selected part, use the manual direction keys. The view screen will be outlined by a bold blue border indicating that the arrow keys are active. Pressing the arrow keys will allow movement of the part to the desired location on the plate. Each time the arrow keys are pressed, the selected part will move in the direction of the arrow by the increment set by the Arrow Key distance soft key. By use of the arrow distance key, arrow keys and zooming in the view field, exact placement of the desired part may be obtained.

Additional parts may be added to the nest in the same fashion as described above. To customize your nest, you may decide to delete parts or add parts to the list and change the order in which they are cut by use of the soft keys displayed. When finished, press OK to return to the Main Cut screen and begin cutting the nest. The part nest is currently saved as a temporary file until another part is loaded.

Saving a Nest
From the Main Cut screen, press the Files soft key to Save to Disk. From here the part can be saved to a hard disk folder on the control, Diskette or USB memory stick. The nested parts file may be saved as a nest or a part. Saving as a nest using the save as Nester File feature, will create a larger file which will allow future modification of the nest through Nester™. Nested parts saved as a part file cannot be modified.

HyperNest – CNC Automatic Nesting Software

Optional *HyperNest® - CNC* feature - This true shape, single station, automatic nesting package allows quick and simple nesting of profiles on to selected material sizes. With its advanced Graphical User Interface, ease of use and advanced profile positioning algorithms, *HyperNest® - CNC* can greatly improve the output of your shape cutting operation by reducing overall process time and increasing plate utilization.

Main Screen Layout
The main viewing area is the largest area of the screen and is located in the upper left corner and is used to preview manual nests. During an automatic nest, this area will remain blank. The plate size used during Automatic nesting is based on plate information that has been selected at the main setup screen.

The upper right corner of the main screen displays the list of part programs and quantities of parts to be automatically nested. In the lower right, there locations to save the nested part program to a folder location and to assign a file name.
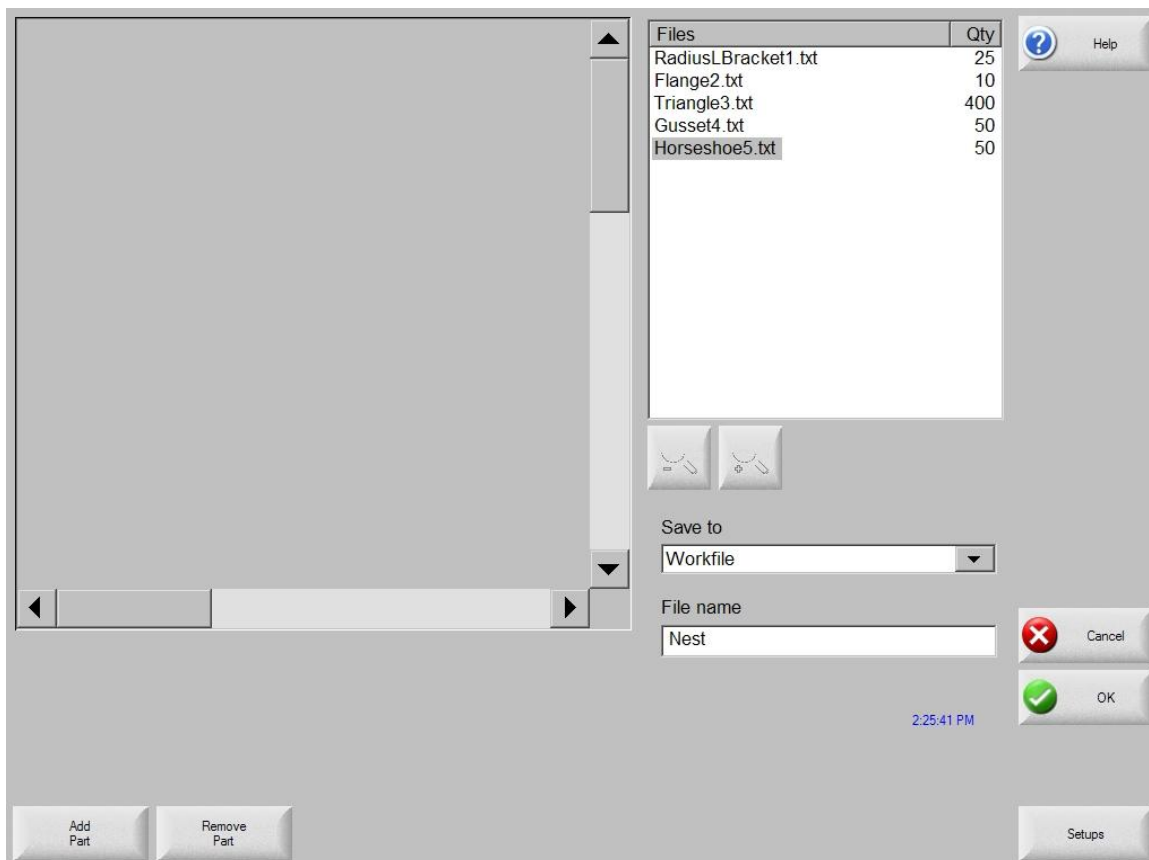
Note: This software feature is protected both by a software enable and a hardware key (dongle) installed on the control.

Automatic Nesting Setup

Pressing the Setup soft key accesses the following setup parameters and can be used to configure the automatic nesting process for use. Note: If this feature is not available (greyed out), the feature has not been enabled on your controller. Please contact your control vendor for details on how to enable the Automatic Nesting feature.

Automatic Nesting
Switching the Nesting Parameter to Automatic enables the feature for use.

Part Spacing
The Part Spacing feature sets the spacing between parts during the Automatic Nesting process.

Plate Edge Spacing
This parameter allows the user to set spacing around the edge of the plate to be used during the Automatic Nesting process.

Program Origin
The Program Origin (nest start location) may be set to lower left, upper left, bottom left or bottom right.

Cut Direction
Cut Direction allows to user to select the direction the parts will be placed in during the Automatic Nesting process. Options are: Left or Right, Right to Left, Top to Bottom and Bottom to Top.

Return to Nest Start
When enabled, the Return to Nest Start feature will insert a traverse segment back to the start point at the end of the nest.

Using HyperNest – CNC
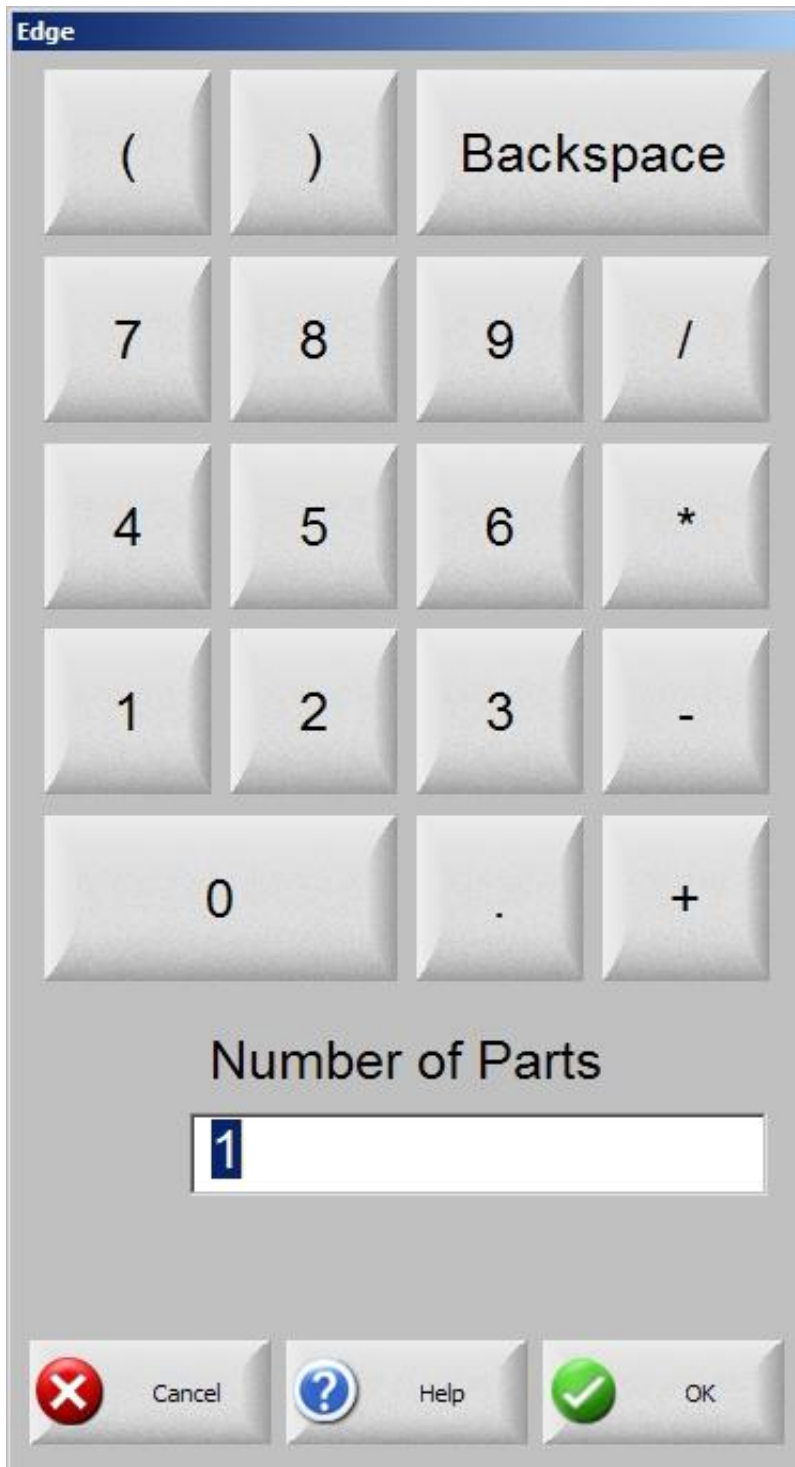
To begin, first select the plate size requirements for the nest at the Main Setup screen. Press the Nester™ soft key from the Shape Manager Screen then enter the Setup Screen to enable the Automatic Nesting software feature and configure the setup parameters for use. Press OK to return to the Main Screen and begin placing parts in the nest.

Adding Parts
At the Main Screen, press the Add Part soft key to add a new part to the nesting part list. The Add Part screen will allow the user to select a part from the Simple Shape Library, from a disk or from the host computer via link communications.
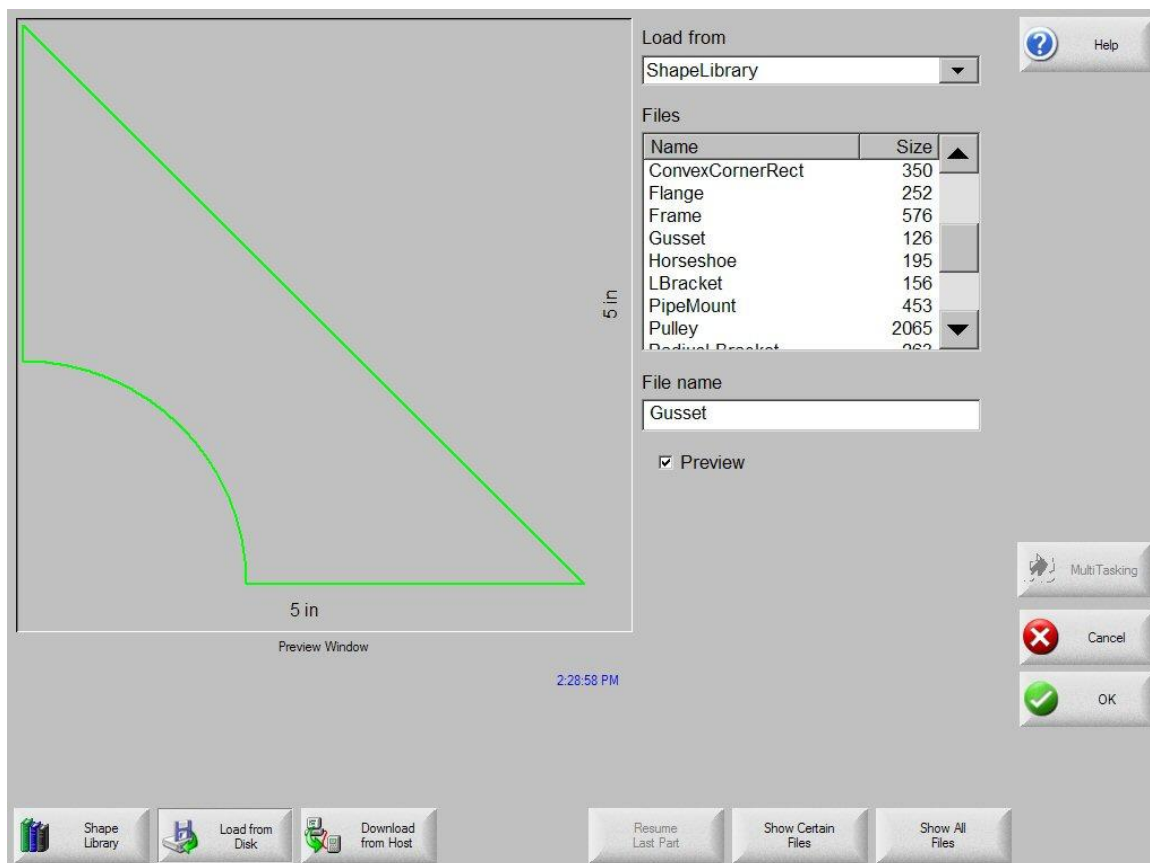
Once a part has been selected from the desired location, the user will be prompted to select the number of pieces desired.

As new parts are added, the part file name and quantity will be displayed in the parts list window in the upper right corner of the screen in preparation for final placement during the Automatic Nesting process.

Files	Qty
RadiusLBracket1.txt	25
Flange2.txt	10
Triangle3.txt	400
Gusset4.txt	50
Horseshoe5.txt	50

Save to
Workfile

File name
Nest

2:25:41 PM

Add Part   Remove Part   Setups
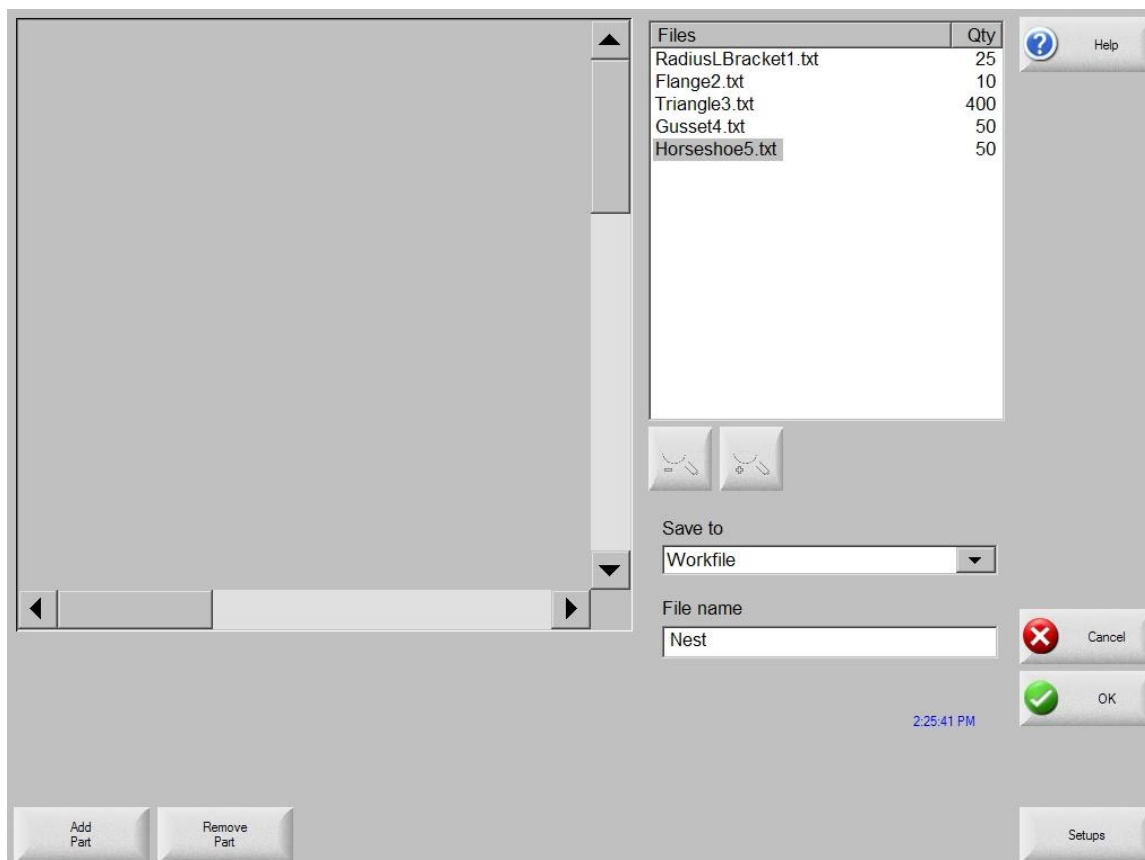
Select the desired file location and assign a file name, then press the OK soft key to begin the automatic nesting process. A progress window will be displayed during the nesting process.

HyperNest Progress

Nesting....   Cancel
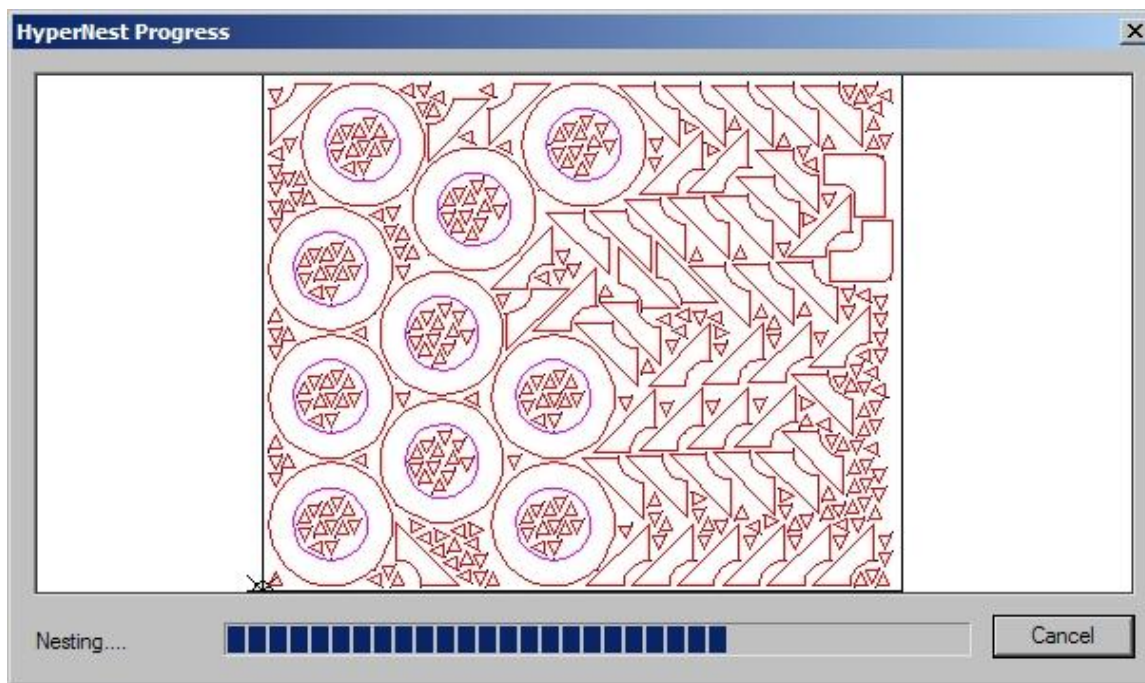
Note: The nest process progresses quickly and not all shapes may be visible on screen or other drawing anomalies may be noted during the nesting process.

In the event that more parts are selected than can fit on one plate, multiple plates or sheets (nested program) files will be generated and saved in the selected folder with the selected file name, but a numeric suffix will be added. Example: saving the part file as Nest may generate multiple part files named NEST1.txt, NEST2.txt, NEST3.txt, etc.
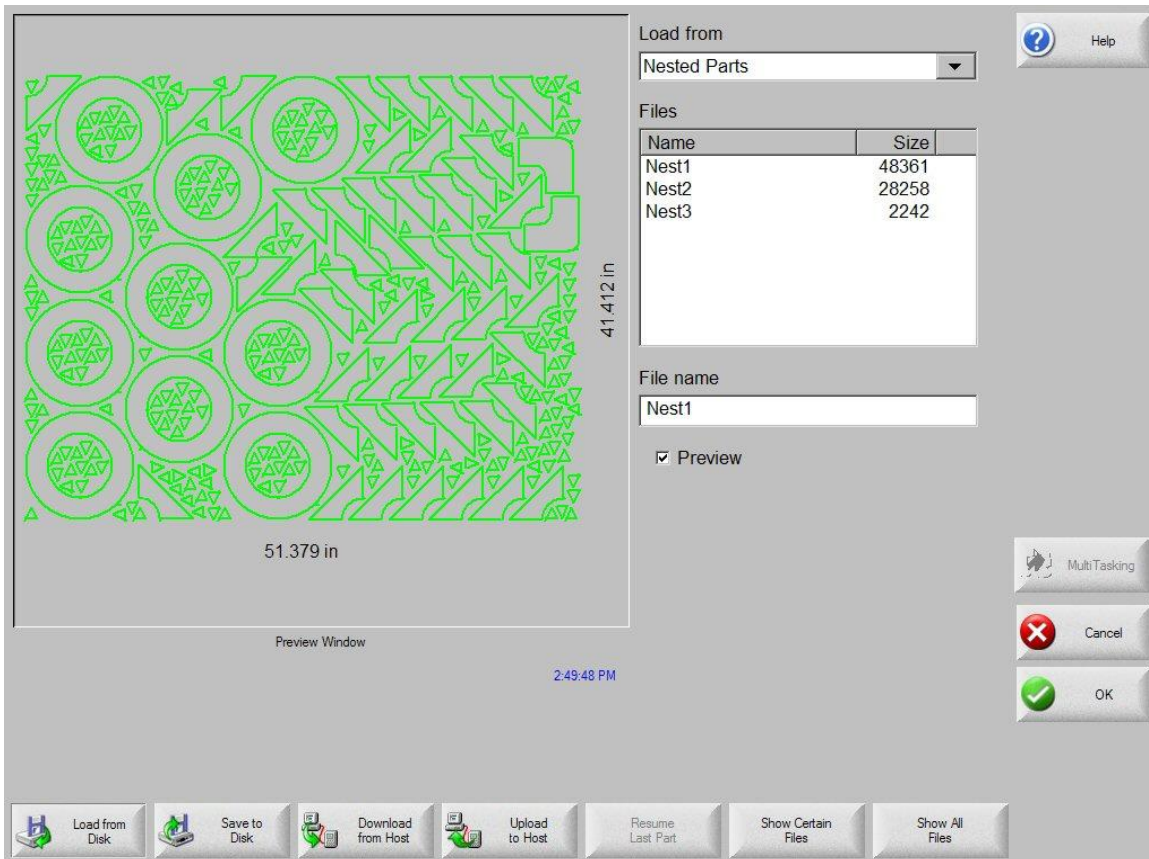
Remove Part
A part may be removed from the part files list by highlighting the selected part in the files list and pressing the Remove Part soft key prior to executing the nesting.

Note: The software feature on the control is protected by a hardware key or dongle. If the hardware key has been removed from the control, the following message will appear when the Nest Parts soft key has been pressed.
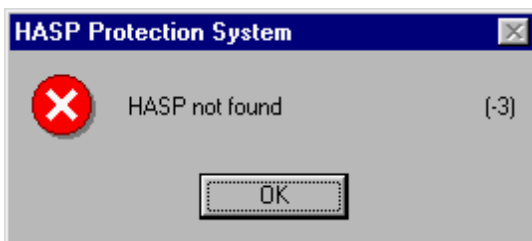
Nest Summary
Upon completion of the nest, the software will provide a summary of the Automatic Nesting process.
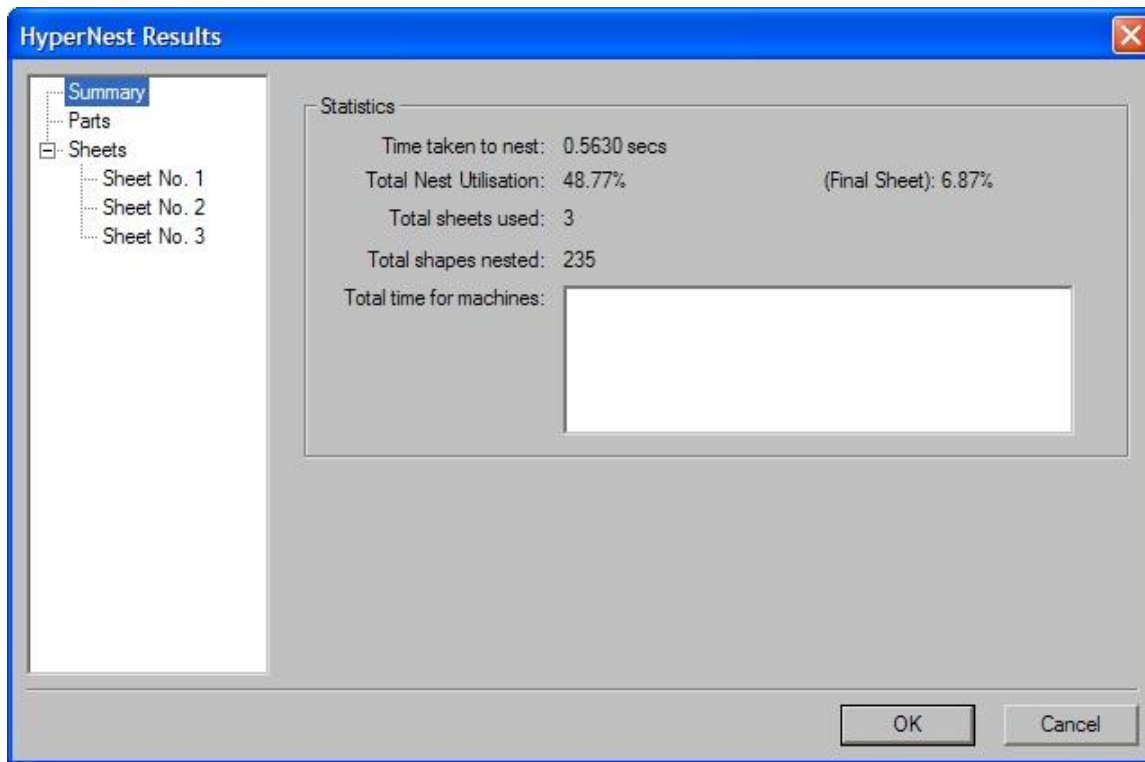
Statistical analysis of the process is provided for the number of sheets, time to execute nest, total nest utilization and total number of shapes nested.

Note: Sheets that are generated with the exact same part configuration will be listed as "Sheet No. # (total #)".

HyperNest Results

- Summary
- Parts
- Sheets
  - Sheet No. 1
  - Sheet No. 2
  - Sheet No. 3

Name	Loaded	Qty	Nested	
Flange2	Yes	10	10	
Gusset4	Yes	50	50	
Horseshoe5	Yes	50	50	
RadiusLBracket1	Yes	25	25	
Triangle3	Yes	400	400	

OK   Cancel
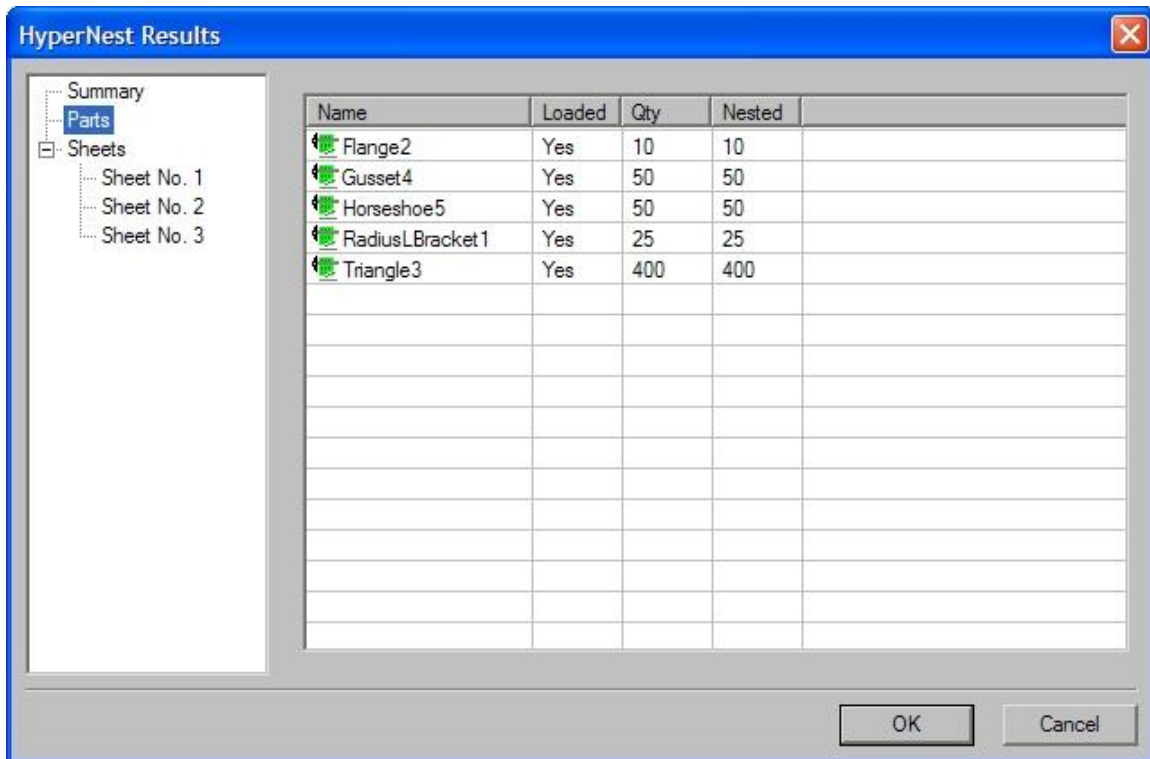
Scrolling down will allow you to view an analysis of the parts used and to view the individual sheets produced and a listing of the net utilization for the specific sheet.

HyperNest Results

- Summary
- Parts
- Sheets
  - Sheet No. 1
  - Sheet No. 2
  - Sheet No. 3

Utilisation (Net)   : 53.2762%

☐ Output Program
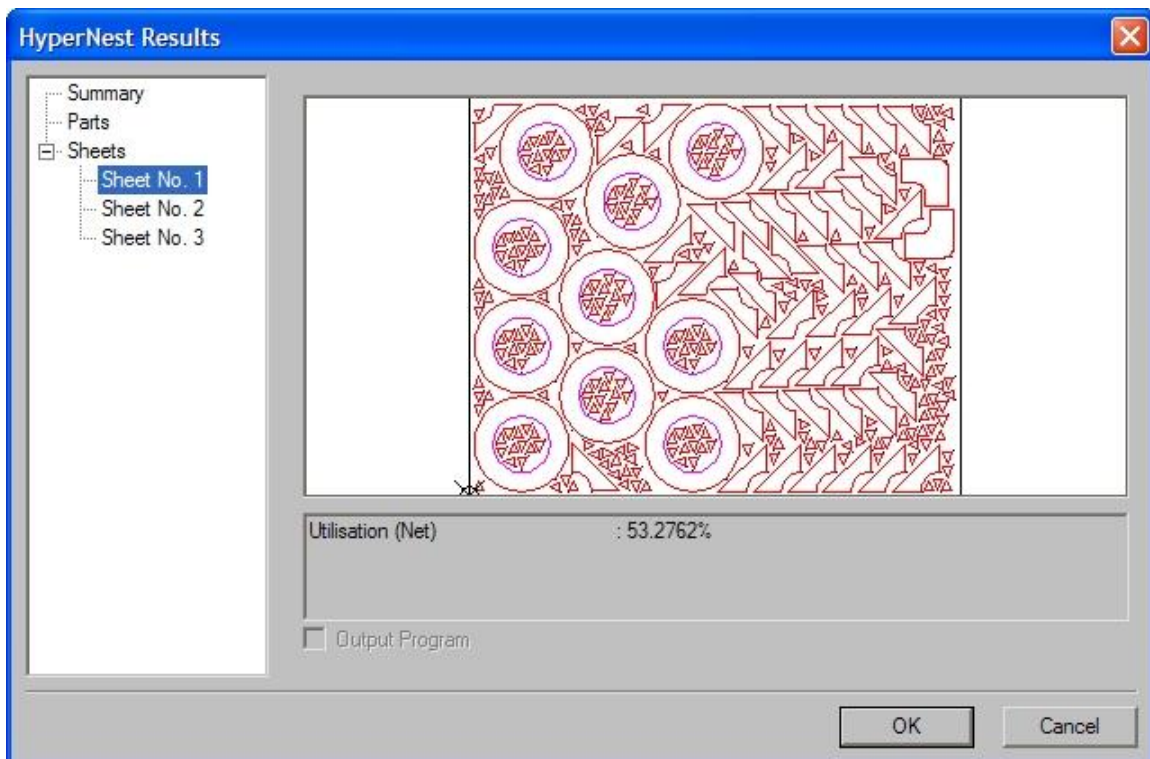
OK   Cancel

Press OK to accept the nest and have the first sheet become the current part. Press the Cancel key to reject the nest and return to the main nesting screen to add or remove parts from the nest.

Main Screen View of Nest
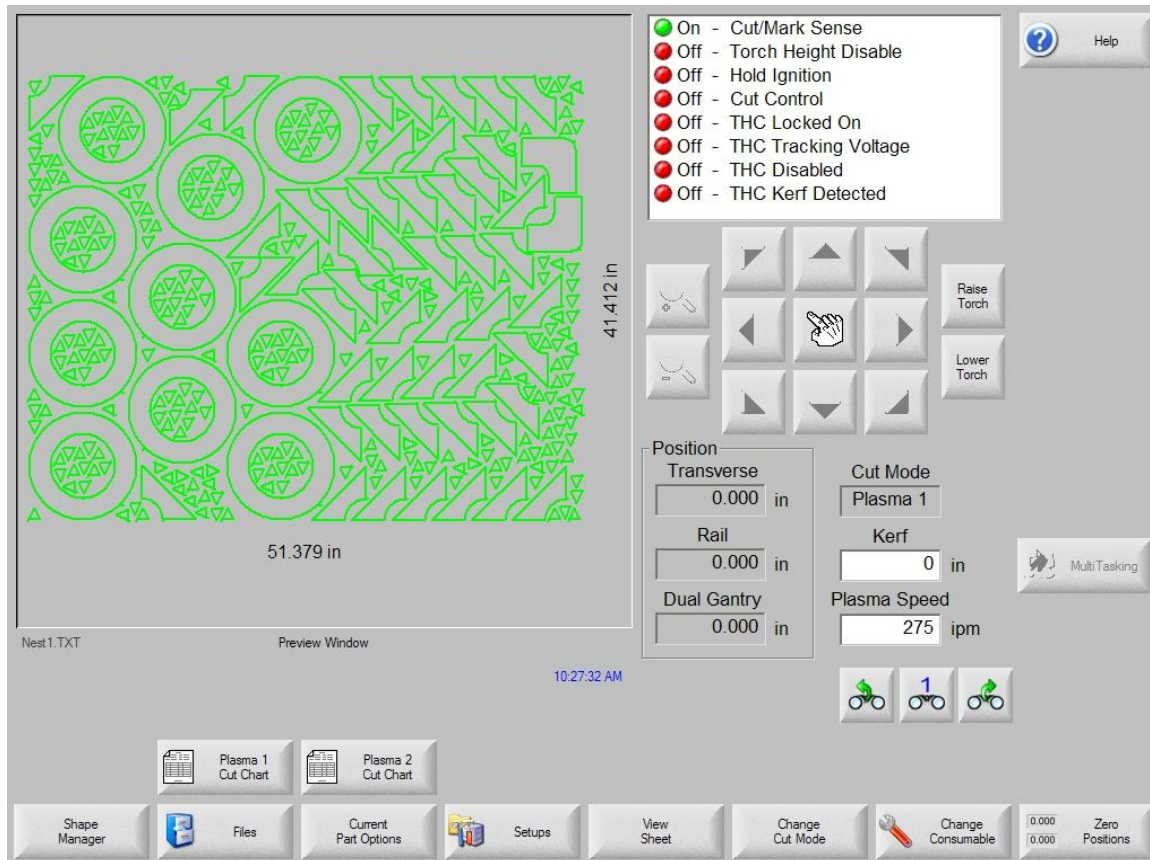
Note: Parts with open loops or other invalid geometries may not be able to be automatically nested. It may be possible to manually nest parts which have been rejected by the Automatic Nesting function.

HyperCAD

HyperCAD® is an easy to use 2D drawing application specifically designed for shape cutting. The software's powerful CAD utilities let users import DXF and CNC files or draw from scratch. Files can be converted to graphical parts for editing and saving or go directly to cutting.

This simple CAD/CAM application lets you move easily from drawing to cutting.

HyperCAD® Features

- English or Metric Units
- Part / Sheet viewing capabilities
- Scaling, mirroring or rotating of parts
- Repeating and copying of shapes
- Moving / modifying of lead-ins and lead-outs
- Add-on of chamfers, fillets and notches
- On-screen, full-part cutting simulation
- Built in Help functions
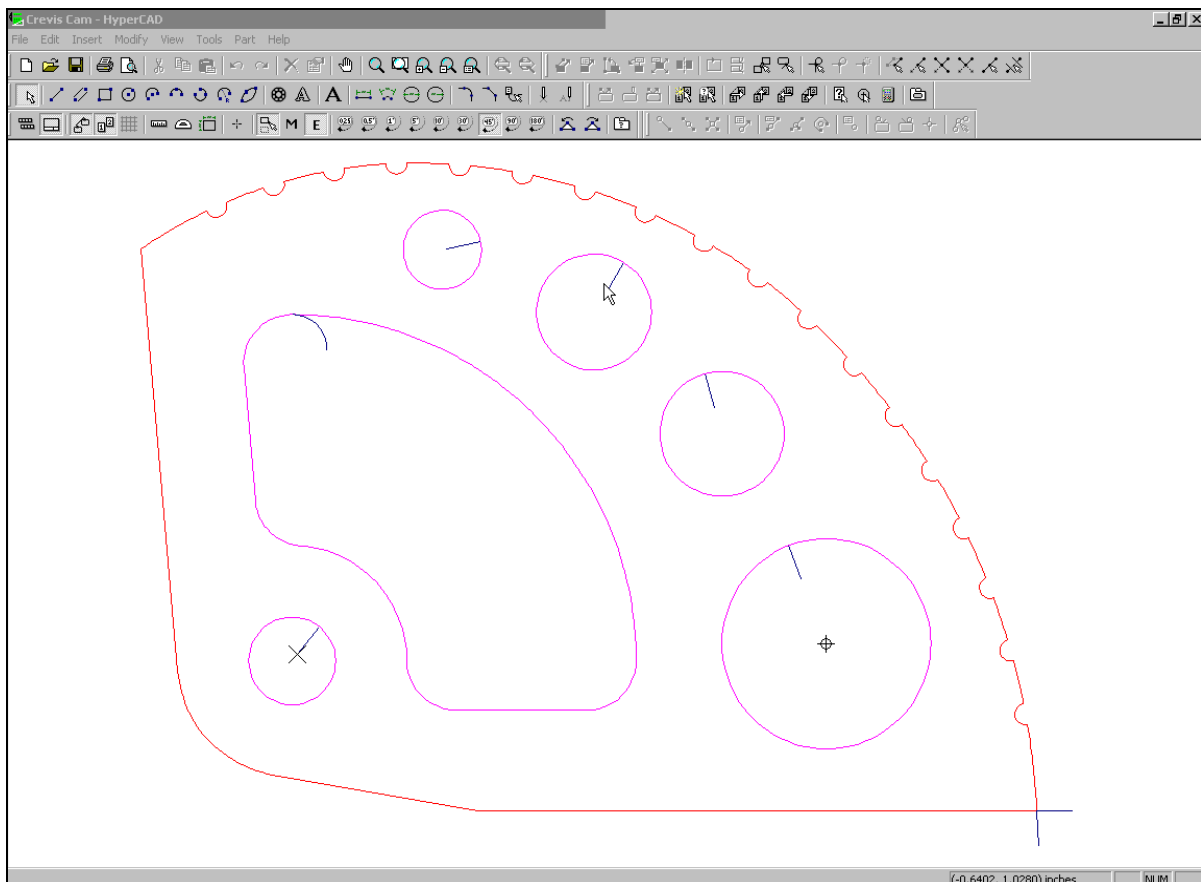
This feature is offered as a limited use trial version. Please contact your control vendor for information on enabling unlimited use of this feature. This package may be used on the CNC equipped with mouse and PC keyboard or offline on a PC.

HyperNEST

HyperNEST® is a full featured, automatic true shape application designed to allow quick and simple nesting of profiles onto standard material sizes. With its advanced Graphical User Interface, HyperNEST® greatly improves the output of any shape cutting operation.

HyperNEST® Features
HyperNEST® also lets mechanized end users achieve:

- Multi-torch nesting with a variable number of torches
- Bridging and chain cutting for common line cutting
- Extending consumable life
- "Move, drag and drop" manual interactive nesting
- Viewing and modifying of multiple sheets at the same time
- Multiple nesting scenarios for optimizing plate use and process cutting time
- Use of Wild Card parts to optimize plate utilization
- Automatic off-cut generation
- Built in Help functions
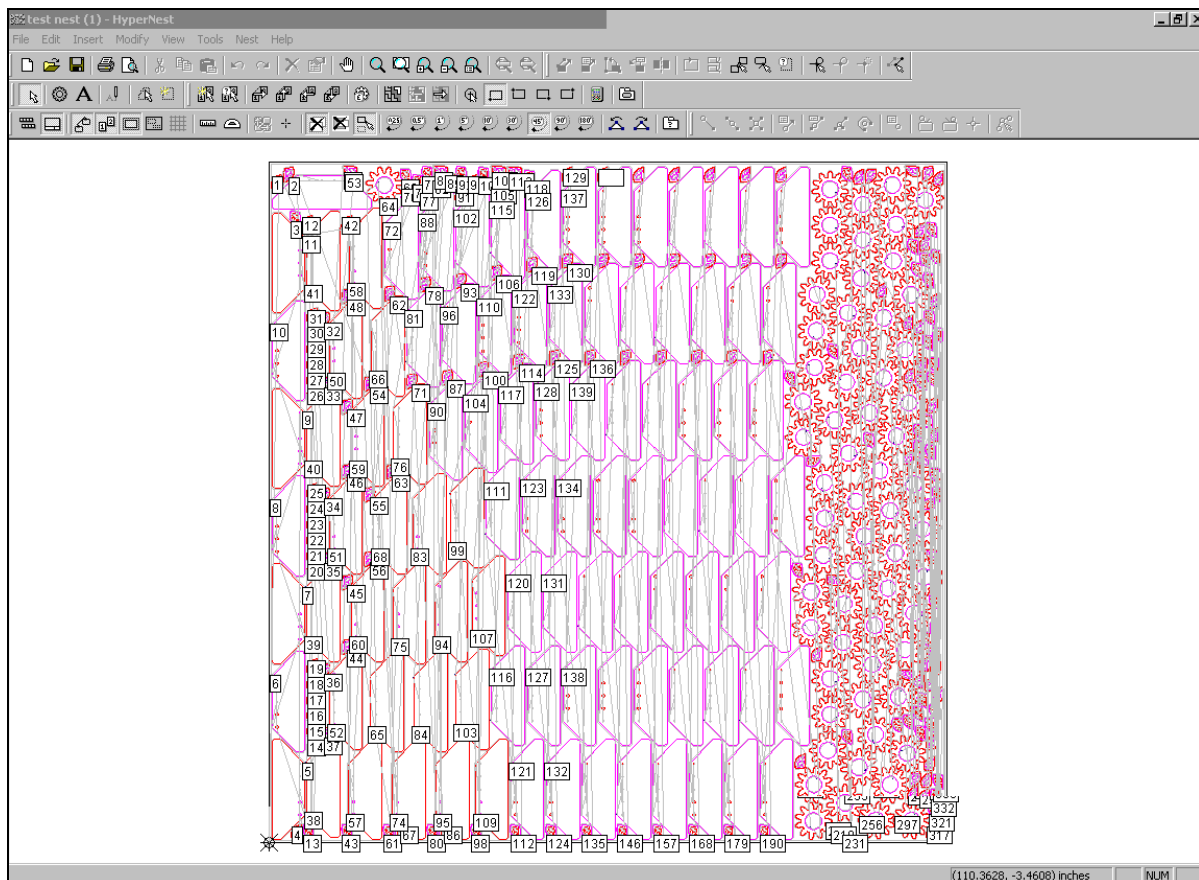
This feature is offered as a limited use trial version. Please contact your control vendor for information on enabling unlimited use of this feature. This package may be used on the CNC equipped with mouse and PC keyboard or offline on a PC.

Evaluation Timer
Trail version software will prompt the user with a notification of the number of "uses" left at each launch. To enable unlimited use, a password would be provided by the control vendor.

To launch the trial software, select the Evaluation Version.

Example:
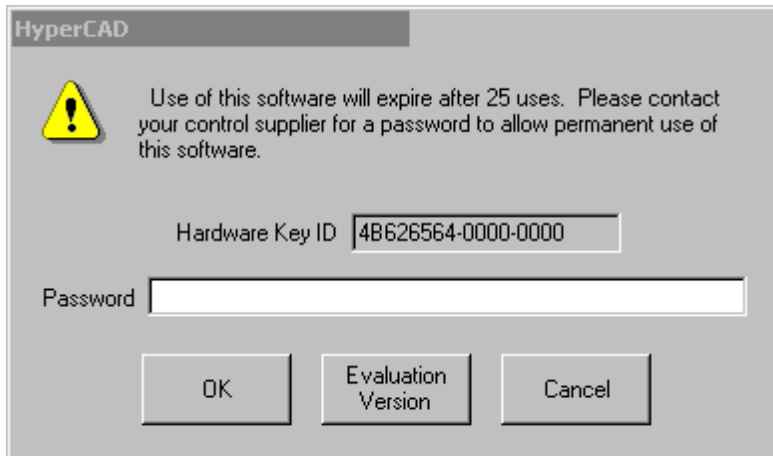
Files

Load from Disk

The following screen is used to load a part from a diskette, USB memory stick or the hard drive. Once all the parameters below are set, press ENTER on the keyboard to load the part.
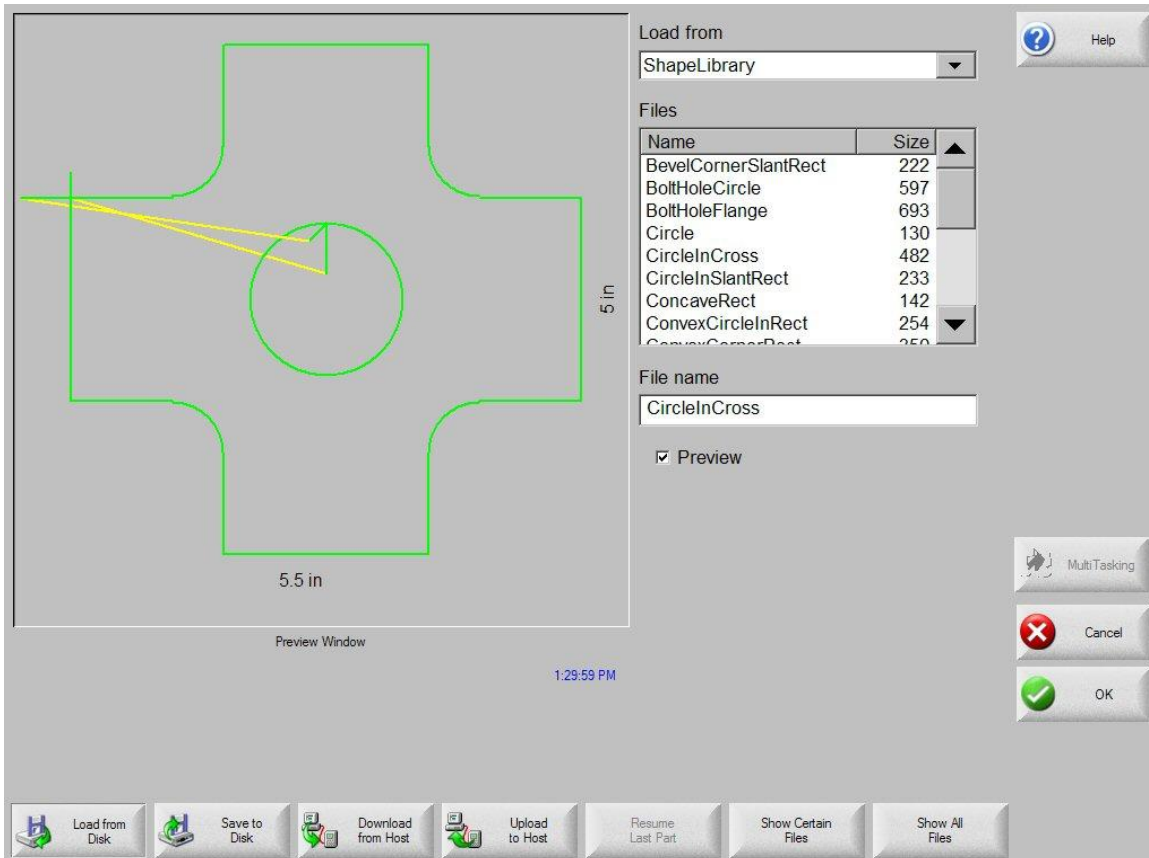
Load from

The Load from list selects whether you load from the diskette, USB memory stick or from a directory on the hard disk. To add or remove a directory, double click on the touch screen where indicated.

Keypad operation: To select a different directory, use the ↑ and ↓ keys on the keyboard. To add or remove new directory use the + or **–** key.

Files

The Files list box is a list of all the files that are in the Load from directory that can be loaded from the disk.

Keypad operation: To scroll through different files, use the ↑, ↓**,** PAGE UP and PAGE DOWN keys on the keyboard. To remove a file, use the **-** key on the keyboard. To select multiple files to load, highlight the first file selection, then use the ↑ and ↓ keys while pressing the shift key to highlight the remaining files. **Note:** Multiple file selection is only available if loading from the Diskette or USB memory stick to the hard drive.

File name/Diskette file name
The File name /Diskette file name is the name of the file to load from disk/diskette/memory stick. To remove a file, highlight the file name and double click on the touch screen where indicated.

Keypad operation: To remove using a keyboard, use the **–** key.

Preview
When checked, the Preview checkbox allows the file that is selected in the Files list box to be previewed.

Load to
The Load to list selects whether you load to the current part or to a directory on the hard disk. To add or remove a directory, double click on the touch screen where indicated.

Keypad operation: To select a different directory, use the ↑ and ↓ keys on the keyboard. To add a new directory, use the **+** key on the keyboard. To remove a directory, use the **-** key on the keyboard. **Note:** This selection is only available if loading from the Diskette or USB memory stick.

Hard drive file name
The Hard drive file name is the name that you are giving the file you are loading on the hard drive. **Note:** This selection is only available if loading from the Diskette or USB memory stick.

Resume Last Part
The Resume Last Part soft key will be visible when the Rush Job Interrupt or Automated Power Loss Recovery feature is in use. These features allow the user to pause the current part program and retain the part and current position information. This then allows the user to load and execute another part program and return to the original part using the Resume Last Part soft key.

Show Certain Files
This soft key allows the operator to search the selected folder for specific part files by using wildcard type search tools. Both the asterisk (*) and question mark (?) can be used.

Keypad operation: To input the asterisk when using a keyboard, press the left shift key (purple) and the backspace key. To input the question mark, press the right shift key (blue) and the backspace key.

Show All Files
This will allow the operator to switch from the selected "certain files" to viewing all files with the predetermined file extensions.

Resume Last Part Features

Rush Job Interrupt
Rush Job Interrupt allows the user to pause the current part program and retain the part and current position information. When at the Pause screen, press the Cancel key. A prompt will appear on screen to ask the user if they wish to save the part information for later use.
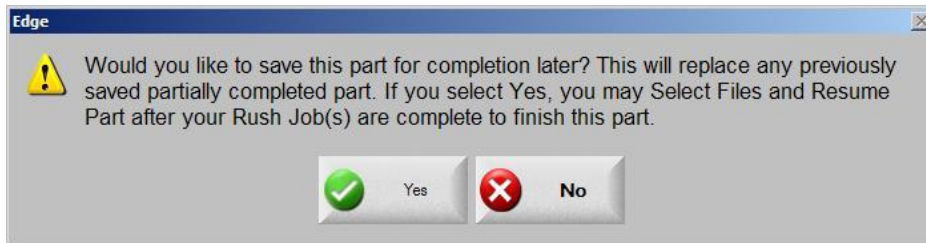
If the user selects YES, the Resume Last Part button will be viewable at the Files Screen. The user can then load and execute another part program and later return to the original part using the Resume Last Part soft key. The part program and position will be resumed.

Automated Power Loss Recovery
The Automated Power loss recovery uses the Resume Last Part feature similar to the Rush Job Interrupt. However, the Machine must be "Homed" to ensure proper positioning prior to resuming the part.

This feature may also be used in the event of an "Overtravel" or similar fault.

Save to Disk

The following screen is used to save a part to a diskette, USB memory stick or the hard drive. Once all the parameters below are set, press OK to save the part.

Save to
The Save to list selects whether you save to the diskette, USB memory or to a directory on the hard disk. To add or remove a directory, double click on the touch screen where indicated.

Keypad operation: To select a different directory, use the ↑ and ↓ keys on the keyboard. To add a new directory, use the **+** key on the keyboard. To remove a directory, use the **-** key on the keyboard.

File name/Diskette file name
The File name /Diskette file name is the name that you are giving the file you are loading on the disk.

Save Original Text
Selecting the Save Original Text option will save the part to disk in its original programming format.
Note: This selection is not available if saving to the Diskette or USB memory stick from the hard drive.

Save from

The Save from list selects whether you save from the current part or from a directory on the hard disk. To add or remove a directory, double click on the touch screen where indicated.

Keypad operation: To select a different directory, use the ↑ and ↓ keys on the keyboard. To add a new directory, use the **+** key on the keyboard. To remove a directory, use the **-** key on the keyboard. **Note:** This selection is only available if saving to the Diskette or USB memory stick from the hard drive.

Files
The Files list box is a list of all the files that are in the Load from directory that can be loaded from the disk. To remove a file, double click on the touch screen where indicated.

Keypad operation: To scroll through different files, use the ↑, ↓**,** PAGE UP and PAGE DOWN keys on the keyboard. To remove a file, use the **-** key on the keyboard. To select multiple files to load, highlight the first file selection, then use the ↑ and ↓ keys while pressing the shift key to highlight the remaining files. **Note:** This selection and Multiple file selection are only available if saving to the Diskette or USB memory stick from the hard drive.

Hard drive file name
The Hard drive file name is the name that you are giving to the file loading on the hard drive. **Note:** This selection is only available if saving to the Diskette or USB memory stick from the hard drive.

Preview
When checked, the Preview checkbox allows the file that is selected in the Files listbox to be previewed.

Keypad operation: To check or uncheck the box, press the SPACE key on the keyboard when the Preview box has the focus. **Note:** This selection is only available if saving to the Diskette or USB memory stick from the hard drive.

Save KeyLog to Disk
This feature is enabled when the Key Logging feature has been selected in setups.

The Key Logging feature is used as a troubleshooting diagnostic tool to record key presses made at the control during operation. When enabled, all key presses and application faults will be saved to a daily log file that may be sent to the control manufacturer for evaluation.
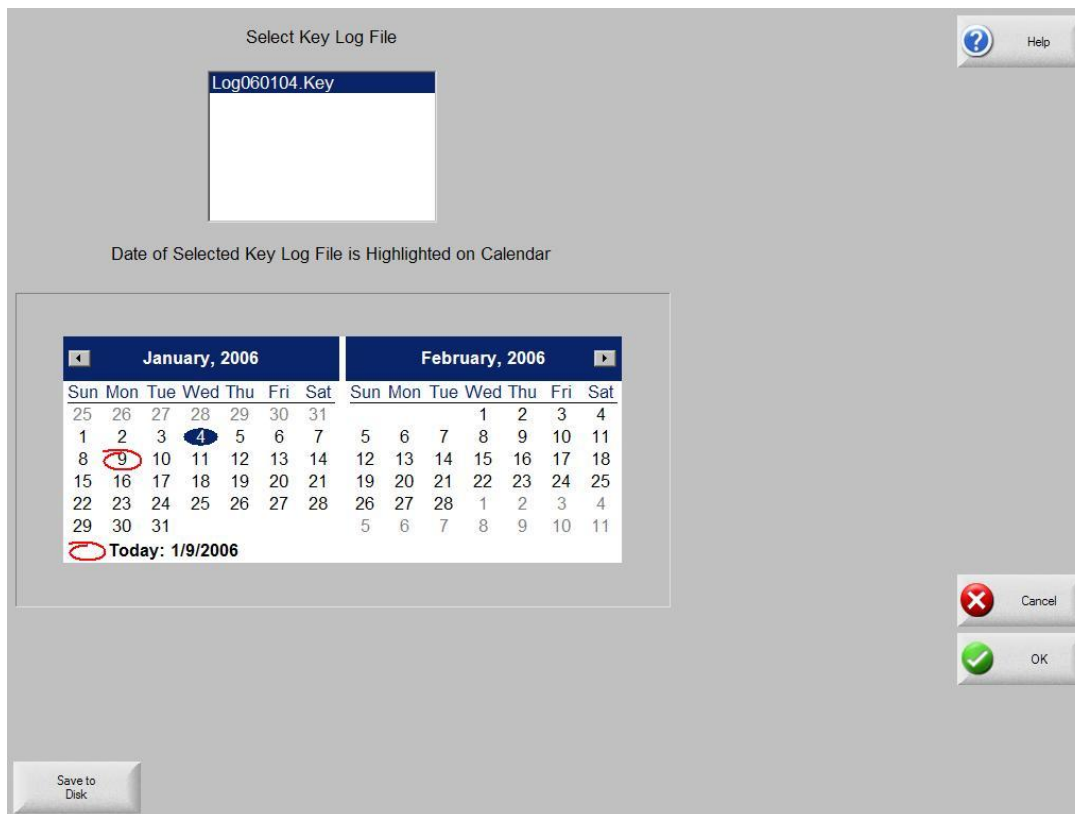
Download from Host

The following screen is used to download a part from a host computer. Once all the parameters below are set, press ENTER on the keyboard to start the download.
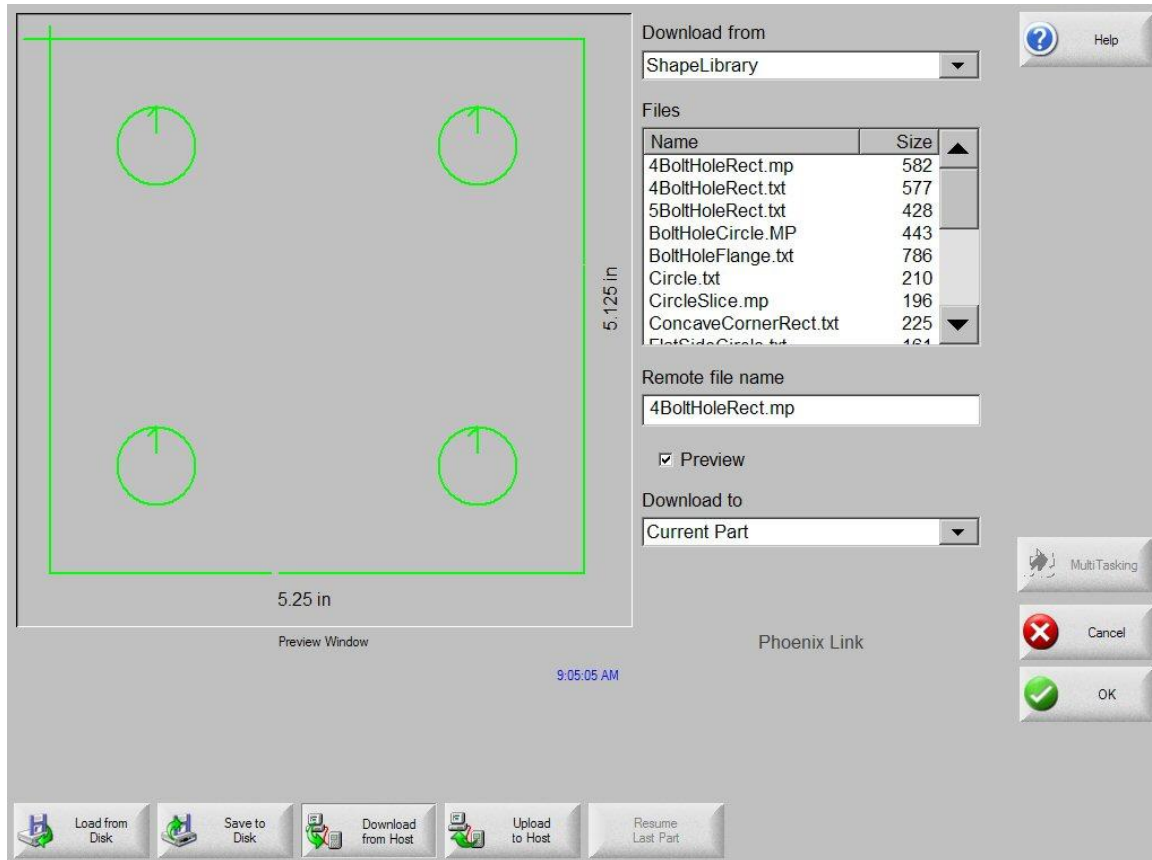
Download from
The Download from list selects which directory on the host computer you want to download from. To add or remove a directory, double click on the touch screen where indicated.

Keypad operation: To select a different directory, use the ↑ and ↓ keys on the keyboard. To add or remove new directory use the + or – key.

Files
The Files list box contains a list of all the files in the Download from directory that can be downloaded from the host computer.

Keypad operation: To scroll through different files, use the ↑, ↓, PAGE UP and PAGE DOWN keys on the keyboard. To remove a file, use the - key on the keyboard. To select multiple files to download, highlight the first file selection, then use the ↑ and ↓ keys while pressing the shift key to highlight the remaining files.

Remote file name
The Remote file name is the name of the remote file that will be downloaded from the host computer.

Preview
When checked, the Preview checkbox allows the file that is selected in the Files list box to be previewed. To check or uncheck the box, press the SPACE key on the keyboard when the Preview box has the focus.

Download to
The Download to list selects whether you download to the current part in memory or to a directory on the local hard disk. If you select one of the local directories, the following field is available: Local file name.

Keypad operation: To select a different directory, use the ↑ and ↓ keys on the keyboard. To add a new directory, use the **+** key on the keyboard. To remove a directory, use the **-** key on the keyboard.

Local file name
The Local file name is the user defined file name assigned to the file that is being downloading to the hard drive.

Upload to Host

The following screen is used to upload a part to a host computer. Once all the parameters below are set, press ENTER on the keyboard to start the upload.
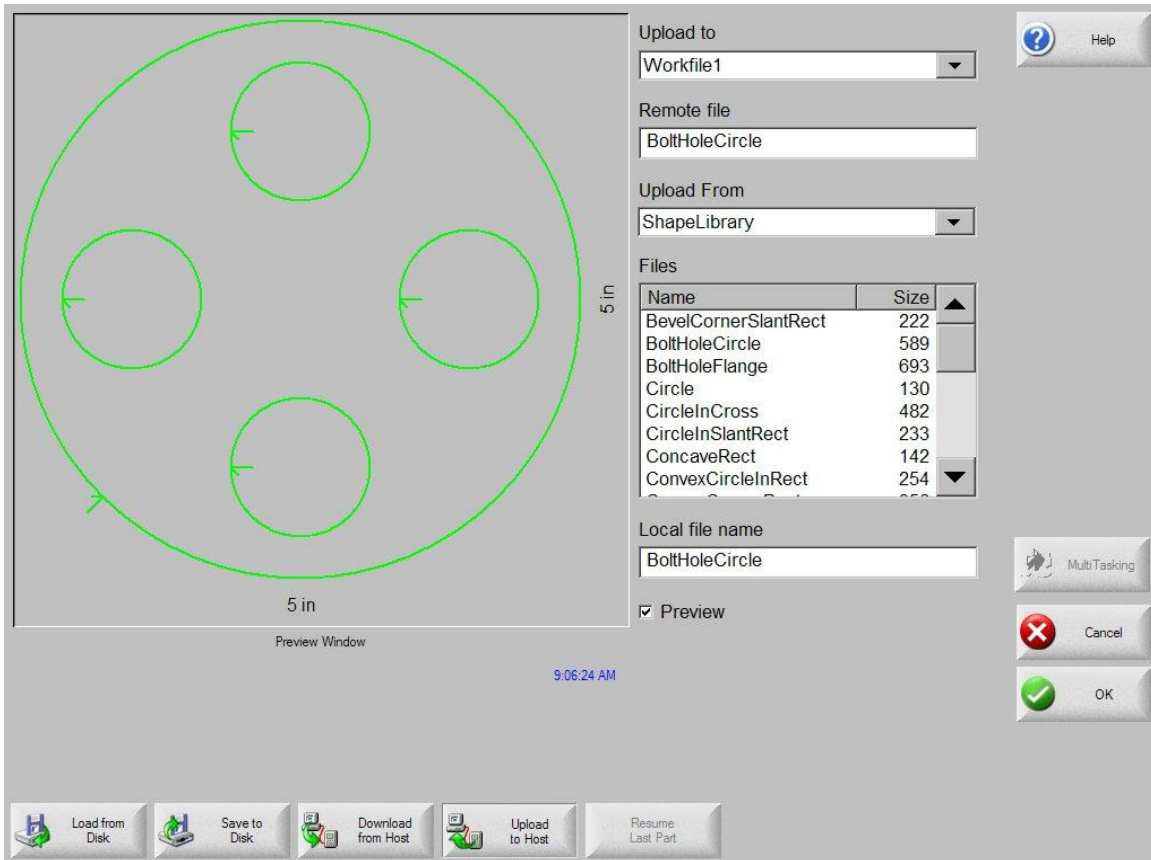
Upload to
The Upload to list selects which directory on the host computer that you want to upload to. To add or remove a directory, double click on the touch screen where indicated.

Keypad operation: To select a different directory, use the ↑ and ↓ keys on the keyboard. To add a new directory, use the **+** key on the keyboard. To remove a directory, use the **-** key on the keyboard.

Remote file name
The Remote file name is the name you want the file that you are uploading to have on the host computer.

Upload from
The Upload from list selects whether you upload the current part in memory or from a directory on the local hard disk. If you select one of the local directories, the following fields are available: Files, Local file name and Preview. To add or remove a directory, double click on the touch screen where indicated.

Keypad operation: To select a different directory, use the ↑ and ↓ keys on the keyboard. To add a new directory, use the **+** key on the keyboard. To remove a directory, use the **-** key on the keyboard. **Note:** This selection is only available if saving to the Diskette or USB memory stick from the hard drive.

Files
The Files list box contains a list of all the files that are in the Upload from directory that can be uploaded to the host computer. To remove a file, double click on the touch screen where indicated.

Keypad operation: To scroll through different files, use the ↑, ↓, PAGE UP and PAGE DOWN keys on the keyboard. To remove a file, use the - key on the keyboard. To select multiple files to upload, highlight the first file selection, then use the ↑ and ↓ keys while pressing the shift key to highlight the remaining files.

Local file name
The Local file name is the name of the local file that will be uploaded to the host computer.

Preview
When checked, the Preview checkbox allows the file that is selected in the Files list box to be previewed.

Keypad operation: To check or uncheck the box, press the SPACE key on the keyboard when the Preview box has the focus.

Loading Of Invalid Files

While loading the desired part file, the control will check the part for proper geometry and other similar errors. If a part is loaded in which an error is detected, a message will be posted on screen to indicate the error.
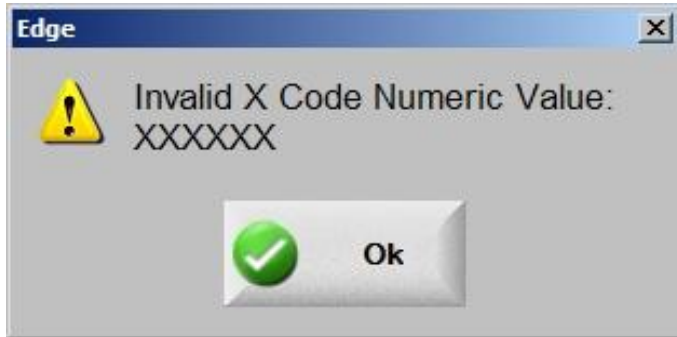
If the part is attempted to be loaded, the control will display the invalid line of code from the text editor.

Example: In the following example, the line of code "XXXXXXXX" is invalid and has been highlighted for easy detection. The part file may be corrected using the text editor. After the invalid code has been corrected, the control will attempt to translate the part file and will indicate any additional invalid codes.
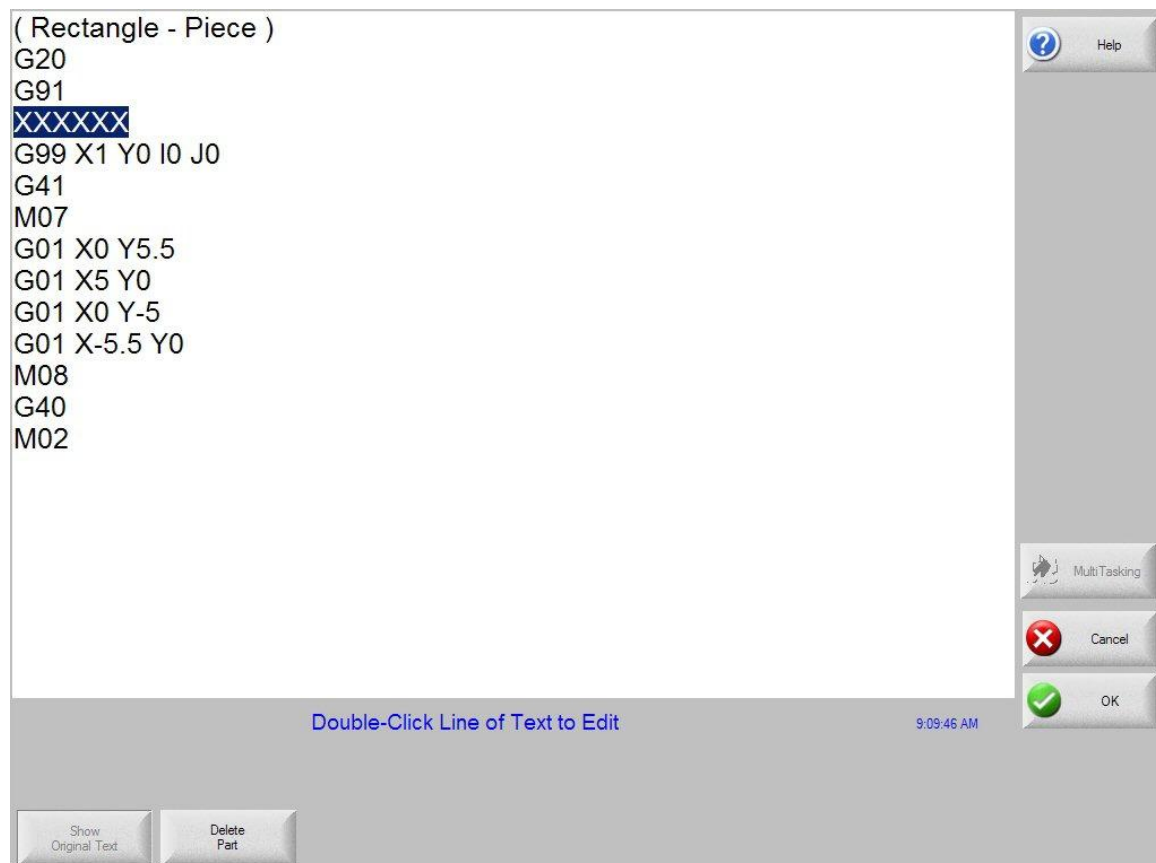
Library Shapes

Double click on the shape to edit for use.

Library Shape Setup

Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

While you are entering in parameters, the control is performing some general checks for proper geometries. Should the control encounter a set of parameters that do not make sense, a warning message will be displayed and the parameters in conflict will be highlighted in red. **Note**: It is not possible to check for all improper geometries and it may still be possible to enter in a part that does not make geometric sense.

As you are entering dimensional parameters, the control is automatically drawing your new shape with the entered values. This is extremely useful in providing a visual check of the shape that has been entered.

Lead-In, Lead-Out

Enter the appropriate value to ensure proper piercing (Lead-in) and gas bleed-off (Lead-out) to obtain optimum cut quality.

The location for the lead-in and lead-out is fixed, but can be changed by using the ShapeWizard and then saving the new shape to disk. *Note:* the Rectangle simple shape has the ability to select the location for the lead-in and lead-out by pressing the SPACE key. Pressing the SPACE key will move the lead-in and lead-out to the next available location.

Overburn Length
Overburn is used for parts that contain a circular element. Overburn specifies arc length that the torch will travel past the circle closure point. The dimension entered is the chord length of the overburn-arc.

In some cases it is desirable to have an underburn length. For these conditions, simply enter a negative number for the Overburn length.

Part Type
Selects whether you want to cut the part as a separate Piece or a Hole in a larger part. Chain cut options are available for simple shapes that have external cut paths.

Lead Type
Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

Note: Some shapes will offer drop down fields to increase options with additional parameters.

Rectangle

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

While you are entering in parameters, the control is performing some general checks for proper geometries. Should the control encounter a set of parameters that do not make sense, a warning message will be displayed and the parameters in conflict will be highlighted in red. **Note**: It is not possible to check for all improper geometries and it may still be possible to enter in a part that does not make geometric sense.

As you are entering dimensional parameters, the control is automatically drawing your new shape with the entered values. This is extremely useful in providing a visual check of the shape that has been entered.

Lead-In, Lead-Out
Enter the appropriate value to ensure proper piercing (Lead-in) and gas bleed-off (Lead-out) to obtain optimum cut quality.

The location for the lead-in and lead-out is fixed, but can be changed by using the ShapeWizard and then saving the new shape to disk. *Note:* the Rectangle simple shape has the ability to select the location for the lead-in and lead-out by pressing the SPACE key. Pressing the SPACE key will move the lead-in and lead-out to the next available location.

Overburn Length
Overburn is used for parts that contain a circular element. Overburn specifies arc length that the torch will travel past the circle closure point. The dimension entered is the chord length of the overburn-arc.

In some cases it is desirable to have an underburn length. For these conditions, simply enter a negative number for the Overburn length.

Part Type
Selects whether you want to cut the part as a separate Piece or a Hole in a larger part. Chain cut options are available for simple shapes that have external cut paths.

Lead Type
Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

Note: Some shapes will offer drop down fields to increase options with additional parameters.

Circle

Library Shape Setup
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Lead-In, Lead-Out
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Triangle

Library Shape Setup
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Lead-In, Lead-Out
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L-Bracket

Base Width	5	in
Top Width	2.5	in
Overall Height	5	in
Side Height	2.5	in
Lead In Length	0	in
Lead Out Length	0	in
Part Type	Piece	

5 in

5 in

Preview Window

9:23:36 AM

Help

Cancel

OK

Shape Options

View EIA Text

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

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Trapezoid

Library Shape Setup

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Slant Rectangle

Library Shape Setup
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Gambrel Rectangle

Base Width	5	in
Left Slant Width	1.25	in
Right Slant Width	1.25	in
Overall Height	5	in
Side Height	3.75	in
Lead In Length	0	in
Lead Out Length	0	in
Part Type	Piece	

5 in

5 in

Preview Window

9:32:25 AM

Help

Cancel

OK

Shape Options

View EIA Text

Library Shape Setup
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Roofed Rectangle

Library Shape Setup
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4 Sided Polygon

Library Shape Setup
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5 Sided Polygon

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Oval

Library Shape Setup
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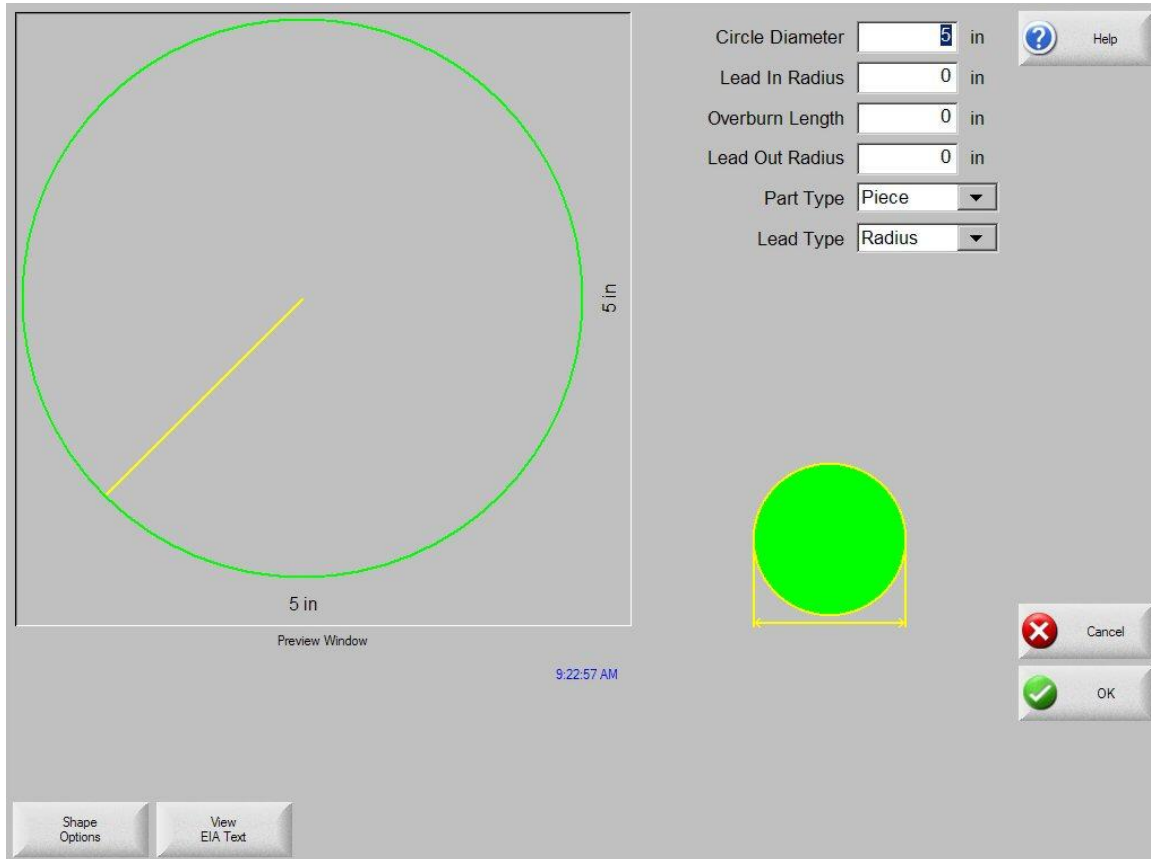
Lead Type
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Circle w/ Flat Side

Library Shape Setup
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Circle Slice

Library Shape Setup

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Straight Slots

Library Shape Setup

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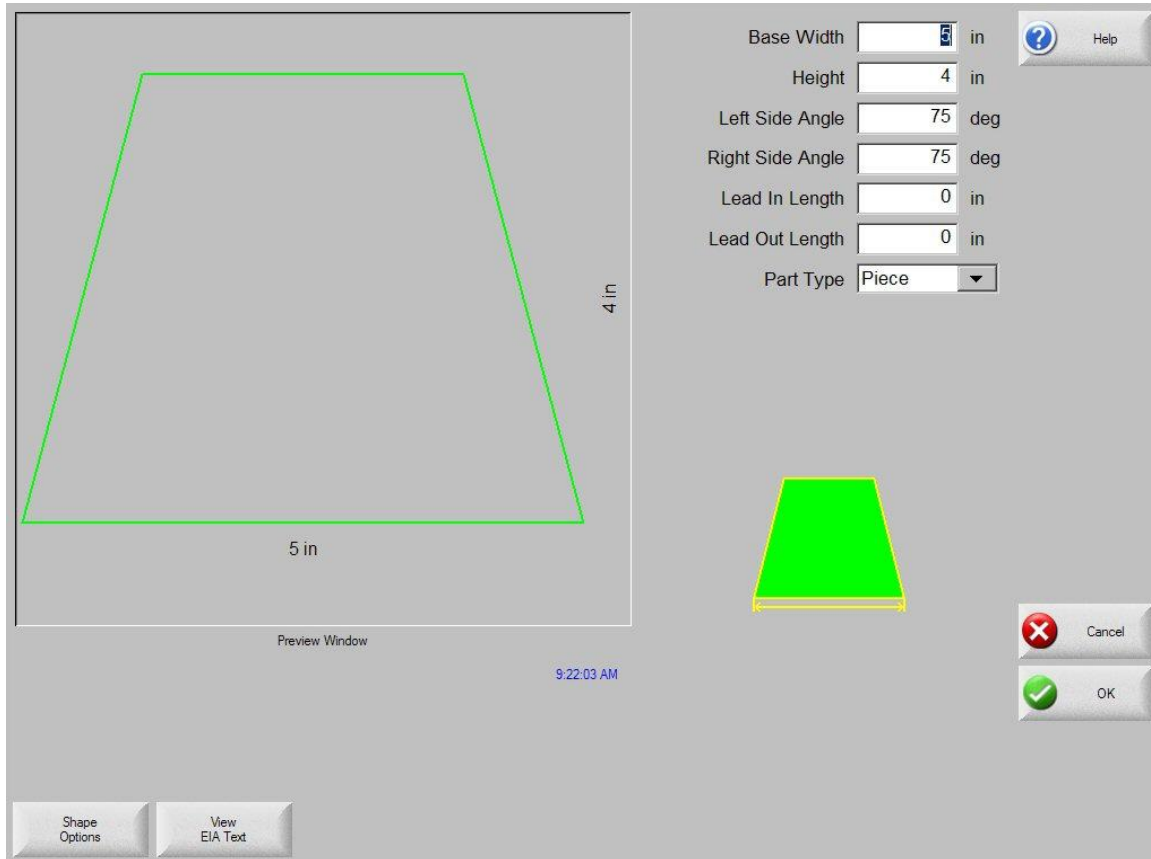

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Angled Slots

Slot Width	5	in
Slot Height	1.25	in
Slot Angle	97	deg
Number of Slots	2	
Lead In Length	0	in
Lead Out Length	0	in

Preview Window

9:38:09 AM

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

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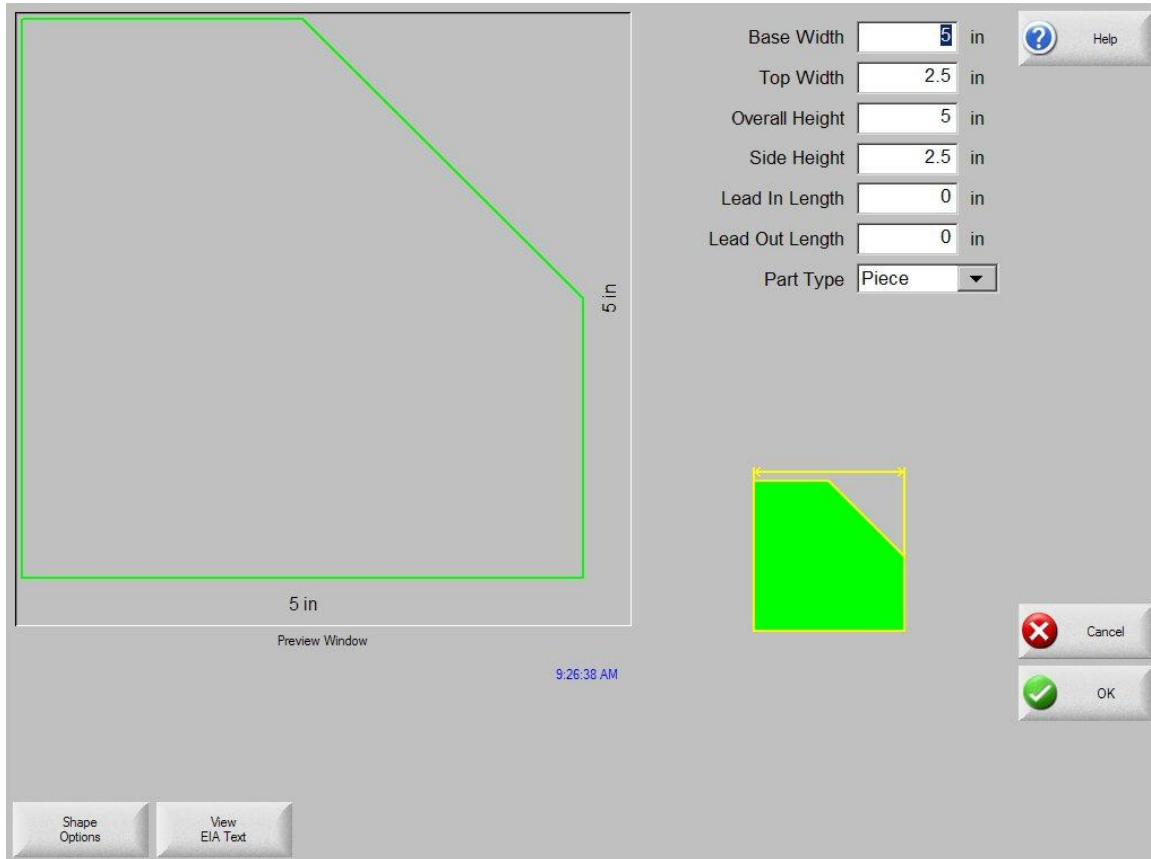
Lead Type
Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

Note: Some shapes will offer drop down fields to increase options with additional parameters.

Horizontal Rip

Length [5] in   Help

0 in

5 in

Preview Window

9:38:25 AM

Cancel

OK

Shape
Options

View
EIA Text

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

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Enter the appropriate value to ensure proper piercing (Lead-in) and gas bleed-off (Lead-out) to obtain optimum cut quality.

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Overburn Length
Overburn is used for parts that contain a circular element. Overburn specifies arc length that the torch will travel past the circle closure point. The dimension entered is the chord length of the overburn-arc.

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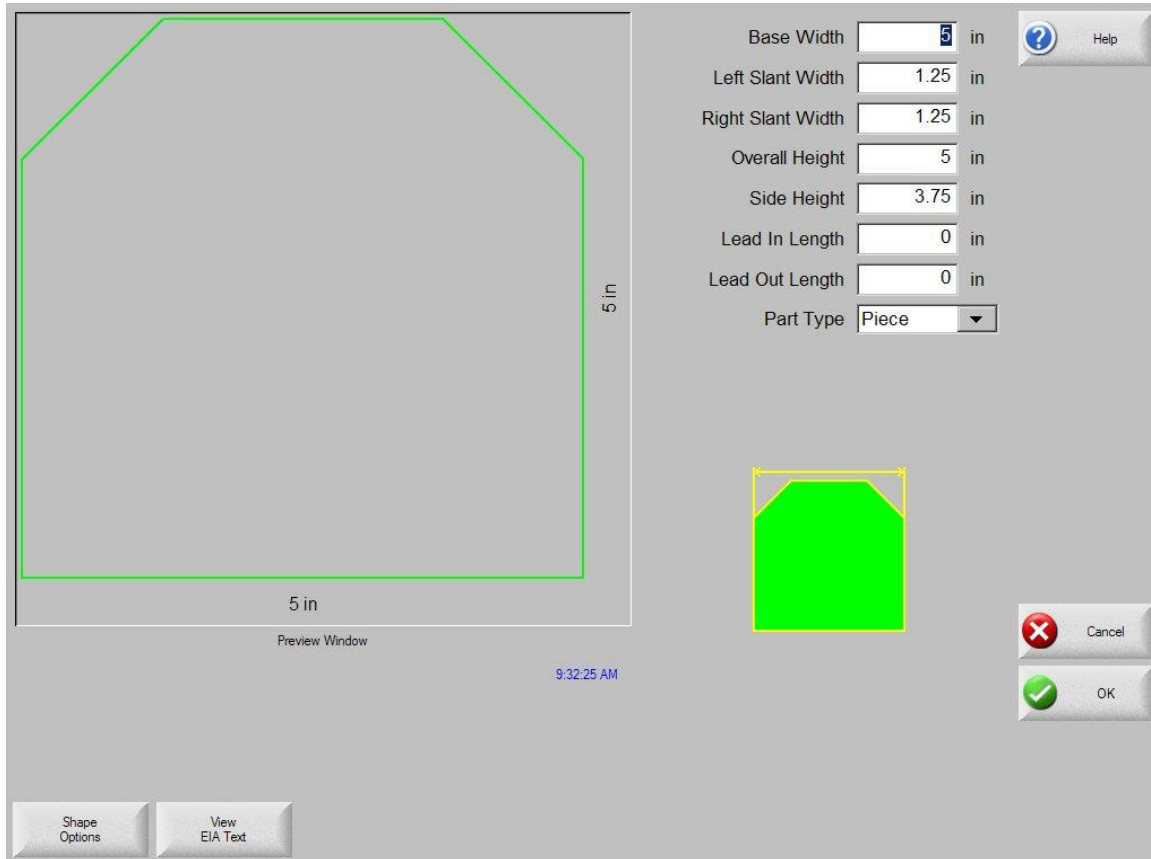
Part Type
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Vertical Rip

Length [5] in   (?) Help

5 in

0 in

Preview Window

9:38:41 AM

Shape Options   View EIA Text

Cancel

OK

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

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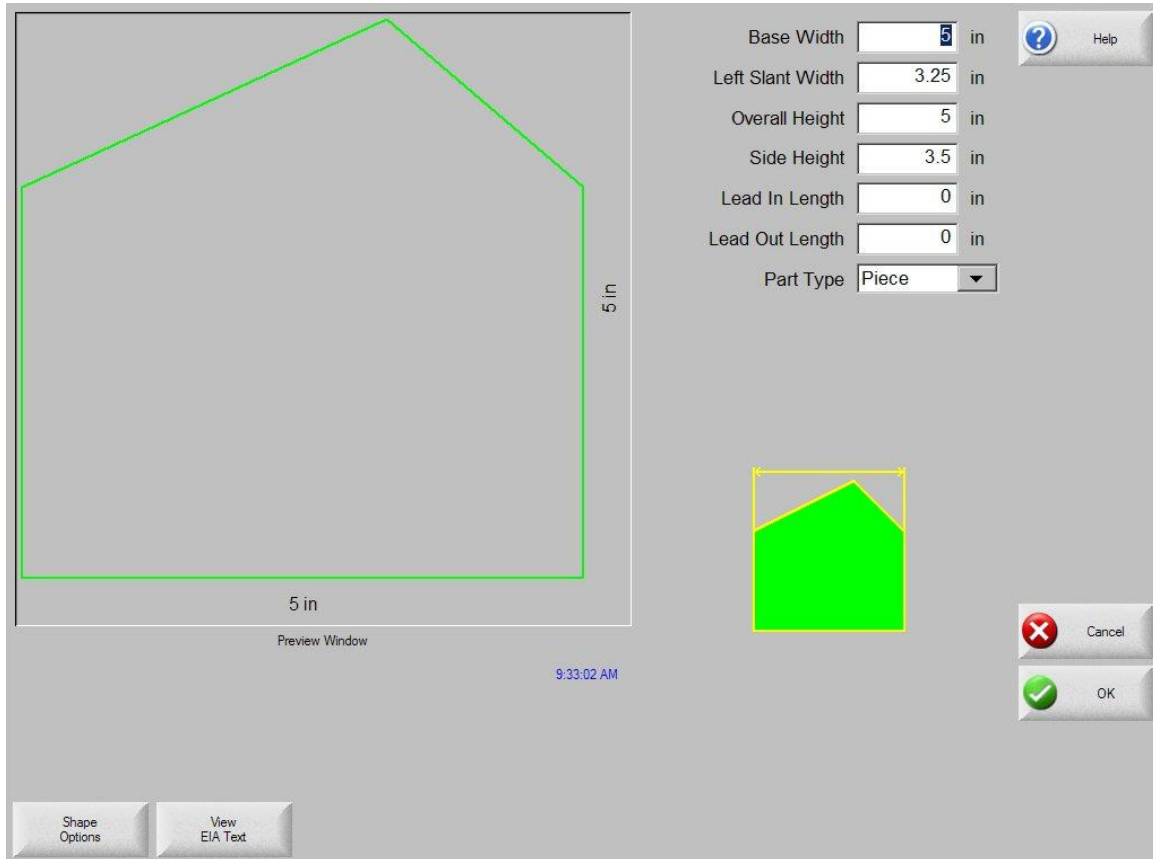
Part Type
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Lead Type
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Flange

Library Shape Setup
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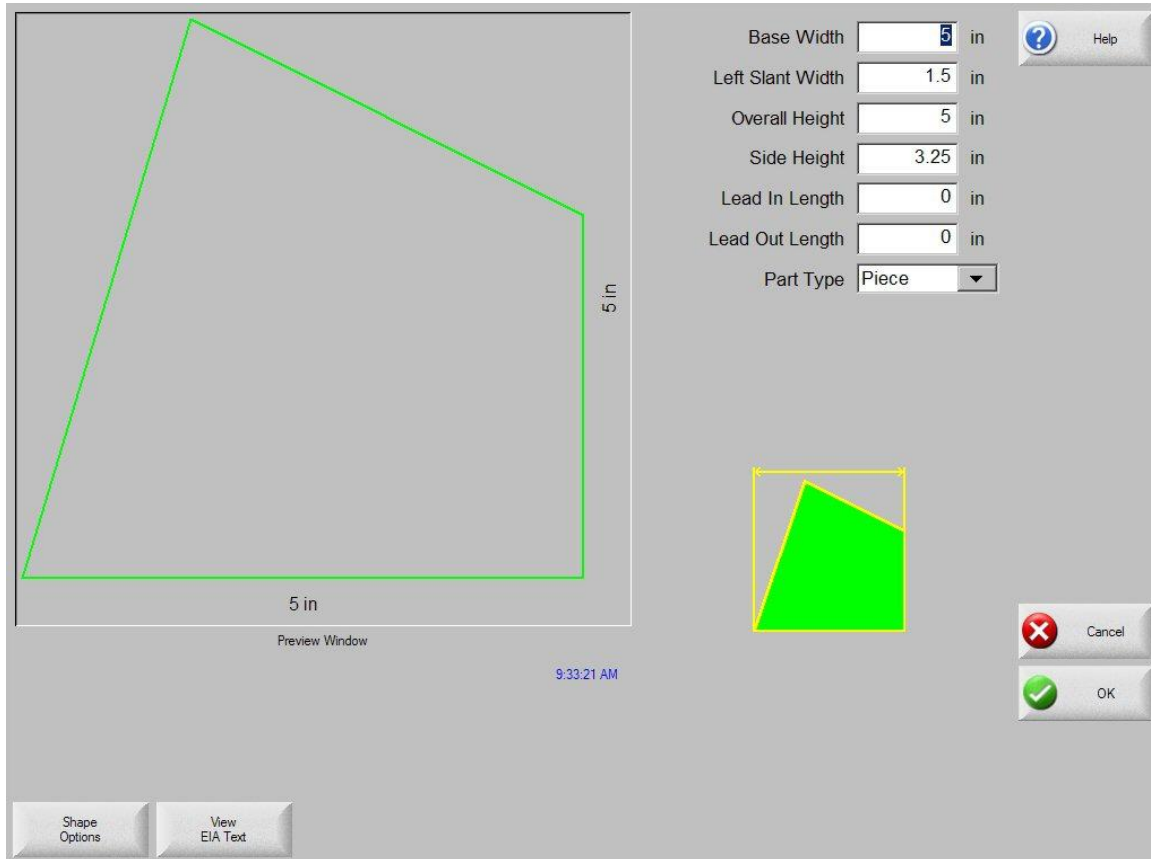
Part Type
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Circle w/ Rectangular Hole

Library Shape Setup

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Part Type
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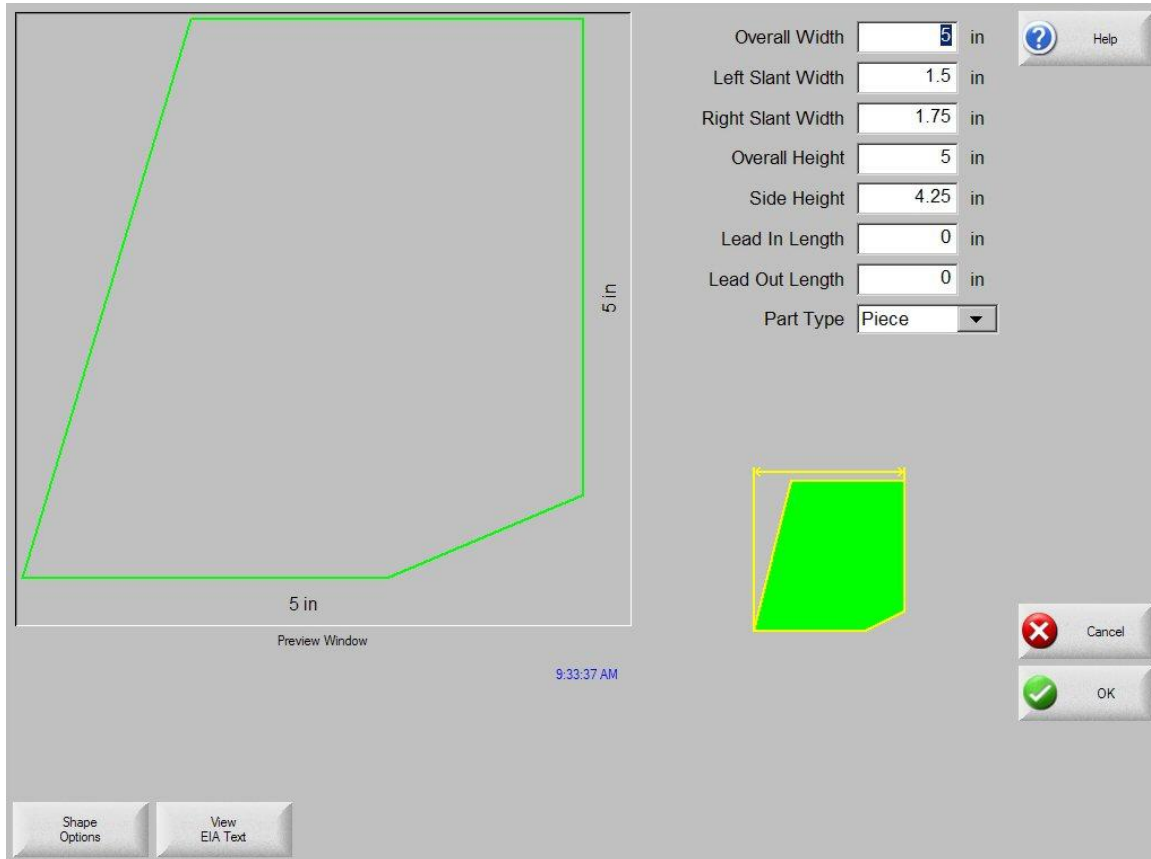
Lead Type
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Gusset

Library Shape Setup
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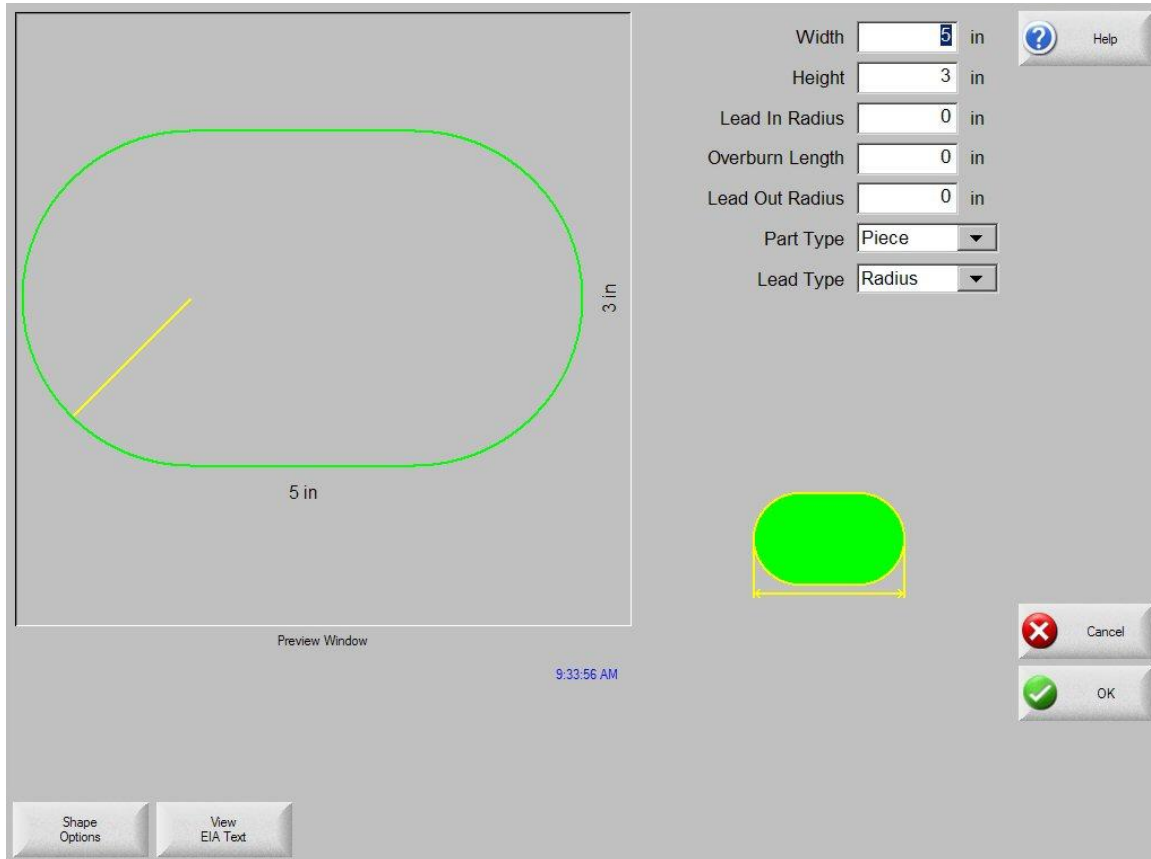
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8 Sided

Library Shape Setup
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Rectangle w/ Convex Corners

Base Width	5	in
Height	5	in
Corner Radius	1	in
Convex Corners	4	
Lead In Radius	0	in
Lead Out Radius	0	in
Part Type	Piece	
Lead Type	Radius	

5 in

5 in

Preview Window

11:12:27 AM

Help

Cancel

OK

Shape Options

View EIA Text

Library Shape Setup
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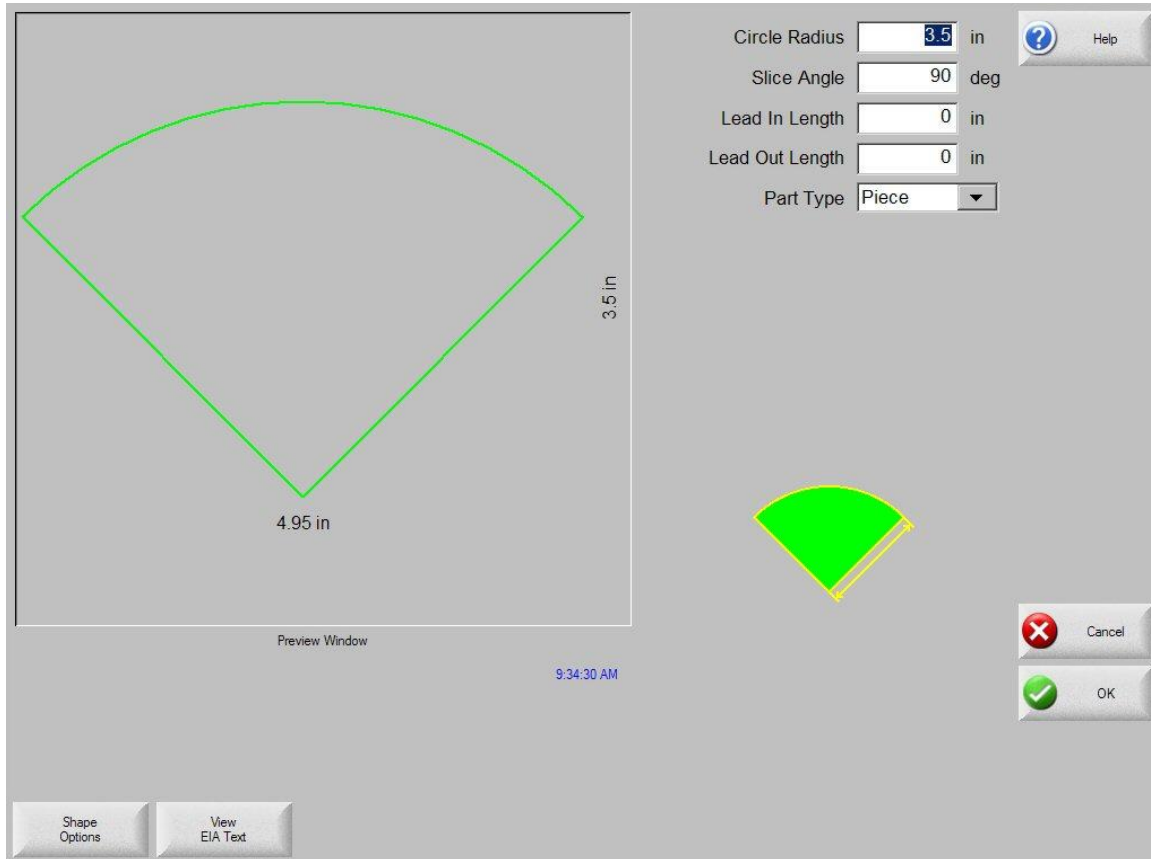
Part Type
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Note: Some shapes will offer drop down fields to increase options with additional parameters.

Rectangle w/ Concave Corners

Base Width	5	in
Height	5	in
Corner Radius	1	in
Concave Corners	4	
Lead In Length	0	in
Lead Out Length	0	in
Part Type	Piece	

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

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Part Type
Selects whether you want to cut the part as a separate Piece or a Hole in a larger part. Chain cut options are available for simple shapes that have external cut paths.

Lead Type
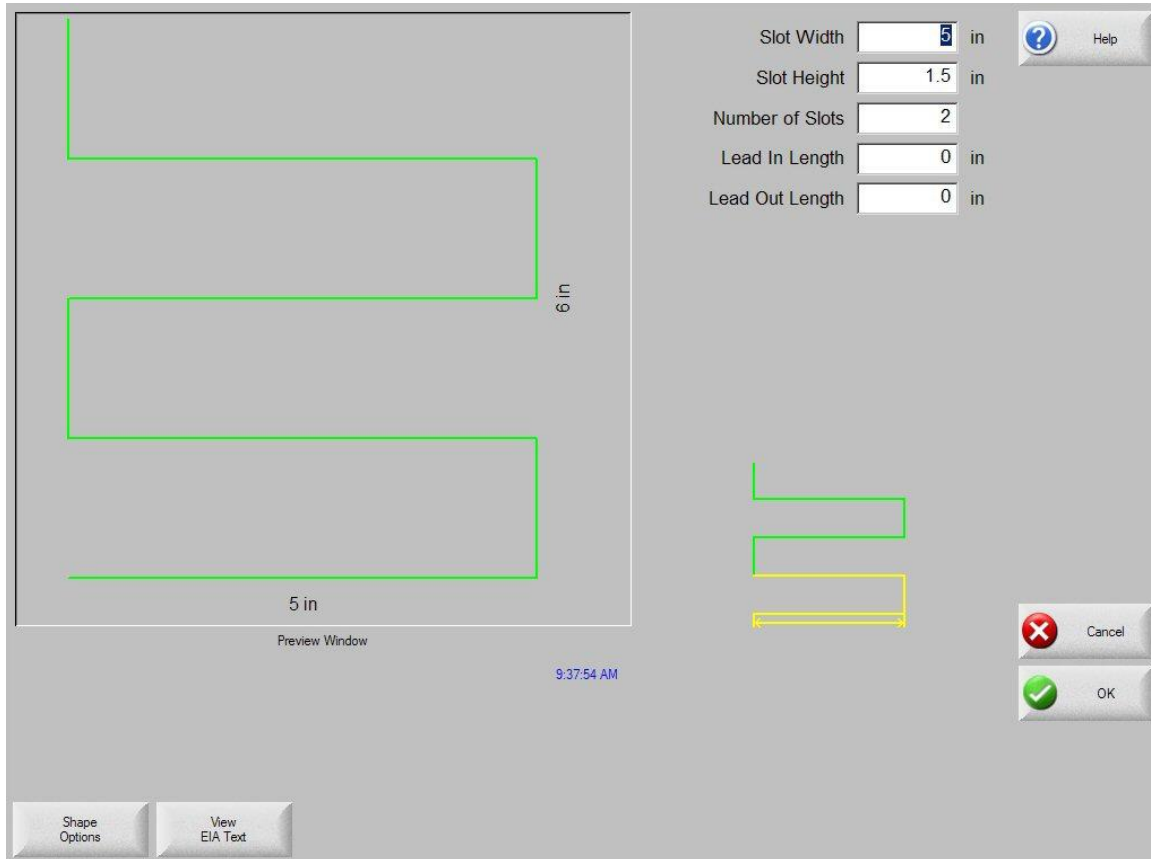Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

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L-Bracket w/ Elbow Radii

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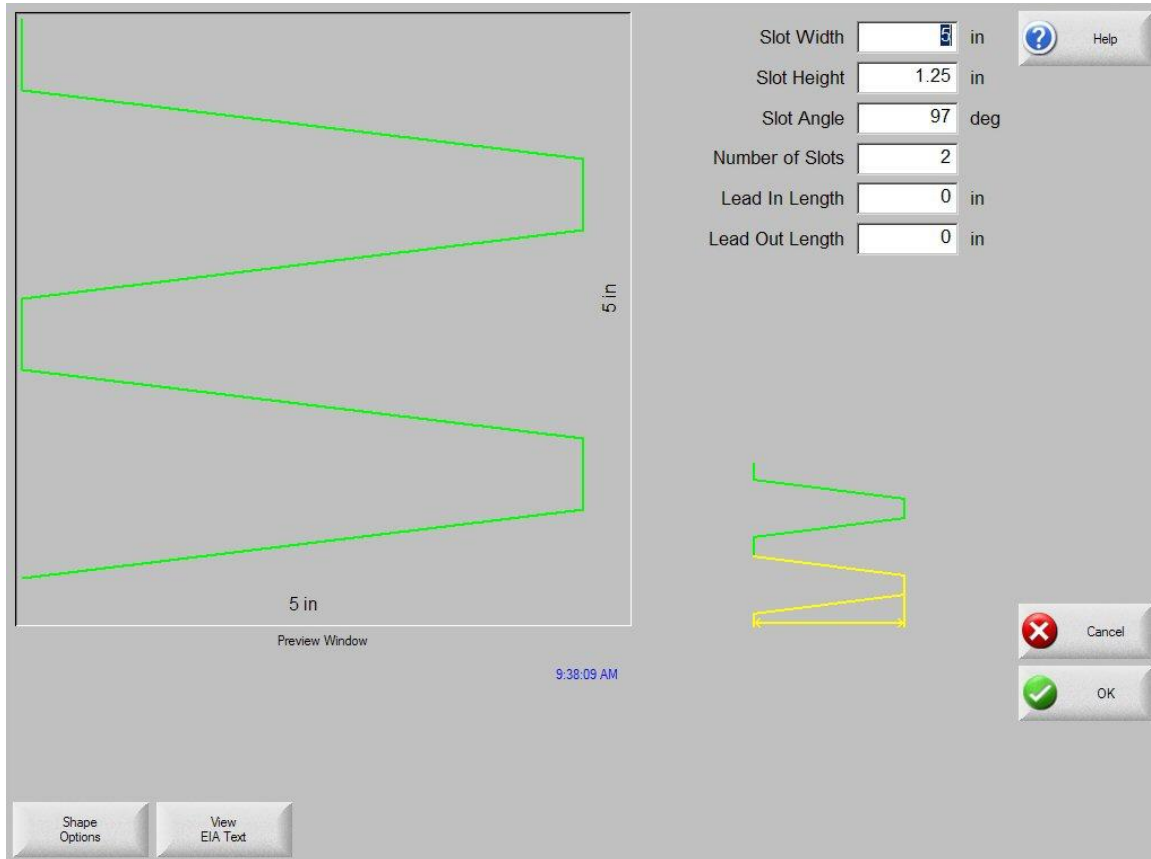
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Slant L-Bracket w/ Elbow Radii

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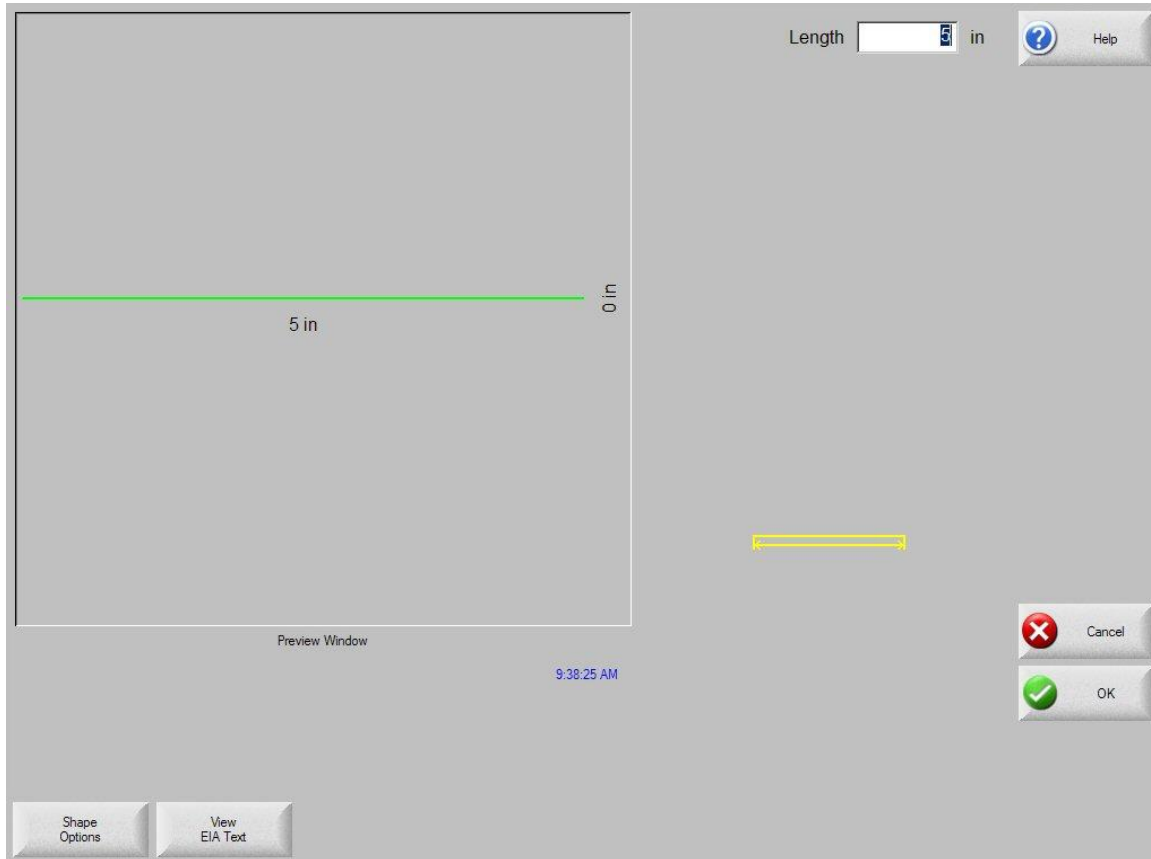
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Trapezoid w/ Convex Corners

Library Shape Setup
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Flange Slice

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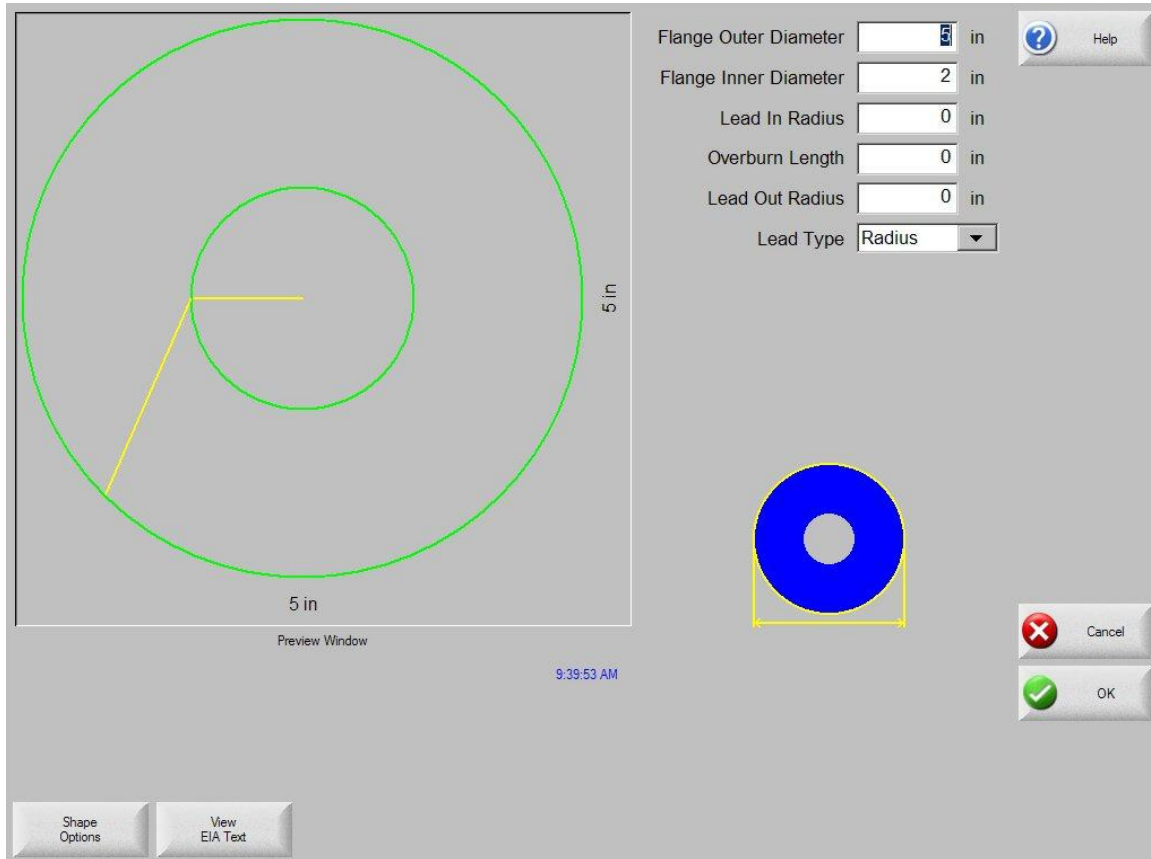
Lead Type
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Elbow

Library Shape Setup

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In some cases it is desirable to have an underburn length. For these conditions, simply enter a negative number for the Overburn length.

Part Type
Selects whether you want to cut the part as a separate Piece or a Hole in a larger part. Chain cut options are available for simple shapes that have external cut paths.

Lead Type
Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

Note: Some shapes will offer drop down fields to increase options with additional parameters.

Flange Repair Ring

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

While you are entering in parameters, the control is performing some general checks for proper geometries. Should the control encounter a set of parameters that do not make sense, a warning message will be displayed and the parameters in conflict will be highlighted in red. **Note**: It is not possible to check for all improper geometries and it may still be possible to enter in a part that does not make geometric sense.

As you are entering dimensional parameters, the control is automatically drawing your new shape with the entered values. This is extremely useful in providing a visual check of the shape that has been entered.

Lead-In, Lead-Out
Enter the appropriate value to ensure proper piercing (Lead-in) and gas bleed-off (Lead-out) to obtain optimum cut quality.

The location for the lead-in and lead-out is fixed, but can be changed by using the ShapeWizard and then saving the new shape to disk. *Note:* the Rectangle simple shape has the ability to select the location for the lead-in and lead-out by pressing the SPACE key. Pressing the SPACE key will move the lead-in and lead-out to the next available location.

Overburn Length
Overburn is used for parts that contain a circular element. Overburn specifies arc length that the torch will travel past the circle closure point. The dimension entered is the chord length of the overburn-arc.

In some cases it is desirable to have an underburn length. For these conditions, simply enter a negative number for the Overburn length.

Part Type
Selects whether you want to cut the part as a separate Piece or a Hole in a larger part. Chain cut options are available for simple shapes that have external cut paths.

Lead Type
Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

Note: Some shapes will offer drop down fields to increase options with additional parameters.

Rectangle w/ Rectangular Hole

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

While you are entering in parameters, the control is performing some general checks for proper geometries. Should the control encounter a set of parameters that do not make sense, a warning message will be displayed and the parameters in conflict will be highlighted in red. **Note**: It is not possible to check for all improper geometries and it may still be possible to enter in a part that does not make geometric sense.

As you are entering dimensional parameters, the control is automatically drawing your new shape with the entered values. This is extremely useful in providing a visual check of the shape that has been entered.

Lead-In, Lead-Out
Enter the appropriate value to ensure proper piercing (Lead-in) and gas bleed-off (Lead-out) to obtain optimum cut quality.

The location for the lead-in and lead-out is fixed, but can be changed by using the ShapeWizard and then saving the new shape to disk. *Note:* the Rectangle simple shape has the ability to select the location for the lead-in and lead-out by pressing the SPACE key. Pressing the SPACE key will move the lead-in and lead-out to the next available location.

Overburn Length
Overburn is used for parts that contain a circular element. Overburn specifies arc length that the torch will travel past the circle closure point. The dimension entered is the chord length of the overburn-arc.

In some cases it is desirable to have an underburn length. For these conditions, simply enter a negative number for the Overburn length.

Part Type
Selects whether you want to cut the part as a separate Piece or a Hole in a larger part. Chain cut options are available for simple shapes that have external cut paths.

Lead Type
Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

Note: Some shapes will offer drop down fields to increase options with additional parameters.

Rectangle w/ Circular Hole

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

While you are entering in parameters, the control is performing some general checks for proper geometries. Should the control encounter a set of parameters that do not make sense, a warning message will be displayed and the parameters in conflict will be highlighted in red. **Note**: It is not possible to check for all improper geometries and it may still be possible to enter in a part that does not make geometric sense.

As you are entering dimensional parameters, the control is automatically drawing your new shape with the entered values. This is extremely useful in providing a visual check of the shape that has been entered.

Lead-In, Lead-Out
Enter the appropriate value to ensure proper piercing (Lead-in) and gas bleed-off (Lead-out) to obtain optimum cut quality.

The location for the lead-in and lead-out is fixed, but can be changed by using the ShapeWizard and then saving the new shape to disk. *Note:* the Rectangle simple shape has the ability to select the location for the lead-in and lead-out by pressing the SPACE key. Pressing the SPACE key will move the lead-in and lead-out to the next available location.

Overburn Length
Overburn is used for parts that contain a circular element. Overburn specifies arc length that the torch will travel past the circle closure point. The dimension entered is the chord length of the overburn-arc.

In some cases it is desirable to have an underburn length. For these conditions, simply enter a negative number for the Overburn length.

Part Type
Selects whether you want to cut the part as a separate Piece or a Hole in a larger part. Chain cut options are available for simple shapes that have external cut paths.

Lead Type
Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

Note: Some shapes will offer drop down fields to increase options with additional parameters.

Rectangle w/ Circular Hole and Convex Corners

Base Width	5	in
Overall Height	5	in
Hole Diameter	2	in
Side to Hole	2	in
Top to Hole	2.5	in
Corner Radius	1	in
Lead In	0	in
Overburn Length	0	in
Lead Out	0	in
Hole Lead Type	Radius	

Preview Window

10:05:44 AM

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

While you are entering in parameters, the control is performing some general checks for proper geometries. Should the control encounter a set of parameters that do not make sense, a warning message will be displayed and the parameters in conflict will be highlighted in red. **Note**: It is not possible to check for all improper geometries and it may still be possible to enter in a part that does not make geometric sense.

As you are entering dimensional parameters, the control is automatically drawing your new shape with the entered values. This is extremely useful in providing a visual check of the shape that has been entered.

Lead-In, Lead-Out
Enter the appropriate value to ensure proper piercing (Lead-in) and gas bleed-off (Lead-out) to obtain optimum cut quality.

The location for the lead-in and lead-out is fixed, but can be changed by using the ShapeWizard and then saving the new shape to disk. *Note:* the Rectangle simple shape has the ability to select the location for the lead-in and lead-out by pressing the SPACE key. Pressing the SPACE key will move the lead-in and lead-out to the next available location.

Overburn Length
Overburn is used for parts that contain a circular element. Overburn specifies arc length that the torch will travel past the circle closure point. The dimension entered is the chord length of the overburn-arc.

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Part Type
Selects whether you want to cut the part as a separate Piece or a Hole in a larger part. Chain cut options are available for simple shapes that have external cut paths.

Lead Type
Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

Note: Some shapes will offer drop down fields to increase options with additional parameters.

Rectangle w/ Tab

Tab to Left Side	1.25	in
Tab Width	1.5	in
Tab to Right Side	2.25	in
Tab Height	1.25	in
Overall Height	5	in
Lead In Length	0	in
Lead Out Length	0	in
Part Type	Piece	

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

While you are entering in parameters, the control is performing some general checks for proper geometries. Should the control encounter a set of parameters that do not make sense, a warning message will be displayed and the parameters in conflict will be highlighted in red. **Note**: It is not possible to check for all improper geometries and it may still be possible to enter in a part that does not make geometric sense.

As you are entering dimensional parameters, the control is automatically drawing your new shape with the entered values. This is extremely useful in providing a visual check of the shape that has been entered.

Lead-In, Lead-Out
Enter the appropriate value to ensure proper piercing (Lead-in) and gas bleed-off (Lead-out) to obtain optimum cut quality.

The location for the lead-in and lead-out is fixed, but can be changed by using the ShapeWizard and then saving the new shape to disk. *Note:* the Rectangle simple shape has the ability to select the location for the lead-in and lead-out by pressing the SPACE key. Pressing the SPACE key will move the lead-in and lead-out to the next available location.

Overburn Length
Overburn is used for parts that contain a circular element. Overburn specifies arc length that the torch will travel past the circle closure point. The dimension entered is the chord length of the overburn-arc.

In some cases it is desirable to have an underburn length. For these conditions, simply enter a negative number for the Overburn length.

Part Type
Selects whether you want to cut the part as a separate Piece or a Hole in a larger part. Chain cut options are available for simple shapes that have external cut paths.

Lead Type
Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

Note: Some shapes will offer drop down fields to increase options with additional parameters.

Rectangle w/ Convex Tab

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

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As you are entering dimensional parameters, the control is automatically drawing your new shape with the entered values. This is extremely useful in providing a visual check of the shape that has been entered.

Lead-In, Lead-Out
Enter the appropriate value to ensure proper piercing (Lead-in) and gas bleed-off (Lead-out) to obtain optimum cut quality.

The location for the lead-in and lead-out is fixed, but can be changed by using the ShapeWizard and then saving the new shape to disk. *Note:* the Rectangle simple shape has the ability to select the location for the lead-in and lead-out by pressing the SPACE key. Pressing the SPACE key will move the lead-in and lead-out to the next available location.

Overburn Length
Overburn is used for parts that contain a circular element. Overburn specifies arc length that the torch will travel past the circle closure point. The dimension entered is the chord length of the overburn-arc.

In some cases it is desirable to have an underburn length. For these conditions, simply enter a negative number for the Overburn length.

Part Type
Selects whether you want to cut the part as a separate Piece or a Hole in a larger part. Chain cut options are available for simple shapes that have external cut paths.

Lead Type
Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

Note: Some shapes will offer drop down fields to increase options with additional parameters.

Rectangle w/ Notch

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

While you are entering in parameters, the control is performing some general checks for proper geometries. Should the control encounter a set of parameters that do not make sense, a warning message will be displayed and the parameters in conflict will be highlighted in red. **Note**: It is not possible to check for all improper geometries and it may still be possible to enter in a part that does not make geometric sense.

As you are entering dimensional parameters, the control is automatically drawing your new shape with the entered values. This is extremely useful in providing a visual check of the shape that has been entered.

Lead-In, Lead-Out
Enter the appropriate value to ensure proper piercing (Lead-in) and gas bleed-off (Lead-out) to obtain optimum cut quality.

The location for the lead-in and lead-out is fixed, but can be changed by using the ShapeWizard and then saving the new shape to disk. *Note:* the Rectangle simple shape has the ability to select the location for the lead-in and lead-out by pressing the SPACE key. Pressing the SPACE key will move the lead-in and lead-out to the next available location.

Overburn Length
Overburn is used for parts that contain a circular element. Overburn specifies arc length that the torch will travel past the circle closure point. The dimension entered is the chord length of the overburn-arc.

In some cases it is desirable to have an underburn length. For these conditions, simply enter a negative number for the Overburn length.
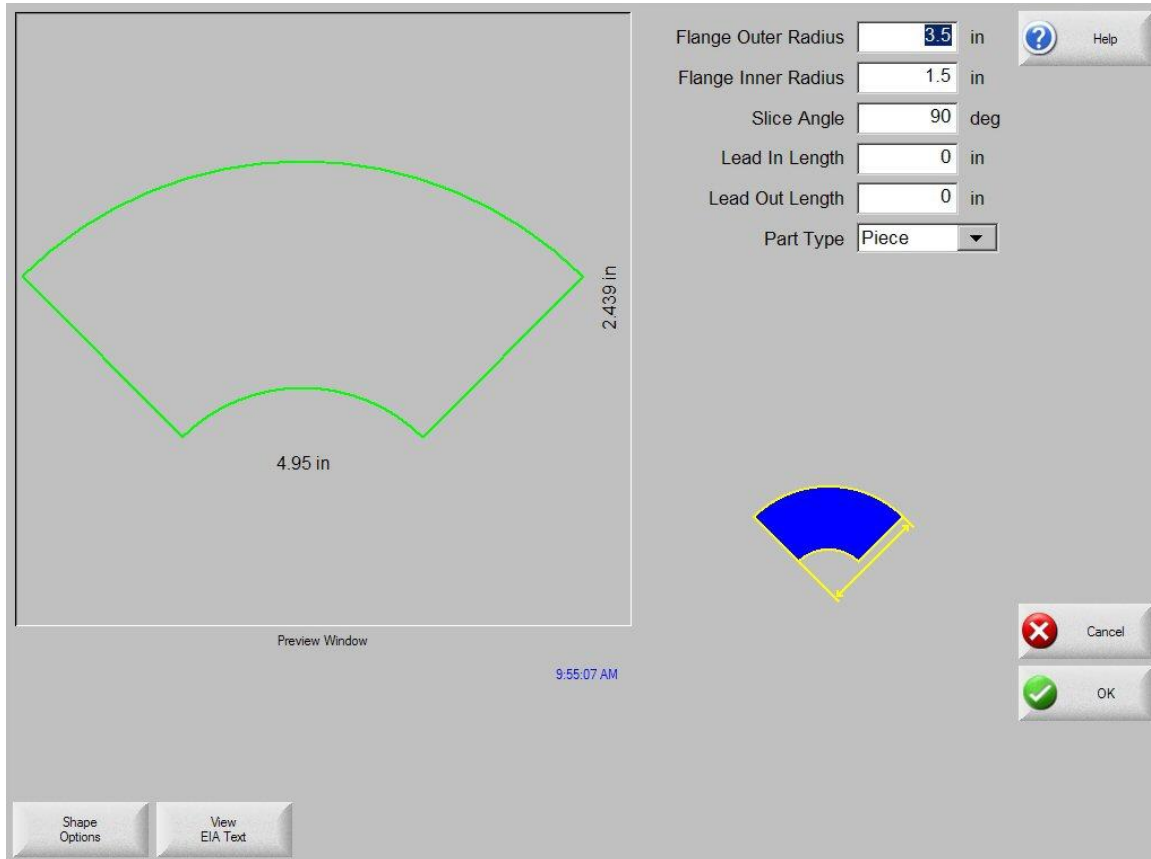

Part Type
Selects whether you want to cut the part as a separate Piece or a Hole in a larger part. Chain cut options are available for simple shapes that have external cut paths.

Lead Type
Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

Note: Some shapes will offer drop down fields to increase options with additional parameters.

Rectangle w/ Slant Notch

Notch to Left Side	1.25	in
Left Slant Width	0.5	in
Notch Width	0.5	in
Right Slant Width	0.5	in
Notch to Right Side	2.25	in
Notch Height	1.5	in
Overall Height	5	in
Lead In Length	0	in
Lead Out Length	0	in
Part Type	Piece	

Preview Window

10:06:53 AM

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

While you are entering in parameters, the control is performing some general checks for proper geometries. Should the control encounter a set of parameters that do not make sense, a warning message will be displayed and the parameters in conflict will be highlighted in red. **Note**: It is not possible to check for all improper geometries and it may still be possible to enter in a part that does not make geometric sense.

As you are entering dimensional parameters, the control is automatically drawing your new shape with the entered values. This is extremely useful in providing a visual check of the shape that has been entered.

Lead-In, Lead-Out
Enter the appropriate value to ensure proper piercing (Lead-in) and gas bleed-off (Lead-out) to obtain optimum cut quality.

The location for the lead-in and lead-out is fixed, but can be changed by using the ShapeWizard and then saving the new shape to disk. *Note:* the Rectangle simple shape has the ability to select the location for the lead-in and lead-out by pressing the SPACE key. Pressing the SPACE key will move the lead-in and lead-out to the next available location.

Overburn Length
Overburn is used for parts that contain a circular element. Overburn specifies arc length that the torch will travel past the circle closure point. The dimension entered is the chord length of the overburn-arc.

In some cases it is desirable to have an underburn length. For these conditions, simply enter a negative number for the Overburn length.
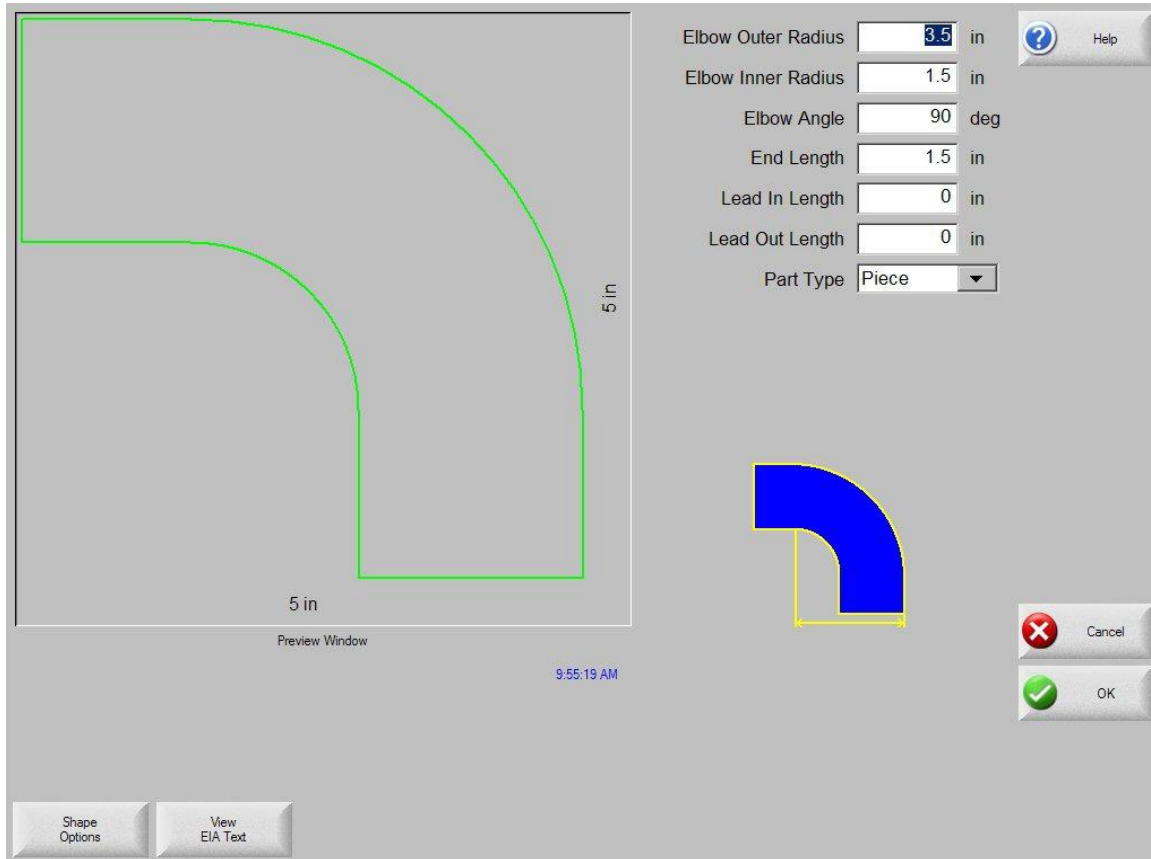
Part Type
Selects whether you want to cut the part as a separate Piece or a Hole in a larger part. Chain cut options are available for simple shapes that have external cut paths.

Lead Type
Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

Note: Some shapes will offer drop down fields to increase options with additional parameters.

Rectangle w/ Radius Notch

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

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As you are entering dimensional parameters, the control is automatically drawing your new shape with the entered values. This is extremely useful in providing a visual check of the shape that has been entered.

Lead-In, Lead-Out
Enter the appropriate value to ensure proper piercing (Lead-in) and gas bleed-off (Lead-out) to obtain optimum cut quality.

The location for the lead-in and lead-out is fixed, but can be changed by using the ShapeWizard and then saving the new shape to disk. *Note:* the Rectangle simple shape has the ability to select the location for the lead-in and lead-out by pressing the SPACE key. Pressing the SPACE key will move the lead-in and lead-out to the next available location.

Overburn Length
Overburn is used for parts that contain a circular element. Overburn specifies arc length that the torch will travel past the circle closure point. The dimension entered is the chord length of the overburn-arc.

In some cases it is desirable to have an underburn length. For these conditions, simply enter a negative number for the Overburn length.
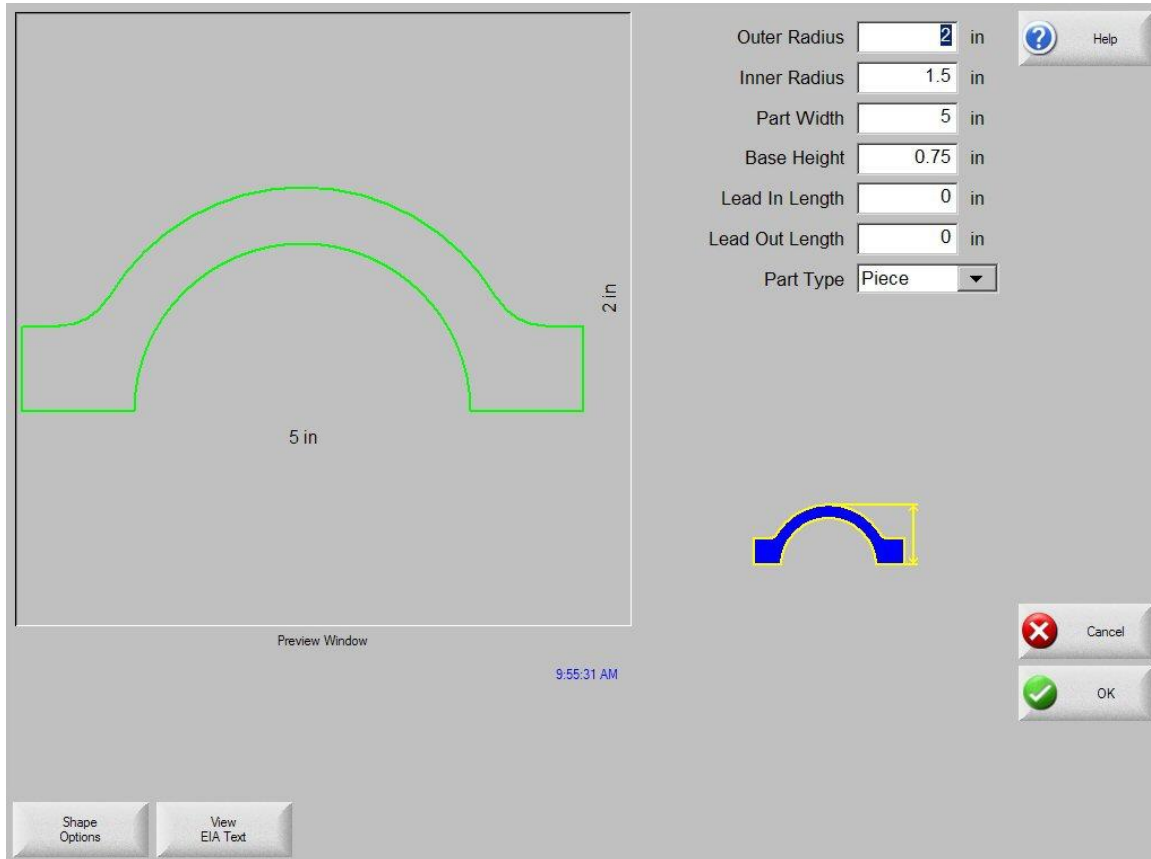
Part Type
Selects whether you want to cut the part as a separate Piece or a Hole in a larger part. Chain cut options are available for simple shapes that have external cut paths.

Lead Type
Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

Note: Some shapes will offer drop down fields to increase options with additional parameters.

Convex Rectangle

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

While you are entering in parameters, the control is performing some general checks for proper geometries. Should the control encounter a set of parameters that do not make sense, a warning message will be displayed and the parameters in conflict will be highlighted in red. **Note**: It is not possible to check for all improper geometries and it may still be possible to enter in a part that does not make geometric sense.

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Lead-In, Lead-Out
Enter the appropriate value to ensure proper piercing (Lead-in) and gas bleed-off (Lead-out) to obtain optimum cut quality.

The location for the lead-in and lead-out is fixed, but can be changed by using the ShapeWizard and then saving the new shape to disk. *Note:* the Rectangle simple shape has the ability to select the location for the lead-in and lead-out by pressing the SPACE key. Pressing the SPACE key will move the lead-in and lead-out to the next available location.

Overburn Length
Overburn is used for parts that contain a circular element. Overburn specifies arc length that the torch will travel past the circle closure point. The dimension entered is the chord length of the overburn-arc.

In some cases it is desirable to have an underburn length. For these conditions, simply enter a negative number for the Overburn length.

Part Type
Selects whether you want to cut the part as a separate Piece or a Hole in a larger part. Chain cut options are available for simple shapes that have external cut paths.

Lead Type
Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

Note: Some shapes will offer drop down fields to increase options with additional parameters.

Concave Rectangle

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

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As you are entering dimensional parameters, the control is automatically drawing your new shape with the entered values. This is extremely useful in providing a visual check of the shape that has been entered.

Lead-In, Lead-Out
Enter the appropriate value to ensure proper piercing (Lead-in) and gas bleed-off (Lead-out) to obtain optimum cut quality.

The location for the lead-in and lead-out is fixed, but can be changed by using the ShapeWizard and then saving the new shape to disk. *Note:* the Rectangle simple shape has the ability to select the location for the lead-in and lead-out by pressing the SPACE key. Pressing the SPACE key will move the lead-in and lead-out to the next available location.

Overburn Length
Overburn is used for parts that contain a circular element. Overburn specifies arc length that the torch will travel past the circle closure point. The dimension entered is the chord length of the overburn-arc.

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Part Type
Selects whether you want to cut the part as a separate Piece or a Hole in a larger part. Chain cut options are available for simple shapes that have external cut paths.

Lead Type
Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

Note: Some shapes will offer drop down fields to increase options with additional parameters.

Triangle w/ Concave Side

Base Width 5 in
Height 5 in
Concave Radius 5 in
Lead In Length 0 in
Lead Out Length 0 in
Part Type Piece

Help

5 in

5 in

Preview Window

10:12:42 AM

Cancel

OK

Shape Options   View EIA Text

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

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As you are entering dimensional parameters, the control is automatically drawing your new shape with the entered values. This is extremely useful in providing a visual check of the shape that has been entered.

Lead-In, Lead-Out
Enter the appropriate value to ensure proper piercing (Lead-in) and gas bleed-off (Lead-out) to obtain optimum cut quality.

The location for the lead-in and lead-out is fixed, but can be changed by using the ShapeWizard and then saving the new shape to disk. *Note:* the Rectangle simple shape has the ability to select the location for the lead-in and lead-out by pressing the SPACE key. Pressing the SPACE key will move the lead-in and lead-out to the next available location.

Overburn Length
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Part Type
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Lead Type
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Note: Some shapes will offer drop down fields to increase options with additional parameters.

Polygon w/ Concave Side

Base Width [4.5] in
Overall Height [5] in
Side Height [0.5] in
Concave Radius [4.5] in
Lead In Length [0] in
Lead Out Length [0] in
Part Type [Piece ▼]

5 in

4.5 in

Preview Window

10:12:55 AM

Help

Cancel

OK

Shape Options

View EIA Text

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

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Lead-In, Lead-Out
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The location for the lead-in and lead-out is fixed, but can be changed by using the ShapeWizard and then saving the new shape to disk. *Note:* the Rectangle simple shape has the ability to select the location for the lead-in and lead-out by pressing the SPACE key. Pressing the SPACE key will move the lead-in and lead-out to the next available location.

Overburn Length
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Part Type
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Lead Type
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Note: Some shapes will offer drop down fields to increase options with additional parameters.

Slant Rectangle with Radius

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

While you are entering in parameters, the control is performing some general checks for proper geometries. Should the control encounter a set of parameters that do not make sense, a warning message will be displayed and the parameters in conflict will be highlighted in red. **Note**: It is not possible to check for all improper geometries and it may still be possible to enter in a part that does not make geometric sense.

As you are entering dimensional parameters, the control is automatically drawing your new shape with the entered values. This is extremely useful in providing a visual check of the shape that has been entered.

Lead-In, Lead-Out
Enter the appropriate value to ensure proper piercing (Lead-in) and gas bleed-off (Lead-out) to obtain optimum cut quality.

The location for the lead-in and lead-out is fixed, but can be changed by using the ShapeWizard and then saving the new shape to disk. *Note:* the Rectangle simple shape has the ability to select the location for the lead-in and lead-out by pressing the SPACE key. Pressing the SPACE key will move the lead-in and lead-out to the next available location.

Overburn Length
Overburn is used for parts that contain a circular element. Overburn specifies arc length that the torch will travel past the circle closure point. The dimension entered is the chord length of the overburn-arc.

In some cases it is desirable to have an underburn length. For these conditions, simply enter a negative number for the Overburn length.

Part Type
Selects whether you want to cut the part as a separate Piece or a Hole in a larger part. Chain cut options are available for simple shapes that have external cut paths.
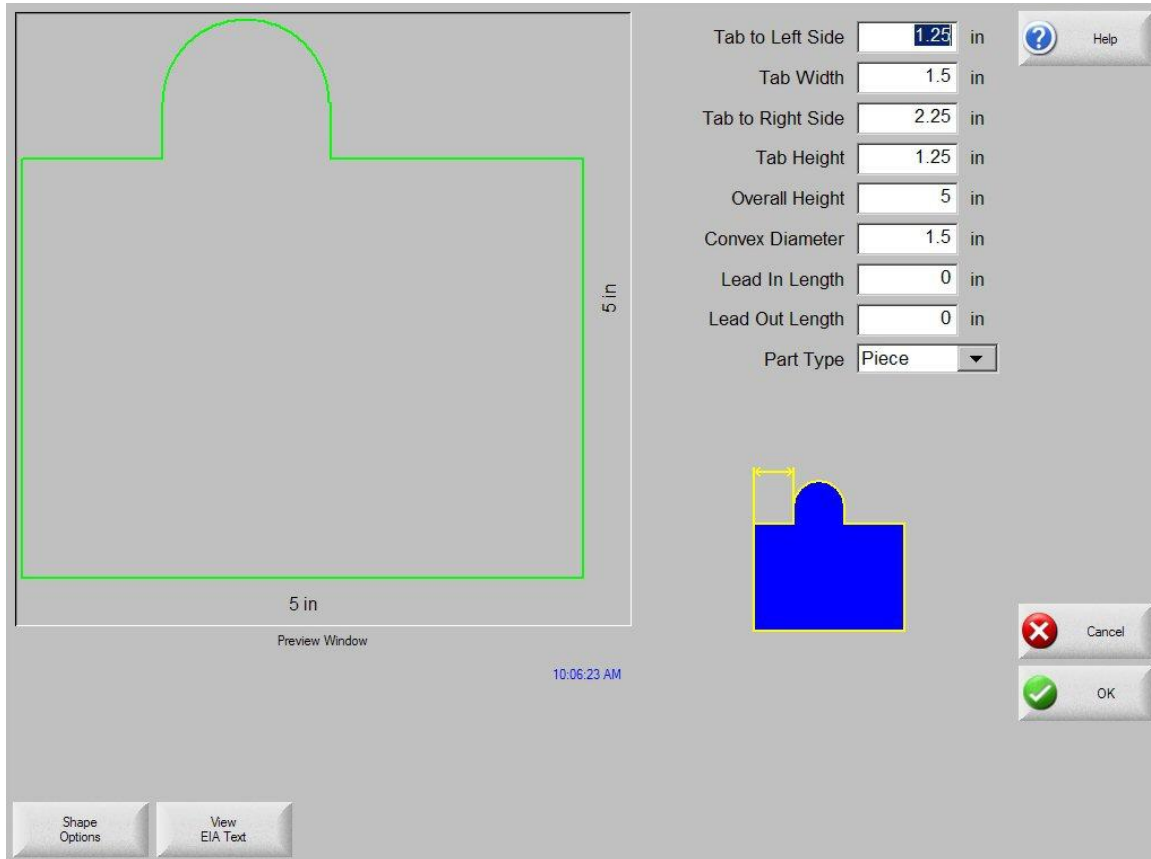
Lead Type
Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

Note: Some shapes will offer drop down fields to increase options with additional parameters.

Slant Rectangle with Circular Hole

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

While you are entering in parameters, the control is performing some general checks for proper geometries. Should the control encounter a set of parameters that do not make sense, a warning message will be displayed and the parameters in conflict will be highlighted in red. **Note**: It is not possible to check for all improper geometries and it may still be possible to enter in a part that does not make geometric sense.

As you are entering dimensional parameters, the control is automatically drawing your new shape with the entered values. This is extremely useful in providing a visual check of the shape that has been entered.

Lead-In, Lead-Out
Enter the appropriate value to ensure proper piercing (Lead-in) and gas bleed-off (Lead-out) to obtain optimum cut quality.

The location for the lead-in and lead-out is fixed, but can be changed by using the ShapeWizard and then saving the new shape to disk. *Note:* the Rectangle simple shape has the ability to select the location for the lead-in and lead-out by pressing the SPACE key. Pressing the SPACE key will move the lead-in and lead-out to the next available location.

Overburn Length
Overburn is used for parts that contain a circular element. Overburn specifies arc length that the torch will travel past the circle closure point. The dimension entered is the chord length of the overburn-arc.

In some cases it is desirable to have an underburn length. For these conditions, simply enter a negative number for the Overburn length.
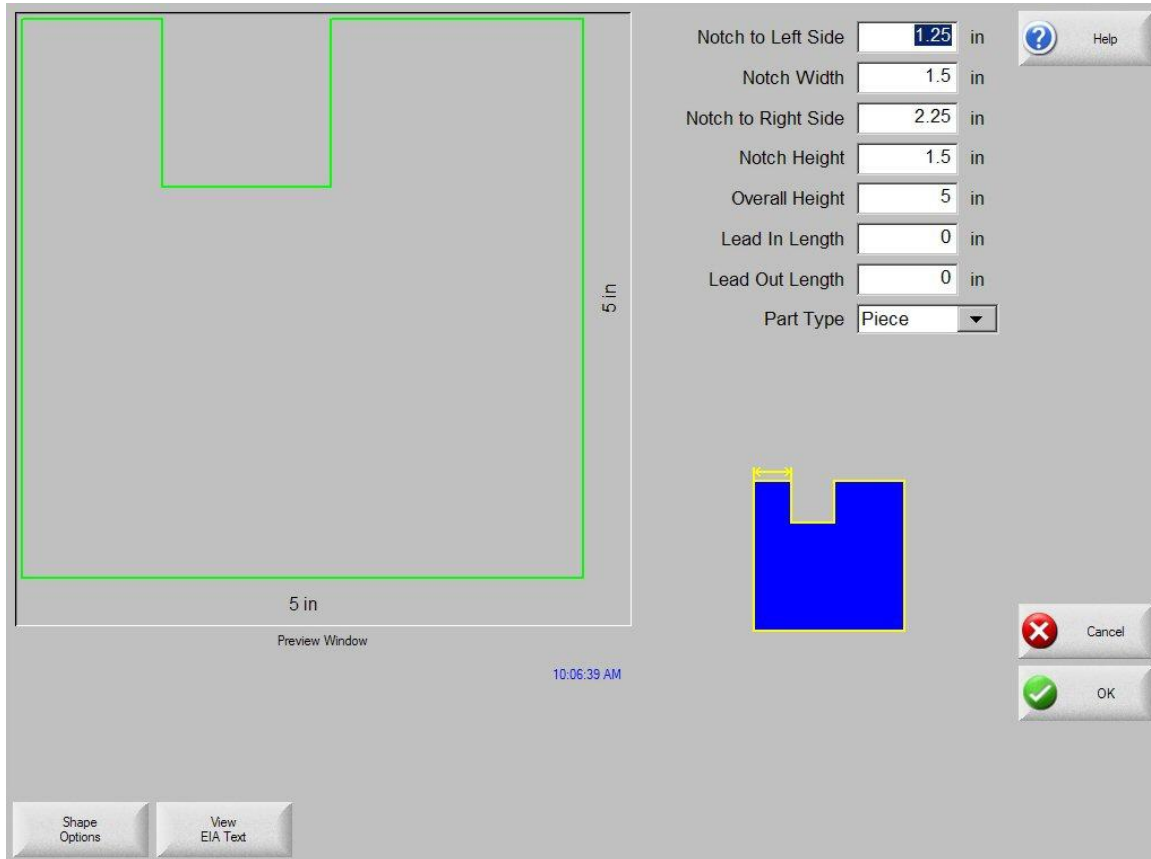
Part Type
Selects whether you want to cut the part as a separate Piece or a Hole in a larger part. Chain cut options are available for simple shapes that have external cut paths.

Lead Type
Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

Note: Some shapes will offer drop down fields to increase options with additional parameters.

Slant Rectangle w/ Beveled Corners

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

While you are entering in parameters, the control is performing some general checks for proper geometries. Should the control encounter a set of parameters that do not make sense, a warning message will be displayed and the parameters in conflict will be highlighted in red. **Note**: It is not possible to check for all improper geometries and it may still be possible to enter in a part that does not make geometric sense.

As you are entering dimensional parameters, the control is automatically drawing your new shape with the entered values. This is extremely useful in providing a visual check of the shape that has been entered.

Lead-In, Lead-Out
Enter the appropriate value to ensure proper piercing (Lead-in) and gas bleed-off (Lead-out) to obtain optimum cut quality.

The location for the lead-in and lead-out is fixed, but can be changed by using the ShapeWizard and then saving the new shape to disk. *Note:* the Rectangle simple shape has the ability to select the location for the lead-in and lead-out by pressing the SPACE key. Pressing the SPACE key will move the lead-in and lead-out to the next available location.

Overburn Length
Overburn is used for parts that contain a circular element. Overburn specifies arc length that the torch will travel past the circle closure point. The dimension entered is the chord length of the overburn-arc.

In some cases it is desirable to have an underburn length. For these conditions, simply enter a negative number for the Overburn length.
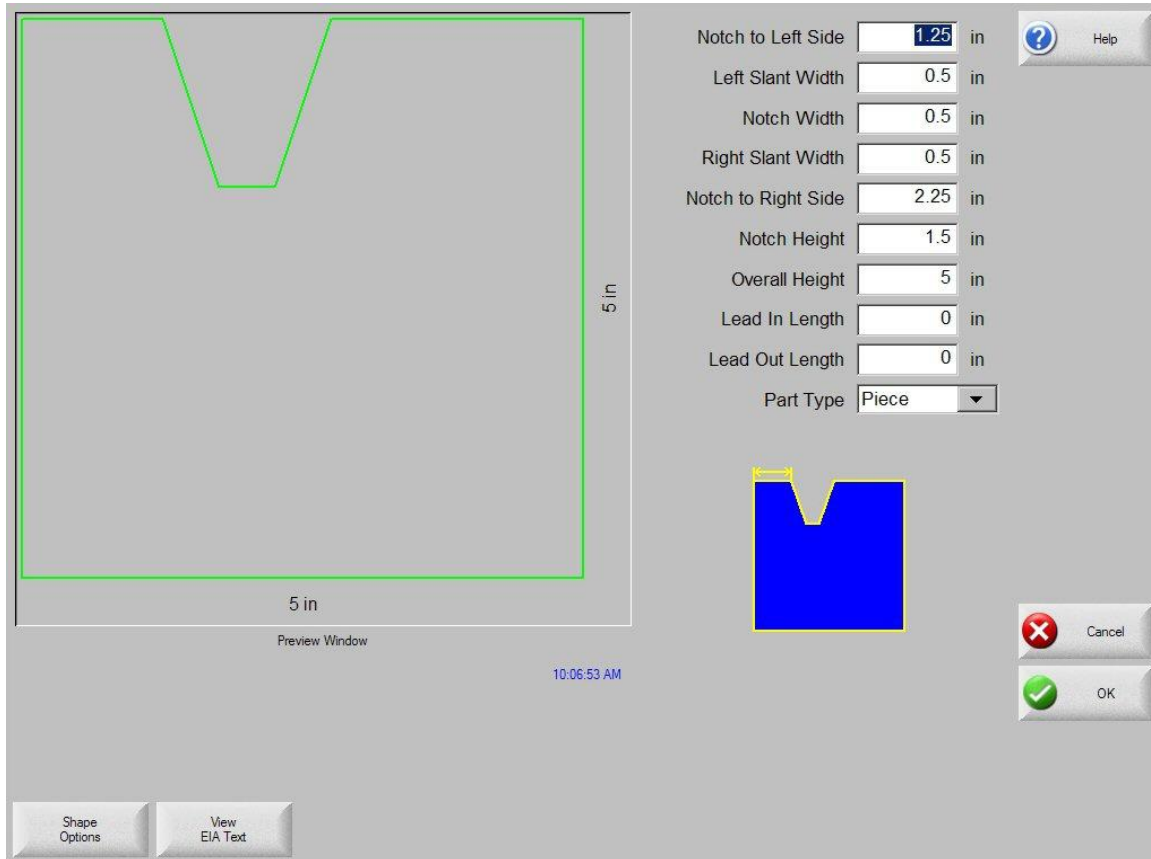
Part Type
Selects whether you want to cut the part as a separate Piece or a Hole in a larger part. Chain cut options are available for simple shapes that have external cut paths.

Lead Type
Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

Note: Some shapes will offer drop down fields to increase options with additional parameters.

Cross

Left Width	**1.5** in
Center Width	2 in
Right Width	1.5 in
Top Height	1.5 in
Center Height	2 in
Bottom Height	1.5 in
Lead In Length	0 in
Lead Out Length	0 in
Part Type	Piece ▼

5 in

5 in

Preview Window

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Help

Cancel

OK

Shape Options

View EIA Text

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

While you are entering in parameters, the control is performing some general checks for proper geometries. Should the control encounter a set of parameters that do not make sense, a warning message will be displayed and the parameters in conflict will be highlighted in red. **Note**: It is not possible to check for all improper geometries and it may still be possible to enter in a part that does not make geometric sense.

As you are entering dimensional parameters, the control is automatically drawing your new shape with the entered values. This is extremely useful in providing a visual check of the shape that has been entered.

Lead-In, Lead-Out
Enter the appropriate value to ensure proper piercing (Lead-in) and gas bleed-off (Lead-out) to obtain optimum cut quality.

The location for the lead-in and lead-out is fixed, but can be changed by using the ShapeWizard and then saving the new shape to disk. *Note:* the Rectangle simple shape has the ability to select the location for the lead-in and lead-out by pressing the SPACE key. Pressing the SPACE key will move the lead-in and lead-out to the next available location.

Overburn Length
Overburn is used for parts that contain a circular element. Overburn specifies arc length that the torch will travel past the circle closure point. The dimension entered is the chord length of the overburn-arc.

In some cases it is desirable to have an underburn length. For these conditions, simply enter a negative number for the Overburn length.

Part Type
Selects whether you want to cut the part as a separate Piece or a Hole in a larger part. Chain cut options are available for simple shapes that have external cut paths.

Lead Type
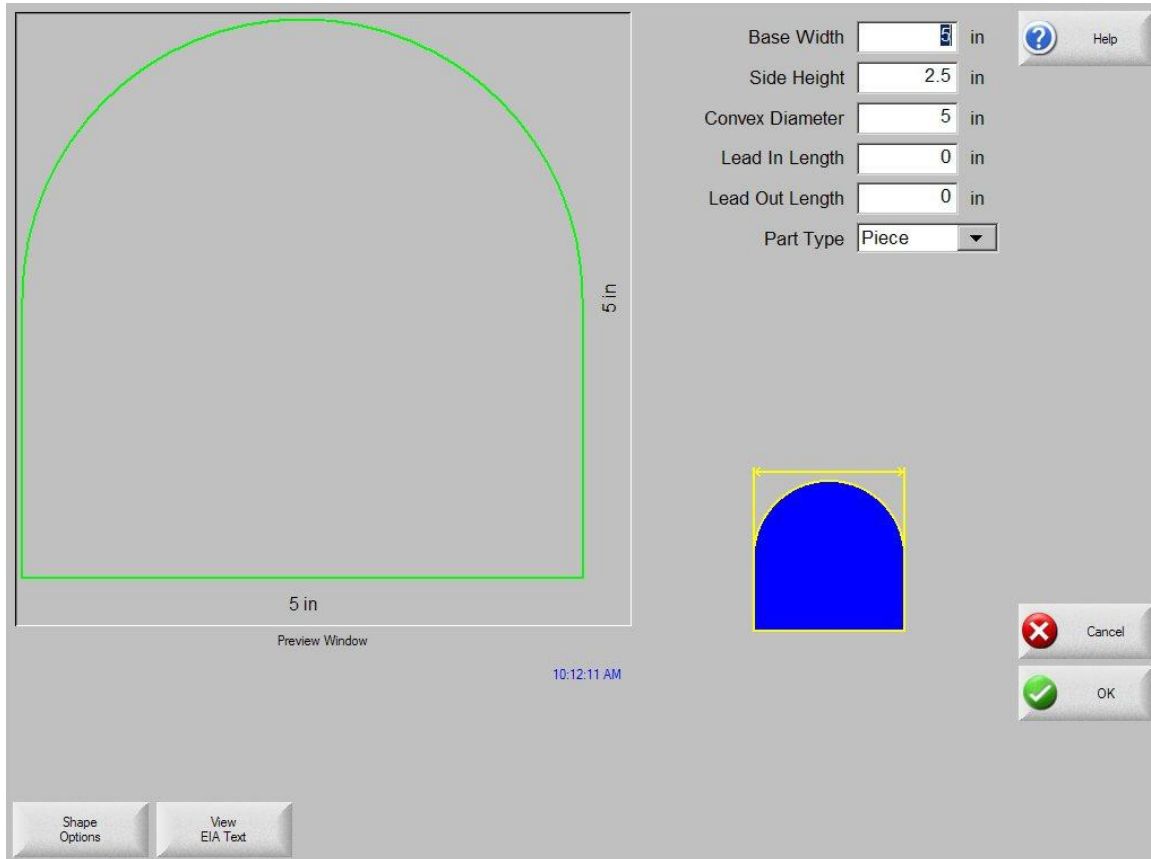Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

Note: Some shapes will offer drop down fields to increase options with additional parameters.

Cross w/ Circular Hole and Concave Inside Corners

Left Width	1.5	in
Center Width	2	in
Right Width	1.5	in
Top Height	1.5	in
Center Height	2	in
Bottom Height	1.5	in
Hole Diameter	1.5	in
Inside Corner Radius	0.5	in
Lead In Radius	0	in
Lead Out Radius	0	in

Preview Window

10:14:21 AM

Shape Options

View EIA Text

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

While you are entering in parameters, the control is performing some general checks for proper geometries. Should the control encounter a set of parameters that do not make sense, a warning message will be displayed and the parameters in conflict will be highlighted in red. **Note**: It is not possible to check for all improper geometries and it may still be possible to enter in a part that does not make geometric sense.

As you are entering dimensional parameters, the control is automatically drawing your new shape with the entered values. This is extremely useful in providing a visual check of the shape that has been entered.

Lead-In, Lead-Out
Enter the appropriate value to ensure proper piercing (Lead-in) and gas bleed-off (Lead-out) to obtain optimum cut quality.

The location for the lead-in and lead-out is fixed, but can be changed by using the ShapeWizard and then saving the new shape to disk. *Note:* the Rectangle simple shape has the ability to select the location for the lead-in and lead-out by pressing the SPACE key. Pressing the SPACE key will move the lead-in and lead-out to the next available location.

Overburn Length
Overburn is used for parts that contain a circular element. Overburn specifies arc length that the torch will travel past the circle closure point. The dimension entered is the chord length of the overburn-arc.

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Part Type
Selects whether you want to cut the part as a separate Piece or a Hole in a larger part. Chain cut options are available for simple shapes that have external cut paths.

Lead Type
Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

Note: Some shapes will offer drop down fields to increase options with additional parameters.

4 Sided Convex Rectangle

Library Shape Setup

Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

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Lead-In, Lead-Out
Enter the appropriate value to ensure proper piercing (Lead-in) and gas bleed-off (Lead-out) to obtain optimum cut quality.

The location for the lead-in and lead-out is fixed, but can be changed by using the ShapeWizard and then saving the new shape to disk. *Note:* the Rectangle simple shape has the ability to select the location for the lead-in and lead-out by pressing the SPACE key. Pressing the SPACE key will move the lead-in and lead-out to the next available location.

Overburn Length
Overburn is used for parts that contain a circular element. Overburn specifies arc length that the torch will travel past the circle closure point. The dimension entered is the chord length of the overburn-arc.

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Part Type
Selects whether you want to cut the part as a separate Piece or a Hole in a larger part. Chain cut options are available for simple shapes that have external cut paths.

Lead Type
Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

Note: Some shapes will offer drop down fields to increase options with additional parameters.

4 Sided Concave Rectangle

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

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As you are entering dimensional parameters, the control is automatically drawing your new shape with the entered values. This is extremely useful in providing a visual check of the shape that has been entered.

Lead-In, Lead-Out
Enter the appropriate value to ensure proper piercing (Lead-in) and gas bleed-off (Lead-out) to obtain optimum cut quality.

The location for the lead-in and lead-out is fixed, but can be changed by using the ShapeWizard and then saving the new shape to disk. *Note:* the Rectangle simple shape has the ability to select the location for the lead-in and lead-out by pressing the SPACE key. Pressing the SPACE key will move the lead-in and lead-out to the next available location.

Overburn Length
Overburn is used for parts that contain a circular element. Overburn specifies arc length that the torch will travel past the circle closure point. The dimension entered is the chord length of the overburn-arc.

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Part Type
Selects whether you want to cut the part as a separate Piece or a Hole in a larger part. Chain cut options are available for simple shapes that have external cut paths.

Lead Type
Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

Note: Some shapes will offer drop down fields to increase options with additional parameters.

Pipe Mount

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

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As you are entering dimensional parameters, the control is automatically drawing your new shape with the entered values. This is extremely useful in providing a visual check of the shape that has been entered.

Lead-In, Lead-Out
Enter the appropriate value to ensure proper piercing (Lead-in) and gas bleed-off (Lead-out) to obtain optimum cut quality.

The location for the lead-in and lead-out is fixed, but can be changed by using the ShapeWizard and then saving the new shape to disk. *Note:* the Rectangle simple shape has the ability to select the location for the lead-in and lead-out by pressing the SPACE key. Pressing the SPACE key will move the lead-in and lead-out to the next available location.

Overburn Length
Overburn is used for parts that contain a circular element. Overburn specifies arc length that the torch will travel past the circle closure point. The dimension entered is the chord length of the overburn-arc.

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Part Type
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Lead Type
Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

Note: Some shapes will offer drop down fields to increase options with additional parameters.

Bolt Hole Circle

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

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As you are entering dimensional parameters, the control is automatically drawing your new shape with the entered values. This is extremely useful in providing a visual check of the shape that has been entered.

Lead-In, Lead-Out
Enter the appropriate value to ensure proper piercing (Lead-in) and gas bleed-off (Lead-out) to obtain optimum cut quality.

The location for the lead-in and lead-out is fixed, but can be changed by using the ShapeWizard and then saving the new shape to disk. *Note:* the Rectangle simple shape has the ability to select the location for the lead-in and lead-out by pressing the SPACE key. Pressing the SPACE key will move the lead-in and lead-out to the next available location.

Overburn Length
Overburn is used for parts that contain a circular element. Overburn specifies arc length that the torch will travel past the circle closure point. The dimension entered is the chord length of the overburn-arc.

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Part Type
Selects whether you want to cut the part as a separate Piece or a Hole in a larger part. Chain cut options are available for simple shapes that have external cut paths.

Lead Type
Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

Note: Some shapes will offer drop down fields to increase options with additional parameters.

Bolt Hole Flange

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

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As you are entering dimensional parameters, the control is automatically drawing your new shape with the entered values. This is extremely useful in providing a visual check of the shape that has been entered.

Lead-In, Lead-Out
Enter the appropriate value to ensure proper piercing (Lead-in) and gas bleed-off (Lead-out) to obtain optimum cut quality.

The location for the lead-in and lead-out is fixed, but can be changed by using the ShapeWizard and then saving the new shape to disk. *Note:* the Rectangle simple shape has the ability to select the location for the lead-in and lead-out by pressing the SPACE key. Pressing the SPACE key will move the lead-in and lead-out to the next available location.

Overburn Length
Overburn is used for parts that contain a circular element. Overburn specifies arc length that the torch will travel past the circle closure point. The dimension entered is the chord length of the overburn-arc.

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Part Type
Selects whether you want to cut the part as a separate Piece or a Hole in a larger part. Chain cut options are available for simple shapes that have external cut paths.

Lead Type
Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

Note: Some shapes will offer drop down fields to increase options with additional parameters.

Bolt Hole Rectangle

Base Width	5	in
Overall Height	5	in
Bolt Hole Diameter	0.75	in
Bolt Hole Offset Width	1	in
Bolt Hole Offset Height	1	in
Lead In	0	in
Overburn Length	0	in
Lead Out	0	in
Bolt Hole Lead Type	Radius	

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

While you are entering in parameters, the control is performing some general checks for proper geometries. Should the control encounter a set of parameters that do not make sense, a warning message will be displayed and the parameters in conflict will be highlighted in red. **Note**: It is not possible to check for all improper geometries and it may still be possible to enter in a part that does not make geometric sense.

As you are entering dimensional parameters, the control is automatically drawing your new shape with the entered values. This is extremely useful in providing a visual check of the shape that has been entered.

Lead-In, Lead-Out
Enter the appropriate value to ensure proper piercing (Lead-in) and gas bleed-off (Lead-out) to obtain optimum cut quality.

The location for the lead-in and lead-out is fixed, but can be changed by using the ShapeWizard and then saving the new shape to disk. *Note:* the Rectangle simple shape has the ability to select the location for the lead-in and lead-out by pressing the SPACE key. Pressing the SPACE key will move the lead-in and lead-out to the next available location.

Overburn Length
Overburn is used for parts that contain a circular element. Overburn specifies arc length that the torch will travel past the circle closure point. The dimension entered is the chord length of the overburn-arc.

In some cases it is desirable to have an underburn length. For these conditions, simply enter a negative number for the Overburn length.

Part Type
Selects whether you want to cut the part as a separate Piece or a Hole in a larger part. Chain cut options are available for simple shapes that have external cut paths.

Lead Type
Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

Note: Some shapes will offer drop down fields to increase options with additional parameters.

Bolt Hole Rectangle w/ Convex Corners

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

While you are entering in parameters, the control is performing some general checks for proper geometries. Should the control encounter a set of parameters that do not make sense, a warning message will be displayed and the parameters in conflict will be highlighted in red. **Note**: It is not possible to check for all improper geometries and it may still be possible to enter in a part that does not make geometric sense.

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Lead-In, Lead-Out
Enter the appropriate value to ensure proper piercing (Lead-in) and gas bleed-off (Lead-out) to obtain optimum cut quality.

The location for the lead-in and lead-out is fixed, but can be changed by using the ShapeWizard and then saving the new shape to disk. *Note:* the Rectangle simple shape has the ability to select the location for the lead-in and lead-out by pressing the SPACE key. Pressing the SPACE key will move the lead-in and lead-out to the next available location.

Overburn Length
Overburn is used for parts that contain a circular element. Overburn specifies arc length that the torch will travel past the circle closure point. The dimension entered is the chord length of the overburn-arc.

In some cases it is desirable to have an underburn length. For these conditions, simply enter a negative number for the Overburn length.

Part Type
Selects whether you want to cut the part as a separate Piece or a Hole in a larger part. Chain cut options are available for simple shapes that have external cut paths.

Lead Type
Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

Note: Some shapes will offer drop down fields to increase options with additional parameters.

Bolt Hole Rectangle w/ Center Hole

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

While you are entering in parameters, the control is performing some general checks for proper geometries. Should the control encounter a set of parameters that do not make sense, a warning message will be displayed and the parameters in conflict will be highlighted in red. **Note**: It is not possible to check for all improper geometries and it may still be possible to enter in a part that does not make geometric sense.

As you are entering dimensional parameters, the control is automatically drawing your new shape with the entered values. This is extremely useful in providing a visual check of the shape that has been entered.

Lead-In, Lead-Out
Enter the appropriate value to ensure proper piercing (Lead-in) and gas bleed-off (Lead-out) to obtain optimum cut quality.

The location for the lead-in and lead-out is fixed, but can be changed by using the ShapeWizard and then saving the new shape to disk. *Note:* the Rectangle simple shape has the ability to select the location for the lead-in and lead-out by pressing the SPACE key. Pressing the SPACE key will move the lead-in and lead-out to the next available location.

Overburn Length
Overburn is used for parts that contain a circular element. Overburn specifies arc length that the torch will travel past the circle closure point. The dimension entered is the chord length of the overburn-arc.

In some cases it is desirable to have an underburn length. For these conditions, simply enter a negative number for the Overburn length.

Part Type
Selects whether you want to cut the part as a separate Piece or a Hole in a larger part. Chain cut options are available for simple shapes that have external cut paths.

Lead Type
Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

Note: Some shapes will offer drop down fields to increase options with additional parameters.

Bolt Hole Rectangle w/ Center Hole and Convex Corners

Base Width	5	in
Overall Height	5	in
Corner Radius	0.75	in
Center Diameter	1.5	in
Bolt Hole Diameter	0.75	in
Bolt Hole Offset Width	1	in
Bolt Hole Offset Height	1	in
Lead In Radius	0	in
Overburn Length	0	in
Lead Out Radius	0	in

Preview Window

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Shape Options   View EIA Text

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

While you are entering in parameters, the control is performing some general checks for proper geometries. Should the control encounter a set of parameters that do not make sense, a warning message will be displayed and the parameters in conflict will be highlighted in red. **Note**: It is not possible to check for all improper geometries and it may still be possible to enter in a part that does not make geometric sense.

As you are entering dimensional parameters, the control is automatically drawing your new shape with the entered values. This is extremely useful in providing a visual check of the shape that has been entered.

Lead-In, Lead-Out
Enter the appropriate value to ensure proper piercing (Lead-in) and gas bleed-off (Lead-out) to obtain optimum cut quality.

The location for the lead-in and lead-out is fixed, but can be changed by using the ShapeWizard and then saving the new shape to disk. *Note:* the Rectangle simple shape has the ability to select the location for the lead-in and lead-out by pressing the SPACE key. Pressing the SPACE key will move the lead-in and lead-out to the next available location.

Overburn Length
Overburn is used for parts that contain a circular element. Overburn specifies arc length that the torch will travel past the circle closure point. The dimension entered is the chord length of the overburn-arc.

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Part Type
Selects whether you want to cut the part as a separate Piece or a Hole in a larger part. Chain cut options are available for simple shapes that have external cut paths.

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Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

Note: Some shapes will offer drop down fields to increase options with additional parameters.

Rounded L-Bracket

Base Width	5	in
Top Width	2.5	in
Overall Height	5	in
Side Height	2.5	in
End Radius	0.5	in
Elbow Radius	1	in
Lead In Radius	0	in
Lead Out Radius	0	in
Part Type	Piece	
Lead Type	Radius	

5 in

5 in

Preview Window

10:37:40 AM

Help

Cancel

OK

Shape Options

View EIA Text

Library Shape Setup
Enter in the desired dimensions to obtain the part you require. There will be a small Help icon in the lower right hand corner of the display to indicate which parameter the control is looking for. The current parameter being entered will be highlighted with a yellow arrow.

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Overburn Length
Overburn is used for parts that contain a circular element. Overburn specifies arc length that the torch will travel past the circle closure point. The dimension entered is the chord length of the overburn-arc.

In some cases it is desirable to have an underburn length. For these conditions, simply enter a negative number for the Overburn length.

Part Type
Selects whether you want to cut the part as a separate Piece or a Hole in a larger part. Chain cut options are available for simple shapes that have external cut paths.

Lead Type
Depending on the shape selected, the style of the Lead in/ Lead out may be selected as Radius, Lock or Straight line. The Lock style Lead-in creates greater stability for the part and is only available if the Part Type is set to Piece. Lead-in selection is only available if the Part Type is set to Piece or Hole.

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Horseshoe

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Convex Roof Trapezoid w/ Hole

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Convex Roof Polygon w/ Hole

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Convex Roof Polygon w/ Oval Hole and Concave Bottom

Convex Diameter	3.25	in
Hole Width	1.5	in
Hole Height	2.25	in
Left Side to Hole	2.5	in
Right Side to Hole	2.5	in
Bottom to Hole	2.375	in
Side Height	0.75	in
Bottom Radius	8	in
Lead In	0	in
Lead Out	0	in

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Pulley Cover

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Paddle Blind

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Water Pump Gasket

Library Shape Setup

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Frame

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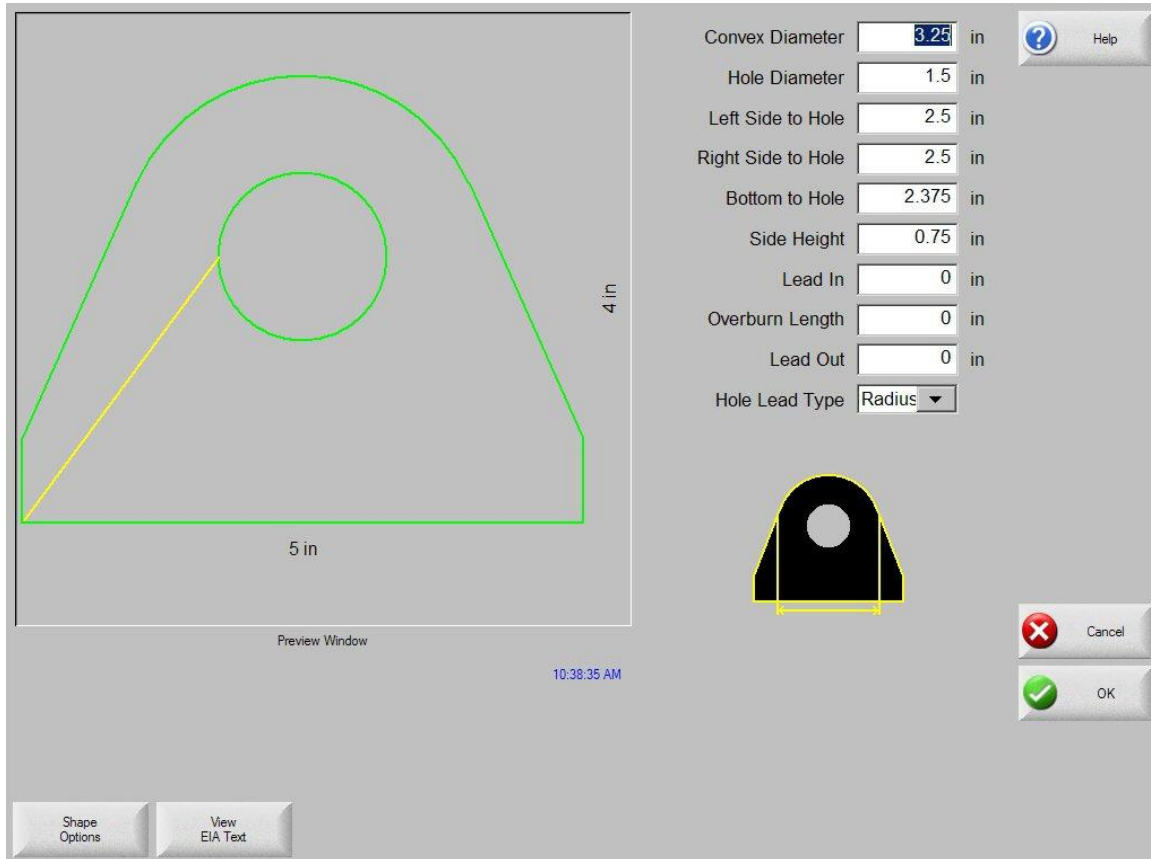
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Sprocket

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Test Pattern

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Part Options

There are a number of options available under the Part Options soft key. These options can be used to customize the current part loaded into working memory. All options will display the effects of the changes in the Preview Window.
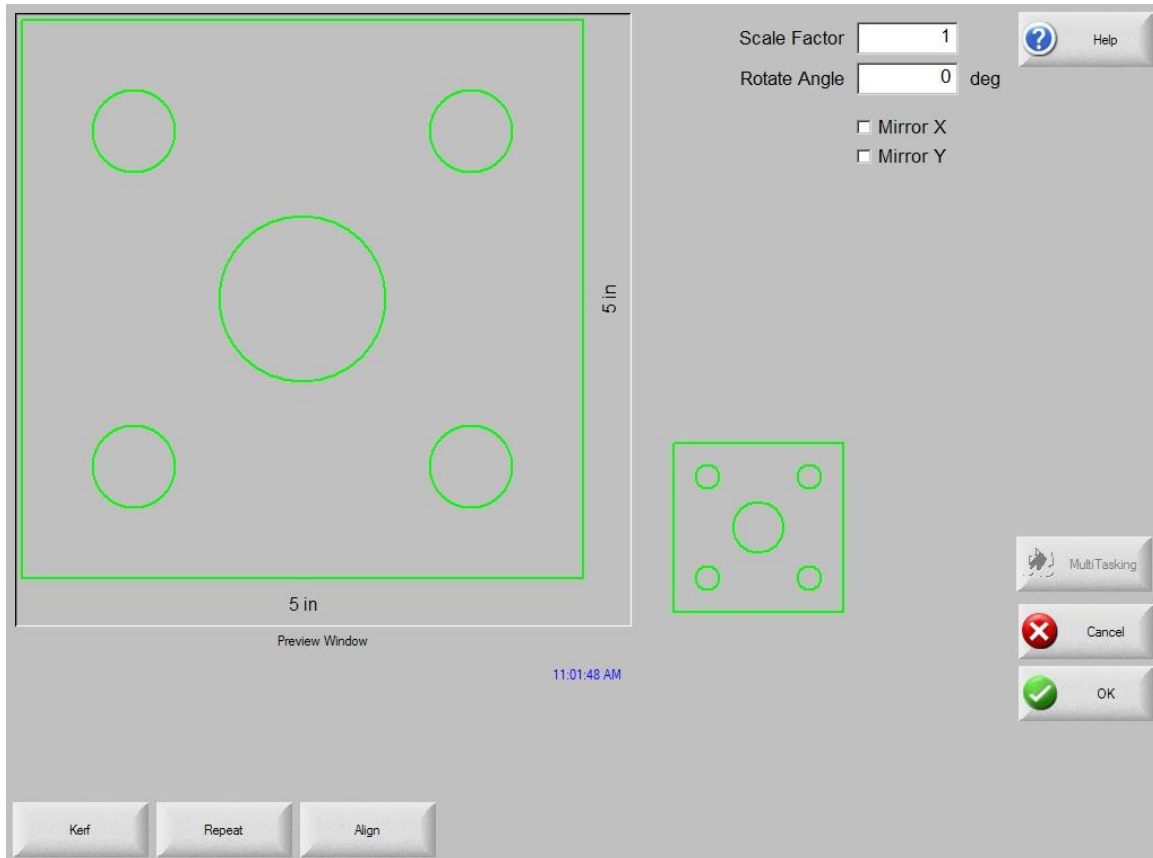
Scale Factor
Allows the operator to scale the current part in memory by a programmed factor. After a new scale factor has been entered, the part will be redrawn and its overall dimensions shown. Scale factor must be greater than zero.

Rotate Angle
Allows the operator to rotate the current part in memory by a programmed value. After a new rotate angle has been entered, the new part will be displayed in the Preview window. Rotate angle can be any positive or negative angle.

Mirror X/Mirror Y
These checkboxes allow the X and/ or Y dimensions to be negated. The result will be a mirror image of the current part in memory.

Keypad operation: Press the NEXT or ENTER key to toggle to the X or Y field. Once on the field, the SPACE key will place a checkmark in the current highlighted field.

Kerf
Pressing the Kerf soft key will graphically show the kerf cut path in a light blue color. This can be extremely valuable in visually seeing the Kerf path prior to cutting. Pressing the button again turns the Kerf part graphics off.
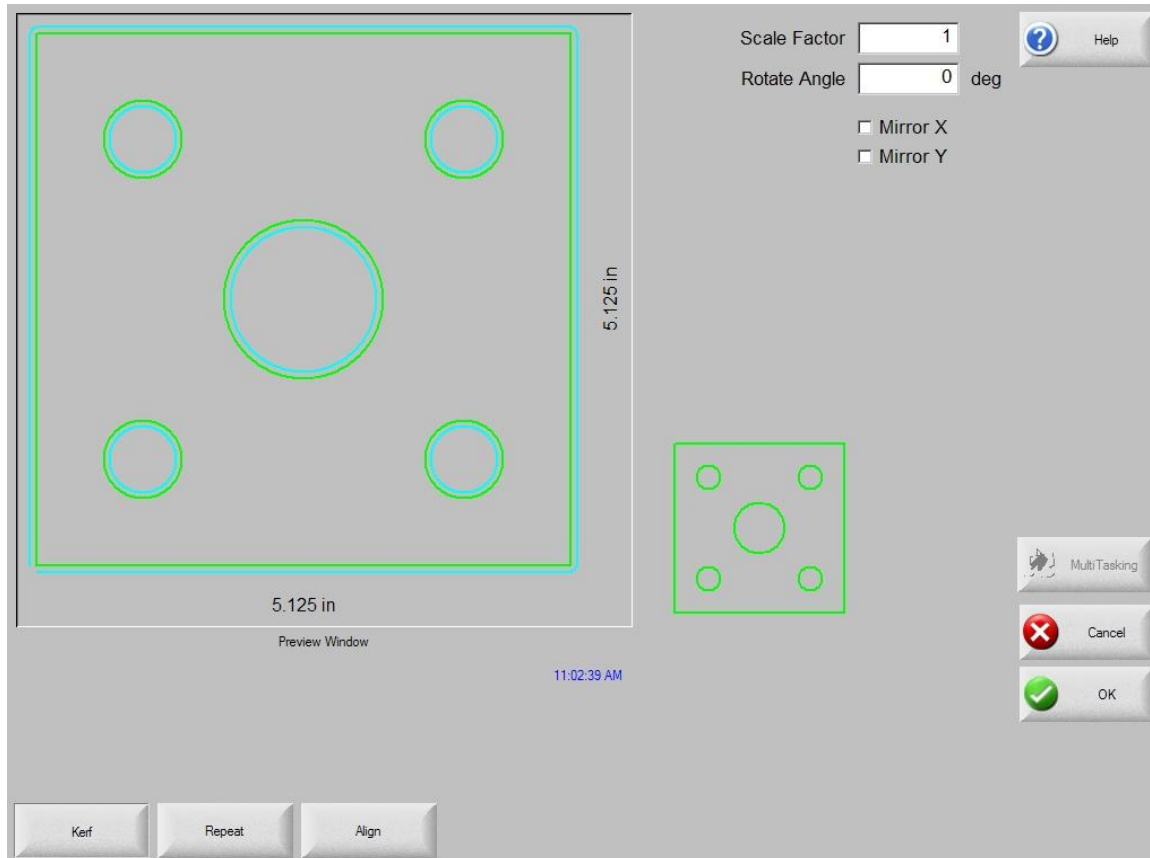
Repeat

The control has three built-in automatic repeat types: Straight, Staggered, and Nested.

Straight Repeat
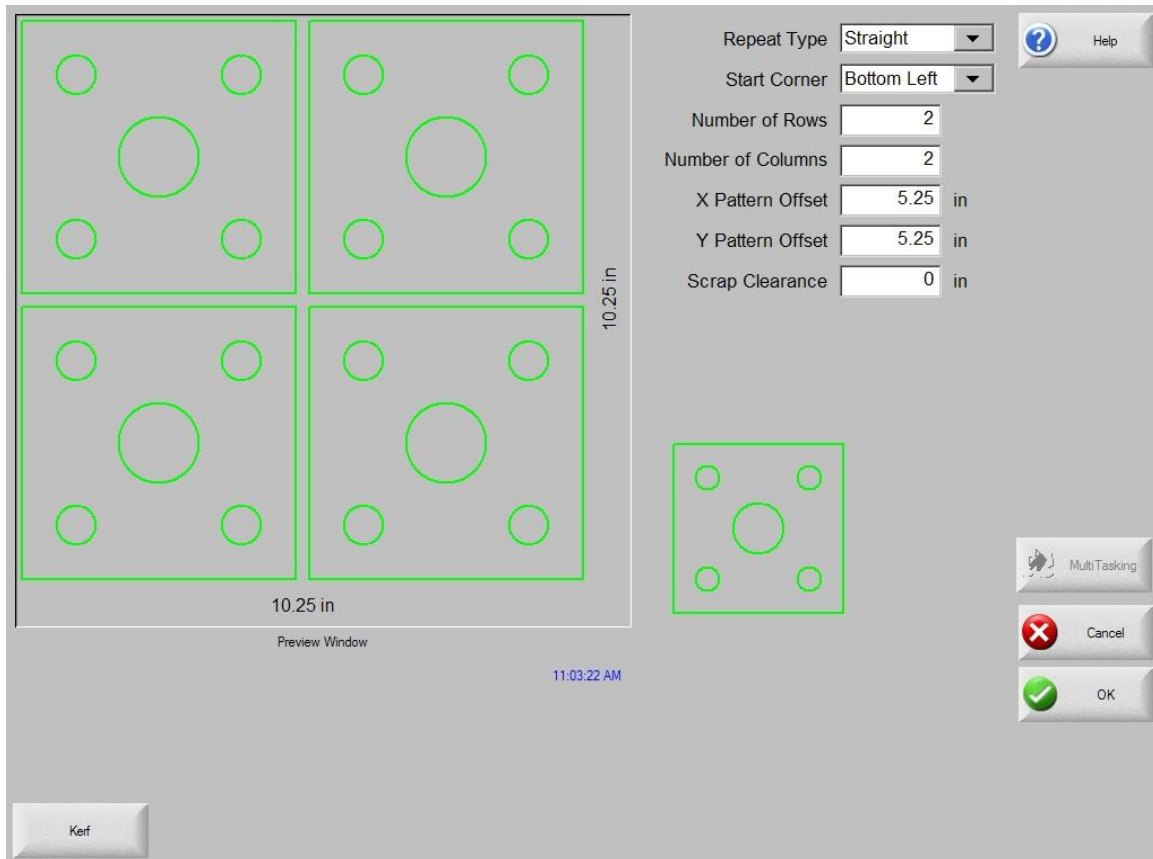
Repeat Type
Allows the user to select which type of the three repeats to use: Straight, Staggered or Nested

Start Corner
Allows the user to select which corner of the plate from which to start the shape repeat.

Number of Rows
Program the number of rows to cut.

Number of Columns
Program the number of columns.

X Pattern Offset/Y Pattern Offset
The control automatically calculates the pattern offset based on the dimension of the current part in memory.

Scrap Clearance
Allows the user to insert scrap clearance between parts in the grid pattern. The same value is used for X and Y dimensions.

X Nest Distance/Y Nest Distance
The control automatically calculates the nest offset based on the dimension of the current part in memory. This parameter is only available for the Nested type of repeat.

Staggered Repeat
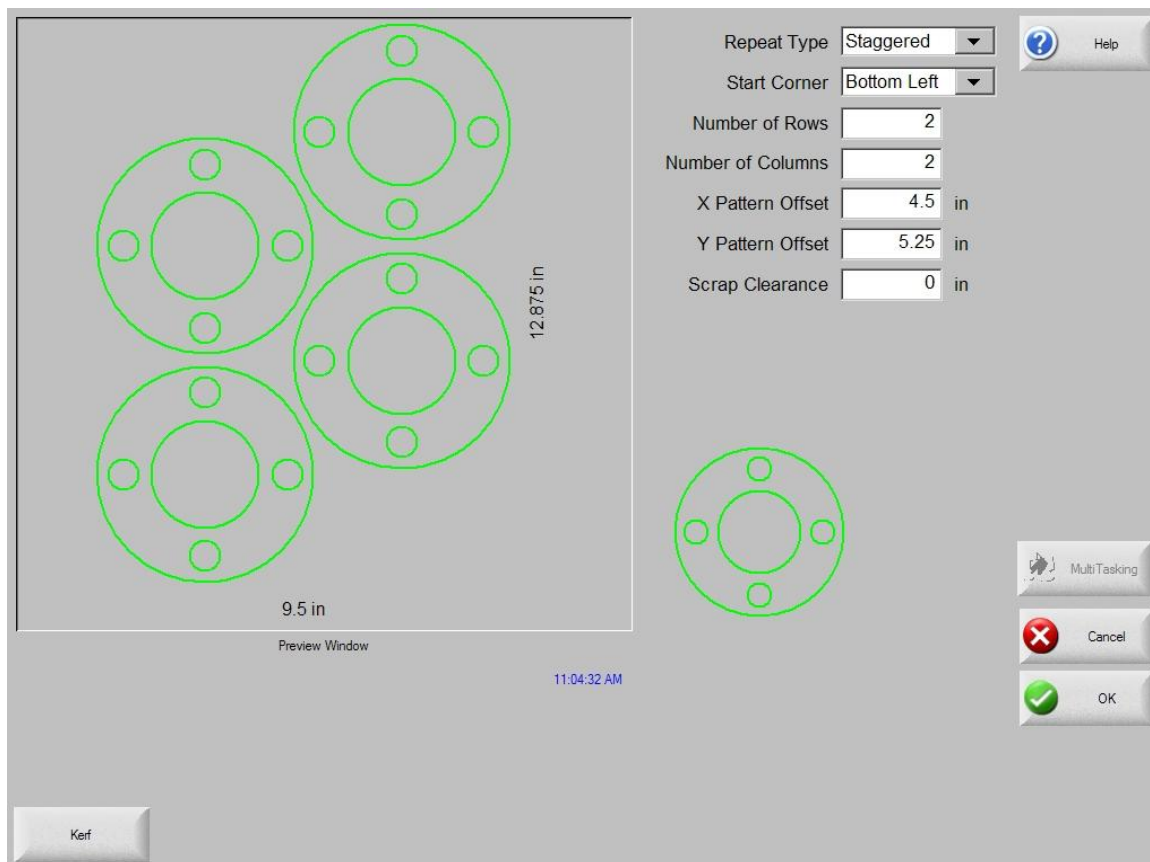
Nested Repeat
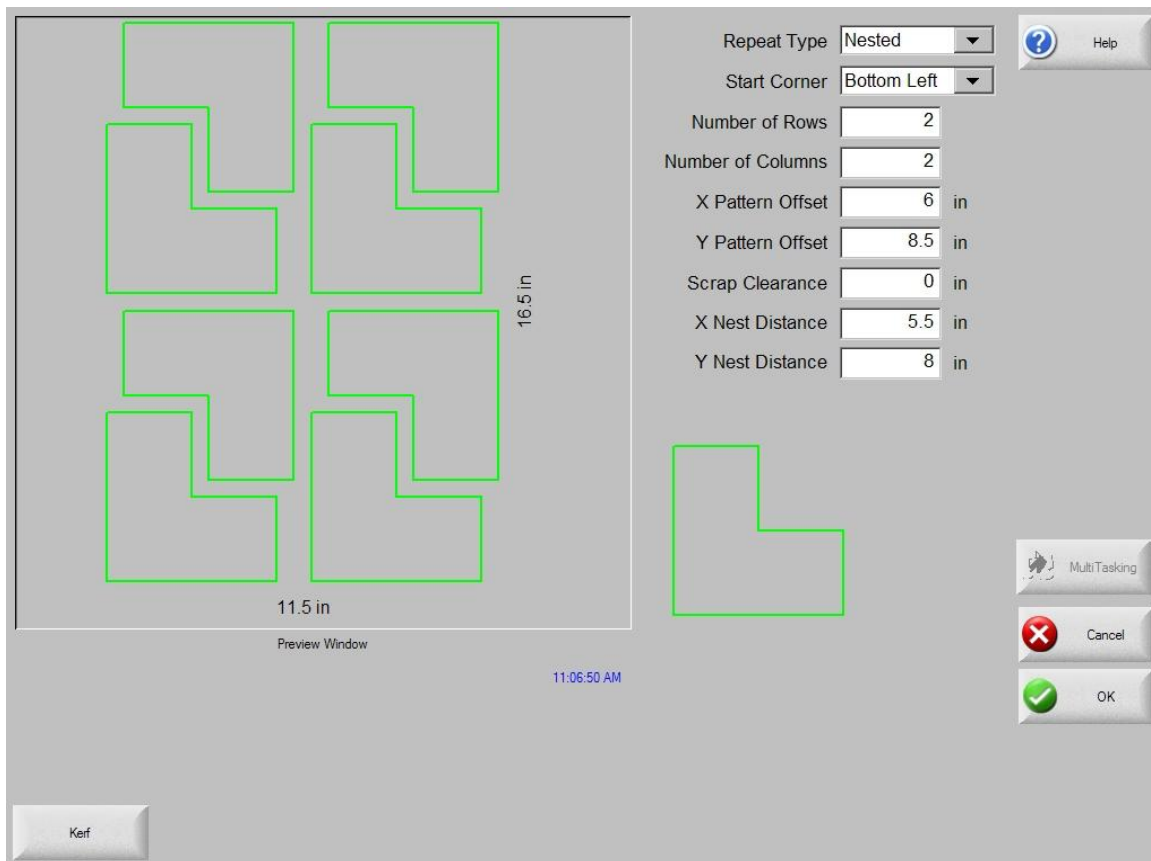
Pattern Offsets
The control has an automated feature that calculates the minimum spacing required between repeated parts. This is based on the size of the part (including Lead in and Lead out), the Kerf value and scrap clearance. This calculated spacing is not always optimum but will allow the part to be repeated without overlapping.

The user may choose to use this pre-calculated value or select to manually select new values. As you are entering new pattern offset values, the control will automatically draw the new group pattern with the entered values. This is extremely useful in providing a visual check of the nest as it is entered.

Nest Distance
The control has an automated feature that calculates the minimum spacing required between nested parts. This is based on the size of the part (including Lead in and Lead out), the Kerf value and scrap clearance. This calculated spacing is not always optimum but will allow the part to be repeated without overlapping.

The user may choose to use this pre-calculated value or choose to manually select new values. As you are entering new nest pattern offset values, the control will automatically draw the new nested pattern with the entered values. This is extremely useful in providing a visual check of the nest as it is entered.

Generally, when manually changing the Nest Distance values, it is easiest to start with a simple nest (1 column x 1 row) and perform adjustments based on the graphic display. As the nest Distance

values are adjusted, the pattern displayed on screen will be updated. When the desired Nest Distance has been obtained, increase the nest size to a two column, two row nest. The X and Y pattern offsets can then be adjusted in the same fashion. When the desired nest spacing has been reached, the nest size can be increased to the required volume up to the maximum plate potential.

Align

This screen is used to align the current part in memory into one of the four corners of the plate for cutting. This function also allows for skewed plates to be taken into account when aligning the part.

Part Alignment is used to position a part or nest of parts, on to a squared plate so that it will fit on to the plate. This is commonly with parts that have an internal pierce point such as a flange.

Skew Alignment is used to position a part or nest of parts, on to a skewed or angled plate so that it will fit accurately onto the plate without going over the edges. This is commonly used with a nest of parts which has little margin of error for placement of the nest on to the plate.

Instructions for use

To Align a part to the plate, follow these steps:
1.   Set parameters to those needed for aligning your part in the upper right corner of the screen.
2.   Move the torch to the first corner location ("Corner to Align with") using the jog keys.
3.   Press the "At Corner" soft key.
4.   If performing a Part Alignment, go to step 7. If performing a Skew Alignment, go to step 5.
5.   Move the torch to a point along the edge of the plate towards the selected "Skew Reference".
6.   Press the "At Skew Point" soft key.
7.   Press the OK soft key. The machine will move to the start point for the part and return to the Main screen ready for cutting.
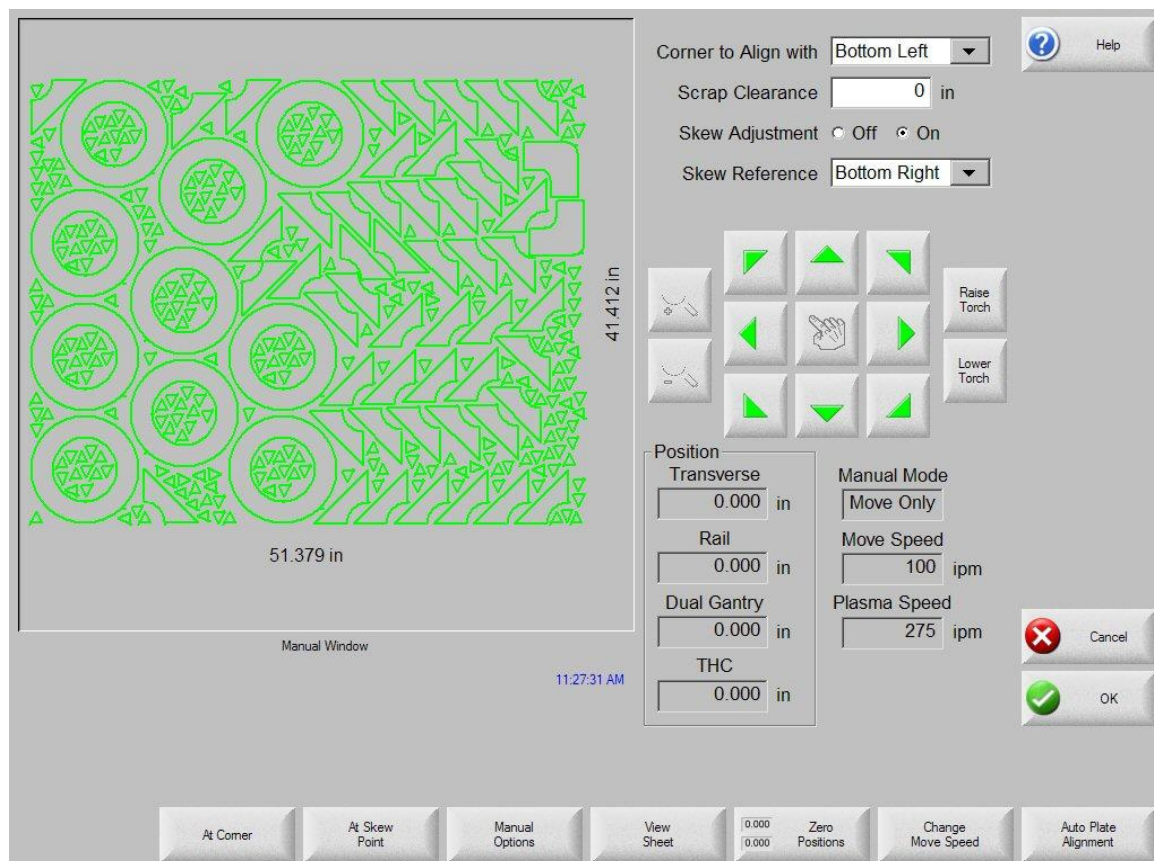
Corner to Align with

Selects the corner of the plate to align the part in.

Scrap Clearance
This is the amount of clearance between the edge of the plate and the part the control will add in when moving to the start point of the part.

Skew Adjustment
This determines if the control will adjust for plate skew when performing the align function.

Skew Reference
This is the skew reference corner which you will move towards and mark a point along the edge. This is only available if Skew Adjustment is On.

At Corner
Press this soft key when at the corner of the plate you want to align the part in.

At Skew Point
Press this soft key when at the edge of the plate for skew adjustment. This is only available if Skew Adjustment is On.

Automatic Plate Alignment (APA)

The Automatic Plate Align (APA) feature is a fully automated function to detect the edges of a rectangular plate and calculate the degree of skew for aligning a part program to the plate. Both five point and three point align sequences are available for use

Five Point Align
This feature uses a five point reference scheme for skew and plate size calculations. When executed, the controller commands motion of the sensor around the plate searching for the edges at five specific reference points. After the five reference points have been detected, the control will position the torch in the proper location to start the part program with the calculated skew.
Set Up/ Notes:
1) The Auto Plate Align Sensor(s) <u>must</u> first be assigned in I/O setups. The logic state(s) must be set so that the input is active when over the plate.

2) The predetermined motion path will move to the outward edges of the plate in five locations and is executed at a fast peed until the Sensor switches to an off state indicating the edge of the plate. For accuracy, motion will then reverse until the sensor is then activated again. Please refer to Sensing Sequence below.

3) The Manual Options "User Defined" Manual Offset value will be used if a X/Y tool offset is required to compensate for the distance between the master torch and the APA Sensor.

4) Scrap clearance, if required, would be entered at the align screen. Additionally, Corner to Align with on the align screen will set the start corner location of the program.

5) If your machine requires "Homing", the Homing function should be performed at some point prior to operation.

6) Sensor radius should be programmed to the "sensing" radius of the sensor. If dual sensors are used the radius applies to both sensors.

7) For dual sensors, the distance between the first and second sensor should be programmed in tool offset #11.

Typical Sensing Sequence

1) Motion will move at high traverse speed or 650ipm / 1600mm/m (whichever is slower).

2) Motion will move back onto the plate at medium traverse speed.

3) Motion will move off the plate at slow traverse speed. Edge of the plate will detected and recorded.
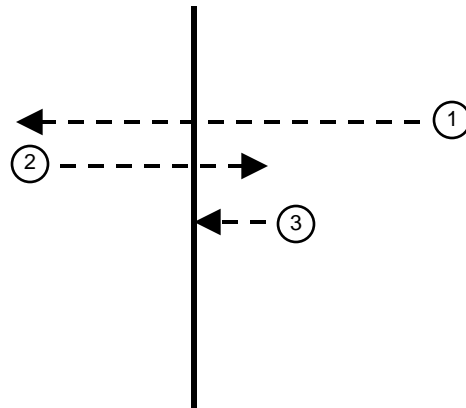
Instructions

1) To start the Automatic Plate Alignment function, manually position the Plate Sensor above the plate. At this point the Auto Plate Align Sensor Input should be active.

2) Press the Automatic Plate Align Soft key at the Part Options screen.

Auto Plate Alignment

3) A motion sequence will then be executed to detect the right, left, top, bottom and bottom right skew reference edges of the plate. In each case, the control will move to the outward edge of the plate until the sensor detects the edge of the plate (off state). The control will then reverse motion at a med speed until the sensor again becomes active then moves off at a slow speed. This position is recorded as the respective reference point. Motion continues until all five points are detected.
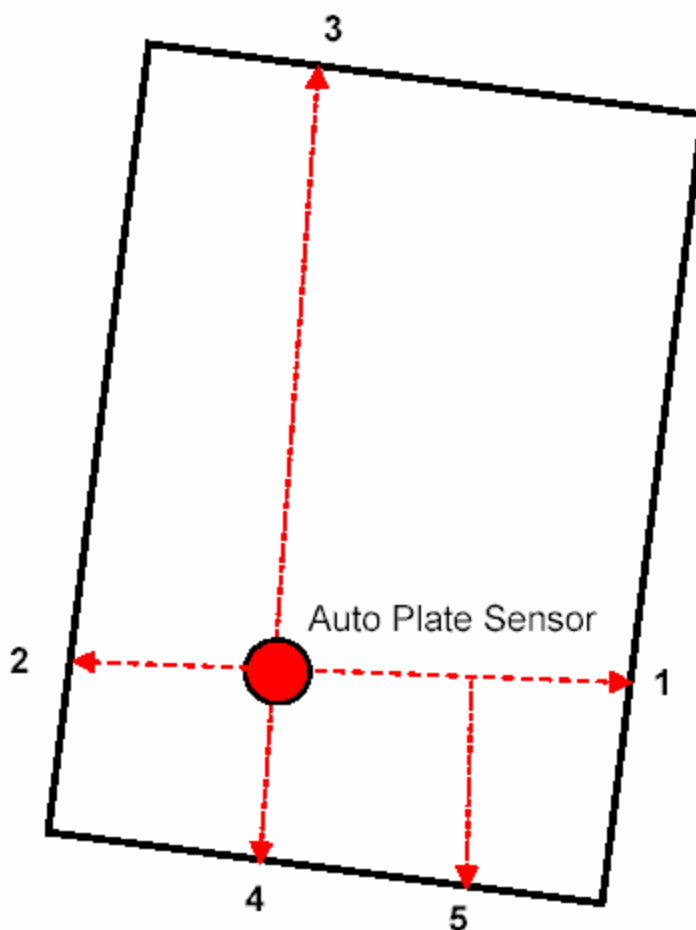
4) Upon completing detection of the five reference points, the control will then position the Plate Sensor (if no tool offset used) or the torch (if a tool offset is used) to the start point of the part program. Scrap Clearance (from the Align screen) and Start Corner (from the Align screen) will also be executed in the final position move, and will set the plate size to the detected dimension.

Three Point Align
When executed, the controller commands motion of the sensor around the plate searching for the edges at three specific reference points on a square plate based on motion commands within the part program. After the three reference points have been detected, the control will position the torch in the proper location to start the part program with the calculated skew. Traverse distance and speeds are defined in the program code to improve the speed and accuracy of the process.

Set Up/ Notes:
1) The Auto Plate Align Sensor(s) <u>must</u> first be assigned in I/O setups. The logic state must be set so that the input(s) are active when over the plate.

2) The 3 point align feature must be enabled in Machine Setup and assign Sensor radius for accuracy.

3) The Manual Options "User Defined" Manual Offset value will be used if a X/Y tool offset is required to compensate for the distance between the master torch and the APA Sensor.

4) Scrap clearance, if required, would be entered at the Align screen. Additionally, Corner to Align With and Skew Point parameters on the Align screen will set the start corner location of the program and sequence for edge detection.

5) If your machine requires "Homing", the Homing function should be performed at some point prior to operation.

6) Insert program codes into the part program.

Program Code
The EIA program code should be placed at the start of the part program. The parameters will be effective until changed or restart.

Three point alignment distance and speeds can be defined with the following EIA format program code.

<div align="center">

G66D100B300C30

</div>

G66 -Three point alignment command

D value - Distance between two plate edge reference points

B value - Rapid feedrate value for distance D motion

C value – Slow feedrate value for distance to Edge
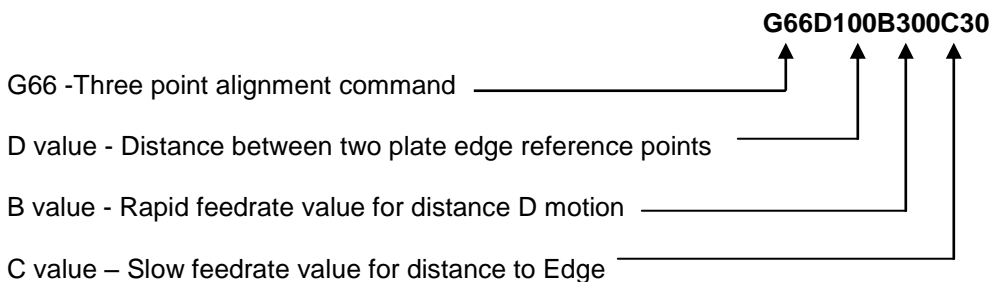
Motion Path
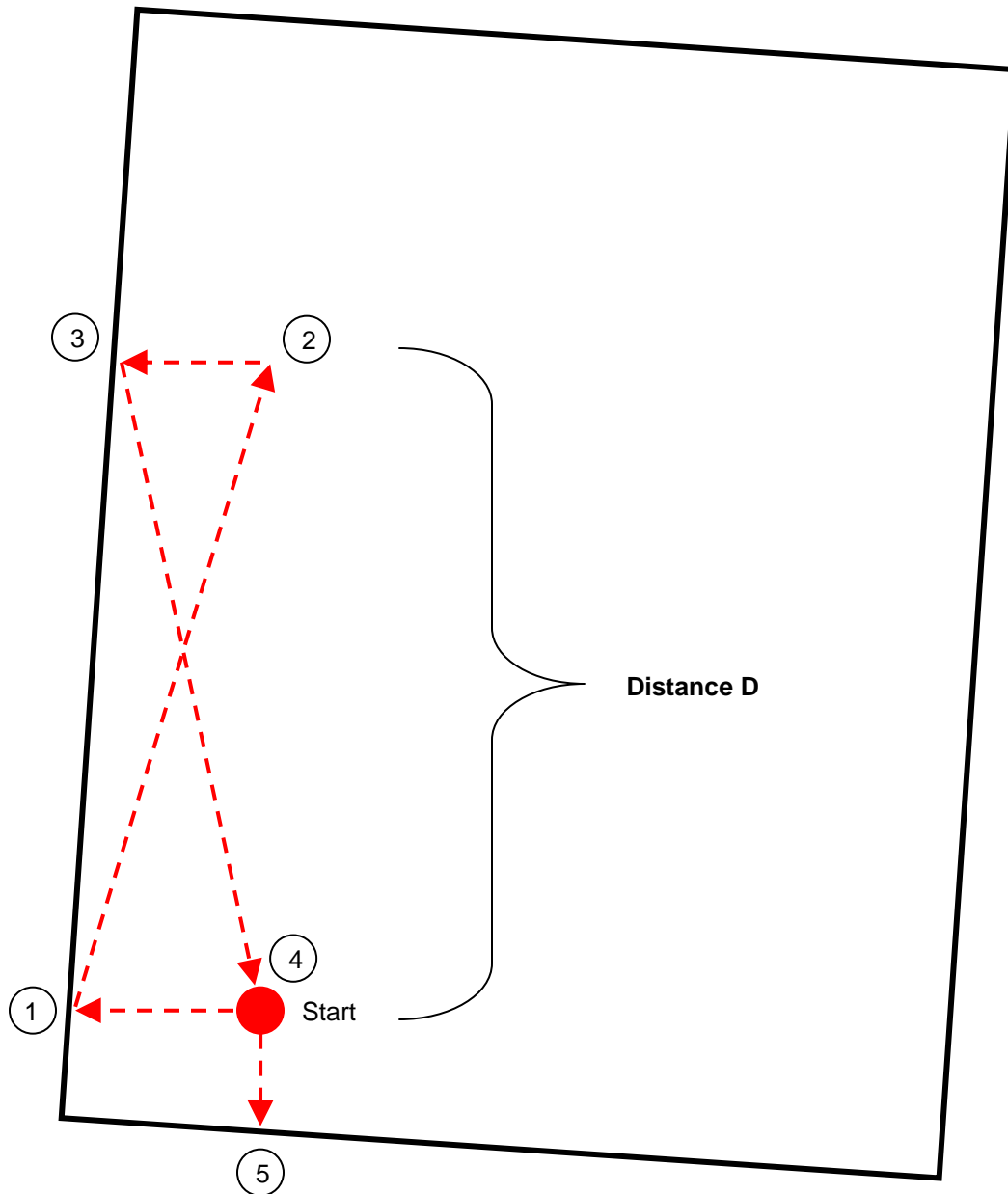
This drawing shows a typical edge detection sequence for the Automatic Align feature with Corner selected as lower left and Skew point selected as upper left on the Align screen. Alternate start points and sequence and may be used by selecting different Corner to Align and Skew Point parameters.

Instructions

1) To begin the auto-align, load the desired part program with the appropriate program codes included at the beginning of the program.

2) To start the Automatic Plate Alignment function, manually position the Plate Sensor above the plate. At this point the Auto Plate Align Sensor Input should be active.

3) Go to PART OPTIONS/ ALIGN. Verify that the correct corner has been selected. Edit parameters for Skew alignment.

4) Press press the Auto Plate Alignment button.

The machine will perform the alignment as previously shown.

Upon completing detection of the three reference points, the control will then position the Plate Sensor (if no tool offset used) or the torch (if a tool offset is used) to the start point of the part program. Scrap Clearance (from the Align screen) and Start Corner (from the Align screen) will also be executed in the final position move.

The part program may be automatically executed at the end of the alignment, or it may wait for cycle start, as selected in the Setup screen.

Dual Sensor Note:
Some sensors may detect the table slats as an extension of the plate during the plate edge detection cycle. For this reason, use of dual sensors is highly recommended.

Sensor radius should be programmed to the "sensing" radius of the sensor. If dual sensors are used the radius applies to both sensors. When a second sensor is used, the first sensor to detect "no plate" will be used for all plate detection at that location.

An appropriate X/Y offset for the two sensors is recommended to minimize the potential that booth sensors would pick up a false plate detection from the slats.   The sensor offset distance should be programmed in tool offset #11.

Cutting

After determining that the cut mode, cut speed and Kerf values are all set correctly, a part can be cut by pressing the START key from the Main window or Manual window. The following window is displayed:
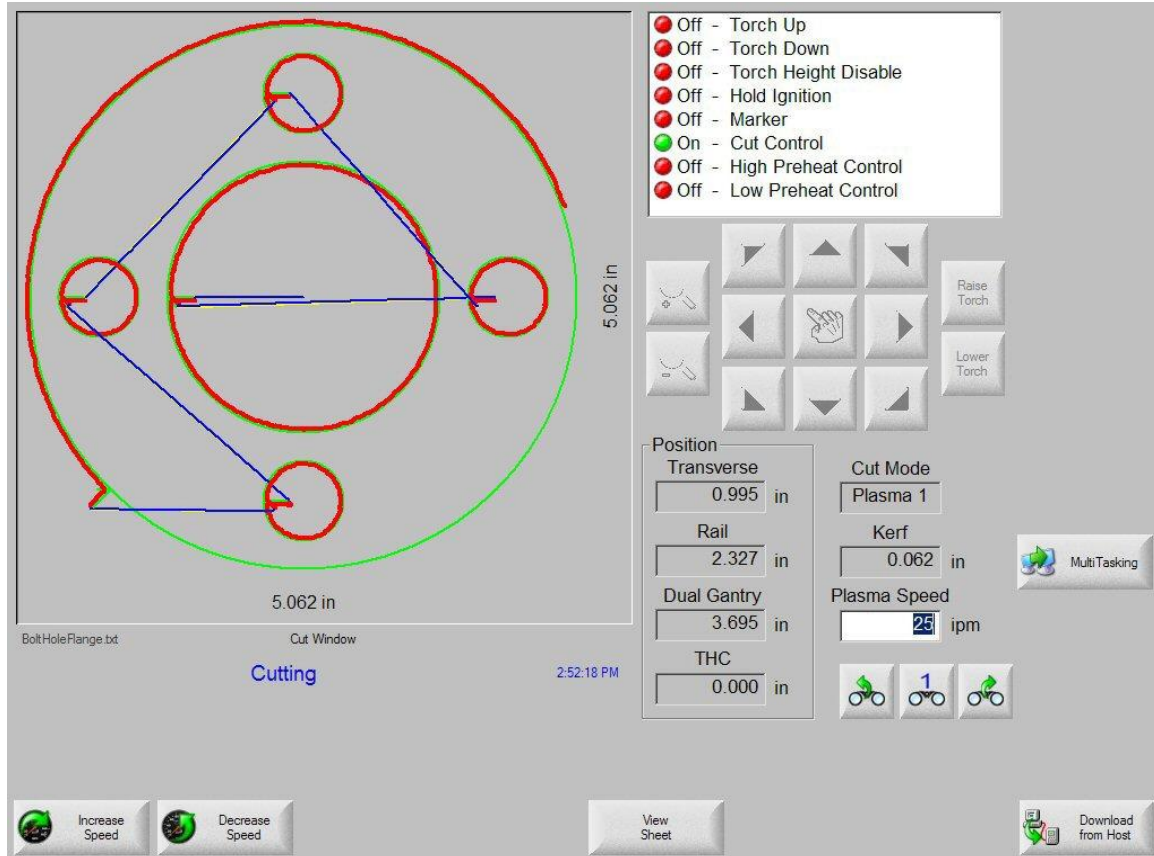
To cut the part, make sure that the Cut Mode is set to the selected cut type and that the Kerf and Cut Speed settings are correct, then press the START key. This initiates cutting in the selected Cut Mode.

To preview the path, press the Change Cut Mode soft key until Trial appears in the Cut Mode window. Pressing the START key causes the cutting device to follow the cut path, but cutting is not activated. Motion is performed at the programmed Speed.

You may stop a cut, at any time, by pressing the STOP key on the front panel. The machine decelerates to a smooth stop along the cut path. If the cutting process was on when the STOP key was pressed, it is de-activated according to the programmed cut logic.

During a cut, the Watch window displays information about the part being cut, such as the current cut speed, current axes positions and path position.

While cutting in sheet view, the control will automatically scroll to keep the cut location centered within the view screen. This feature is useful in normal cutting to closely follow the cut-path while zoomed in.

View Sheet is more useful when proper Plate Size values have been entered in Cutting setups and when the machine has been previously homed. Viewing of large parts when fully zoomed during a

cut may not allow the part to be fully drawn on screen before moving onto the next view location. This may appear as a flashing view screen and may be corrected by zooming out to get a larger view area.

Speed Increase
Pressing the Speed Increase soft key increases the current cut speed by 3%.

Speed Decrease
Pressing the Speed Decrease soft key decreases the current cut speed by 3%.

Note: The user can also double click the speed field to enter a new speed value

Keyboard operation: To change the current cut speed while cutting a part, press the Enter key once to highlight the current cut speed, enter in the desired cut speed and press Enter to accept.

Repeats
If a Shape Repeat option has been enabled, you can also see the number of rows and columns remaining to be cut by pressing the Repeats soft key. The Repeats soft key is shared with the Extend soft key which is only active during initiation of the cut sequence.

Cut Delay Timers
Cut Delay Timers that define the timing logic for the cut are available for both Oxy-Fuel and Plasma at the Cut Types setup screen. When in cut mode, the control displays the preset delays as executed in the lower right corner of the screen.   For certain delay times such as Preheat and Pierce, a continuously updated countdown timer which shows the preset time and time remaining is also displayed. An example of the Preheat Timer is illustrated below:
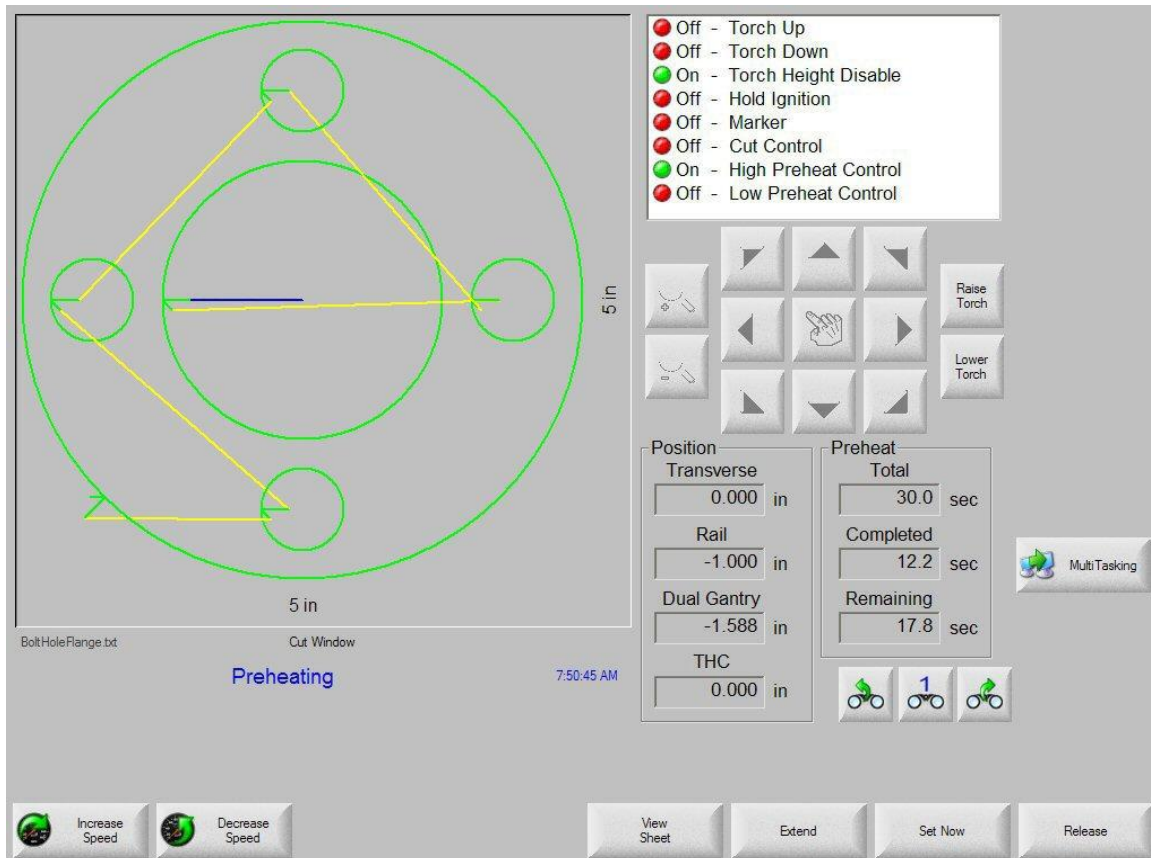
The Preheat times, Total, Completed and Remaining, are shown to a tenth of a second. Activating the Cut Sense input will terminate the Preheat delay time cycle and the time at the point of activation will become the new Preheat time for subsequent cuts. Three soft keys are also displayed which may be used to modify the Preheat cycle in progress. Pressing the Start key twice will bypass the Preheat and Pierce Time Delays and begin the cut for the Oxy Fuel cut mode.

The function of these keys is explained below:

Extend
When pressed, this soft key extends the Preheat timer until it is stopped, either by a Set-Now or Release soft key press.

Set Now
Pressing the Set Now soft key terminates the selected delay timer and saves the new set time. The Set Now soft key is often used in conjunction with the Extend soft key to modify the preset Preheat time.

Release
A Release soft key press will terminate the selected delay timer, but will not modify the original delay time. The original delay time is retained for any remaining pierces.

Multitasking
The multitasking feature allows the user to load and configure a new part program while in the middle of cutting executing current part program. This feature is only available in advanced operation mode.

This feature is only available in Advanced mode. To begin, press the multitasking soft key on screen.

At this time the current part program will be displayed in the lower right corner of the Preview Window. Any new program will be shown in large format in main view area.
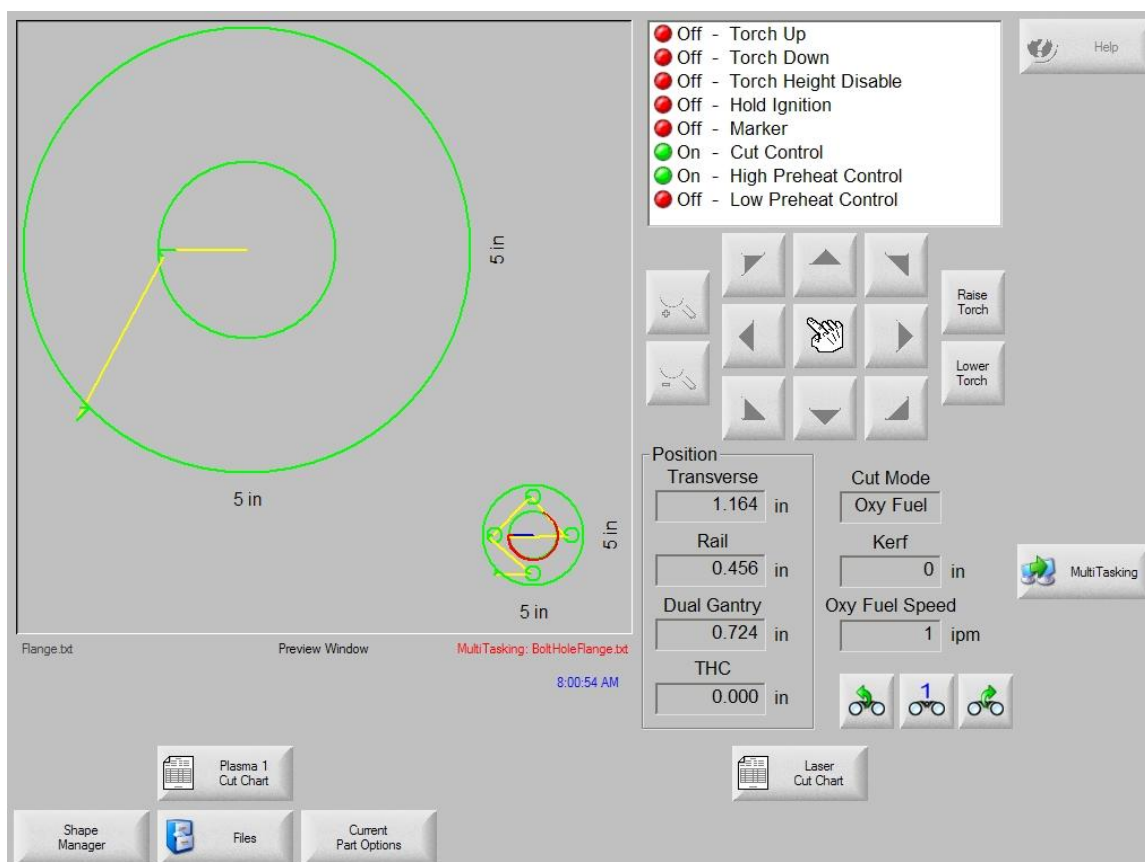
Pressing the multitasking soft key allows the user to switch between the programs.

Pause

For those unavoidable times when the cut process fails, the control has full-featured Cut Loss Recovery capabilities.

The Cut Loss Recovery features of the control are available from the Pause screen, which is reached whenever STOP is pressed or if Cut Sense is lost. The Pause screen appears below.
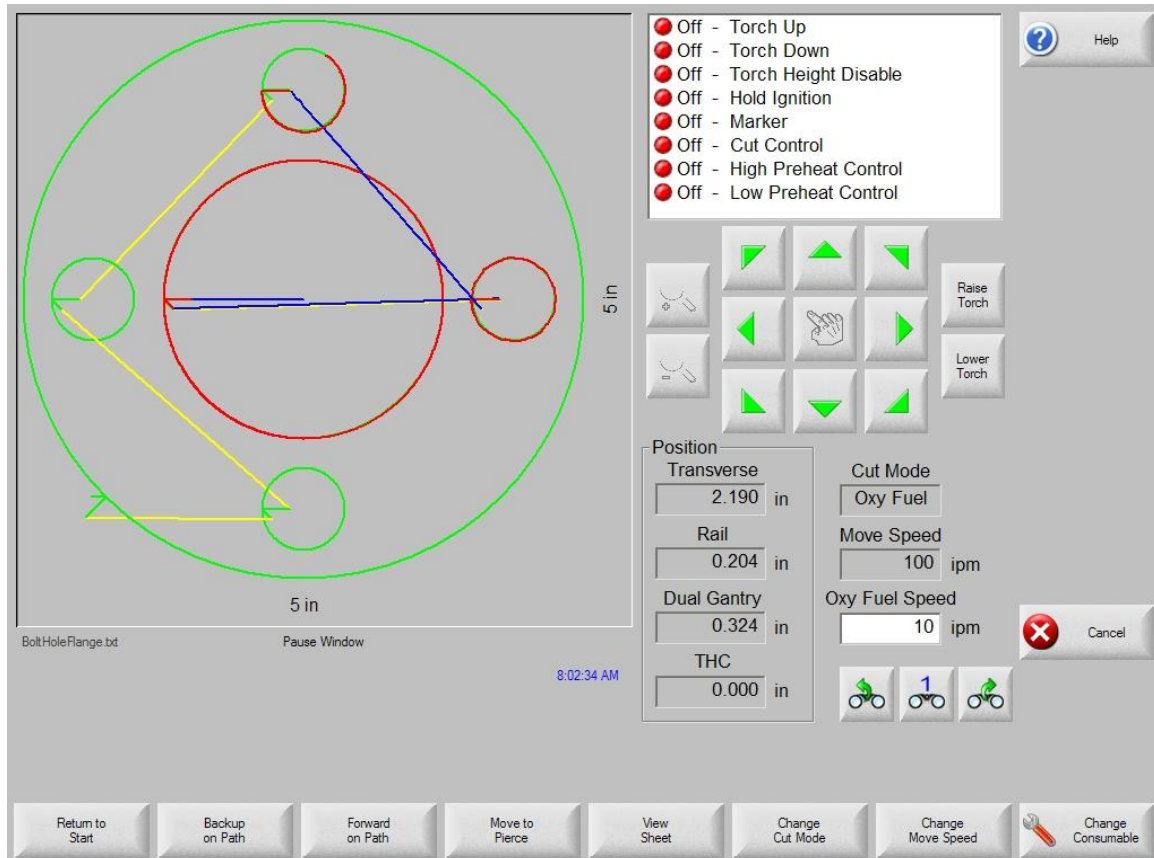
Pressing the CANCEL key while the Pause screen is displayed aborts the current part.

Return to Start
Allows the operator to return to the initial starting point of the part. **Note:** If the Return to Start function is utilized after a cut loss, all information about the current position of the cutting device on the path will be lost.

Backup and Forward on Path
Use these two soft keys to move backwards and to move forward along the cut path at the selected Move Speed to locate the desired pierce restart point. Then press the START key to resume the cut at the programmed cut speed. In addition to all segments of a standard part, the Backup and Forward on Path functions allow full movement through all sections of Shape Repeat part as well.

Like the Manual Mode functions, Backup and Forward on Path use the currently selected Move Speed. The different speeds allow moving rapidly along the path, or precisely positioning the cutting device.

When a cut loss occurs, the initial backup and forward speed is the one that was used last. To toggle between the move speeds, press the Change Move Speed soft key in the Pause window. The corresponding speed is displayed in the Move Speed window.

Move to Pierce
Pressing the Move to Pierce soft key allows the operator to directly move to any pierce point.
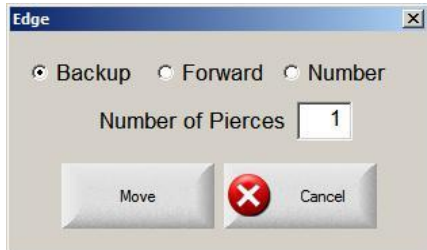
Enter the information for the desired pierce point and press ENTER. The cutting device will move directly to the selected pierce point.

Change Cut Mode
The Change Cut Mode soft key changes the restart mode from Cut to Trial or from Trial to Cut. This allows the operator to move through the part partially as a Cut and partially as an actual Cut.

Change Move Speed
Is used to toggle through the four Move Speeds available. The four Move Speeds are the Maximum Machine Speed, High Jog Speed, Medium Jog Speed and Low Jog Speed from the Speeds setups.

Change Consumable
Takes you to the Change Consumable screen.

On-Path Restart
To restart the cut at the pierce point selected using On-Path Backup, press the START key. The cut speed and the cut mode are the same as they were prior to when the motion was paused, unless the values have been edited in the Watch window.

While the Pause Window is displayed, the Manual arrow keys are fully functional to move the cutting device around. This allows the machine to be moved in any direction (not necessarily along the path) to inspect the partially cut piece. Once the cutting device is moved off the cut path, a different window is displayed. The Off-path Pause Window is shown below:
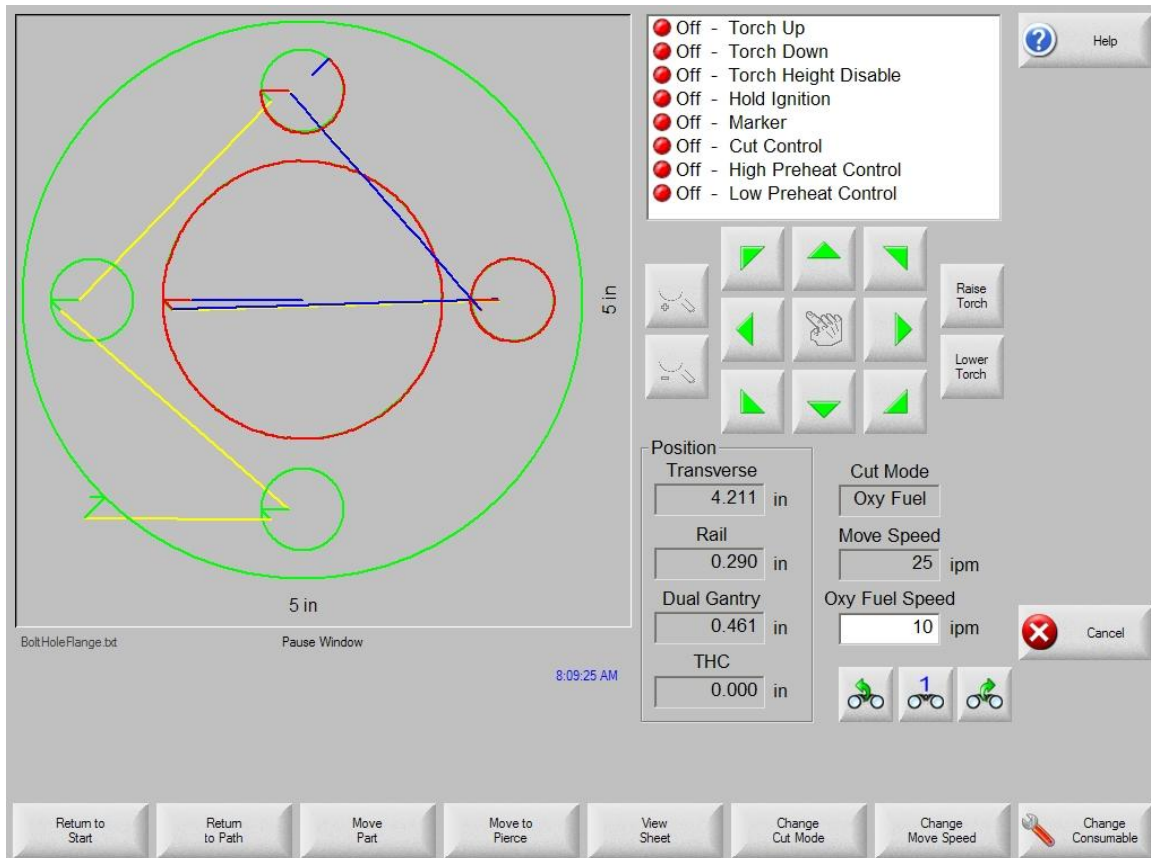
The differences between the On-path Pause Window and the Off-path Pause window are outlined below.

Return to Path
Pressing the Return to Path soft key in the Off-path Pause window returns the cutting device to the point on the cut path from which it was jogged away. Most useful for inspecting or replacing cutting device components after a cut loss and then returning to the cut loss point. When the cutting device is back on the cut path, the On-path Pause Window is restored and the cut may be resumed.

Move Part
When the Move Part soft key is pressed, the entire part is shifted on the plate. The point along the cut path to which the cutting device was moved becomes the new current position of the cutting device. The On-path Pause window is then re-displayed since the cutting device is now back on path.

Off-Path Restart
By pressing the START key from the Off-path Pause window, a lead-in is constructed from the off-path point back to the original part.

In a cut loss situation, the operator would use the Backup on Path key in the On-path Pause window menu to position the cutting device on the cut path where the cut was lost. The operator would then use the Manual arrow keys to jog the cutting device off path to a suitable pierce point. Pressing START at this point causes a new lead-in to be cut from the off-path pierce point to the point along the path from which the cutting device was jogged away. When the cutting device is back on path, it continues along the path to cut the remainder of the part.

Rush Job Interrupt
Rush Job Interrupt allows the user to pause the current part program and retain the part and current position information. When at the Pause screen, press the Cancel key. A prompt will appear on screen to ask the user if they wish to save the part information for later use.
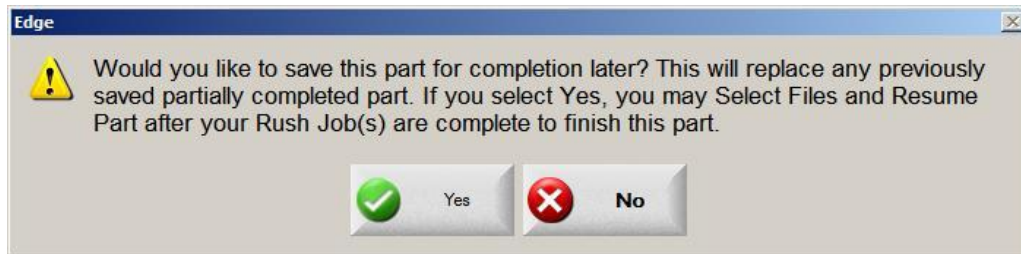
If the user selects YES, the Resume Last Part button will be viewable at the Files Screen. The user can then load and execute another part program and then return to the original part using the Resume Last Part soft key. The part program and position will be resumed.

Change Consumable

This screen is used to keep track of consumable life data for statistical analysis. Additionally, the feature may be used to prompt the operator that a consumable has reached its expected life cycle by using an output from the control to activate an indicator such as an indicator lamp or audible alarm. This feature allows the operator to change the appropriate consumable and avoid a consumable failure that may effect cut quality or damage the torch.

Note: This Change Consumable feature can only track consumable life data and offer features related to that data. The control cannot detect consumable condition or failures.

Overview
If the New Torch Tip or New Electrode soft key is pressed every time a torch tip or electrode is changed, the last information for the corresponding consumable will be added to a database. This database will show the date a consumable was changed and how long it lasted in minutes, pierces, inches and millimeters.

To reset the current consumable value press the New Tip/New Electrode button. Select the desired Torch Tip or Electrode to be updated. The value of the tracking information will be reset to zero and will start counting up as you cut in the selected mode. The "Installed on" date for the selected consumable will be updated and the current values for the selected consumable will be recorded with the date in a database that can be saved to disk.

The database is saved in CSV (Comma Separated Value) format at the control and may be downloaded for use with standard database software programs for productivity and cost analysis. Additionally, this data may also be viewed in the Watch window during cutting.

Which consumable information is updated (Oxy torch 1-12 / Plasma torch 1-8) is determined by the "Station Select 1-20" inputs.

For the example given above Plasma Torch #1 torch tip has a limit of 5000 minutes of operation. After 5000 minutes have been performed on Torch #1, the Change Consumable output will become active. Generally, this output is tied to an indicator lamp or audible alarm. The intent is to set the limits at an expected life value of the consumable so that the operator will be reminded to change the consumable when it has reached its expected life.

The data collected on the consumable life will automatically update to the new highest value. For the example above, the new maximum value could extend above 5000 minutes as the new value is attained (e.g. the value would increment to 5001 and continue to count). This auto update feature may be disabled in the password protected Special Setups screen.

Minutes
This is the estimated life in time that the torch tip or electrode will last. This value will increase to the maximum life achieved or a maximum value may be entered

Pierces
This is the estimated life in pierces that the torch tip or electrode will last. This value will increase to the maximum life achieved or a maximum value may be entered

Inches/millimeters
This is the estimated life in distance that the torch tip or electrode will last. This value will increase to the maximum life achieved or a maximum value may be entered

Minutes per Pierce
Generally, the process of piercing the plate causes additional wear to the consumable life. This parameter allows the user to enter a value which will be added to the overall Minutes value for each pierce, providing a more accurate representation of overall consumable wear.

Arc Errors
Actual Arc Errors may be tracked using the Arc Error Input to the control from the Plasma supply. The power supply indicates and Arc Error when the Plasma Arc did not achieve a long-life ramp down. The Arc Error input to the control is through the HD4070® Serial Communications or through the discrete "Arc Error" Input.

Volts per Minute
The Volts per Minute parameter allows the user to input a value that will be used to change the cut Arc Voltage based on the number of minutes that have elapsed while cutting in Plasma mode. This value will adjust the Voltage offset value. Note: This feature is only available for systems configured with the Sensor™ THC.

Last Torch Tip Installed
Displays the date and time when the selected tip was installed.

Last Electrode Installed
Displays the date and time when the selected electrode was installed.

New Torch Tip
Pressing the New Torch Tip soft key allows the operator to select which Torch Tip has been replaced and to update the database.

New Electrode
Pressing the New Electrode soft key allows the operator to select which Electrode has been replaced and to update the database.

New Nozzle
Pressing the New Nozzle soft key allows the operator to select which Nozzle has been replaced and to update the database.

Setups
Pressing the Setups soft key accesses the control setups for adjustment of the cut process.

Reset Database
This soft key is used to reset the values in the database on the control, clearing the torch tip or electrode information after uploading or saving the database.

Upload Database
This soft key is used to upload the current database to a host computer running our link.

Save Database
This soft key is used to save the current database to the Diskette or USB memory stick.

Manual

The manual key is indicated by the "hand" Icon.

After pressing the Manual key on screen, the following screen is displayed. The directional jog keys will be active when shown in green.
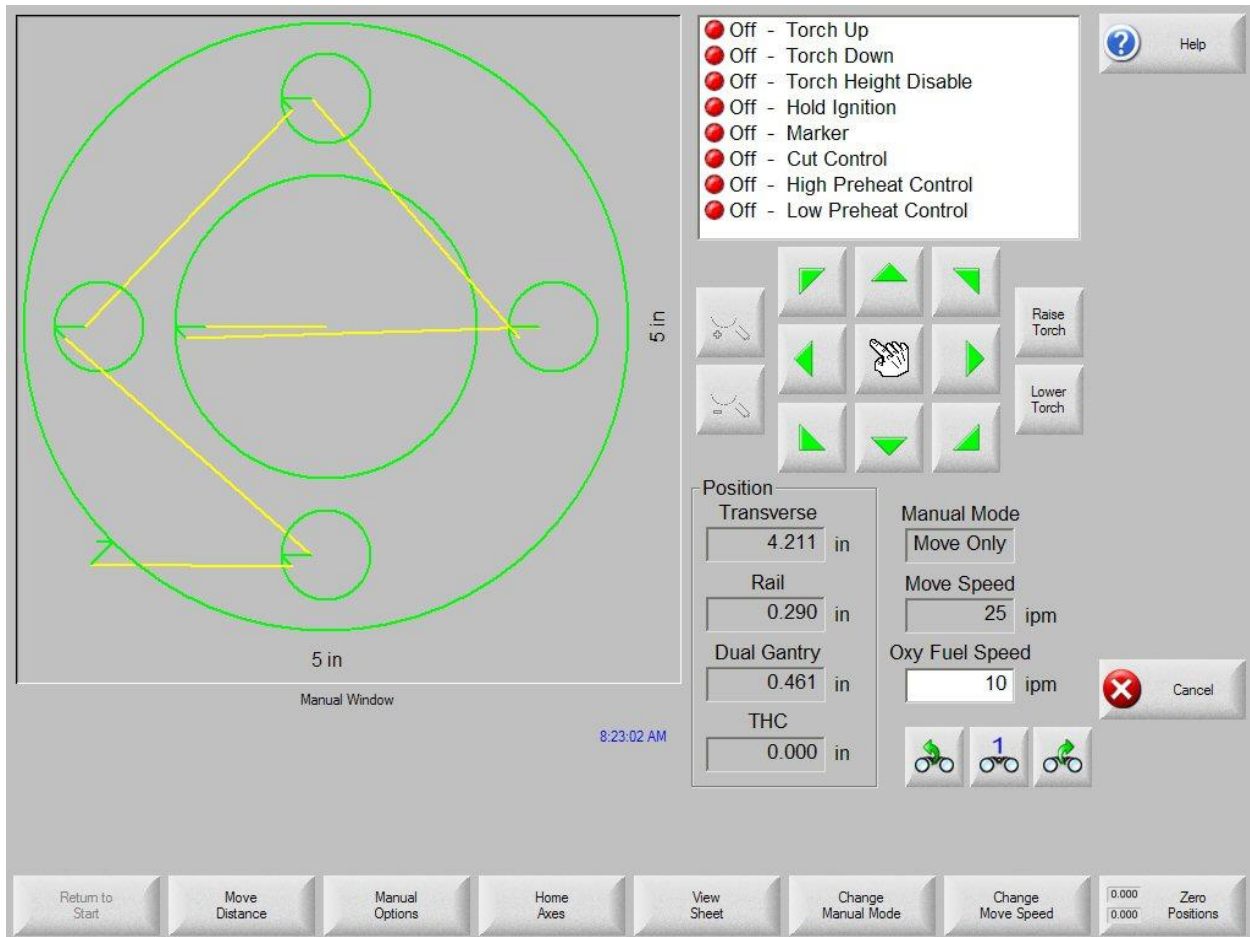
Whenever the manual keys are active, the cursor icon in the graphics display window will be in the shape of a tiny hand.

From the Manual window, the machine can be moved manually in one of eight directions using the arrow keys. The dual-purpose arrow keys are press on/release off. The cutting device moves as long as the key is held down. When the key is released, it comes to a smooth stop.

If the Latched Manual Key feature is enabled in the control setups, pressing the manual key a second time will allow motion to continue without holding down the arrow key. This feature is available for the manual direction keys in the Manual, Align and Pause screens. When this feature is activated, the dialog "Latched Manual Keys On" will be displayed in red at the bottom right corner of the part

window. Motion can be paused by use of the Stop, Cancel or an arrow key. The Latched Manual Key feature can be turned off by pressing the manual key again.

Return to Start
Whenever the Manual window is entered, the Transverse and Rail positions at that point are saved. After rip cutting or other manual operations it may be desirable to return to this "start" position. Pressing the Return to Start soft key will generate motion in the Transverse and Rail axes from the machine's current position to the position saved at entry into the Manual window.

Move Distance
When Move Only is displayed in the Manual Mode window, the second soft key from the left changes to Move Distance, allowing manual moves of an exact distance to be performed. After pressing Move Distance, the control prompts the operator for Traverse and Rail distance values for machine motion. Enter the desired values and press ENTER. The cutting device then moves the entered distance in a straight line without executing any cut logic.
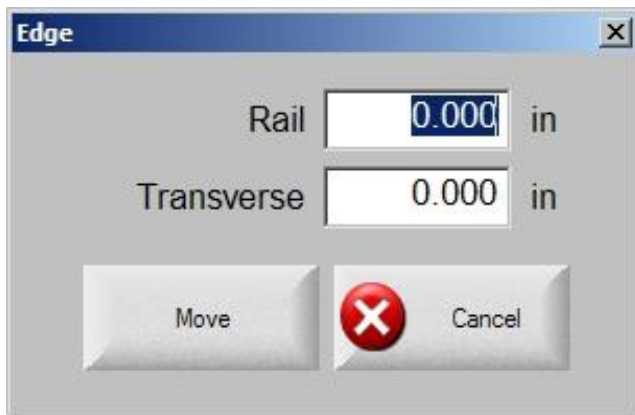
Values are entered the same way as described in the Cut Distance paragraphs above.

As with any automatic motion, you may press STOP on the front panel at any time to bring the machine smoothly to a stop before the programmed motion is complete.

Cut Distance
When Rip Cut mode is selected in the Manual Mode window, the second soft key from the left changes to Cut Distance, allowing rip cuts of an exact distance to be performed. After pressing Cut Distance, the control prompts the operator for Traverse and Rail distance values for machine motion. Enter the desired values and press ENTER. After executing the cut logic sequence, the cutting device then moves the entered distance in a straight line.
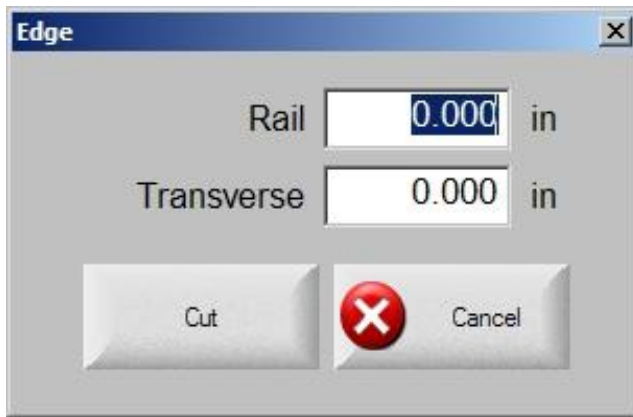
If you enter incorrect values, press the CANCEL key at any time. After motion has begun, press STOP on the front panel to bring the machine smoothly to a stop before the programmed motion is complete.

Rip Cut mode is useful for making a cut along a specified linear path. Motion stops and cutting action ceases either when the new position is reached or when the STOP key is pressed. If an exact distance is not known, enter a distance longer than needed in the right direction, and then press STOP to abort the cut.

Manual Options
Pressing the Manual Options soft key accesses the Manual Options screen.

Home Axes
Pressing the Manual Options soft key accesses the Homes Axes screen.

View Sheet/View Part
View Sheet allows the viewing of a part as it would appear on the plate. After pressing the View Sheet soft key, the display window zooms out to show the part in relationship to the entire plate.
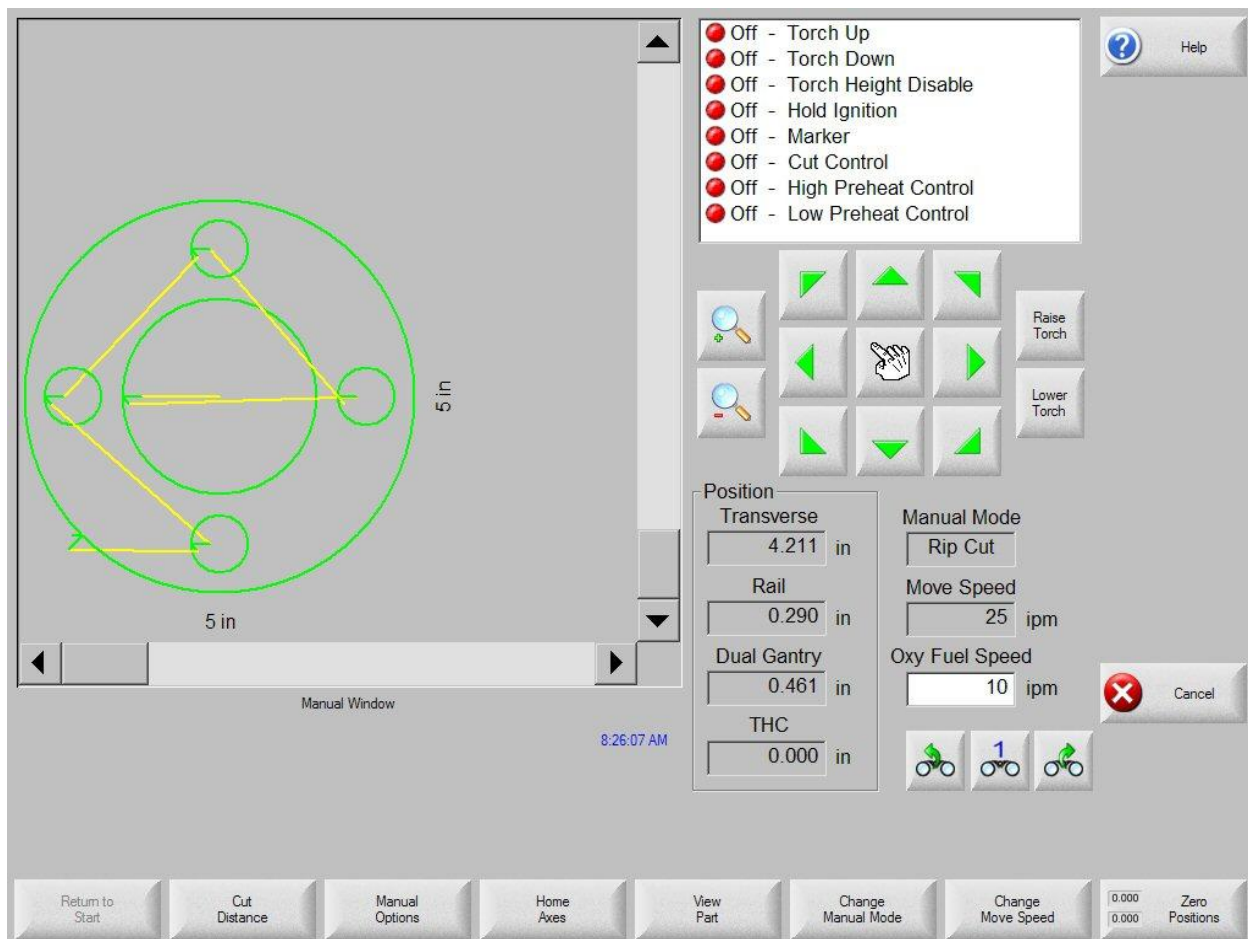
After zooming out, the display can be zoomed in again by pressing the **+** key, which causes horizontal and vertical scroll bars to be displayed. Pressing the **-** key will zoom back out.
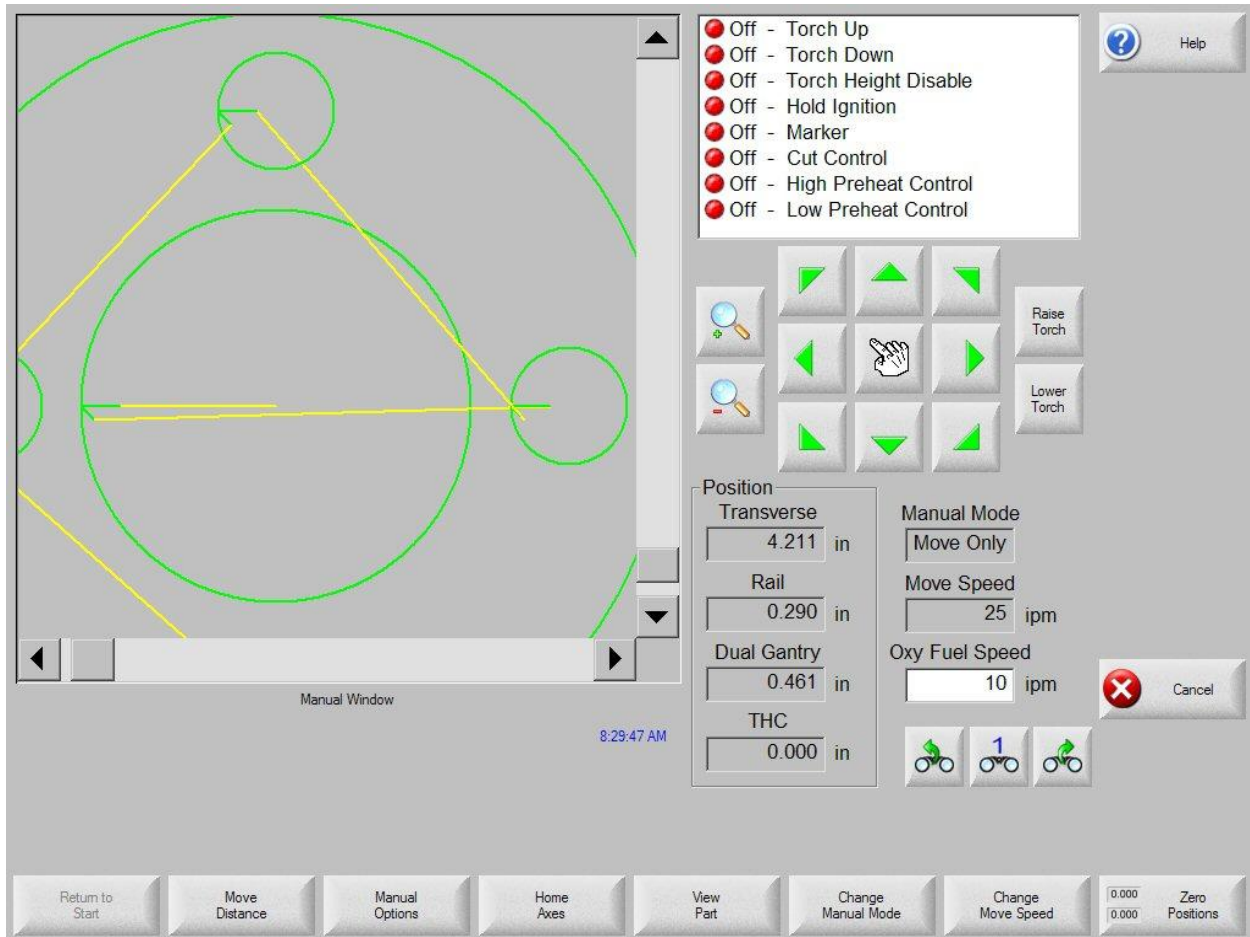
While the scroll bars are displayed, the view of the machine can be shifted horizontally and vertically by holding down the scroll bar and moving in the desired direction. This mode is useful in normal cutting to closely follow the cut path while in zoom.

While cutting in sheet view, the control will automatically scroll to keep the cut location centered within the view screen. This feature is useful in normal cutting to closely follow the cut-path while zoomed in.

View Sheet is more useful when proper Plate Size values have been entered in Cutting setups and when the machine has been previously homed. Viewing of large parts when fully zoomed during a cut may not allow the part to be fully drawn on screen before moving onto the next view location. This may appear as a flashing view screen and may be corrected by zooming out to get a larger view area.

Change Manual Mode
This soft key changes the control Manual Mode from Move Only to Rip Cut and vice versa. Pressing this soft key also causes the second soft key from the left to change function from Move Distance to Cut Distance. Rip Cutting is described in more detail below.

Change Move Speed
Is used to toggle through the four Move Speeds available. The four Move Speeds are the Maximum Machine Speed, High Jog Speed, Medium Jog Speed and Low Jog Speed from the Speeds setups.

Zero Positions
Pressing this soft key zeroes all axes positions.

Rip Cutting
When the Manual Mode window displays Rip Cut, the arrow keys can then be used to initiate a cut sequence and machine motion in the direction chosen.

To initiate a Rip Cut, first ensure that the proper cut-mode (Oxy or Plasma) was previously selected. Next, make sure that the proper cut speed is displayed in the Cut Speed window (editable in Rip Cut mode) and then press the arrow key corresponding to the desired start direction for the cut. The cutting sequence proceeds even after the key is released; however, machine motion is generated **only as long as an arrow key is held down**, unless the latched manual key feature has been enabled. Use the various arrow keys to change direction and the cutting device will continue to operate until the Stop, Cancel or Manual Key is pressed.

Manual Options

Raise Torch
Raises the cutting torch while the soft key is pressed or until the Torch Up sense input is activated.

Lower Torch
Lowers the cutting torch while the soft key is pressed or until the Torch Down sense input is activated. If the Torch Down Output has been enabled to stay on during the cut in Plasma setups, pressing the Lower Torch soft key will keep the torch in the down position until the Lower Torch soft key is depressed a second time.

Manual Offset
Manual Offset is useful for cutting tables that have a laser alignment tool attached and allows you to use your laser alignment tool for aligning a part to a plate. The offset will stay in place until it is turned off from this screen or a part is cut in either Oxy-Fuel or Plasma cut mode.

The user may select the following offsets:

> User Defined – Uses the selected X / Y Offset distance.
> Laser pointer to Plasma 1 – Offset 10
> Laser pointer to Plasma 2 – Offset 11
> Laser pointer to Oxy Fuel – Offset 12

Space Torches
Space Torches automatically uses the following M Codes as described in the Program Codes
Automatic Torch Spacing section:

M305 - Capture Home Position 5.
M32 – Unclamp and Unlock All Torches
M77 or M78 – Rail Go to Home command moves all Torches based on Machine Axes Orientation
M33 - Unclamp and Lock All Torches
M34T - Clamp Specific Torch for Spacing (for the number of torches to space)
M79T5 - Return to Home Position 5.
Torch Spacing Complete.

In addition to the Clamp and Unclamp M codes above, Clamping I/O must be defined and wired to
each Torch Station. Please make sure that all I/O is defined and wired properly before using this
function.

Once the machine has been set up properly per the above requirements, Space Torches may be
used standalone or after activating a Laser Pointer Manual Offset above for maximum precision.
Use the steps below when using nests that have a starting Rapid Traverse from the plate corner:

1. Position Torch 1 at Corner of plate where nest will start.
1a. Optionally use the Laser Pointer/Manual Offset for more accuracy.
2. Enter number of Torches and Spacing Distance.
3. Press Space Torches Button.

Note if the Laser Pointer offset is used, then if in Trial Mode the offset is maintained during Torch
Spacing. If in any cut mode other than Trial, the Laser Pointer offset is automatically cancelled before
starting the Torch Spacing.

4. Upon completion of Torch Spacing the operator can load the part/nest and trial with laser pointer or
cut with torches as desired.

Adjust Dual Gantry Skew
Allows the operator to manually realign the Dual Gantry Axis using the directional manual jog (arrow
↑ and ↓) keys.

Home Axes

From the Home screen, each axis or all axes can be "homed". In addition, the Transverse and Rail axes can be sent to one of four programmed alternate home positions.

The Home feature is used to set a known absolute physical position location on the cutting table that is used for referencing future manual "Go to Home" and other motion commands. This is generally performed through activation of a home switch positioned on the appropriate axis giving it a known physical location.

When the Homing Command is entered at the control, the control will move the axis towards the Home Switches at the Fast Home Speed until the switches have been activated. Once the switches have been activated, motion stops and then the axis moves in the opposite direction off switch at the Slow Home Speed. The moment that the switch is deactivated, the position is recorded at the control providing an absolute reference point for future motion commands.

Transverse
Pressing the Transverse soft key causes the automated homing procedure to be executed. This procedure generally produces machine motion in the Transverse axis, depending on the homing parameters set in the Setups.

Rail
Pressing the Rail soft key causes the automated homing procedure to be executed. This procedure generally produces machine motion in the Rail axis, depending on the homing parameters set in the Setups.

CBH
Pressing the CBH soft key causes the automated homing procedure to be executed. This procedure generally produces machine motion in the CBH axis, depending on the homing parameters set in the Setups.

THC
Pressing the THC soft key causes the automated homing procedure for the Sensor™ THC to be executed. This procedure generally produces machine motion in the THC axis, depending on the homing parameters set in the Setups.

Tilt
Pressing the Tilt soft key causes the automated homing procedure for the Tilt Axis to be executed.

Rotate
Pressing the Rotate soft key causes the automated homing procedure for the Rotate Axis to be executed.

Note: If Tilt and Rotate Axes are enabled, the following window will appear to allow access to the Tilt/ Rotate or other axes.
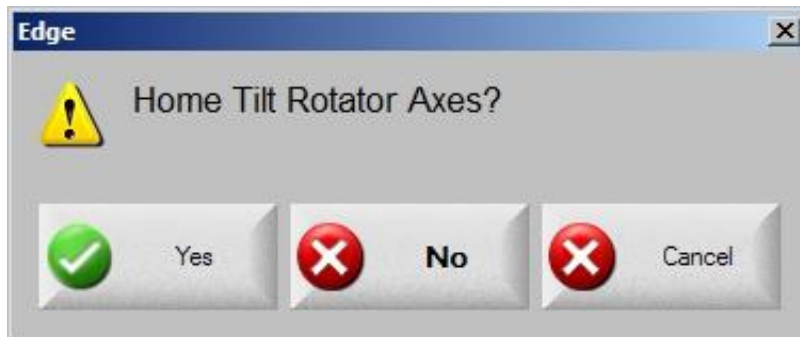
Selecting "Yes" will access Homing for the Tilt and Rotate Axes. Selecting "No will access the Homing functions for the other axes,

All
Pressing the All soft key causes the automated homing procedure to be executed. This procedure generally produces machine motion in one or more axes, depending on the homing parameters set in the Setups.

Go To Home Position
Pressing one of the four Go To Home Position soft keys causes the Transverse and Rail axes to move to the predefined position set in the corresponding edit window. The Go To Positions are absolute and require that an automated home procedure be executed previously.

Diagnostics

Control Information

Shows the current software versions and hardware configuration of the control. This information is
required when contacting the factory for support. Below is a typical control information screen.

Hardware
The Hardware section shows the current hardware configuration which includes the Processor Type,
Processor Speed, Memory Installed, Hard Drive Size, Hard Drive Free Space and Motion Control
Card revision.

Software Versions
The Software Versions section shows the current version of the Control's Operating System,
Operator Interface (software version), Virtual Device Driver and the Motion Control Card software.

Control Information
The control Information section displays the Hardware Key number, the control model number, serial number, control I/O type, axes enabled and I/O enabled.

Software Modules
The Software Modules information will display the optional software features which have been loaded or have been enabled for use (e.g. DXF Translator, McAfee VirusScan Software or NJWIN font Viewer).

Voltage
System Voltages at the motherboard will be displayed for motherboards equipped with this monitoring feature.

Temperature
Temperature at the motherboard will be displayed for motherboards equipped with this monitoring feature.

Fans
Fans speed at the motherboard will be displayed for motherboards equipped with this monitoring feature.

Limited Version
The Limited Version information will be displayed if the control is operating on a trial version of software. The version of software is available for 90 days of use and may be enabled for permanent use through use of a password available from the control vendor.
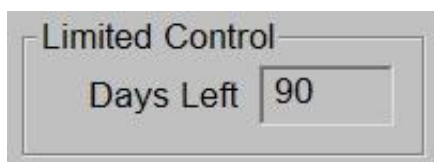
THC Revision
The current Command$^®$ THC Interface and Real Time Revision Levels will be displayed at the Control Information screen when enabled.
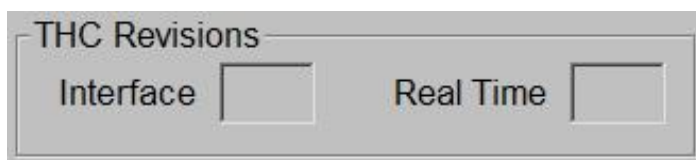
System Diagnostics
Pressing the System Diagnostics Softkey accesses the touch screen calibration utility for tuning touch screen response.

I/O

Inputs

This test continuously monitors and displays the current state of all of the optically-isolated discrete inputs in the control. The current state of each input, On or Off, is displayed to the left of the input name. Below is an input screen with all of the inputs off.

Inputs displayed with a white background allow for the input name to be changed by the user. To change the input name, use the Previous/Next arrow key to highlight the desired input and type the new text for the input name. The input can then be connected to the control and used as commanded in the part program. Example: The EIA W7 S1 code will pause the program and wait for input 7 to become active.

A password is required when entering this screen.

Note: The number and name of the Inputs will vary due to control software and hardware configurations.

Outputs
This test allows the activation of all optically-isolated discrete outputs in the control. Each Output's state can be changed by selecting the desired output with the PREV and NEXT keys and then pressing the SPACE key. The current state of each output, On or Off, is displayed to the left of the output name. Below is an output screen with all of the outputs Off.

Warning: When manually activating the control's outputs, Machine, Torch and Marker motion may occur and the cutting device may activate.

Outputs displayed with a white background allow for the Output name to be selected by the user. To change the output name, use the Previous/Next arrow key to highlight the desired output and type the new text for the output name. The output can then be connected to the control and used as commanded in the part program. Example: The EIA M22 and M23 code will turn on and off output 12.

Note: The number and name of the Outputs will vary due to control software and hardware configurations.

Expaned I/O

For controls equpped with more than 64 I/O a series of selection softkeys are available to access the required Inputs, Ouputs and Analog I/O.

Note: The optional USB Front Panel I/O are not accessible from the I/O Diagnostics screen. Functionality for the USB Front Panel may be tested through the Keyboard Diagnostics.

Analog Input Diagnostics

Note: View screen may vary depending on the Analog Input Card installed.

Inputs
The Analog Input Card required to operate the optional Joy Stick and Speed Pots is equipped with six low voltage Inputs that are optically isolated and can operate at 24 – 120 VAC/DC. The first four inputs are used for the optional Joystick feature and inputs five and six are used to support THC One and THC Two Nozzle Contact Sense respectively. The Input Logic for these inputs is normally open.

Analog Inputs
The Analog Input values shown in the upper right hand of the screen are the actual voltages coming into the analog card. Analog Inputs one and two are used for THC One and Two. Analog inputs three and four are used for optional external speed pot referencing.

Oscilloscope

This diagnostic screen allows any Digital Input, Digital Output, Analog Input, Analog Output, or Status to be recorded over a period of time. The recorded I/O can then be played back or saved for future reference. The functionality is similar to that of a digital storage oscilloscope.
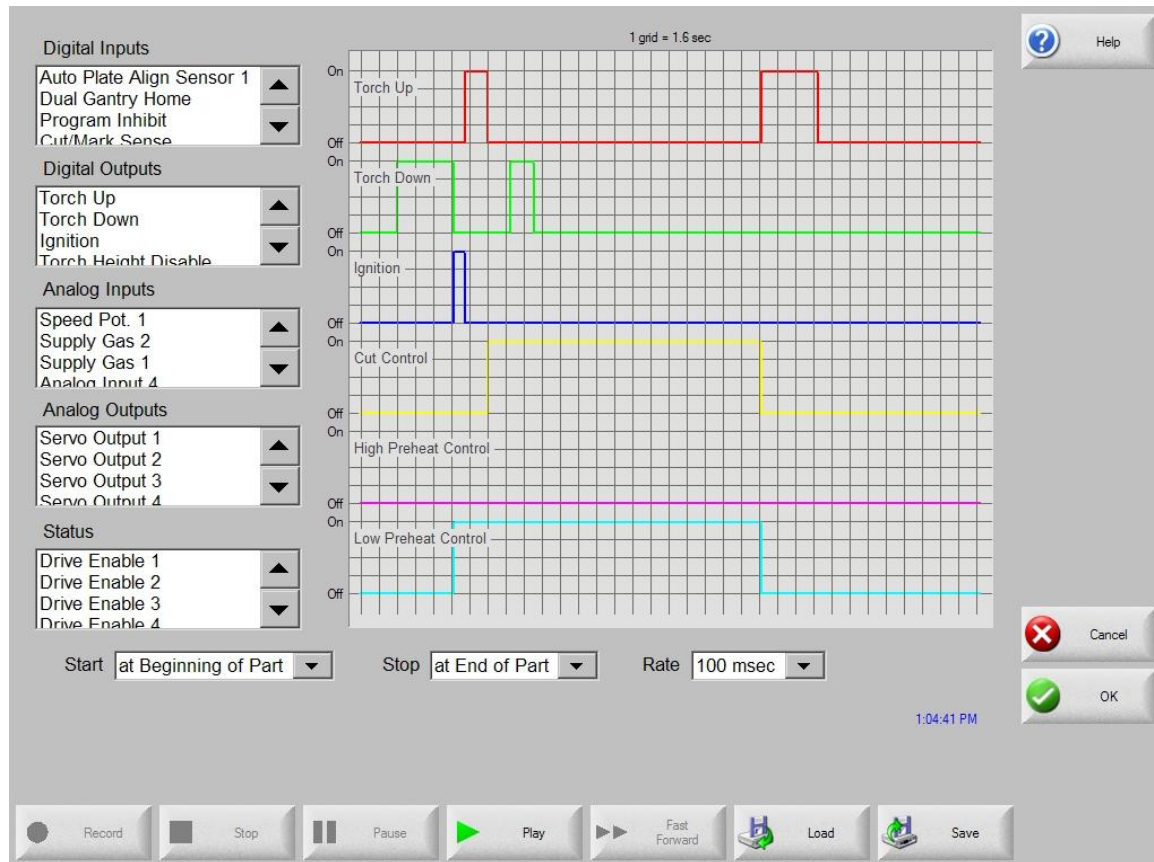
Digital Inputs
The list of all Digital Inputs available on the control that can be recorded.

Digital Outputs
The list of all Digital Outputs available on the control that can be recorded.

Analog Inputs
The list of all Analog Inputs available on the control that can be recorded. Sensor THC voltage feedback and Speed Pots. can be found in this section.

Analog Outputs
The list of all Analog Outputs available on the control that can be recorded. Servo Outputs for each of the motors are the most common items in this list.

Status
The list of all Statuses available on the control that can be recorded. Common Statuses found here are Drive Enables and Sensor THC Statuses when a Sensor THC is installed.

Note: While any of the above I/O or Statuses can be recorded, and in any combination, the maximum number of items that can be recorded at any one time is eight (8).

Start
This combo box is used to select whether the oscilloscope is Manually started with the Record soft key, is started at the Beginning of a Part, or started at the First Cut On.

Stop
This combo box is used to select whether the oscilloscope is Manually stopped with the Stop soft key, is stopped at the End of a Part, or stopped at the End of a Cut.

Rate
This combo box is used to select whether the oscilloscope records the selected I/O and Statuses every millisecond, every 10 milliseconds, every 100 milliseconds, or every second. The record buffers are limited to 60,000 points of data for each item being recorded. If the Rate selected and record time exceeds 60,000 points, only the last 60,000 points will be recorded.

Rate	Maximum Record Time
1 millisecond	1 Minute
10 milliseconds	10 Minutes
100 milliseconds	1 Hour and 40 Minutes
1 second	16 Hours and 40 Minutes

Note: The above combo boxes are independent of each other and can be used in any combination of the three.

Record
This soft key is used to start recording when the Start combo box above is set to Manually.

Stop
This soft key is used to Stop Recording when the Stop combo box above is set to Manually and to stop playback when playing back a previously recorded file.

Pause
This soft key is used to Pause playback when playing back a previously recorded file. This key will also Pause playback when Fast Forwarding.

Play
This soft key is used to Start playback for previously recorded files. These could be files that where just recorded or files loaded using the Load soft key below.

Fast Forward
This soft key is used to Fast Forward playback and is only available when playing back previously recorded files.

Load
This soft key is used to Load previously recorded files that were saved using the Save soft key below.

Save
This soft key is used to Save previously recorded files for future playback or viewing using third party software on a remote PC.

Note: The above soft keys will only be enabled for use when their functions are allowed.

Serial Port

This diagnostic screen allows the testing of the control serial ports. To perform the test, install the appropriate jumper or jumpers. If the serial port being tested is configured for RS-232, jump pin 2 to pin 3. If the serial port being tested is configured for RS-422, jump pin 2 to pin 3 and pin 4 to pin 7. Select the appropriate serial port to test and press the Test Port soft key to initiate the test. If the serial port is functioning properly, the exact text in the Send window will appear in the Received window. If the serial port is not functioning properly, a Communications Time Out message will appear below the Received window. If the serial port test fails, then the control may be defective and the factory should be consulted for further instructions. Below is a serial port test screen with a successful test.
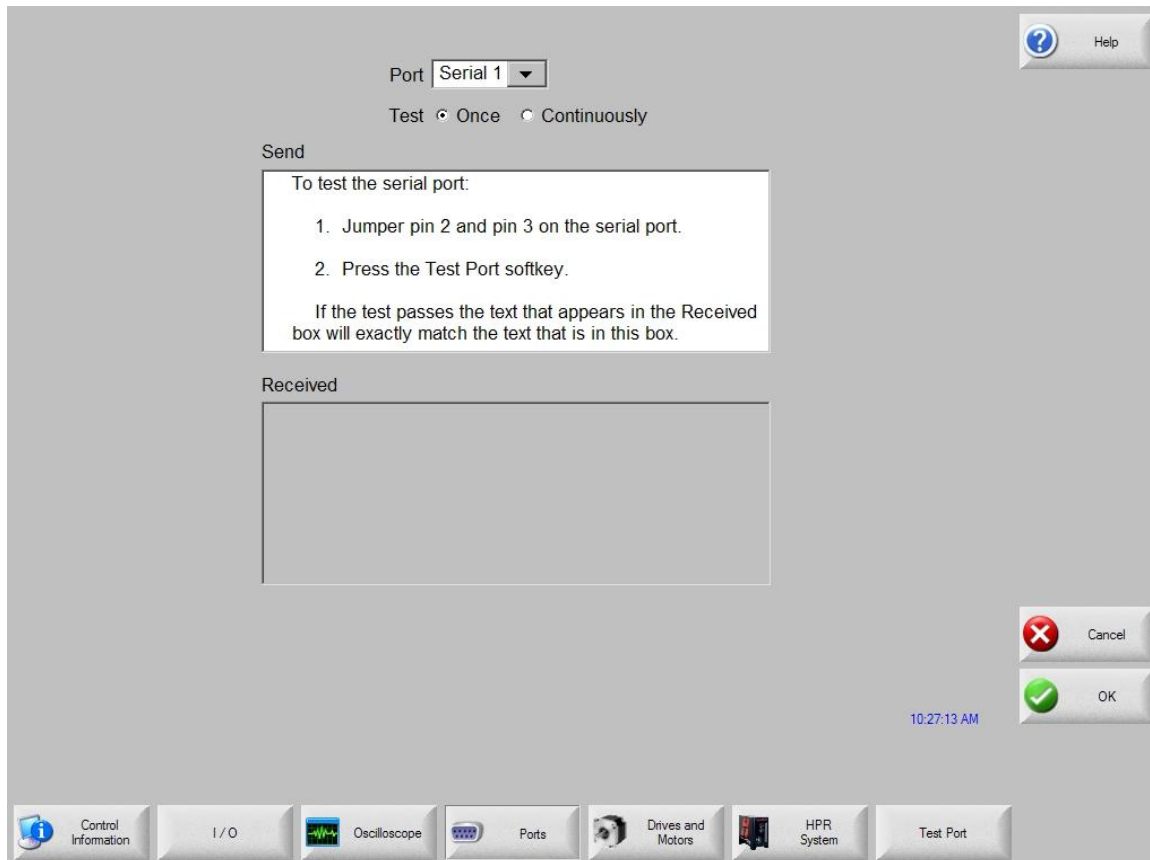
Port
The Port parameter is used to select which port will be tested.

Test
The Test feature is used to select a single or continuous signal is to be sent for testing.

Send
This window contains the text that will be transmitted during the serial port test.

Received
This window will contain the text that is received during the serial port test. If the test is successful, it should match the text contained in the Send window.

Test Port
Used to initiate the serial port test on the selected port.

Drives and Motors

The Drives and Motors diagnostic screen allows a technician to send a direct signal to the drive amplifiers without enabling the servo loop for testing purposes.

Warning! When sending direct signals to the drive amplifiers, unexpected motion on the cutting table may occur and extreme caution should be used.

When the Drives and Motors screen has been pressed, the following warning message will appear.
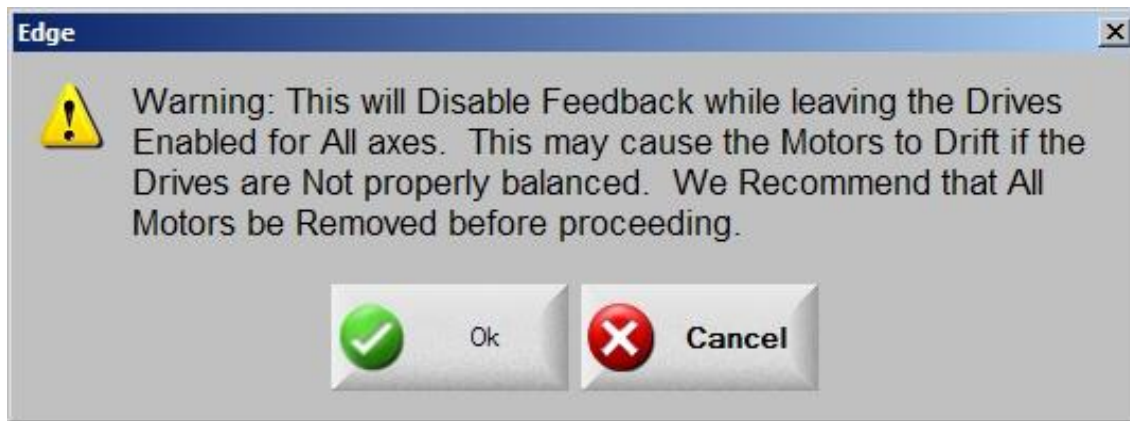
Select OK and then enter the machine password to view the Drives and Motors screen.

Pulse Type
Selects whether the signal that will be sent to the drive amplifier will be a single pulse or a repeated pulse. If the repeated pulse is selected, the signal will continue until the Test soft key for that axis is pressed again.

Pulse Direction
Selects whether the signal that will be sent to the drive amplifier will be a positive, negative or alternating pulse.

Pulse Magnitude
Sets the voltage of the signal to be sent to the drive amplifier.

Pulse Duration
Sets the amount of time for each segment of the signal to be sent to the drive amplifier.

Test Transverse/Rail/Dual Gantry/CBH
The Test buttons will send the selected output signal to the appropriate drive amplifier. If a repeating signal has been selected, any combination of available test buttons may be used for the test. Each drive amplifier will be sent the selected output signal until the selected output soft key has been pressed a second time to end the test.

Test All
Pressing the Test All soft key will send the selected output signal to all drive amplifiers.

Speed
The Speed window displays the current speed for each axis.

Note: When more than four axes are selected, the user will be prompted to select which group of axes will be available for testing when entering the Drives & Motors Diagnostic screen,
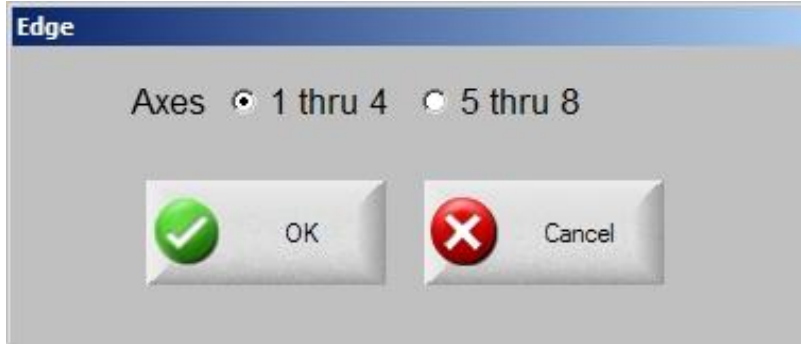
SERCOS Drives & Motors

Use of the SERCOS Interface™ allows the user to easily expand the number of axes available for use. The form of communication with the drives for Motion commands is over a serial link using diagnostic software provided by the Drive vendor.

Warning! When sending direct signals to the drive amplifiers, unexpected motion on the cutting table may occur and extreme caution should be used.

When the Drives and Motors screen has been pressed, the following warning message will appear.
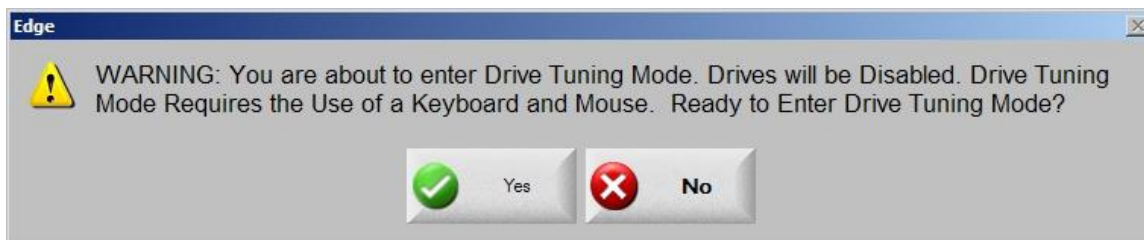
When entering the Drive and Motors Diagnostics screen the specific drive communications software will be launched for the drive being used. Please refer to information supplied by the Drive vendor on how to use the drive setup software for the specific drive being used. The following are some examples of drive setup and tuning software.

DriveTop from Indramat

PacSci 800Tools from Pacific Scientific
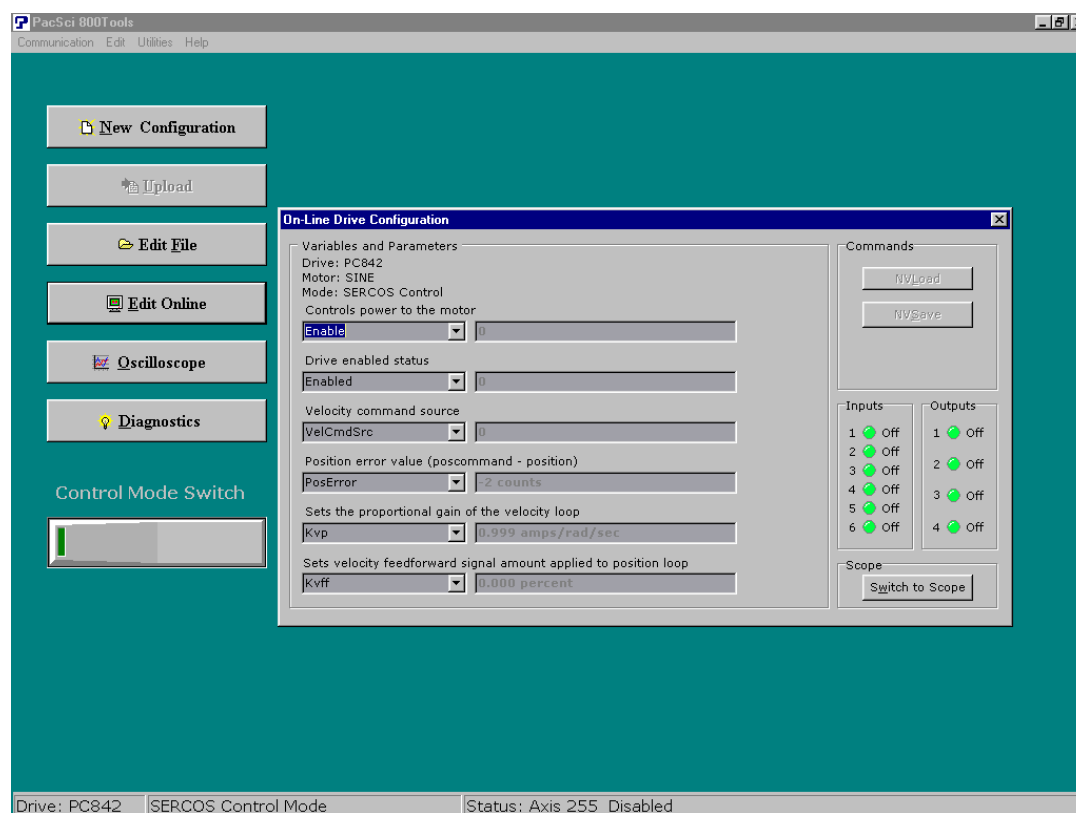
Note: screen resolution may temporarily change during use of the above utilities.

Error Messages

The control contains a number of error messages that will be displayed when programming, machine, or internal errors are detected. A list of the more common error messages are explained below.

SERCOS Errors
A number of different errors can be posted from the SERCOS Interface™ for both motor and I/O performance. The error messages are specific to the drive and I/O modules being used. Please refer to information supplied by the Drive and I/O hardware supplier for appropriate response.

SERCOS Ring Not Running
This error indicates that communication with the SERCOS ring has been lost. Generally this is due to a fault condition on the ring. Check SERCOS hardware and cycle power.

No Part Loaded
This message is displayed whenever the control does not contain a valid part program in memory. To clear this error message, load a valid part program from either the Shape Library, hard drive, diskette USB Memory or from a Host system.

Part Larger than Plate
This message will be displayed if the part program that has been loaded is larger than the plate size information in Setups. The operator may choose to ignore and continue the cut or return to Setups to correct the plate size.

Kerf too Large, Arc/Line has Disappeared. Abort Cut?
This message is displayed when the Kerf size selected is too large and will affect the shape of the part. The operator can continue to cut the part, abort the cut to review the Kerf information selected or abort the cut to review the part program for any errors. Electing to continue cutting of a part program which prompts the display of this error, may lead to unexpected results.

Cut Sense Lost
This message is displayed if the Arc ON Feedback setup parameter is enabled and the Cut Sense input is deactivated by the plasma unit while cutting. When this condition occurs, the control displays the Pause screen, which allows use of the Cut Recovery features to finish cutting the piece.

Communications Time Out
This message is displayed whenever the Host system does not respond within the Link Time Out setup parameter for either a Host Upload or Download. To correct this problem, increase the Link Time Out setup parameter and check the communications setup parameters on the Host system and the control.

Host Not Responding
This message is displayed whenever the communications is lost to the Host system after the initial communication was established. To correct this problem, try exiting and re-entering the Upload or Download to Host screens to re-establish communications and/ or check the communications setup parameters on the Host system and the control.

Scale Factor must be between .001 and 1000
This message is displayed whenever a value less than .001 or greater than 1000 is entered for a Scaling Factor. To correct this problem, enter a value between .001 and 1000 for the Scaling Factor.

Radius at Arc Beginning and Radius at Arc End are not within the Arc Radial Error Tolerance
This message is displayed whenever the radius beginning-arc and the radius-ending arc of a part program are not within the Arc Radial Error setup parameter in the Main Setup screen. To correct this problem, either increase the Arc Radial Error Tolerance setup parameter or correct the part program itself.

Transverse Position Error Exceeded
This message is displayed whenever the current Transverse position error exceeds the Servo Error Tolerance Setup parameter in the machine setups screen. It also may appear if the position feedback loops are not operating properly, or the machine is being commanded to move or accelerate faster than it is capable. To correct this problem, either increase the Servo Error Tolerance Setup parameter in the machine setups screen, re-tune the system, decrease the Maximum machine speed setup parameter or the acceleration rate setup parameter. Generally, this error is displayed when the setting for Incremental or Absolute EIA I and J codes is set to the wrong state for the active part program.

Rail Position Error Exceeded
This message is displayed whenever the current Rail position error exceeds the Servo Error Tolerance Setup parameter in the machine setups screen. It also may appear if the position feedback loops are not operating properly or the machine is being commanded to move or accelerate faster than it is capable. To correct this problem, either increase the Servo Error Tolerance Setup parameter in the machine setups screen, re-tune the system, decrease the maximum machine speed setup parameter, or the acceleration rate setup parameter. This error generally indicates a servo drive or motor problem. First check for fault indications on the servo drives.

Dual Gantry Position Error Exceeded
This message is displayed whenever the current Dual Gantry position error exceeds the Servo Error Tolerance Setup parameter in the machine setups screen. It also may appear if the position feedback loops are not operating properly or the machine is being commanded to move or accelerate faster than it is capable. To correct this problem, either increase the Servo Error Tolerance Setup parameter in the machine setups screen, re-tune the system, decrease the Maximum machine speed setup parameter, or the acceleration rate setup parameter. This error generally indicates a servo drive or motor problem. First check for fault indications on the servo drives.

Transverse Positive Hardware Overtravel Reached
This message is displayed whenever the control detects a positive limit switch in the Transverse axis. This can also occur if the limit switch input is set for the wrong polarity or the limit switch wiring is not properly connected. If the Transverse axis did trip the positive limit switch, use Manual mode to jog the Transverse axis away from the limit switch. This error generally indicates a servo drive or motor problem. First check for fault indications on the servo drives.

Rail Positive Hardware Overtravel Reached
This message is displayed whenever the control detects a positive limit switch in the Rail axis. This can also occur if the limit switch input is set for the wrong polarity or the limit switch wiring is not properly connected. If the Rail axis did trip the positive limit switch, use Manual mode to jog the Rail axis away from the limit switch.

Transverse Negative Hardware Overtravel Reached
This message is displayed whenever the control detects a negative limit switch in the Transverse axis. This can also occur if the limit switch input is set for the wrong polarity or the limit switch wiring is not properly connected. If the Transverse axis did trip the negative limit switch, use Manual mode to jog the Transverse axis away from the limit switch.

Rail Negative Hardware Overtravel Reached
This message is displayed whenever the control detects a negative limit switch in the Rail axis. This can also occur if the limit switch input is set for the wrong polarity or the limit switch wiring is not properly connected. If the Rail axis did trip the negative limit switch, use Manual mode to jog the Rail axis away from the limit switch.

Transverse Positive Software Overtravel Reached
This message is displayed whenever the Transverse axis position is greater than the Maximum Travel Limit setup parameter for the Transverse axis. When this occurs, use Manual mode to jog the Transverse axis to a position within the Travel Limit setup parameters.

Rail Positive Software Overtravel Reached
This message is displayed whenever the Rail axis position is greater than the Maximum Travel Limit setup parameter for the Rail axis. When this occurs, use Manual mode to jog the Rail axis to a position within the Travel Limit setup parameters.

Transverse Negative Software Overtravel Reached
This message is displayed whenever the Transverse axis position is less than the Minimum Travel Limit setup parameter for the Transverse axis. When this occurs, use Manual mode to jog the Transverse axis to a position within the Travel Limit setup parameters.

Rail Negative Software Overtravel Reached
This message is displayed whenever the Rail axis position is less than the Minimum Travel Limit setup parameter for the Rail axis. When this occurs, use Manual mode to jog the Rail axis to a position within the Travel Limit setup parameters.

Dual Gantry Skew Error Exceeded
This error message is displayed when the control has detected a position error fault between the two drive axes on the dual gantry. It also may appear if the position feedback loops are not operating properly, or the machine is being commanded to move or accelerate faster than it is capable. To correct this problem, either increase the Skew Error Tolerance Setup parameter in the machine setups screen, re-tune the system, decrease the maximum machine speed setup parameter or the acceleration rate setup parameter.

Need Station Selection
The Need Station Selection error message is displayed if the input for a station or process has not been activated. Example: When cutting in Plasma mode, a Plasma 1 or Plasma 2 input may be required to execute the selected Plasma cut process.

Buffer Time Out
This may appear if there is an instance where the motion buffer is full and cannot record the data being saved. This error allows the operator to stop the motion, back up on path to the last pierce and start over without a position error. This error should be reported to the control vendor.

CNC Time Out
This is a general error that may appear if there is an instance when any buffer is full and cannot record the data being saved. This error allows the operator to stop the motion, back up on path to the last pierce and start over. This error should be reported to the control vendor.

Unable to Find HASP
The HASP is a hardware protection key (dongle) that enables the software and features for use. If the HASP is not installed, the control will not work. If this message appears and the hardware key is in place, please contact your control vendor for assistance.

Norton Ghost Utility

In the unlikely event that an extreme system error has occurred which prevents the control from operating, the Norton Ghost™ Utility is available on specified controls to replace core system files and re-enable operation of the control. Norton Ghost™ must be previously installed on the control hard drive with an appropriate ghost image file.

The Norton Ghost Utility works by allowing the user to retrieve an image file from the D: partition of the hard drive to replace all data on drive C: The Ghost Image may be a factory default or custom user created image files. **NOTE:** All current information on Drive C: will be lost. It is recommended that a unique user image be created after table configuration which will include all the important table settings.

This feature may be executed from the System Tools screen or through use of a Ghost image utility. This tool may obtained from the control supplier and transmitted via the Internet.

Norton Ghost™ is a Trademark of Symantec™ Corporation.

Create Utility from E-mail
To create a Norton Ghost tool utility from the compressed software sent via the Internet:

USB Memory
Instructions to download USB format tools and files are available to create a bootable USB device. Specific batch files to run the utility are included.

Diskette
The file sent by the Internet will be an auto-executable file which will place the required files onto a diskette to be used at the control. First place a blank diskette into your PC. Double click on the recovery EXE file.   A message box will be displayed. Click on the "Create Floppy" button to execute. The EXE will copy the new files to the floppy disk to take to the control.

Instructions for Ghost Recovery
Creating a Custom Image File: Place the Norton Diskette or USB memory device into the control and turn the unit on. Norton Ghost will progress as follows.

"Starting PC DOS......."

Current Copyright information will be displayed

"Select 1 to make a New Backup Image or 2 to restore existing [1,2]"

Press 1 to create a new back up image. Up to three custom images may be created. They are created as "newest" to "oldest" image and are automatically assigned. The "original" ghost image is the factory default and may not be over written.

Back up will begin automatically.

"--------------------------------Backing Up Drive, Please Wait -------------------------------"
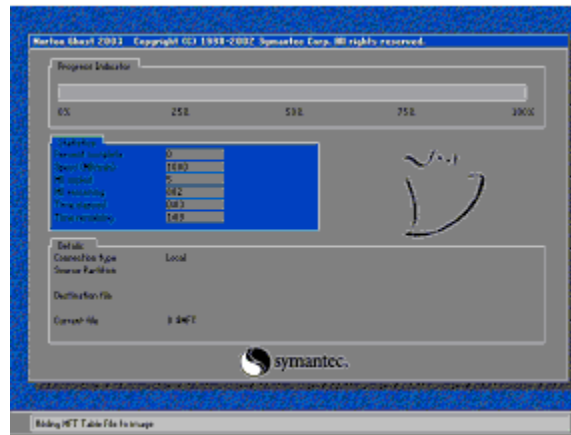
Norton Ghost will launch as above indicating back up progress.   The following Message will appear when complete.

"-------------------- Back Up Complete, Please Remove Disk and Reboot ----------------------"

Remove the diskette or USB memory device. Turn the control Off and then On. Table setups and software updates may need to be reloaded if the image is not current.

Retrieving an Image File
Place the Norton Diskette or USB memory device into the control and turn the unit on. Norton Ghost will progress as follows.

"Starting PC DOS......."

Current Copyright information will be displayed

"Select 1 to make a New Backup Image or 2 to restore existing [1,2]"

Press 2 to retrieve the back up image. Up to three custom images may be created. They are created as "newest" to "oldest" image. The "original" ghost image is the factory default. The next message allows the user to select which version to use when restoring.

"1. Newest.gho"
"2. Older.gho"
"3. Oldest.gho"
"4. Original.gho"

"Select the Number of the Image to restore from the choices above [1,2,3.4]"

Press the number for the desired image.

"--------------------------------Restoring, Please Wait -------------------------------"
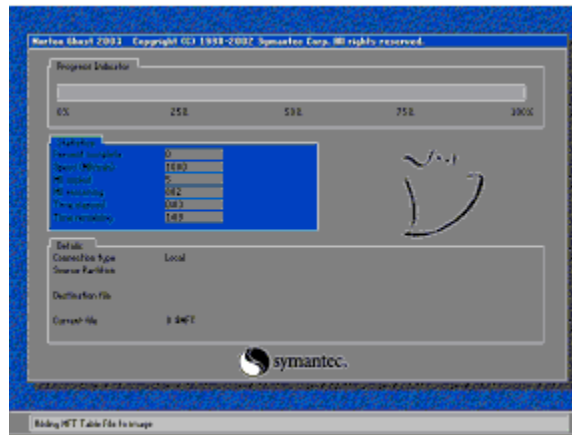
Norton Ghost will launch as above indicating restore progress.   The following Message will appear when complete.

"--------------------End Restoring, Please Remove Disk and Reboot ----------------------"

Remove the diskette or USB memory device. Turn the control Off and then On. Table setups and software updates may need to be reloaded if the image is not current.

Password Setups

The following setup screens are only available with the supervisory passwords. This will help prevent unauthorized personnel from entering these screens.

Warning! Extreme care should be taken when changing these parameters as they may cause machine damage if incorrectly set. Only trained service personnel should have access to these passwords.

The "2865" password is provided for viewing of the Machine, Speeds, Link and Axes setups without allowing changes. This password is useful for verifying setups without the danger of accidentally changing them or revealing the supervisory password to an unauthorized user.

Note: After installation of the control to the cutting table or if any setup parameters are changed, it is important to save the current setup file to both the hard drive and floppy disk for future reference.

Machine

X Axis Orientation
The control allows specifying the X axis as being either the Transverse or Rail axis. The default setting is Transverse. This parameter should be set before cutting the part.

Up Direction
This parameter defines the machine motion that will occur when the ↑ arrow key is pressed during manual mode.

Right Direction
This parameter defines the machine motion that will occur when the → arrow key is pressed during manual mode.

Dual Gantry Installed
Selecting Yes will enable the Dual Gantry axis and allows configuring of that axis.

CBH Installed
Selecting Yes will enable the Contour Bevel Head axis and allows configuring of that axis.

X and Y Motor/Encoder
Selecting this feature as Swapped will internally swap the X and Y Axis encoder signals. This feature simplifies the installation to systems with alternate wiring configurations.

Auto Torch Spacing
Selecting Yes enables an automatic torch spacing feature for use. This feature uses embedded part program codes and dedicated outputs to control individual torch stations to set spacing and clamping of direct and mirrored cutting. Please refer to the Auto Torch Spacing information provided in this guide for additional information.

Tilt Rotator Installed
The Tilt Rotator Installed parameter is used to enable use of the Tilt Rotator feature. Tilt Rotator is a unique rotational cutting tool which combines a rotational axis with a Tilt (bevel) axis allowing for compound cutting. Note: The Tilt Rotator feature will execute the commanded Tilt Angle motion over the length of the line segment (linear interpolation).

Dual Tilt Rotator Installed
This parameter enables use of a second Tilt Rotator feature. Additionally a second Transverse Axis is enabled for use allowing individual, parallel and Mirror cutting.

Auto Home at Power Up
Determines if the Contour Bevel Head (CBH) and Tilt / Rotate axes will automatically go into the homing routine upon powering up the control.

Follower Initially
This parameter is used to determine if the CBH and Rotate features will always be enabled after power up or would be enabled through the part program.

Dual Tilting Rotator Mode
The Dual Tilting Rotator Mode defines the Tilt Rotator to use two Tilt Axes rather than a Rotation Axis and Tilt Axis for Rotational Bevel Cutting. Tilt Rotator parameter must be active for this feature.
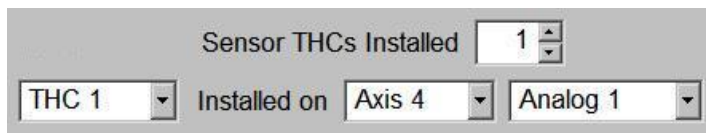
Key Press Logging
The Key Logging feature is used to record key press and other related information in a daily log file. This is intended for use by Service Technicians when a fault occurs to help review events prior to the fault experienced. When enabled, the file will be saved to the hard drive which then may be retrieved through the Files feature by transferring the file to floppy diskette or USB memory. Generally, this parameter is set to NO unless instructed by a technician to be enabled.

Table Size
Enter a value for the active cutting area for the X and Y axis. These values are used to limit the Plate size parameter in the cutting setup screen to the maximum size of the table.

THCs Installed
The THC Installed parameter defines the total number of Sensor™ THC Axes assigned for operation at the control.

THC Installed On Axis / Analog
This setup parameter is used to define the THC axis for use. The user can select which axis the THC is to be commanded on, and the analog input to use (arc voltage feedback)

Note: Refer to the Station Configuration and Sensor™ THC sections of this guide for additional information on the setup and use of the Sensor™ THC.

Ignore Torch Collision During IHS
This allows the user to ignore the torch collision input during the initial height sense cycle. This may be advantageous for some THC mechanics.

Command THCs Installed
The Command[®] THC selection is used to enable the Command THC serial Link. For more information on this feature, please refer to the Command[®] THC section of this guide. Shown in Type P mode only.

SERCOS

The SERCOS interface requires configuration to establish communications for motion and I/O.

Drive Type
The manufacturer of the SERCOS style drive being used would be selected. This allows proper operation and tuning parameters to be available.

Update Rate
The update rate for the ring may be selected for motion and I/O. One millisecond is recommended but it is dependent on the capabilities of the hardware being used.

Baud Rate
Communication rate for the ring may be selected. This is determined by the type of drive and I/O being used.

Light Level
The user has the ability to adjust the intensity of the light pulses used on the fiber optic ring. This feature is used to compensate for diminished signal due to issues such as ring distance.

Drive I/O
The user may select to use I/O options directly supported on the Drive Amplifier. Options are None, Overtravel and Home Switches only or All I/O. Note: The Drive I/O will populate the general purpose I/O (both analog and digital) in order from the lowest SERCOS drive axis to the highest SERCOS drive axis. All I/O is the default setting for SMCC interface.

RECO/Beckoff I/O at Address 50
This parameter is set to Yes if the Indramat RECO or Bechkoff I/O module is being used to expand the total number of I/O being used on the fiber optic ring. Note: The RECO I/O will populate the general purpose I/O (both analog and digital) following all drive I/O.

HPR/4070 at address 60
This parameter is set to Yes if the optional SERCOS interface for HPR/4070 is being used.

HTA I/O at Address 70
This parameter is set to Yes if the optional Hypertherm SERCOS interface card is being used.

Speeds

The Speeds setup screen is used for setting the various machine speeds for different operating modes.

Given that the drives, motors, gearboxes and mechanics are capable, the control is capable of operating over a wide range of speeds.

Speed 0 to	500	ipm			Help
Acceleration Rate	10	mG			
Fast Deceleration Rate	100	mG	THC Acceleration Rate	50	mG
Maximum Machine Speed	500	ipm	Maximum THC Speed	600	ipm
High Jog Speed	250	ipm	THC Jog Speed	200	ipm
Medium Jog Speed	100	ipm	THC Home / Fast IHS Speed	50	ipm
Low Jog Speed	25	ipm	THC Slow IHS Speed	5	ipm
Fast Home Speed	200	ipm	CBH Acceleration Rate	10	rev/sec^2
Slow Home Speed	10	ipm	Maximum CBH Speed	10	rpm
Minimum Corner Speed	80	ipm	CBH Fast Jog/Home Speed	10	rpm
Limited Machine Speed	100	ipm	CBH Slow Jog/Home Speed	5	rpm
Creep Speed	25	% of Cut Speed			
Torch Height Disable Speed	90	% of Cut Speed			
Distance Before THD Speed	0	in			Cancel
Distance After THD Speed	0	in			OK

11:32:38 AM

Machine	Speeds	Ports	I / O	Axes

Speed 0 To
This parameter allows the technician to input selected speed ranges to customize the acceleration rates for the various speeds selected. When a speed range lower than the maximum speed is entered, a new range at the maximum machine speed setting will be created, up to a maximum of five. To reduce the number of Speed To ranges, input the maximum machine speed into the range that is to be the highest speed selection and the additional range fields will be removed from the screen.

Acceleration Rate
All mechanical systems have different acceleration and deceleration rates to move the cutting device smoothly. The higher the acceleration rate, the quicker the machine will get up to speed. The lower the acceleration rate the smoother the machine will position the cutting device. This setup parameter is used to determine both the acceleration and deceleration rate for all motion.

Enter a value in milligees for the desired acceleration rate. A milligee (milliG) is 1/1000 of a G, which is the acceleration due to gravity. One milligee is approximately 0.384 inches per second^2. A good starting point for most systems is 10 mgee's.

Fast Stop Deceleration Rate
Activated by the Fast Stop or Torch Collision Input, the Fast Stop Deceleration Rate Parameter specifies in milligees how quickly the system will stop when the Fast Stop Input is active.   Generally, this value is much higher then the Acceleration rate.

A milligee (milliG) is 1/1000 of a G, which is the acceleration due to gravity. One milligee is approximately 0.384 inches per second^2.

Maximum Machine Speed
Enter the maximum value at which the system is capable of contouring. This parameter will be used to range limit all subsequent speed entries. In addition, it is used to scale the speedometer widget in the Watch window during runtime operation.

The maximum speed at which the control can contour can be calculated with the following equation.

Maximum Contouring Rate (IPM) =

$$\frac{60 \text{ seconds}}{\text{minute}} \ \Theta \ \frac{1 \text{ Inch}}{\text{User edges}} \ \Theta \ \frac{100,000 \text{ edges}}{\text{second}}$$

For example: the control could command a cutting machine with 4000 edges per inch resolution at 1,500 IPM.

Limited Machine Speed
The Limited Speed feature allows for a user-defined maximum machine speed when the Limited Speed Input is active. This is commonly used to set a reduced machine speed for the purpose of increased safety when testing or maintenance of the machine is being performed.

High Jog Speed
Enter a value for the desired high manual motion speed.

Medium Jog Speed
Enter a value for the desired medium manual motion speed.

Low Jog Speed
Enter a value for the desired low manual motion speed.

Minimum Corner Speed
This is the minimum speed to use when negotiating corners. The control has sophisticated centripetal velocity and acceleration contouring algorithms, which should provide optimal cut quality for most cut operations. In some situations it may be desirable to enter a minimum corner speed to prevent over-burning at corners. In normal operations, this parameter should be set to zero.

Fast Home Speed
Enter the machine speed the control will use during the first phase of the homing sequence. During the first phase, the cutting device will move towards the home limit switches at the fast rate.

Slow Home Speed
Enter the machine speed the control will use during the second phase of the homing sequence. During the second phase, the cutting device will move off the home limit switch and proceed to the marker pulse. Upon detection of the marker pulse, the control will decelerate to a stop and perform a small move in the opposite direction to the marker pulse.

Creep Speed Percentage
The Creep Speed Percentage parameter allows the operator to select what percentage of the machine cut speed will be used when creeping. Generally, this is 25% of the cut speed.

Plasma Hi/Lo Speed Percentage
The Hi/Lo Speed specifies the percentage of the entered Cut Speed below which the control will activate the Torch Height Disable output. The plasma system may use this output to switch from low to high current or to disable the height control. **Note:** The Dual Grid/THC feature must first be enabled at the Plasma Setups Screen.

Plasma Distance To Corner
The Plasma Distance to Corner parameter specifies the distance to the corner at which the plasma system should switch from High current to low current and disable the Automated Height Sensor. Distance to Corner is active whenever the speed drops below the Plasma Hi/Lo Percentage, or segments intersect at an angle greater than the tangent angle. **Note:** The Dual Grid/THC feature must first be enabled at the Plasma Setups Screen.

Plasma Distance From Corner
The Plasma Distance from Corner parameter specifies the distance from the corner when exiting, at which the plasma system should enable the Automated Height Sensor. Distance from Corner is active whenever the speed drops below the Plasma Hi/Lo Percentage, or segments intersect at an angle greater than the tangent angle. **Note:** The Dual Grid/THC feature must first be enabled at the Plasma Setups Screen.

For additional details on how the Torch Height Disable feature of this control operates, please refer to the Cutting Section of this guide.

CBH Speed Setups (Shown only when enabled)

CBH Acceleration Rate
This parameter allows the operator to set the acceleration rate for smooth and stable movement of the contoured bevel head. The higher the acceleration rate the quicker the CBH will get up to speed. The lower the acceleration rate the smoother the machine will position the cutting device. Values are entered in Rev/ Sec^2.

Maximum CBH Speed
Enter the maximum speed for the CBH rotation in Rev/Min.

CBH High Jog / Home Speed
Enter a value for the desired manual CBH jog and fast Home speed.

CBH Low Jog / Home Speed
Enter a value for the desired CBH slow home speed.

THC Speed Setups (Shown only when enabled)

THC Acceleration Rate
This parameter allows the operator to set the acceleration rate for smooth and stable movement of the Sensor™ Torch Height Control. The higher the acceleration rate, the quicker the THC will get up to speed. The lower the acceleration rate, the smoother the machine will position the cutting device. Values are entered in milligees.

Maximum THC Speed
Enter the maximum speed for the Sensor™ THC movement in inches per minute.

THC Jog Speed
Enter a value for the desired THC jog speed.

THC Home/Fast IHS Speed
The THC Home/Fast IHS Speed entered here is used to home the torch at the top of the slide and to move the torch from the selected IHS height towards the plate, looking for the surface of the plate.
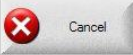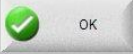
THC Slow IHS Speed
The THC IHS Speed is used to retract the torch after the plate has been sensed. The torch will retract at this speed until the contact sense is lost. This determines the exact distance to the plate regardless of any flexing of the plate. A very small speed is recommended for optimal accuracy.

The following Speeds setup parameter will be available when Tilt Rotator has been enabled.

Speed 0 to	500	ipm			Help
Acceleration Rate	10	mG			

Fast Deceleration Rate	100	mG	THC Acceleration Rate	50	mG
Maximum Machine Speed	500	ipm	Maximum THC Speed	600	ipm
High Jog Speed	250	ipm	THC Jog Speed	200	ipm
Medium Jog Speed	100	ipm	THC Home / Fast IHS Speed	50	ipm
Low Jog Speed	25	ipm	THC Slow IHS Speed	5	ipm
Fast Home Speed	200	ipm	Rotate Acceleration Rate	10	rev/sec^2
Slow Home Speed	10	ipm	Maximum Rotate Speed	10	rpm
Minimum Corner Speed	80	ipm	Rotate Fast Jog/Home Speed	10	rpm
Limited Machine Speed	100	ipm	Rotate Slow Jog/Home Speed	5	rpm
Creep Speed	25	% of Cut Speed	Tilt Acceleration Rate	10	rev/sec^2
Torch Height Disable Speed	90	% of Cut Speed	Maximum Tilt Speed	10	rpm
Distance Before THD Speed	0	in	Tilt Fast Jog/Home Speed	10	rpm
Distance After THD Speed	0	in	Tilt Slow Jog/Home Speed	5	rpm

Cancel

OK

11:33:22 AM

Machine   Speeds   Ports   I / O   Axes

Rotate Acceleration Rate
This parameter allows the operator to set the acceleration rate for smooth and stable movement of the contoured bevel head. The higher the acceleration rate, the quicker the Rotate Axis will get up to speed. The lower the acceleration rate, the smoother the machine will position the cutting device. Values are entered in Rev/ Sec^2.

Maximum Rotate Speed
Enter the maximum speed for the Rotate Axis rotation in RPM.

Rotate High Jog Speed
Enter a value for the desired Rotate Axis High Jog Speed.

Rotate Low Jog Speed
Enter a value for the desired Rotate Axis Low Jog Speed.

Tilt Acceleration Rate
This parameter allows the operator to set the acceleration rate for smooth and stable movement of the contoured bevel head. The higher the acceleration rate the quicker the Tilt Axis will get up to speed. The lower the acceleration rate the smoother the machine will position the cutting device. Values are entered in Rev/ Sec^2.

Maximum Tilt Speed
Enter the maximum speed for the Tilt Axis in RPM.

Tilt High Jog Speed
Enter a value for the desired Tilt Axis High Jog Speed.

Tilt Low Jog Speed
Enter a value for the desired Tilt Axis Low Jog Speed.

Torch Height Disable Feature

The Torch Height Disable Feature is used to activate the Torch Height Disable output and "freeze" or disable the automatic adjustment of the Automated Torch Height Control system and prevent diving or crashing of the torch in corners. **Note:** The Dual Grid/THC feature must first be enabled in the Plasma Setups screen.

This output is activated by the control based on the values of Plasma Hi/Lo % of Cut Speed, Plasma Distance to Corner and Plasma Distance from Corner setup parameters. When any one of these conditions is met, the Torch Height Disable feature will be implemented. The definition of a corner is based on the tangent angle in the Special Password screen and the value of the Plasma Hi/Lo speed.

Tangent Angle
This parameter is used to set degree of the tangent angle for control motion. Segments within a part that intersect at angles greater than the selected tangent angle will decel to zero or minimum corner

speed. Segments within a part that intersect at angles less than or equal to the selected tangent angle will not decel, unless the next segment is a speed limited arc.

Plasma Hi/Lo Speed Percentage
The Hi/Lo Speed specifies the percentage of the entered Cut Speed below which the control will activate the Torch Height Disable output. The plasma system may use this output to switch from low to high current or to disable the height control.

Plasma Distance To Corner
The Plasma Distance to Corner parameter specifies the distance to the corner at which the plasma system should switch from low current to high current or disable the Automated Height Sensor. Distance to Corner is active whenever the speed drops below the Plasma Hi/Lo Percentage, or segments intersect at an angle greater than the tangent angle.

Plasma Distance From Corner
The Plasma Distance from Corner parameter specifies the distance from the corner when exiting, at which the plasma system should enable the Automated Height Sensor. Distance from Corner is active whenever the speed drops below the Plasma Hi/Lo Percentage, or segments intersect at an angle greater than the tangent angle.

Example:
For the example illustrated below, the Torch Height Disable output will be activated based on the values of the setup parameters.
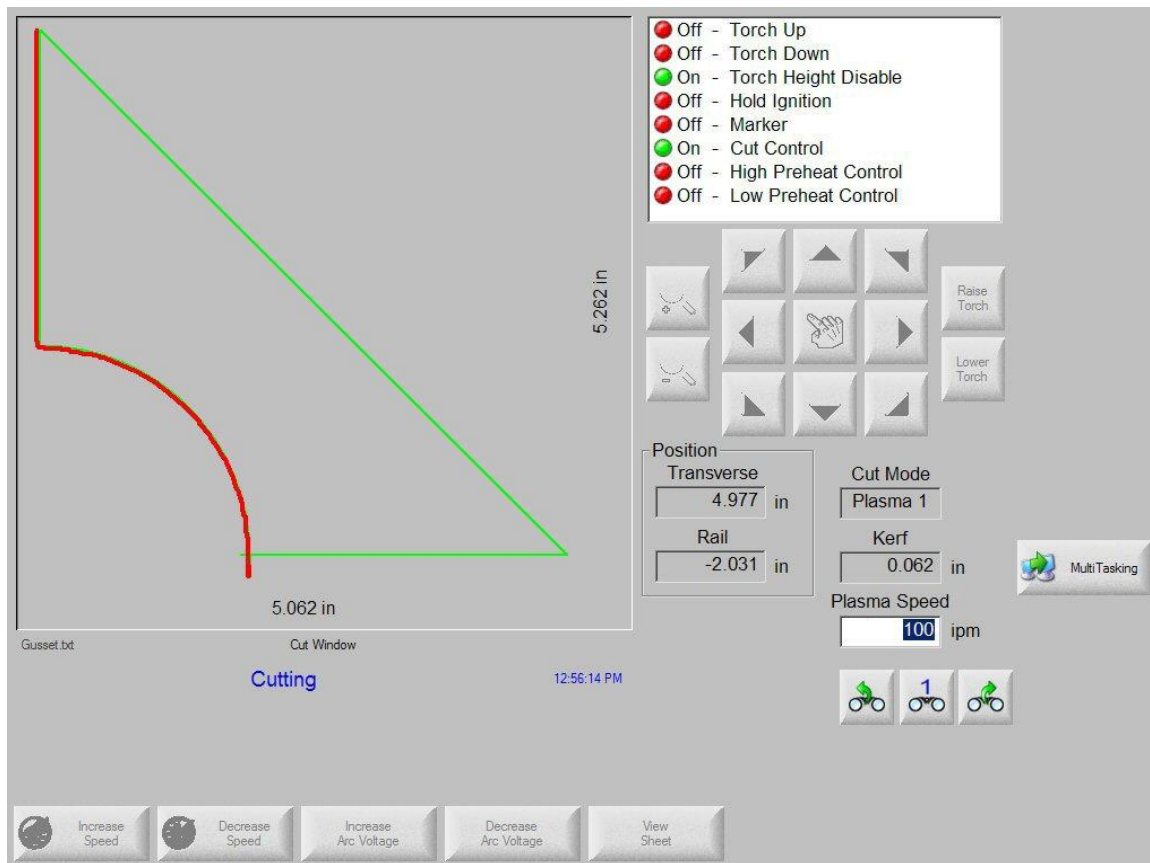
Plasma Hi/Lo Percentage Value	90%
Distance to Corner Value	.2 inches
Distance from Corner Value	.2 inches
Tangent Angle Value	20 Degrees

For the above listed values, the Torch Height Disable output is active .5 inches before and .5 inches after each 90 degree corner. The THD output is also activated as the torch accelerates away from the pierce and through the arc due to the speed being below the Plasma Hi/Lo value. Finally, because the arc intersects at greater than the 20 degree tangent angle, the THD output is activated for .2 inches before and after the beginning of the arc, and is activated for .2 inches before and after the end of the arc.

Ports

The control comes standard with two RS-232C serial ports, which may be converted to an RS-422 configuration. For more information on the how to change the serial ports to the RS-422 configuration, please refer to Serial Port Connections. This port has been specially designed with opto-isolation and filtering to minimize EMI/RFI noise problems common in many cutting operations. Parameters are enabled and disabled depending on Port feature selections.

The control may be configured to use the communication link provided on the control or the user may enter information to create a custom communication link at the Link Screen to communicate with a host computer. Information on how to access the Phoenix Communication Link Software is provided later in this section.

Up to eight ports may be configured for use in software. Hardware provided with your control may support a smaller number of communication ports.

The following parameters are available to help configure the Serial Ports for your specific communications package and selected communication features.

Port Designation
This parameter allows the user to select which serial port will be configured for link use with the following remote communication settings. Select Link, Messaging, HD4070, FineLine or Command THC (type"V" controls).

Baud Rate
Allows selection of the desired baud rate for the remote Communications Link. The available Baud rates are shown. The control also incorporates a unique compression utility that allows the effective baud rate to be doubled. For example, for links configured to run at 9600 baud, the effective rate will be 19.2K Baud.

Note: For Serial Messaging communication speeds from 1200 Baud to 115200 Baud are available. See Serial Messaging in the Program Code section for more information.

Parity
Enter the desired parity for the remote Communications Link.

Data Bits
Enter the number of data bits the remote link is using. This value is **8** for the link software included with the control.

Time Out Delay
Enter the amount of time the control will wait prior to display communications error should it not be able to establish a link with a remote device.

Transmit Delay
Enter the amount of delay the control will insert between each character that is transmitted over the serial port. Some communications links require a small delay to avoid missing characters that have been sent to them. This parameter should normally be set to zero.

The following parameters allow the user to create a custom communication link on the control by entering the ASCII code equivalent to the character or symbol used by the host computer for dialog start.

For example: The ASCII Decimal Code 33 is equal to the **!** symbol

Rewind
This setup parameter is only enabled when Link File Dump Mode has been enable. Enter the ASCII code equivalent to the character or symbol used by the host computer for tape rewind at the host tape drive system. Enter the number zero to eliminate the rewind command.

Dialog Start
Enter the ASCII code equivalent to the character or symbol used by the host computer for dialog start.

Dialog Done
Enter the ASCII code equivalent to the character or symbol used by the host computer for dialog done.

Dialog Prompt
Enter the ASCII code equivalent to the character or symbol used by the host computer for dialog rompt.

Dialog Pause
Enter the ASCII code equivalent to the character or symbol used by the host computer for dialog pause.

Dialog Acknowledge
Enter the ASCII code equivalent to the character or symbol used by the host computer for dialog acknowledge.

End of Transmission
Enter the ASCII code equivalent to the character or symbol used by the host computer for dialog acknowledge.

Using Phoenix Link
If you are using the Phoenix Communication link program supplied on the control select Yes and the control will automatically enter the appropriate ASCII codes in to the communication link dialog parameters listed above.

Show Host File Names
The Show Host File Names feature allows the user to select whether or not File Names are shown at the Download from Host screen. This is a time saving feature for operators who have very large part folders at the host computer and know the exact file name of the part program to be loaded. The Using Phoenix Link parameter must be set to ON to enable this feature.

File Dump Mode
Select On to configure the link communication protocol to communicate with link programs which operate in File Dump Mode. This will allow the control to accept part programs as one long uninterrupted stream of information as with a tape reader style link.

Allow M65 Auto Reload
Available when a generic link communication has been enabled, this parameter allows the user to select whether the EIA M65 code will be used as an Auto-reload code or ignored.

Auto Home before Auto Reload
When enabled, this feature automatically "homes" the machine before the next Auto reload (EIA M65 code), either serial Link, USB memory or from Diskette, is executed

ESSI Program Termination
This parameter allows the operator to tell the control which ESSI code (0,63, 64 99, / or =) is to be used as machine stop.

Download Updates
The Download Updates parameter allows the operator to download control software updates through the link communications to the host PC. To use this feature, the "Using Phoenix Link" parameter must be set to yes. The new update file would then be placed in the same folder location as the Link software. When the Update Software softkey is pressed at the Special Password screen, the control will search for the new software update via the link rather than the floppy drive.

Control Monitoring
When enabled, the Control Monitoring feature allows the user to view control status at the host PC. Status for File Name, position, cut mode and cut information is displayed. This feature is only available with the Phoenix Link communication software.

Please refer to the Phoenix Link information section of this guide for additional information on the Phoenix link.

The following additional parameters are available when Serial Messaging has been enabled. See Serial Messaging in the Program Code section of this guide for more information.

Flow control
Select to use None, Xon/Xoff or Hardware.

During Jog on Path
The user may select whether messages will be sent when jogging Forward or Backward on Path while at the Pause screen.   Note: All messaging will stop when the Stop Key has been pressed or the Remote Pause input becomes active.

Note: The Message Type 21 will not be executed for "Backup on Path".

Retry on Time Out
For the Message Type 22 (which requires an acknowledgement from the external device after the message) an automatic retransmit of the message may be sent. The user may select the number of retries allowed before faulting from a lack of response from the external device. The fault prompt "Message Error" will be displayed when in a Time Out condition.

Time Out
The Time Out value may be used for the Message Type 22 (which requires an acknowledgement from the external device after the message) if there is no Time Out value used in the command string of the program code. Refer to the Delay Time / Time Out information for more information.

I/O

Pressing the I/O softkey allows the operator to configure the inputs and outputs for the shape cutting table.

Expanded I/O
When more than 64 I/O have been selected a pull down box will be available to assign I/O in the higher I/O ranges.

Note: When the optional USB Front Panel is used, the top 128 I/O will be assigned to USB I/O to support the front panel

Input Logic
The control comes standard with up to 32 discrete inputs. The Input Logic parameter is used as a mask to determine whether or not the input is to be treated as a normally open contact or normally closed contact. Entering a numerical value here will set all the Inputs to a predefined set of logic states for all of the inputs.

With Input Logic set to zero (0), an active input will be displayed as active or On (green lamp) in the input diagnostic screen.

Logic Selection Box
The Logic Selection Box allows the user to select the Logic state for each input to be either normally open or normally closed. The Logic state for the inputs may be switched by selecting the desired input and pressing the space key.

Input Selection
The Input Selection box feature is used to define which inputs will be used by the control and their physical location on the control interface. All controls are shipped with the default selection of Inputs and interface locations for the selected control Interface (I/O) configuration.

Torch Collision Uses
This parameter allows the user to select the type of response used when the Torch Collision input is active. The user may select to use a Fast Stop Decel value or the Fault Ramp time selected for the individual axis. Note that when Fault Ramp Time is used, Torch Collision is treated as a Machine Fault similar to the Hardware Overtravel Fault. Fast Stop Decel will pause the part program at the Fast Deceleration rate.

Inputs Inverted
The Input Selection box feature is used to define which inputs will be used by the control and their physical location on the control interface. All controls are shipped with the default selection of Inputs and interface locations for the selected control Interface (I/O) configuration.

Drive Enables
This setup parameter allows the user to select how the control responds to drive faults. If the setting is Series, then all axes must complete their individual fault ramp times before the drives are disabled. If the setting is independent, each drive is disabled immediately as soon as its axis fault ramp time is finished.

Initial Feedback Delay
This feature allows the initial feedback from the Drive System to be held off after initial power up. This allows the Drive System to fully enable prior to enabling the position loop.

Speed Pot and Joystick Overview

Through the use of Single Ended Inputs to an optional Analog Input Card installed in the control, your shape cutting control may be configured to support an external Joystick or Two Speed Potentiometers. Note: These features are not available for all control types and optional control hardware is required.

The external Joystick is used as a directional command signal when in manual motion.

The optional Speed Pot may be used to adjust the current motion speed.

These features must first be enabled at the password protected I/O screen for use.
Joystick Installed
Select "Yes" to enable the optional external Joystick. Not available for all control types and optional control hardware required.

Speed Pot Installed
Select "Yes" to enable the optional external Speed Potentiometer. Not available for all control types and optional control hardware required.

Plasma Override %
The Plasma Override feature is used in conjunction with the Speed Pot feature to set the minimum and maximum range of adjustment of the plasma Speed Pot based on a percentage of the set cut speed. The Speed Pot feature must be enabled for use.

Oxy Fuel Override %
The Oxy Fuel Override feature is used in conjunction with the Speed Pot feature to set the minimum and maximum range of adjustment of the oxy fuel Speed Pot based on a percentage of the set cut speed. The Speed Pot feature must be enabled for use.

Trial Override %
The Trial Override feature is used in conjunction with the Speed Pot feature to set the minimum and maximum range of adjustment of the Trial Speed Pot based on a percentage of the set Trial speed. The Speed Pot feature must be enabled for use.

Speed Pot Installed On
The Speed Pot installed on Parameter is used to assign Speed Pot inputs to the desired Analog Input if a dedicated Speed Pot input is not available on the Analog input card being used.

Analog Offset 1- 12
The Analog Offsets 1 through 12 are used to correct for any imbalance or "Zero" the incoming analog voltage to the Analog Input Card

Note: To calibrate the Analog Inputs, jumper the two pins specific to the input together and view the incoming voltage at the Diagnostics Analog I/O screen. The incoming voltage should be zero. If any voltage is displayed at the diagnostic screen, an Offset Voltage equal to the incoming voltage being read can be entered here to "Zero" the incoming voltage. Please refer to the installation instructions later in this section for more details.

Input Definitions

Input	Description
Spare	Spare inputs are activated through the part program. If a Spare input is located in the part program, the control will pause the process until the input state is detected. The Spare inputs may be used by use of specific EIA "O" and "M" codes indicating the input number and function. Refer to Appendix A in the operator's manual for a complete description of these commands.
Torch Up Sense	Confirmation signal indicating that the torch is in the full up position.
Torch Down Sense	Confirmation signal indicating that the torch is in the full down position.
Preheat Sense	Confirmation signal indicating that the Preheat Input from the torch is active.
Cut Sense	Activation of this input indicates that the plasma arc has transferred to the work piece. If the "Arc On Feedback" setup parameter is ON, then machine motion will begin at the activation of this input. Type "M" and "P" controls.
Tracer on Path	Tracer On Path is used with the Teach Trace feature and indicates that the tracing system has detected the template line.
Drive Disabled	If the Drive Disabled input is activated, the control will stop all motion and generate a fault message. Position information will be lost.
Remote Pause	A Remote Pause input, when activated, will stop all control motion and display the Pause screen. No motion will be allowed until this input is deactivated.
Remote Start	When a Remote Start input is detected, it will begin the selected program cycle as if the Start button on the control had been pressed.
Program Inhibit	The Program Inhibit input will force the control to command the motion output to a zero (0) speed. This is generally used as a dwell to pause motion during a tool change or as a pause from a PLC interface.
Raise/ Lower Torch	The type "V" control has the ability to operate multiple Sensor™ THCs which are commanded by the control, as separate axes. The Sensor™ THC Torch Raise and Torch Lower commands may be made through the software softkeys or through the use of these external inputs to the control.

Station Select Input   The type "V" control system has the ability to operate multiple Sensor™ THCs which are commanded by the control as separate axes. The control requires an input to indicate which Sensor™ THCs are active. This Input is also used for tracking of consumable data for the specified Plasma or Oxy Torch. Stations 1-8 are designated for Plasma and stations 9-20 are designated for Oxy Fuel.

X Home Switch   This input indicates that the machine has traveled to its X axis home position. If the X axis "Use Home Limit Switch" parameter is set to YES and a Homing function is performed, the X axis moves in the specified home direction at the Fast Home Speed until the input is activated. The X axis then decelerates to a stop and moves in the opposite direction at the Slow Home Speed until the switch is deactivated. Once the switch is deactivated, the X axis will either decel to a stop or continue on until the encoder marker pulse is detected, if the "Use Marker Pulse" parameter is set to YES.

Y Home Switch   This input indicates that the machine has traveled to its Y axis home position. If the Y axis "Use Home Limit Switch" parameter is set to YES and a Homing function is performed, the Y axis moves in the specified home direction at the Fast Home Speed until the input is activated. The Y axis then decelerates to a stop and moves in the opposite direction at the Slow Home Speed until the switch is deactivated. Once the switch is deactivated, the Y axis will either decel to a stop or continue on until the encoder marker pulse is detected, if the "Use Marker Pulse" parameter is set to YES.

Z Home Switch   Z Axis Home Limit Switch indicates that the machine has traveled to its Z axis home position. If the Z axis "Use Home Limit Switch" parameter is set to YES and a Homing function is performed, the Z axis moves in the specified home direction at the Fast Home Speed until the input is activated. The Z axis then decelerates to a stop and moves in the opposite direction at the Slow Home Speed until the switch is deactivated. Once the switch is deactivated, the Z axis will either decel to a stop or continue on until the encoder marker pulse is detected, if the "Use Marker Pulse" parameter is set to YES.

Y Overtravel Switch   This input indicates that the machine has traveled into its full positive travel of a Y axis. If the hardware overtravels are enabled and this input is activated, the control will stop all motion and generate a fault message. Motion will not be re-enabled until the switch is deactivated.

X Overtravel Switch   This input indicates that the machine has traveled into its full positive travel of a X axis. If the hardware overtravels are enabled and this input is activated, the control will stop all motion and generate a fault message. Motion will not be re-enabled until the switch is deactivated.

Limit Switch   This input indicates that the machine has traveled into its full positive travel of an axis. If the hardware overtravels are enabled and this input is activated, the control will stop all motion and generate a fault message. Motion will not be re-enabled until the switch is deactivated. (Type "M" configuration only)

Ready to Fire PS 1-4   Exclusive to the HD4070® multiple power supply configuration, the Ready to Fire Input is used to ensure that all HD4070® power supplies have completed each individual Initial Height Sense and are ready for

use. The torch ignition is held off by the Hold Ignition Input to the power supply from the control.

Raise /Lower 4070 1-2   Exclusive to the HD4070® multiple power supply configuration, the Raise / Lower 4070 Torch Input is used as a manual raise/lower command to the selected HD4070® integrated THC through the control serial – power supply communication link.

X +Overtravel Switch   This input indicates that the machine has traveled into its full positive travel in the X axis. If the hardware overtravels are enabled and this input is activated, the control will stop all motion, generate a fault message and only allow manual motion in the X axis negative direction.

X –Overtravel Switch   This input indicates that the machine has traveled into its full negative travel in the X axis. If the hardware overtravels are enabled and this input is activated, the control will stop all motion, generate a fault message and only allow manual motion in the X axis positive direction.

Y +Overtravel Switch   This input indicates that the machine has traveled into its full positive travel in the Y axis. If the hardware overtravels are enabled and this input is activated, the control will stop all motion, generate a fault message and only allow manual motion in the Y axis negative direction.

Y –Overtravel Switch   This input indicates that the machine has traveled into its full negative travel in the Y axis. If the hardware overtravels are enabled and this input is activated, the control will stop all motion, generate a fault message and only allow manual motion in the Y axis positive direction.

Power Supply OK   This is an input used for the optional Automated Process Controller (APC). It is used to confirm a ready condition from the Plasma Power Supply before beginning the cut process.

Fast Stop   The Fast Stop input is used as an urgent stop input command to the control. When the Fast Stop input becomes active, the control will decelerate motion using a special Fast Stop Decel parameter, and forces the operator to the Pause Screen. One second after the input becomes active, the Drive Enable output from the control will turn off and disable motion. Position information and I/O points will be maintained while the input is active. This will allow the operator to recover the last position after the input has been cleared. *Note:* The Fast Stop Decel parameter is located on the password protected Speeds setup screen.

Torch Collision   The Torch collision input is used on torch systems with "break away" style mounts. In the event that a torch should make contact with the plate or any obstacle which causes the break away mount to release, an input for the mount would be tied back to the control indicating a torch collision has occurred. The operator will then be forced to the Pause screen. While the input is active, the Cut output will be turned off and manual motion will be enabled, allowing the operator to raise, lower and move the torch position to clear the fault. *Note:* Position information, motion command and I/O points are maintained, allowing the operator to return to the cut path and resume cutting. This feature uses the Fast Stop Deceleration rate. Manual raise inputs may be used.

Joystick (Direction)   The Joystick directional inputs (Up, Down, Left and Right) are used to command manual motion when using and external joystick.

Fume Extraction Sense   If selected, the Fume Extraction input is used to confirm that an external Fume Extraction system on the cutting table is operational prior to beginning the cut. An option to override is displayed if the input has not been satisfied at the time of the cut.

Cut/Mark Sense 1& 2   Cut/Mark Sense (arc on feedback) is used to verify that the plasma torch or marker tool has established the Arc for the selected process. This indicates to the control that motion can begin. (Type "V" controls).

THC Cut Sense   THC Cut Sense (arc on feedback) is used to verify that the plasma torch or marker tool has established the Arc for the selected Sensor™ THC . This indicates to the control that motion can begin. (Type "V" controls).

Plasma Select 1 & 2   The Plasma Select 1 & 2 are used to select which Plasma process logic will be used by the control. These inputs are generally run by external switches. (Type "V" controls).

Marker Select 1 & 2   The Marker Select 1 & 2 are used to select which Marker process logic will be used by the control. These inputs are generally run by external switches. (Type "V" controls).

Sensor THC Enable   The type "V" control system has the ability to operate multiple Sensor™ THCs which are commanded by the control, as separate axes.   The control requires an input to indicate which Sensor™ THCs are active. This input is now supported by the Station Select input.

THC Homing to Limit   The THC Enable Input is used during Sensor™ THC Homing as the Current Limit input if the "Home to Hard Stop Current Limited" option is selected.

Nozzle Contact Sense   The Nozzle Contact Sense Input is used during Sensor™ THC Initial Height Sense to detect the location of the cut surface. This input is tied back to the control through the external Voltage Divider Card.

THC Homing to Switch   The Nozzle Contact Sense Input is used during Sensor™ THC Homing as the Home Switch input, if the "Home to Switch" option is selected.

THC Automatic   This input is used as an external input to switch the Sensor™ THC between Automatic and Manual operation.

Speed Limit Input   The Speed Limit Input is used to limit the machine speed for safety
                           during machine testing and maintenance. When active, motion will be
                           limited to the user defined Limited Machine Speed selected in the
                           password protected Speeds screen

Tilt +/– Overtravel Switch This input indicates that the machine has traveled into its full positive
                           travel in the Tilt axis. If the hardware overtravels are enabled and this
                           input is activated, the control will stop all motion, generate a fault
                           message and only allow manual motion in the Tilt axis opposite
                           direction. The Tilt Overtravel Input is also used for Homing of the Tilt
                           Axis.

Tilt +/–   Tilt +/- inputs are used for manual jog commands for the Tilt Axis.

Tilt Home Feature   This feature uses the Tilt Overtravel Switch input to indicate that the
                           machine has traveled to its Tilt axis home position. When a Homing
                           function is performed, the Tilt axis moves in the specified home
                           direction at the Fast Home Speed until the input is activated. The Tilt
                           axis then decelerates to a stop and moves in the opposite direction at
                           the Slow Home Speed until the switch is deactivated. Also see Tilt
                           Overtravel Switch

Rotate +/–   Rotate +/- inputs are used for manual jog commands for the Rotate
                           Axis.

Rotate Home Switch   This input indicates that the machine has traveled to its Rotate axis
                           home position. When a Homing function is performed, the Rotate axis
                           moves in the specified home direction at the Fast Home Speed until the
                           input is activated. The Rotate axis then decelerates to a stop, moves in
                           the opposite direction at the Slow Home Speed until the switch is
                           deactivated.

Pierce Complete   The Pierce Complete input is used for the Laser Cut Process and is
                           used to confirm that the pierce is complete.

Gas Control Read Comp.   The Gas Control Read Complete input is used as part of the HD3070$^{®}$
                           Automatic Gas Console communications to confirm communications is
                           complete.

Gas Control Error   The Gas Control Error input is used as part of the HD3070$^{®}$ Automatic
                           Gas Console communications to notify of an error from the Auto Gas
                           Console.

Enable Oxy Fuel 1-12   These inputs are used for tracking of consumable data for the specified
                           Oxy Torch. This input is now supported by the Station Select input.

Enable Plasma 1-8   These inputs are used for tracking of consumable data for the specified
                           Plasma Torch. This input is now supported by the Station Select input.

Arc Error Counter 1-8   Used as part of the tracking for consumable data, this input triggers a
                           counter on the Change Consumable Screen. A Plasma Enable Input
                           must be mapped to have this enable available for use.

Test Lifter   This Input is used to perform a test IHS function with a Sensor™ THC.

Output Logic
The control comes standard with up to 32 discrete outputs. The Output Logic parameter is used as a mask to determine whether or not the output is to be treated as a normally open contact or normally closed contact.

Logic Selection Box
The Logic Selection Box allows the user to select the Logic state for each input to be either normally open or normally closed. The logic state for the inputs may be switched by selecting the desired Output and pressing the space key.

Output Selection
The Output Selection box feature is used to define which inputs will be used by the control, and their physical location on the control interface. All controls are shipped with the default selection of Outputs and interface locations for the selected control Interface (I/O) configuration.

Output Definitions

Output	**Description**
Spare	Spare outputs are activated through the part program. If a Spare output is located in the part, the control will turn on the output as directed. The Spare outputs may be used by use of specific EIA "W" and "M" codes indicating the output number and function. Refer to Appendix A in the operator's manual for a complete description of these commands.
Torch Up	This output is used to raise the cutting torch. It is activated for the "Primary Torch Up Time" and the "Pierce Torch Up Time" in oxy fuel mode. It is activated for the "Torch Up Time" in plasma mode.
Torch Down	This output is used to lower the cutting torch. It is activated for the "Primary Torch Down Time" and the "Pierce Torch Down Time" in oxy fuel mode. It is activated for the "Torch Down Time" in plasma mode.
Ignition Control	This output is used to turn on the igniters in oxy fuel mode or ignite the plasma system in plasma mode.
Torch Height Disable /Dual Grid Control	This output is used to disable the automatic torch height controller in plasma mode. It is activated whenever the current axis position is within the "Plasma Distance To Corner" or the "Plasma Distance From Corner" parameters while cutting a part. It is also active whenever the current cutting speed drops below the result of (Programmed Cut Speed x (Plasma High/Lo Speed/100)). This Output is also used to reduce the plasma current in a switchable current plasma system when the machine speed is less than the Plasma Hi/Lo speed percentage.
Reduce Current	Used with the HD4070®, this output switches the plasma to low current mode.

CNC/Tracer	This output is used to control a CNC relay. The CNC relay determines whether the control, tracing system or joystick is commanding the amplifiers. This output is deactivated whenever the control is off, in Teach Trace mode or is disabled. Otherwise it is always activated.
Marker / Marker Enable	This output is used to activate an external marking device. It can only be activated by the appropriate "M" code in the part program. Refer to Appendix A in the operator's manual for a complete description of appropriate "M" code commands.
Cut Control	This output is used to enable the cutting oxygen in oxy fuel mode or start the plasma system in plasma mode. This output can also be used to activate a marking device.
Low Preheat Control	The Low Preheat Control output is used to enable the low preheat gas when cutting in oxy fuel mode. It is activated for the "Low Preheat Time" when initiating a cut.
Preheat Control	This output is used to enable the high preheat gas when cutting in oxy fuel mode. It is activated for the "High Preheat Time" when initiating a cut.
Key Press Indicator	The Key Press Indicator output is activated whenever a key is pressed on the control.
Motion Indicator	The Motion Indicator output is activated whenever the control is commanding machine motion.
Plasma Select	The Plasma Select output is activated whenever the control is in the Plasma cutting mode.
Bleed Off Gas	The Bleed Off Gas Output is used by the Oxy fuel cut logic to send an output to the Oxy torch to purge gases at the end of a cut. This Output is on for the duration of the Bleed Off Time selected in setups.
Pierce Control	The Pierce Control Output is used by the Plasma and Oxy fuel cut logic to send an output to the torch during the pierce. This Output is on for the duration of the Pierce Time selected in setups.
Turn ON / Off Supply	The Turn ON OR Turn Off Supply Output is used by the Optional APC (Automated Process Controller) to turn On or Off the plasma supply through the control
N2 Select	The Turn On Supply Output is used by the Optional APC (Automated Process Controller) to enable the use of nitrogen while cutting.
Drive Enable	The Drive Enable Output is used to enable the Drives during normal functions and to disable the Drives during fault conditions.
Shutter Open	The Shutter Open Output is used exclusively with the Laser cut logic and is used to open the Laser Shutter for use.
Assist Gas	The Assist Gas Output is used exclusively with the Laser cut logic and is used to activate the Assist gas.

Digital Beam	The Digital Beam Output is used exclusively with the Laser cut logic and is used to activate the Digital Beam.
Laser Start	The Laser Start Output is used exclusively with the Laser cut logic and is used to activate the Laser System.
Abrasive Control	The Abrasive Control Output is used exclusively with Water Jet cut logic and activates the abrasive control adding abrasive to the cut stream while cutting or for charging the abrasive prior to cutting.
Plasma Enables	These outputs are used for external logic. The appropriate Output(s) is on during plasma cutting, based on the Plasma Select Inputs.
Marker Enables	These outputs are used for external logic. The appropriate Output(s) is on during marking, based on the Marker Select Inputs.
Nozzle Contact Enable	The Nozzle Contact Enable Output is active during Sensor™ THC Initial Height Sense. This input is tied back to the control through the external Voltage Divider Card. This output may also be used to switch an external drive system to low output mode (if equipped) during IHS for stall force plate sensing.
Hold Ignition	The Hold Ignition Output is part of the Sensor™ THC operation and used to hold ignition of the external Plasma Supply. This output may be tied back to the control through the external Voltage Divider Card or direct to the Power Supply depending on configuration.
Gas Flow Set 1 – 100	The Gas flow Set Output is used as part of the HD3070$^{®}$ Automatic Gas Console communications (BCD) to set Gas Flow rates.
Valve Select 1 – 8	The Valve Select Output is used as part of the HD3070$^{®}$ Automatic Gas Console communications to select the appropriate valves for operation.
Gas Control Write	The Gas Control Write Output is used as part of the HD3070$^{®}$ Automatic Gas Console communications to configure the unit for operation.
Remote Test Operate	The Remote Test Operate Output is used as part of the HD3070$^{®}$ Automatic Gas Console communications to Initiate the Remote Test.
Remote Test Preflow	The Remote Test Preflow Output is used as part of the HD3070$^{®}$ Automatic Gas Console communications to test operation of Preflow gases.
Remote Air Plasma	The Remote Air Plasma Output is used as part of the HD3070$^{®}$ Automatic Gas Console communications to signal the Air Plasma Output.
Remote H35/ N2 Plasma	The Remote H35/N2 Plasma Output is used as part of the HD3070$^{®}$ Automatic Gas Console communications to signal the H35/N2 Output.
Remote O2 Plasma	The Remote O2 Plasma Output is used as part of the HD3070$^{®}$ Automatic Gas Console communications to signal the O2 Output.

Change Consumable   This output becomes active when a consumable data value at the
                         Change Consumable Screen has reached it's preset maximum.
                         Generally, this output is tied to an external indicator light or audible
                         alarm to prompt the system operator to change the appropriate
                         consumable (torch tip / electrode). The affected consumable data
                         must be reset at the Change Consumable Screen to clear the output.

Current Set BCD   The Current Set BCD outputs are used to set the current at the
                         plasma power supply or marker supply for use.   These outputs are
                         tied to the BCD inputs. Combinations of the current values are used
                         to attain the desired current set point.

Marker Control   The Marker Control Output is used to activate the Marker tool when
                         in the Marking Process. Traditionally, the Marker tool is activated
                         through the combination of Marker Enable and Cut Control Outputs.
                         All the noted options are available and may be configured at the
                         Marker Setup screen for the desired process timing and operational
                         results.

Program Running   The Program Running Output is active any time the control is
                         operating within a part program.

Station Enable 1-20   Station Select outputs are used to activate any function specific to a
                         torch station and are controlled through M37T and M38T codes
                         within a part program. Typically these are used to enable a torch
                         station for use. Stations 1-8 are plasma and stations 9-20 are oxy
                         fuel / other.

Station Lock 1-19   The Station Lock Outputs are used as part of the Automated Torch
                         Spacing feature. The Station lock is used to Lock the unused torch
                         station to the gantry or beam when not in use.

Station Clamp 1-19   The Station Clamp Outputs are used as part of the Automated Torch
                         Spacing feature. The Station Clamp is used to clamp the selected
                         torch station to the transverse axis for standard cutting.

Station Mirror 1-19   The Station Mirror Outputs are used as part of the Automated Torch
                         Spacing feature. The Station mirror is used to clamp the selected
                         torch station to the transverse axis for mirrored cutting.

Axes

Transverse/Rail

The following screen is identical for both the traverse and rail setup screens.

The control comes with both an advanced position and velocity servo loop. The following parameters are available to help configure the servo loops for your specific drive and mechanical system.

Speed 0 To
This parameter allows the technician to input selected speed ranges to customize the gains for the various speeds selected. *Note:* These speed parameters are directly tied to the Speed To field for the acceleration rates previously noted on the Speeds setup screen. Changing these speed parameters will replace the Speed To values entered at the Speeds setup screen.

Proportional Gain
Proportional Gain correlates to Elastic Stiffness in the control loop. Increasing the proportional gain increases the static stiffness, but decreases response of the servo loop.

Under proportional loop control, the drive system will apply a restoring torque to the motor in proportion the position error of the axis.

With a Proportional Gain too high, the system will be unstable which will result in overshoots, and a generally "nervous" and shaky axis. This is also referred to as a "hot" control loop.
With a proportional gain too low, the system will respond in a loose or sloppy manner. This can be seen in the test pattern when the outside corners become rounded and the circle segments do not all meet in the center.

Integral Gain
Integral Gain improves the positioning accuracy of the control loop. Integral Gain can be used to compensate for static friction or gravity. Excessive Integral Gain can result in system instability.

For most shape cutting machines, this parameter should be set to Zero (0).

Derivative Gain
Derivative Gain helps to dampen out sudden changes in velocity. The higher the derivative gain, the slower the response time to the control loop. For most velocity loop drives, this parameter will be set to Zero (0).

Feedforward Gain
Feedforward Gain can be used to drive the following error to zero during machine motion. In all digital control loops there is a finite amount of error that is introduced by the velocity command. Increasing Feedforward Gain can reduce this introduced error.

Velocity Gain
When using a current loop amplifier, the internal velocity loop in the control can be used to provide dampening without an external tachometer.

Using the internal velocity loop with a current loop amplifier can result in higher static stiffness, smoother machine motion, and less overshoot.

Servo Error Tolerance
Allows the user to program the amount of servo loop Following Error to be allowed prior to display an error message. The parameter is limited to a maximum value of five inches.

Encoder Counts per inch
Enter a value that is the number of encoder edges per inch of machine travel.   It is possible to enter fractional encoder units and the control will keep track of these fractions automatically. Encoder Counts per inch are equal to the resolution of the encoder, multiplied by the encoder revolutions per inch or mm (based on the machine drive gearing).

For example: The resolution of a 4X – 1000 line encoder counts both edges (lines) of channel A and channel B to equal 4 counts per line multiplied by the 1000 lines per revolution would equal 4000 counts per revolution. If the encoder revolutions per inch to travel are 1:1, we would have 4000 encoder counts per inch of travel.

Encoder Counts/ Inch = 4 Counts/ Line x 1000 Lines/ Rev x 1 Rev/ Inch = 4000

Fault Ramp Time
This parameter sets the motion deceleration time after a fault occurs. At the end of "Fault Ramp Time, The drives will be disabled.

Drive Type
This parameter is used to tell the control what type of control loop to run. If you are running an external velocity loop drive (indicated by having an integrated tachometer in the motor), select Velocity. If you are running in torque mode (no tachometer), select Current.

DAC Polarity
This parameter allows changing of the analog output polarity to establish proper control loop feedback without any wiring changes.

Encoder Polarity
This parameter allows changing of the encoder input polarity to establish proper counting for positive machine motion without any wiring changes.

Encoder Decode Mode
Currently, the control only supports 4X encoder decode mode. This has been done to increase positional accuracy.

Use Hardware Overtravels
Select whether or not the cutting machine will be using Hardware Overtravels. If Hardware Overtravels are used, the control will disable feedback and display an error message if the inputs become active. It is recommended that Hardware Overtravels be installed.

Backlash Compensation
The Backlash Compensation parameter is used to offset or compensate for any backlash in the mechanics of the drive system.

Home
The Home parameter is used to activate use of the Home feature. Depending on control I/O configuration, the table may be Homed to either a designated Home Switch or an Overtravel Switch.

The Home feature is used to set a known absolute physical position location on the cutting table that is used for referencing future manual "Go to Home" and other motion commands. This is generally performed through activation of a home switch positioned on the appropriate axis giving it a known physical location.

When the Homing command is entered at the control, the control will move the axis towards the Home Switches at the Fast Home Speed until the switches have been activated. Once the switches have been activated, motion stops and then the axis moves in the opposite direction off switch at the Slow Home Speed. The moment that the switch is deactivated, the position is recorded at the control, providing an absolute reference point for future motion commands.

Absolute Home Position
Defines the position of the axis when the Home Limit Switch or Marker Pulse is detected.

Home Offset Distance
Allows the user to set an offset distance from the Home Limit Switch.

Home Switch Normally
If a Home Limit Switch is used, the user is prompted for switch polarity.

Home Direction
Determines which direction the axes will travel during phase one of the homing sequence.

Use Marker Pulse
When enabled, the absolute home position will be assigned at the instant the marker pulse is detected. It is recommended that the Marker Pulse be used for optimal homing repeatability.

Use Software Travel Limits
The control is capable of running with software Overtravel limit switches based on position. when enabled, this feature allows the user to select the fault logic of fault or Fast Decel when active. Fault operates as hardware switches with immediate fault. Fast Decel uses the fast Decel value to ramp down motion.

Maximum Travel Limit
If Software Overtravels are enabled, the user is prompted for the maximum travel of the cutting machine.

Minimum Travel Limit
If Software Overtravels are enabled, the user is prompted for the minimum travel of the cutting machine.

SERCOS AXES
The SERCOS Interface™ controls the position loop from the amplifier. As a result, limited information for motion is required in the control setups. Tuning is performed through serial port diagnostic software available at the Drives & Motors Diagnostic screen.

The following is a listing of the unique SERCOS parameters. Note: parameters will apply to all SERCOS axes.

SERCOS Drive Address
Each Drive Axes is automatically assigned a Drive Address at the CNC. The appropriate drive amplifier will be coded with the matching Drive Address to provide control motion to the correct amplifier / motor on the SERCOS ring. Note: The drives may be physically located in any order on the ring.

Emulated Encoder Counts/ motor rev
This parameter allows the user to adjust the number of counts per motor rev that the drive generates over the SERCOS ring, to adjust resolution. This parameter is available for Pac Sci drives only. Other drive types allow the emulated Counts /motor rev parameter to be set up in the drive tuning software.

Dual Gantry

The following setup screen is available if the control is configured for a Dual Gantry Axis.

The Dual Gantry Axis is commanded as a separate axis on the control that mirrors the output of the main Rail Axis. Additionally, performance of the Dual Gantry Axis is compared to the main Rail Axis and additional output command is given to keep the axis in position.

The definitions for the setup parameters are the same as for the Transverse/Rail Axes. However, the number of selections are reduced as features for overtravels and homing do not apply.

Speed 0 to	100	to 250	to 500	ipm
Proportional Gain	100	125	150	
Feedforward Gain	0	0	0	
Derivative Gain	0	0	0	
Velocity Gain	0	0	0	
Integral Gain	0	0	0	

Skew Error Tolerance   0.1 in   Use Home Limit Switch ○ No   ⦿ Yes
Encoder Counts per in   4000   Switch Offset Distance   0.5 in
Encoder Polarity ⦿ Positive ○ Negative   Skew Limit   0.25 in
DAC Polarity ⦿ Positive ○ Negative
Backlash Compensation   0 in
Drive Type ⦿ Velocity ○ Current
Current Limit   25 %
Encoder Decode Mode ○ 1X   ○ 2X   ⦿ 4X

Help   Cancel   OK

10:04:00 AM

Transverse   Rail   Dual Gantry   THC

Speed 0 To
This parameter allows the technician to input selected speed ranges to customize the gains for the various speeds selected. *Note:* These speed parameters are directly tied to the Speed To field for the acceleration rates previously noted on the Speeds setup screen. Changing these speed parameters will replace the Speed To values entered at the Speeds setup screen.

Proportional Gain
Proportional Gain correlates to Elastic Stiffness in the control loop. Increasing the proportional gain increases the static stiffness, but decreases response of the servo loop.

Under proportional loop control the drive system will apply a restoring torque to the motor in proportion the position error of the axis.

With a Proportional Gain too high, the system will be unstable which will result in overshoots, and a generally "nervous" and shaky axis. This is also referred to as a "hot" control loop.

With a proportional gain too low, the system will respond in a loose or sloppy manner. This can be seen in the test pattern when the outside corners become rounded and the circle segments do not all meet in the center.

Integral Gain
Integral Gain improves the positioning accuracy of the control loop. Integral gain can be used to compensate for static friction or gravity. Excessive Integral Gain can result in system instability.

For most shape cutting machines this parameter should be set to zero (0).

Derivative Gain
Derivative Gain helps to dampen out sudden changes in velocity. The higher the derivative gain, the slower the response time to the control loop.

For most velocity loop drives this parameter will be set to zero (0).

Feedforward Gain
Feedforward Gain can be used to drive the following error to zero during machine motion. In all digital control loops there is a finite amount of error that is introduced by the velocity command. Increasing Feedforward Gain can reduce this introduced error.

Velocity Gain
When using a current loop amplifier, the internal velocity loop in the control can be used to provide dampening without an external tachometer.

Using the internal velocity loop with a current loop amplifier can result in higher static stiffness, smoother machine motion, and less overshoot.

Skew Error Tolerance
If the Dual Gantry Axis is installed, the user will be prompted for Skew Error Tolerance. This is the amount of position error allowed between the master and slave gantry drive axes prior to an error message being displayed.

Encoder Counts per inch
Enter a value that is the number of encoder edges per inch of machine travel. It is possible to enter fractional encoder units and the control will keep track of these fractions automatically. Encoder Counts per inch are equal to the resolution of the encoder, multiplied by the encoder revolutions per inch (based on the machine drive gearing).

For example: The Resolution of a 4X – 1000 line encoder counts both edges (lines) of channel A and channel B to equal 4 counts per line multiplied by the 1000 lines per revolution would equal 4000 counts per revolution. If the encoder revolutions per inch to travel is 1:1, we would have 4000 encoder counts per inch of travel.

Encoder Counts/Inch = 4 Counts/Line x 1000 Lines/Rev x 1 Rev/Inch = 4000

Note: This value should match the value used for the Rail for proper operation.

Drive Type
This parameter is used to tell the control what type of control loop to run. If you are running an external velocity loop drive (indicated by having an integrated tachometer in the motor), select Velocity. If you are running in torque mode (no tachometer), select Current.

DAC Polarity
This parameter allows changing of the analog output polarity to establish proper control loop feedback without any wiring changes.

Encoder Polarity
This parameter allows changing of the encoder input polarity to establish proper counting for positive machine motion without any wiring changes.

Encoder Decode Mode
Currently the control only supports 4X encoder decode mode. This has been done to increase positional accuracy.

Use Home Limit Switch
Selecting "Yes" will enable the Home feature for the Dual Gantry Axis. Note: The Z Home Switch must first be defined and mapped to an input location in the I/O screen to enable this feature.

Switch Offset Distance
The Switch Offset Distance is used to specify any physical position offset between the Dual Gantry and Rail Home Switch positions. This allows the control to very accurately position the two axes for operation and remove any skew of the gantry.

Backlash Compensation
The Backlash Compensation parameter is used to offset or compensate for any backlash in the mechanics of the drive system.

CBH

The following setup screen is available if the control is configured for a Contour Bevel Head.

The definitions for the setup parameters are the same as for the Transverse/Rail Axes, with the exception of Absolute Home Angle and Home Offset Angle. These two setup parameters serve the same basic function as previously described but are measured in degrees of rotation rather than inches or millimeters. However, the number of selections are reduced as these parameters are not used with a Contour Bevel Head.

Proportional Gain	50
Feedforward Gain	0
Derivative Gain	0
Velocity Gain	0
Integral Gain	0
Servo Error Tolerance	10 deg
Encoder Counts per rev	4000
Encoder Polarity	⊙ Positive ○ Negative
DAC Polarity	⊙ Positive ○ Negative
Follower Initially	⊙ Off ○ On
Drive Type	○ Velocity ⊙ Current
Current Limit	25 %
Encoder Decode Mode	○ 1X ○ 2X ⊙ 4X

Auto Home at Power Up	⊙ No ○ Yes
Absolute Home Angle	0 deg
Home Offset Angle	0 deg
Use Home Limit Switch	⊙ No ○ Yes
Home Direction	⊙ Positive ○ Negative
Use Marker Pulse	⊙ No ○ Yes

Help

Cancel

OK

10:10:07 AM

Transverse	Rail	Dual Gantry	CBH

Proportional Gain
Proportional Gain correlates to Elastic Stiffness in the control loop. Increasing the proportional gain increases the static stiffness, but decreases response of the servo loop.

Under proportional loop control, the drive system will apply a restoring torque to the motor in proportion the position error of the axis.

With a Proportional Gain too high, the system will be unstable which will result in overshoots and a generally "nervous" and shaky axis. This is also referred to as a "hot" control loop.

With a proportional gain too low, the system will respond in a loose or sloppy manner. This can be seen in the test pattern when the outside corners become rounded and the circle segments do not all meet in the center.

Integral Gain
Integral Gain improves the positioning accuracy of the control loop. Integral Gain can be used to compensate for static friction or gravity. Excessive Integral Gain can result in system instability.

For most shape cutting machines, this parameter should be set to zero (0).

Derivative Gain
Derivative Gain helps to dampen out sudden changes in velocity. The higher the Derivative Gain, the slower the response time to the control loop.

For most velocity loop drives, this parameter will be set to zero (0).

Feedforward Gain
Feedforward Gain can be used to drive the following error to zero during machine motion. In all digital control loops there is a finite amount of error that is introduced by the velocity command. Increasing Feedforward Gain can reduce this introduced error.

Velocity Gain
When using a current loop amplifier, the internal velocity loop in the control can be used to provide dampening without an external tachometer.

Using the internal velocity loop with a current loop amplifier can result in higher static stiffness, smoother machine motion, and less overshoot.

Servo Error Tolerance
Allows the user to program the amount of servo loop Following Error to be allowed prior to display an error message. The parameter is limited to a maximum value of 90 degrees.

Encoder Counts per rev
Enter a value that is the number of encoder edges per revolution of the Contour Bevel Head axis.   It is possible to enter fractional encoder units and the control will keep track of these fractions automatically. Encoder Counts per rev are equal to the resolution of the encoder multiplied by the encoder revolutions per rev.

For example: The Resolution of a 4X – 1000 line encoder counts both edges (lines) of channel A and channel B to equal 4 counts per line time multiplied by the 1000 lines per revolution would equal 4000 counts per revolution.

Encoder Counts/Rev = 4 Counts/Line x 1000 Lines/Rev = 4000

Drive Type
This parameter is used to tell the control what type of control loop to run. If you are running an external velocity loop drive (indicated by having an integrated tachometer in the motor), select Velocity. If you are running in torque mode (no tachometer), select Current.

DAC Polarity
This parameter allows changing of the analog output polarity to establish proper control loop feedback without any wiring changes.

Encoder Polarity
This parameter allows changing of the encoder input polarity to establish proper counting for positive machine motion without any wiring changes.

Encoder Decode Mode
Currently the control only supports 4X encoder decode mode. This has been done to increase positional accuracy.

Follower Initially
This parameter is used to determine if the CBH axis will be On when the control is first powered up.

Auto Home At Power Up
Determines if the Contour Bevel Head will automatically go into the homing routine upon powering up the control.

Absolute Home Angle
Defines the position of the axis when the home limit switch or marker pulse is detected.

Home Offset Angle
Allows the user to set an offset angle from the home limit switch.

Use Home Limit Switch
Tells the control to look for a home limit switch during phase one of the homing sequence.

Home Direction
Determines which direction the axes will travel during phase one of the homing sequence.

Use Marker Pulse
When enabled, the absolute home position will be assigned at the instant the marker pulse is detected. It is recommended that the marker pulse be used for optimal homing repeatability.

Rotate

Proportional Gain	50
Feedforward Gain	0
Derivative Gain	0
Velocity Gain	0
Integral Gain	0

Absolute Home Angle	0 deg
Home Offset Angle	0 deg
Use Home Limit Switch	⊙ No ○ Yes
Home Direction	⊙ Positive ○ Negative
Use Marker Pulse	⊙ No ○ Yes

Servo Error Tolerance   10   deg
Encoder Counts per rev   4000
Encoder Polarity ⊙ Positive   ○ Negative
DAC Polarity ⊙ Positive   ○ Negative
Drive Type ○ Velocity   ⊙ Current
Current Limit   10   %
Encoder Decode Mode ○ 1X   ○ 2X   ⊙ 4X

Help

Cancel

OK

10:09:37 AM

Transverse	Rail	Dual Gantry	THC	Rotate	Tilt

Absolute Home Angle
Defines the position of the axis when the home limit switch or marker pulse is detected.

Home Offset Angle
Allows the user to set an offset angle from the home limit switch.

Tilt

Absolute Home Angle
Defines the position of the axis when the home limit switch or marker pulse is detected.

Home Offset Angle
Allows the user to set an offset angle from the home limit switch.

Note: Homing to a limit switch uses the Tilt Overtravel Switch (+/ –) input.

Transverse 2 Axis

Transverse 2 is only available when a second bevel head has been enabled.

Speed 0 to	100	to	250	to	500	ipm

Speed 0 to [100] to [250] to [500] ipm

Proportional Gain [0] [0] [0]

Feedforward Gain [0] [0] [0]

Derivative Gain [0] [0] [0]

Velocity Gain [0] [0] [0]

Integral Gain [0] [0] [0]

Servo Error Tolerance [0] in   Home [to Home Switch ▼]

Encoder Counts per in [4000]   Absolute Home Position [0] in

Encoder Polarity ⊙ Positive ○ Negative   Home Offset Distance [0] in

DAC Polarity ⊙ Positive ○ Negative   Home Direction ⊙ Positive ○ Negative

Use Hardware Overtravels ⊙ No ○ Yes   Use Marker Pulse ⊙ No ○ Yes

Backlash Compensation [0] in   Use Software Travel Limits ○ No ⊙ Fault ○ Fast Decel

Drive Type ○ Velocity ⊙ Current   Maximum Travel Limit [0] in

Current Limit [10] %   Minimum Travel Limit [0] in

Encoder Decode Mode ⊙ 1X ○ 2X ○ 4X   Mirrored Marker Offsets ⊙ No ○ Yes

Fault Ramp Time [0] sec

Minimum Torch Spacing [0] in

10:11:35 AM

[Transverse 2]   [Rotate 2]   [Tilt 2]

[Help]   [Cancel]   [OK]

Minimum Torch Spacing
This value sets a minimum distance allowed between Transverse 1 and Transverse 2 axes.

Mirrored Marker Offsets
This feature allows preset tool offsets to be performed as mirrored motion for the Transverse 2 axis.

Station Configuration

This password protected screen for the Voyager™ III and Mariner™ controls is used to configure a Plasma, Marker or Laser torch station for use. This provides a single location to assign the Tool Selection, Process Selection and Lifter selection for the station. Up to eight stations for the Plasma 1 & 2 and Marker 1 & 2 process selections may be configured.

The "4532" password is provided for viewing of the Station Configuration setup screen without allowing changes. This password is useful for verifying setups without the danger of accidentally changing them or revealing the supervisory password to an unauthorized user.

This Station configuration screen is also used to enable the serial link for the Command® THC as well as serial communication for the HD4070® and HPR130™ Plasma Systems.

These stations may be selected for use through codes within the part program. These codes enable the desired Station (THC) and are used in conjunction with the Process Select codes to configure the desired cut / mark process for use.

When a Station Select has been executed through the program codes the corresponding Station Select Output will be active.

Stations 1-4 / 5-8
The Stations 1-4 / 5-8 Softkey is used to access the desired Station for configuration.

Reset
The Reset Softkey may be used to reset or clear all Station setup parameters setting the values to
"None".

Part Program Support
The following program codes are used to enable a station for use. Station Select and Process Select
codes should be placed prior to the cut / mark.

Station Selects
Stations (Lifter / THCs) may be selected / de-selected using an EIA-274D program code with the
following format.

Code	Description
M19 T*value*	Cancel All Station Selections
M37 T*value*	Select Station 1-20 (Tvalue)
M38 T*value*	De-Select Station 1-20 (Tvalue)

Additionally, these Station Select program codes may be overridden using the user selected THC
inputs to the control. The feature to override the part program must be enabled at the Cutting Setup
Screen.

Process Selects
Process Selections may be selected using an EIA-274D program code with the following format.

Example: M36 T*value*

Misc. M Code

Valve Identity
        T1 = Plasma Process 1
        T2 = Plasma Process 2
        T3 = Marker Process 1
        T4 = Marker Process 2
        T5 = Laser Process

Station Configuration Variables
The following options are available for the station configuration

  Lifter
  None
  Sensor THC
  Command THC (w/ Serial Link)
  HD4070 Integrated THC 1 or 2 (used only with the HD4070® power supply)
  Other (any stand alone Lifter Station)

  Power Supplies

None	HD4070 Torch 1or 2	Powermax series
Max100/ 100D	HT4001	FineLine 100
Max200	HT4100	FineLine 200
HT2000	HT4400	Other (any other Plasma system)
HD3070	HPR130	

Marker

| None | ArcWriter | FineLine 100 & 200 |
| HD4070 Torch 1or 2 | HPR130 | Other (any stand alone Marker) |

Laser

| Rofin RF 40 & 50 | Rofin DC 35 | Rofin TR 60 | Other |

Station Selects may be overridden by manual inputs by setting the Station Select Override feature in Cutting Setups to disabled.

Process Selects may be overridden by manual inputs by setting the Process Select Override feature in Cutting Setups to disabled.

Overview

First press the Stations 1-4 or Station 5-8 Softkey to access the desired station. Select the appropriate Lifter selection for the desired station from the list of available Lifter types. Next select the appropriate tool (Plasma Power Supply / Marker Tool) selection for that station from the list of available tools in the Plasma and Marker Process fields. The tool selection should reflect the actual tools in use for that individual Lifter. The Station may be configured so that all four Plasma and Marker Processes operate on one Station or distributed throughout all 8 stations. If needed, the Reset Softkey may be used to reset or clear all Station setup parameters setting the values to "None".

Selections made for the four processes and THC designations may limit the overall configuration. Additionally, selection of some of certain power supplies may also limit configuration.

Example: If Station 1 has been defined as having a Sensor™ THC and a MAX200® for Plasma Process 1, no other power supply type can be selected for Plasma Process 1. However, MAX200® for Plasma Process 1 may be select at other stations if a Sensor THC has been selected.

Command® THC Support
Selecting a Command THC as the lifter for a process enables the serial Link to be assigned for a single Command® THC. Note: The actual serial port must be assigned on the Ports setup screen. This also configures the selected Plasma / Marker Cut Types screen to display the Command® THC features. If a Command® THC has been selected for a station but does not use the serial communication feature to the control, then the Lifter type should be set to "Other".

Please refer to the Command® THC section of this manual for additional information on the operation of the Command® THC

HD4070® Support
The HD4070® feature establishes the Serial Link HD4070® Power Supply communication link and configures the selected Plasma / Marker Cut Types screen to display the HD4070® features. A single HD4070® must be assigned to Stations 1 & 2. A second multi-dropped HD4070 may be assigned on stations 3 & 4.

Each HD4070® has the ability to use two Integrated Command® THCs. These are controlled by the HD4070® and as such have designated Station locations.

In the previous example, you can see that the Cutting and Marking with the HD4070® Integrated Torch 1 is limited to Plasma Process 1 / Maker Process 1 on Station 1. Additionally, the Cutting and Marking with HD4070® Integrated Torch 2 is limited to Plasma Process 2 / Maker Process 2 on Station 2. These stations may be configured to Cut or Mark or both. A second multi-dropped HD4070 may be also be assigned on stations 3 & 4.

FineLine 100 / 200 Support
Serial communications to INNERLOGIC's FineLine 100 and FineLine 200 may be enabled and configured for use with selected THCs.

Special

Date

Allows the user to enter the current date.

Time

The value for the current time would be entered at this parameter and displayed at the main screen.

Display Time

The Display Time parameter allows the user to select the display time to be shown in either AM/PM format or 24 hour clock format.

Mouse Pointer

Select On to use and external mouse or touch screen.

Keyboard

When set to Not Installed, on screen keypad will be displayed for editing parameters. If an external key board is being used this can be set to Installed and avoid the on screen keypad use.

User Level
This feature is used to adjust view screens and what features are available for use based on operator experience level. The intermediate level provides a larger preview area and an ALT soft key to access additional screens.

File Extensions
The parameter allows the user to enter the file extensions of the part files that will accepted at the control.

Adding Folders
This parameter determines whether the control operator has the ability to add Folders from the parts directory on the control or the host computer.

Deleting Folders
This parameter determines whether the control operator has the ability to delete Folders from the parts directory on the control or the host computer.

Deleting Files
This parameter determines whether the control operator has the ability to delete Folders from the parts directory on the control or the host computer.

Mapping Drives
This parameter determines whether the control operator has the ability to map to external drives from the control through the optional Network feature.

Configuring Watch
When enabled, this parameter will allow the control operator to change the selected items in the Watch Window.

Adding Processes
This feature allows the user to add new processes to the Laser cut charts when enabled.

Removing Processes
This feature allows the user to remove processes to the Laser cut charts when enabled.

.
Force Simulation
When activated, this feature will force the control into a simulation mode that will allow the control to operate with motioned disabled and I/O feedback enabled.

Temperature
The Temperature parameter allows the user to select that the internal control temperature be displayed in Fahrenheit or Celsius in the Watch Window.

Note: Not available for all control types and optional control hardware required.

Tools Installed
This setup parameter is used to select or limit the cut modes available to the control operator.

Message Enables
The following pull down box is used to enable and disable system messages. To change the status of a message, highlight the selected message and press the Space key.

Ready to Start Cutting Message
When enabled, the Ready Message feature will display a ready message when the Start button is pressed.

Kerf Too Large Warning Message
The Kerf Too Large Warning setup parameter allows the user to disable the " Kerf Too Large" warning message. This message is used to notify the user that when a part has been loaded and translated at the control, a conflict with the cut paths has been detected for the given Kerf value and that some detail may be lost when cut. Disabling the "Kerf Too Large" message may lead to unexpected results and allow cutting of invalid parts.

Homing Must Be Performed Message
This message is used to prompt the operator to home the selected axis before motion can begin. The selected axis must have homing enabled on the axes setup screen.

Values Have been Changed Message
This message is displayed as a confirmation when it has been detected that the values within the current configuration screen have changed. This ensures that changes are not made in error when exiting the screen.

Home Torch Height Control Message
This message is used to prompt the operator to home the Sensor™ THC axis at power up and before motion can begin.

Ready to Final Align Message
This message appears as part of the skew alignment function and is displayed just prior to final motion to position the tool is executed.

Part Larger than Plate Message
This message is displayed when the dimensions of the part that have been loaded exceed the selected plate dimensions.

Cut Chart Data Has Changed Message
This message is displayed as a confirmation when it has been detected that the values within the current Cut Chart screen have changed. This ensures that changes are not made in error when exiting the screen.

Save Part for Rush Job
This feature will enable or disable the Resume Part prompt for Rush Job Interrupt.

Latched Manual Keys
This parameter will enable or disable the Latched Manual Key feature which allows the manual motion keys to remain on with a single key press.

Auto Drop Down
When enabled, the Auto Drop Down feature will automatically show the entire list of options at a selection box.
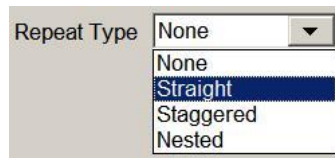
Zero Positions
This parameter determines whether the control operator has the ability to zero positions. When disabled, the zero positions softkey will be grayed out and will be unavailable to the operator.

Auto Size App.
When enabled, the Auto Size App. feature is used for the demo software to size the application software to full screen display or the standard size of 640x480 (disabled).

Language
The language selection parameter allows the user to select the language displayed on the control from the available languages stored on the control. Languages may be added to the control by performing the standard software update with a language specific update file. Eastern languages may also require the installation of a font viewer to properly display the required characters. To change to a different language, select the desired language and press the OK softkey. You will then be prompted to cycle power on the control for the new language to be displayed.

Tangent Angle
This parameter is used to set the degree of the tangent angle for control motion. Segments within a part that intersect at angles greater than the selected tangent angle will decel to zero or minimum corner speed. Segments within a part that intersect at angles less than or equal to the selected tangent angle, will not decel unless the next segment is a speed limited arc.

Password
The password parameter allows the user to enter a new password for machine setups. Numbers or letters may be used.

Special Password
The password parameter allows the user to enter a new password for special setups. Numbers or letters may be used.

Station Configuration Password
The password parameter allows the user to enter a new password for Station Configuration setups. Numbers or letters may be used.

Auto Update Max Consumable Life
When enabled, this feature will continue to track the consumable life values beyond the user defined set point and assign that maximum value as the new set point. If disabled, the user defined set point for maximum consumable life will not be updated.

Machine Position Resets
When enabled, the Machine Position Resets feature will reset the absolute machine position when the Zero Positions softkey is pressed. When disabled, pressing the Zero Positions softkey will not reset the absolute machine position. Position information based on homing will not be lost. Only the current incremental motion (part) position will be reset to zero.

Arc Speed Limit Check
This feature allows the user the ability to turn off the Speed Limit Check performed by *Softmotion* for arcs larger than 10". This may be used to compensate for abrupt motion commands caused by non-tangent line arc segments, smoothing out motion.

HD3070 Auto Gas
When enabled, this feature allows the control to communicate with the Auto Gas Console for the HD3070® and allows access to the related setup parameters.

Front Panel
This feature defines use of an optional 12 station or 6 station operator console.

Save Setups
Pressing the Save Setups button will save the current control setting to the floppy disk or hard drive. A window will be displayed to select the drive and enter a file name.

Note: After installation of the control on the cutting table or if any setup parameters are changed, it is important to save the current setup file to both the hard drive and floppy disk for future reference.

Load Setups
Pressing the Load Setups will load the selected control setting from the floppy or hard drive on to the control. A window will be displayed to select the drive and enter the file name.

Update Software
Pressing the Update Software button will update the control operating software from a floppy disk.

Update Help
Pressing the Update Help button will update the control help files from a floppy disk.

System Tools
Pressing the System Tools button will access core Windows® features for system performance. Features include **Update Registry**, **Scan Hard Disk**, **Defrag Hard Disk** and **Format Disk**. System Tools also accesses features for virus scanning and adding special fonts for some languages.

Restore Last Version
Restore Last Version will restore the control to the previous version of system software.

Make Link Disk
The control is shipped with a proprietary Communication Link software used to communicate with a host computer. Pressing this softkey will transfer the Link software to a floppy disk so it may be loaded on to a host computer for use. Included with the software is a text file to instruct the user on setup and use of the link.

System Tools – Windows® XP

The control Systems Tools involves operational knowledge of Windows® XP operating system and should only be performed by qualified personnel.

Note: A reminder will be posted on screen when entering the Systems Tools that a Mouse and Keyboard will be required for proper operation. The Mouse and Keyboard should be connected to the control before entering the System Tools.
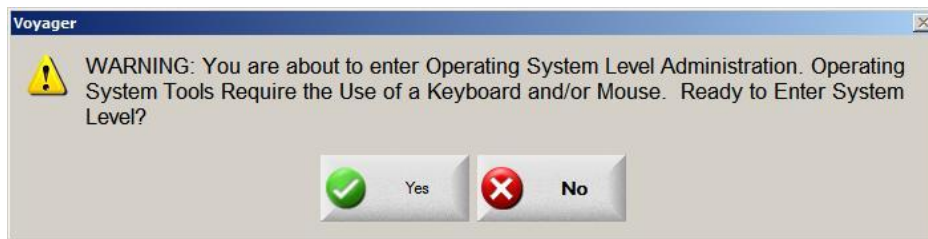
System Tools
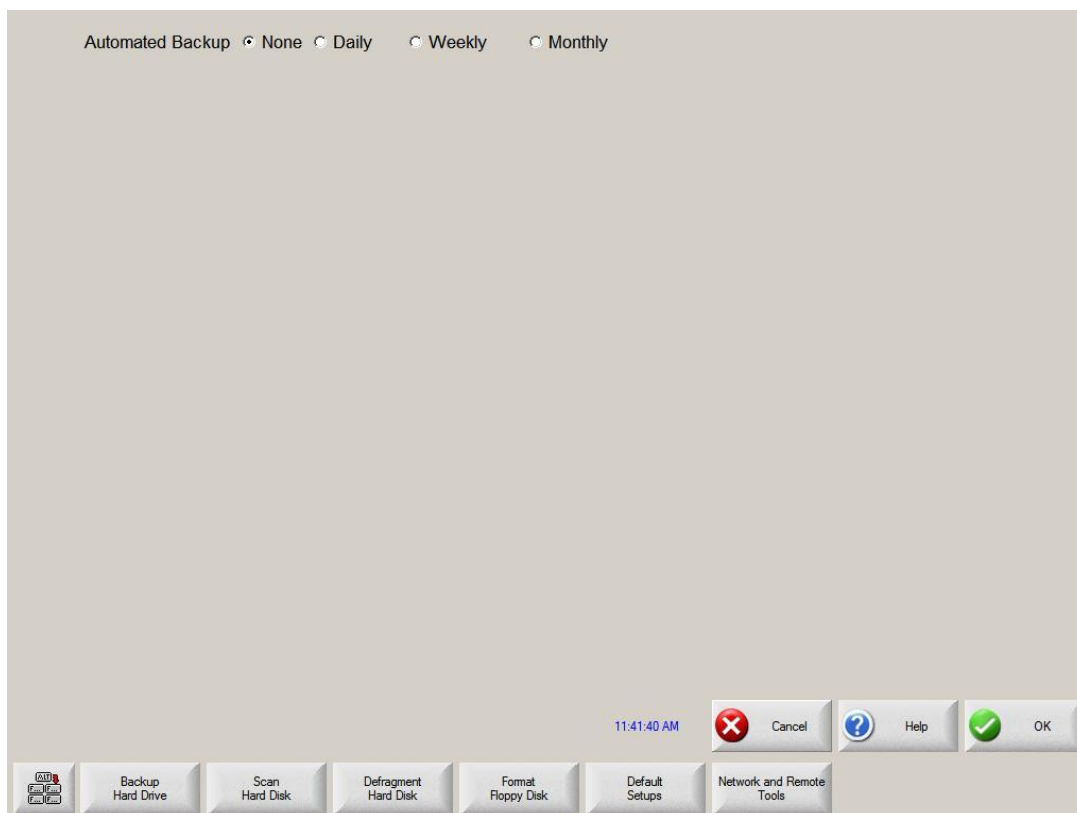
Automated Backup
The Automated Backup feature allows the user to select the frequency of the automatic reminder for the backup of main hard drive information. At the selected time, the user will be prompted to backup the system at power up.

Backup Hard Drive
Pressing the Backup Hard Drive softkey will manually save the contents of the main hard drive to a specified location on the control hard drive or mapped location using the Norton Ghost™ Utility.

Example
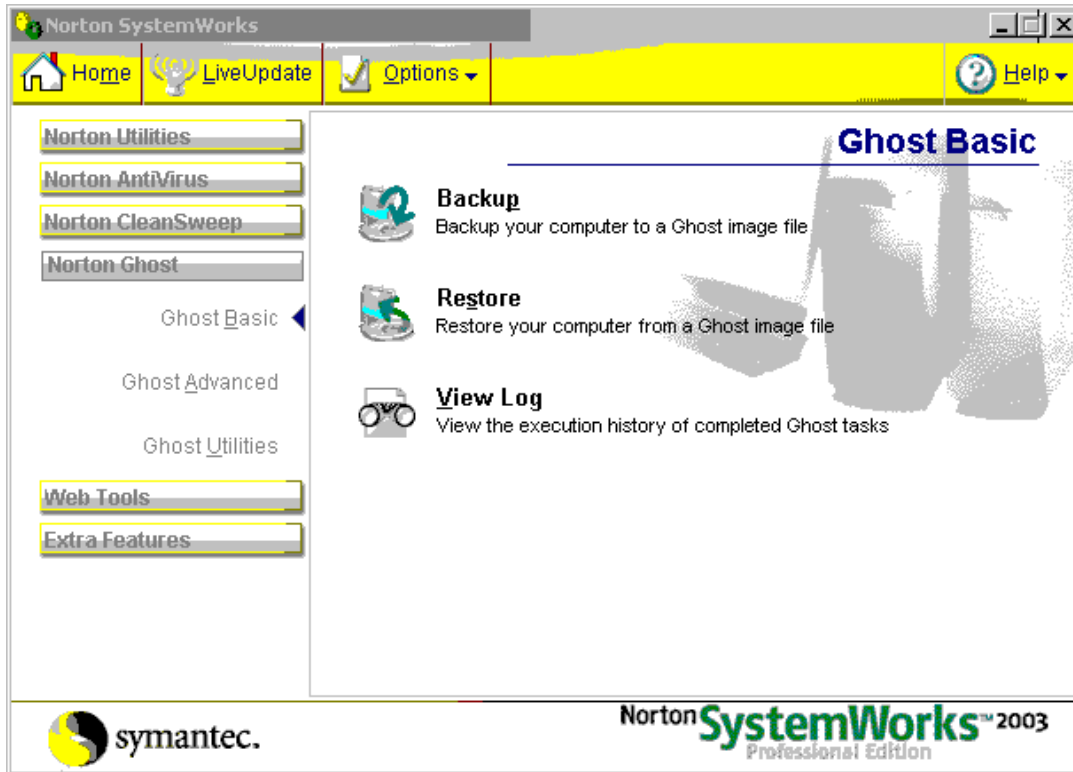
Note: After using Norton Ghost™, all files on Drive C: will be replaced. Control setups will need to be reloaded.

Scan Hard Disk
Pressing the Scan Hard Disk softkey allows the user to scan the Hard Drive for viruses or to Scan the Hard Drive for disk errors.
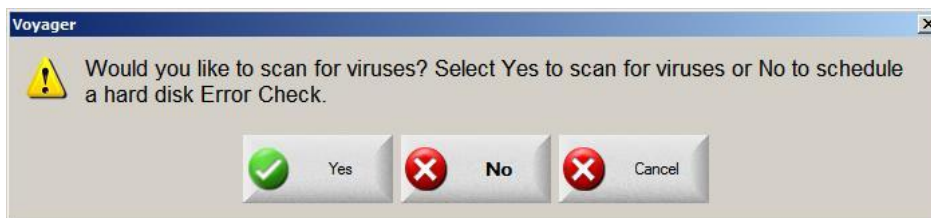
Scan Hard Disk – Selecting <u>NO</u> will allow the user to scan the Hard Drive for errors and correct them using the Windows[®] XP CHKDSK (check disk) utility. This task should be performed approximately every three months depending on the number of files loaded to and removed from the control.

The Check Disk (CHKDSK) function cannot operate while the control software is in operation. You will be prompted to press "Y" for yes to perform the Check Disk at the next boot up of the control.

```
C:\WINDOWS\System32\chkdsk.exe                                    _ □ ×
The type of the file system is FAT32.
Cannot lock current drive.

Chkdsk cannot run because the volume is in use by another
process.  Would you like to schedule this volume to be
checked the next time the system restarts? (Y/N)
```
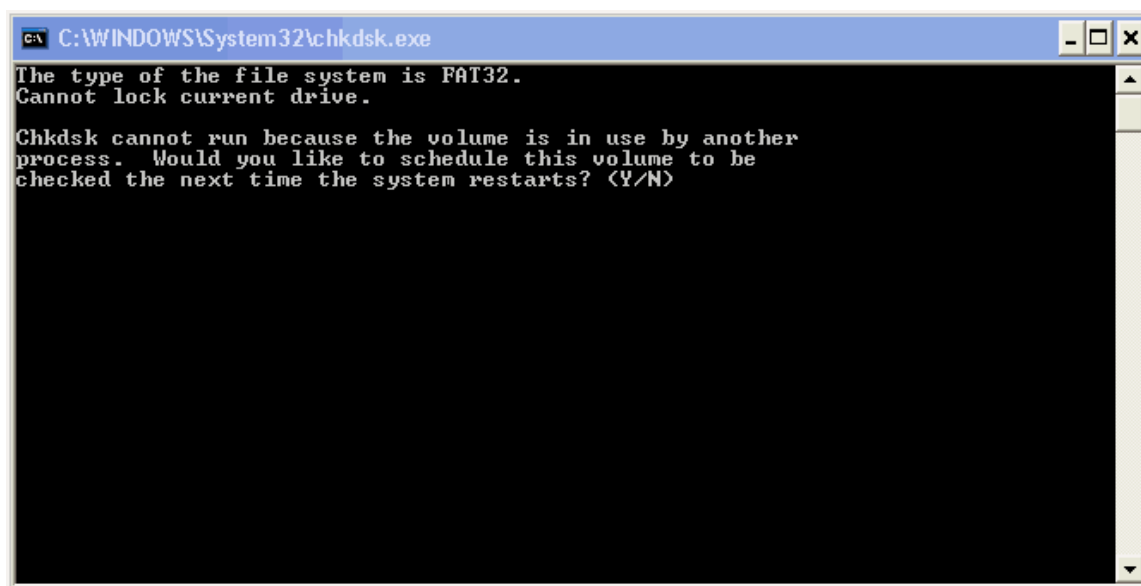
Scan Hard Disk – Selecting <u>YES</u> will allow the user to scan the Hard Drive for viruses using Norton's Anti-virus software.

Antivirus™
The AntiVirus™ feature allows the operator to search files being loaded on to the control for known viruses. Norton AntiVirus™ is a trademark of Symantec™ Corporation. Please contact your control vendor for information on how to obtain the AntiVirus™ software for use on your control.
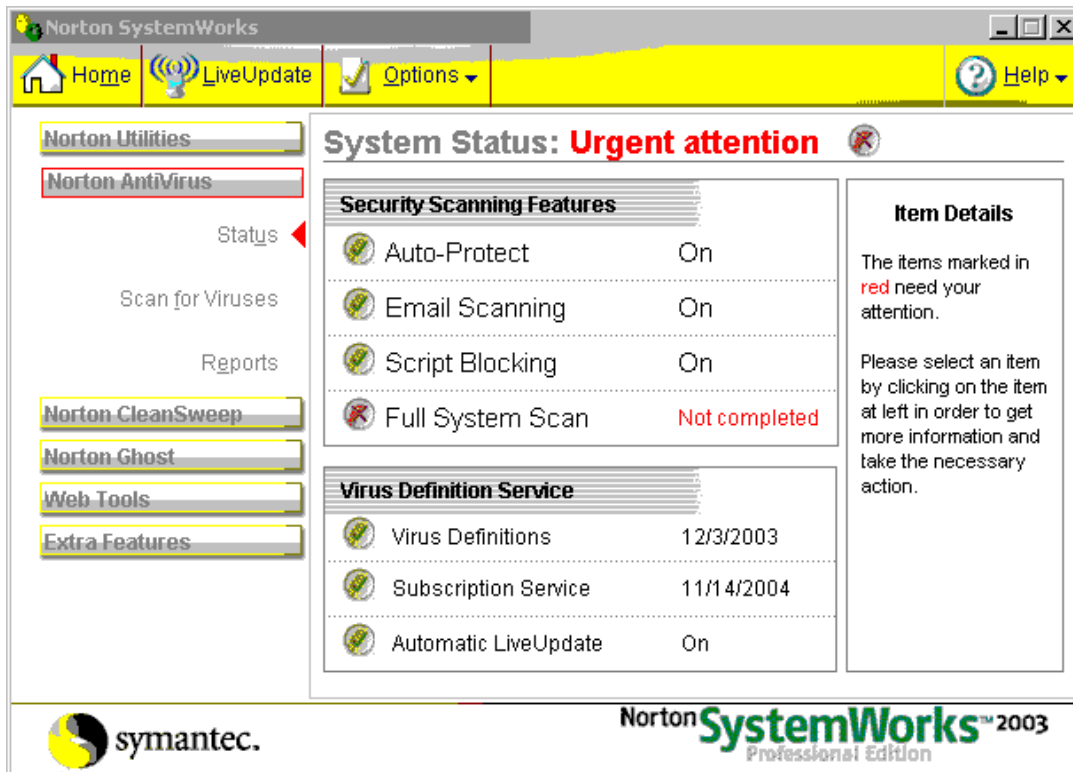
Defragment Hard Disk
The Defragment Hard Disk feature will scan the control hard disk for file locations and rearranges them for optimum performance. This task should be performed approximately every three months.
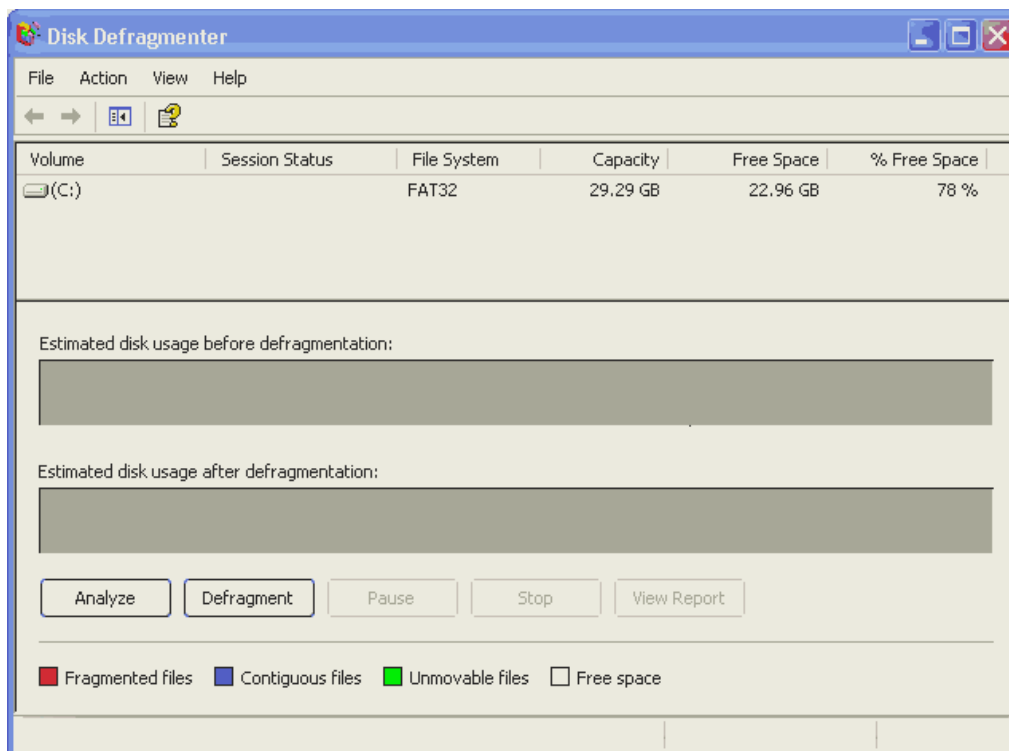
Format Floppy Disk
Pressing the Format Floppy Disk softkey will format a floppy disk placed into the floppy drive. This is advantageous in the event that the control has difficulty reading a floppy disk formatted by a computer. **Note:** Formatting the diskette will remove any files that are stored on the diskette.
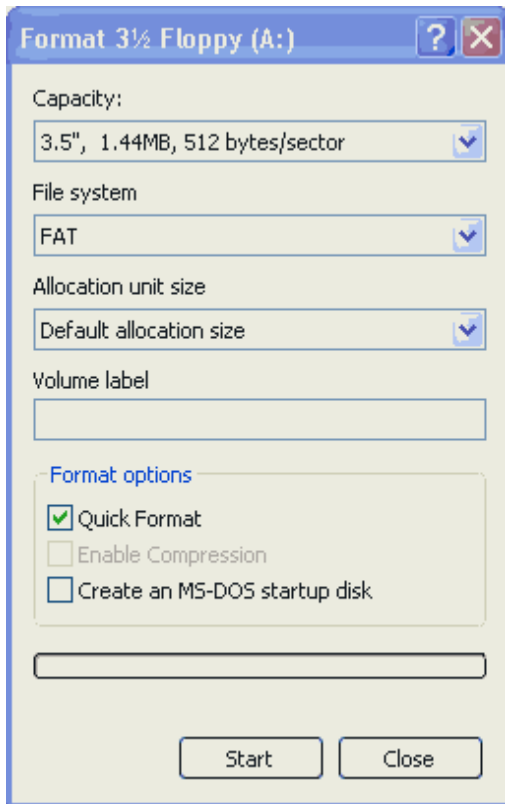
Reset Setups
Reset Setups will delete the current setup file, forcing default values to be loaded. A new setup file can then be loaded on the control through the Special Password screen.

If the control supplier has installed a customized setup file containing information specific to the cutting table, the Reset Setups Softkey is renamed Restore Setups. This custom setup file then becomes the new default setup file and pressing the Restore Setup Key will return the control to the original factory settings, as configured by the control supplier.

Network and Remote Tools

The Network and Remote Tools functions involves operational knowledge of Windows® XP operating system and should only be performed by qualified personnel.

Pressing the Network Tools softkey accesses the Windows® XP Network Connection Utility and Remote Assistant Utility.
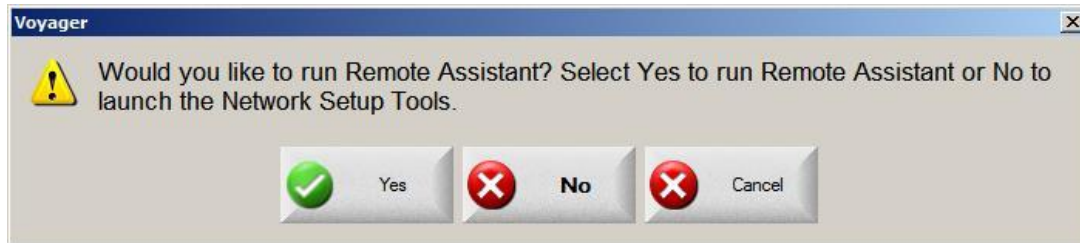
Windows XP® Remote Assistant
Remote Assistance is a feature within Windows XP® and allows a Remote Helper to view and chat over a TCP/IP connection with a control running the Windows XP® Embedded operating system. The Remote Helper can also request to share control of the keyboard and mouse.
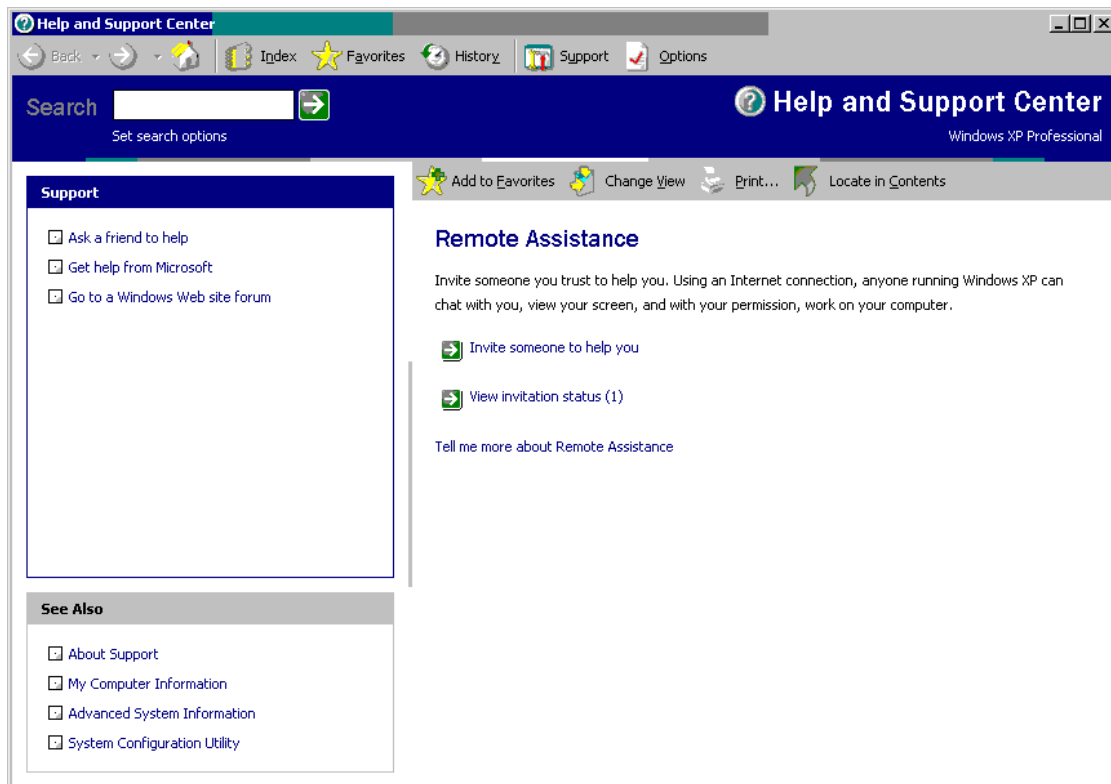
Some applications for Remote Assistance are:
1. Remote demonstrations of CNC software.
2. Show an operator certain features he may not be familiar with.
3. Online chat feature allows direct communication
4. Send or retrieve Software Updates, Database Files or other files with a Remote User.
5. Debug certain customer issues using Log Files.
6. Allow an operator to demonstrate a problem remotely.

Basic Instructions for use of Remote Assistance:
1. Operator connects control to network/internet.
2. Operator launches Remote Assistance Wizard and creates a Remote Assistance Invitation File with password and saves it to floppy disk.
3. Operator E-mails the Remote Assistance Invitation File and password to the Remote Helper.
4. Remote Helper connects to network/internet and launches Remote Assistance Invitation File.
5. Operator accepts Remote Assistance dialog.
6. Chat windows are available to both the operator and Remote Helper to allow them to discuss the feature or issue that is being reviewed remotely.

Requirements for the use of Remote Assistance on the Control:
Windows XP Embedded and Phoenix version 4.5 or 5.0 or higher.
Keyboard, mouse and internet connection (network, dial-up, DSL or other TCP/IP compatible network) is required for Remote Assistance.   High speed connections preferred.

Note: The Remote Helper is not allowed to perform motion unless the control is in forced simulation mode or is a demo version of software running on a desktop. Audio feature is not used.

This feature would only be used with the assistance of and external technician. Please contact your control vendor if you require additional details on the use of this feature.

Network Connection
The optional Network feature allows the control to be incorporated directly into an office PC Network for part allocation. This feature is available on controls Windows XP® operating systems and requires a factory supplied Network card to be installed. Please see your control vendor for additional details on adding this feature.

Network System Requirements:
The Optional Networking feature is approved to work with

Window NT® Servers
Window NT® Workgroups
Window 98® Workgroups
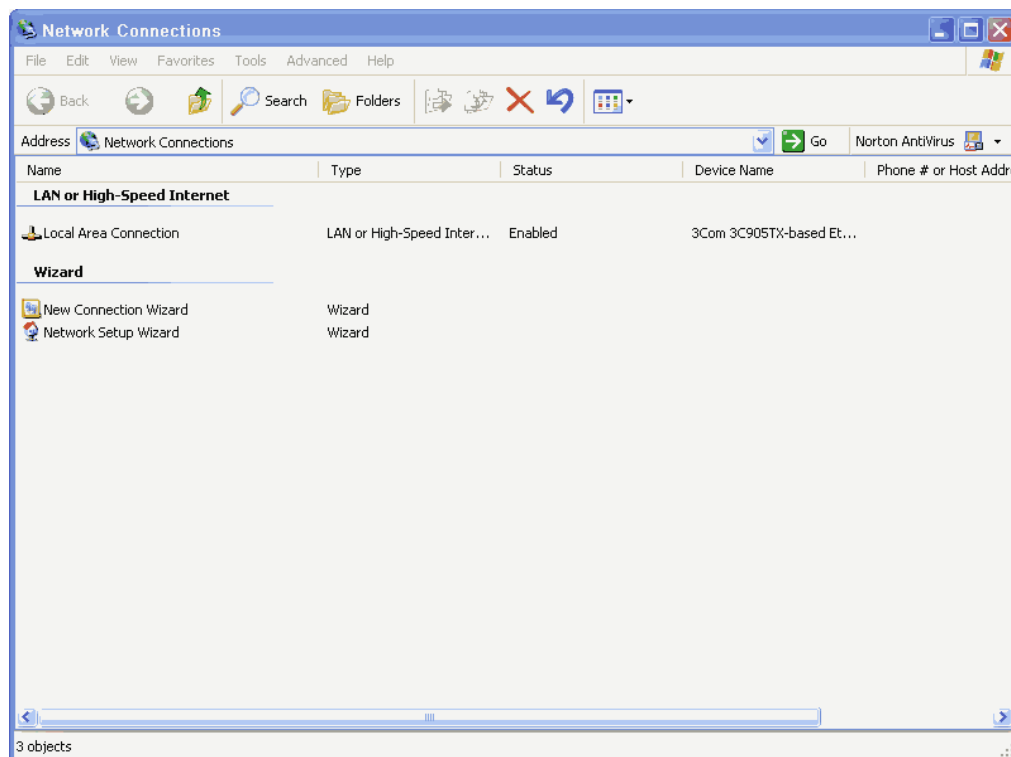
To Map the control for loading files
Enable the Mapped Network Drive feature at the Special Password Screen. At the Files screen, double click on the load from file location or press + Key then enter the desired mapped drive location.
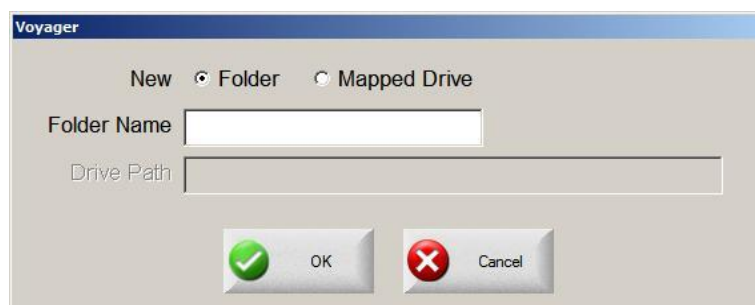
The control will automatically log on to the system at boot up.

Phoenix Link

Phoenix Link Overview

The Phoenix Link Communication Software is a proprietary communication package supplied with the control for optimal communication of part files and consumable database files between the control and the host computer. The program uses a 2X compression feature that allows the communications system to operate at speeds up to 230K Baud.

Phoenix Link
When the Phoenix Link Communication Software is operating, the following window will be displayed at the host computer for configuration. Once the software is running, the window may be minimized.
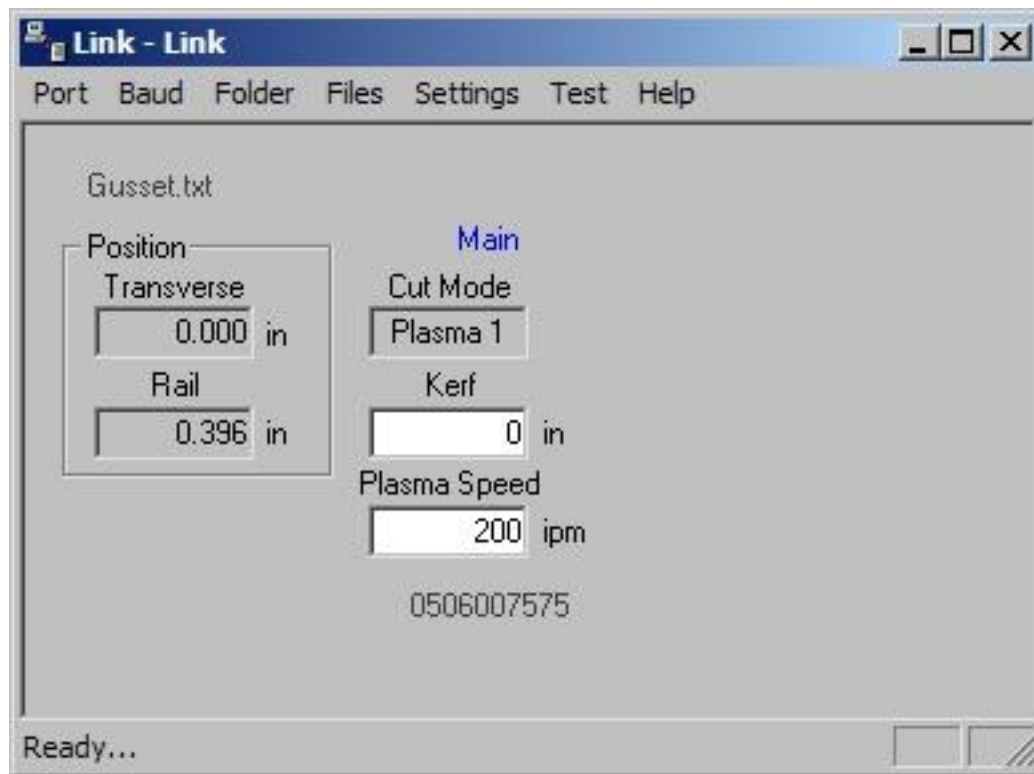
The following is a brief description of the available setup parameters for the Phoenix Link. Simply left click with the computer mouse on the selected feature in the drop down box to select, enable or execute that feature.

Port
This setup parameter allows the user to select the communication port to be used on the host computer.

Baud
This setup parameter allows the user to select the Baud rate used for communication on the host computer. Baud Rates: Min 9600 bps – Max 115,200 bps

Folder
The Folder setup parameter allows the operator to change the path of the Master Folder (Parts Folder). Sub folders and the part files within this Folder will be viewed at the control.

Files
The files setup parameter allows the user to indicate which file extensions will be recognized as acceptable part program files for download by the link software and will be viewed at the control.

Settings
The Settings setup parameter allows the user to configure the link to allow the Auto Reload (M65) feature to be enabled and recognized during communication. Additionally, the user may also select to communicate to multiple controls using the Multi Drop feature and configure it for use.

Test
The Test feature is used to test the operation of the selected communications port. To test, simply connect the transmit and receive signals on the selected communications port by inserting a paper clip and click on the desired port to test. The status of the test will be displayed in the lower left corner of the window.

Help
Selecting Help will display the current version of link software being used.

Files

The Files setup parameter allows the user to indicate which file extensions will be recognized as acceptable part program files for download by the link software and will be viewed at the control.

Once a file has been successfully saved on the control, it is assigned the "txt" file extension for use internally on the control. The operator must be aware of this as **part programs with the same name, but different file extensions, will be overwritten during multiple file downloads**. A warning will be displayed at the control prior to a file being overwritten. Care must be taken when downloading.

The list of acceptable part program types is listed in the lower half of the of the Files option box. The checkmark (√) before the file extension indicates which selected file type will be displayed at the control. Please note that the checkmark (√) in the file extension listing also indicates the file extension which will be placed on a part program when uploading a file to the host.
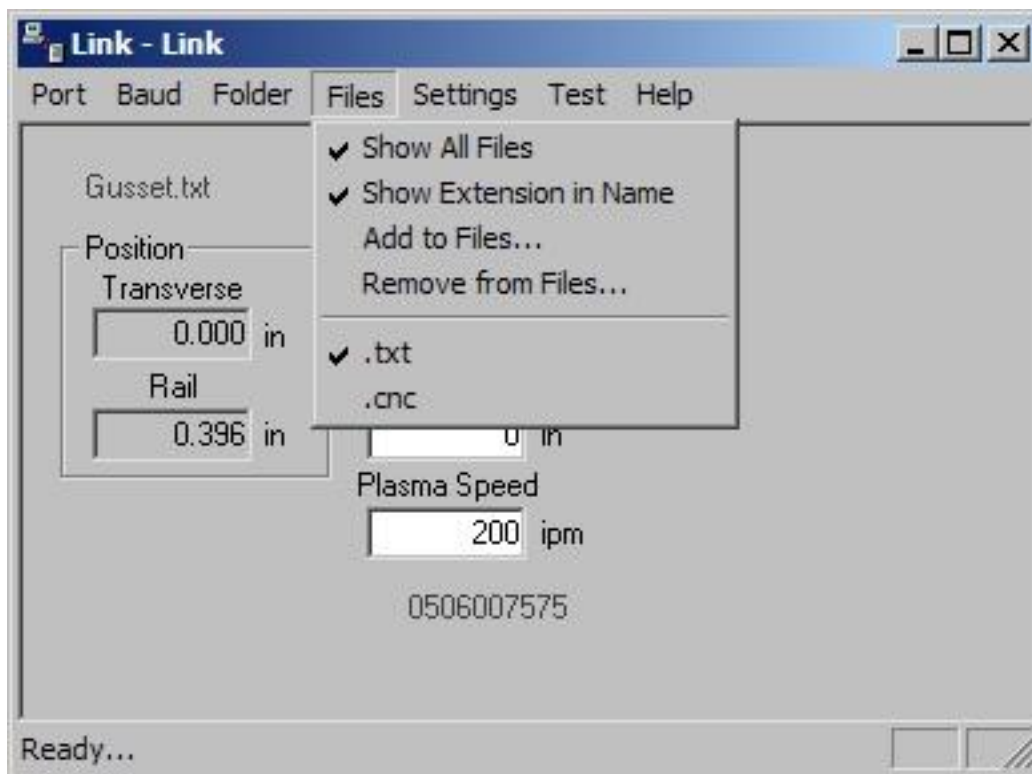
The following options are available to define what part programs may be viewed at the control.

Show All Files
Enabling this feature allows all file types in the selected parts folder to be viewed at the control. A checkmark (√) located before this feature indicates that it has been enabled.

Show Extension in Name
This feature allows the user to view the file extension as part of the name at the control. For the file name "Job123.CNC", the control would only display "Job123_CNC" in the filename location of the download screen. The control would display "Job 123" if this feature was not enabled. This feature is advantageous if more than one file has the same file name with different file extensions is being used. A checkmark (√) located before this feature indicates that it has been enabled.

Add to Files
The Add to Files feature allows the user to add to the list of acceptable part program types to be viewed at the control. Up to four file types (extensions) may be added to the default .txt extension. A checkmark (√) located before a file extension will indicate which file extension will be placed onto any part file being uploaded to the host.

Remove from Files
The Remove from Files feature allows the user to remove file extensions from the list of acceptable part program types.

Settings
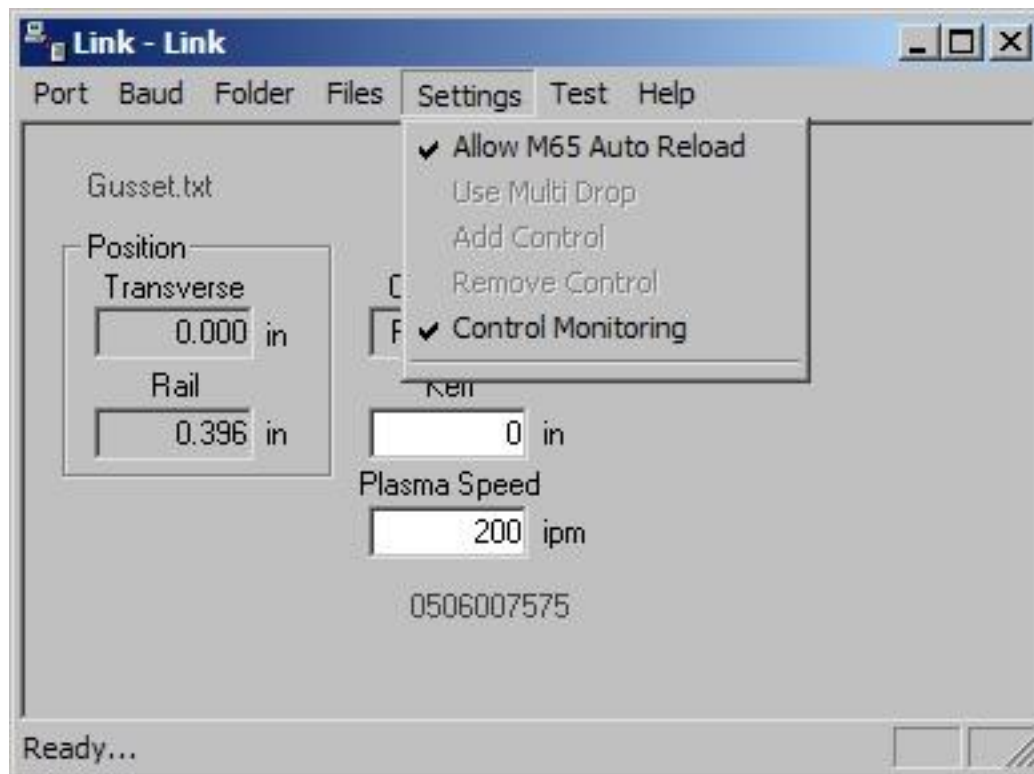
Allow M65 Auto Reload
Selecting the M65 Auto Reload Feature allows part programs to be partitioned into smaller part programs separated by the M65 code. During the download, the control will download the individual sections of the part program and allow the operator to execute that section of the part. When that section of the program has been completed, the next section of the program will be automatically downloaded for execution. The downloads will continue until an end of program (M02) code is detected.

Use Multi Drop
The Use Multi Drop feature allows the Link to be configured to communicate with multiple controls through one communication port on the host PC. Up to eight controls may be supported with the Multi Drop feature.

 Please note: The "Using Phoenix Link" parameter must be set to yes at the control to enable this feature and specific hardware for the control (serial communications board Rev D or higher) and host PC may be required to support this feature. Please contact your control supplier for more details.

Add Control
The Add Control feature is used to add a new control to the list of controls to communicate with. The corresponding control number must then be assigned to the new control in the link set up screen.

Remove Control

The Remove Control feature is used to remove a control from the list of controls that the host PC will communicate with.

Control Monitoring
When enabled, the Control Monitoring feature allows the user to view control status at the host PC. Status for File Name, position, cut mode and cut information is displayed. This feature is only available with the Phoenix Link Communication Software.

Installation

Below is an item list to outline the step by step procedure for the communication setup of the control and installation of the Phoenix Link Communication software:

Disclaimer of Warranty: This link software and accompanying written material (including instructions for use) are provided "as is" without warranty of any kind.

Minimum System Requirements
Processor: Pentium® 100MHZ
Hard Drive Space   0.5 MB
Memory: 4MB
Display: VGA
Floppy Drive: 3.5"
Operating System: MS Windows® 95, 98, NT, 2000, ME or XP
Serial Port: One RS-232 or RS422 serial port will be required per control.

Software

1) At the control, access the Special Password screen, place a diskette or USB memory device into the floppy drive and press the Make Link Disk softkey. Three files will be transferred to the floppy disk. The Link software (Link.exe), a Setup file (Setup.exe) and a Readme file (Readme.txt). The Setup file will create a Link folder on the root directory of the host PC and will copy the Link software into it. The "Readme" file contains additional information about installation and setup of the Link software on to the host computer.

2) When the light goes out on the floppy drive, transfer the floppy disk to the host computer and place the disk into the floppy (A) drive. From the Windows® Start button, select Run. At the opening prompt type A:\Setup.bat and select OK. The setup file will expand the files and create a "Link" directory on the root directory. Placed in this directory will be the Link.exe file. **Please note**: The Link software must be located and run on the PC that is connected to the communication cable coming from the control.

3) From the Windows® Start button, select Run. At the opening prompt, type A:\Link\Link.exe and select OK. After the link software has been launched, two other files will be created. A link.ini file, which contains the Link software configuration information, and a Parts folder, which is the default Master parts folder.   It is recommended that a shortcut to the Link.exe be placed on the desktop of the host PC for ease of use.

4) At the host computer, create one or more folders under the "Parts" directory. Place any part programs to be accessed by the control into these folders.

   For example, if you wish to add the folders "Workfile 1" and "Workfile 2" to the parts directory, the structure of the files would look as below:

   Path C:\Link\Parts\Workfile 1 and C:\Link\Parts\Workfile 2

Any part programs to be viewed and downloaded at the control would be placed here. Only the sub folders Workfile 1 and Workfile 2 and the program files located within them will be viewed at the control.

Change Master Folder
If the host computer currently has existing part programs and folders, the Link software may be configured to operate with the current folder names. This master parts folder may be located on the host PC or another PC that is networked to the host PC. **Please note**: The Link software must be located and run on the PC that is connected to the communication cable coming from the control.

This is accomplished by configuring the Link software through the "Change Master Folder" feature to point the Link to the folder that contains the required part programs.

 Launch the Link Software at the host computer and the Link window will be displayed.
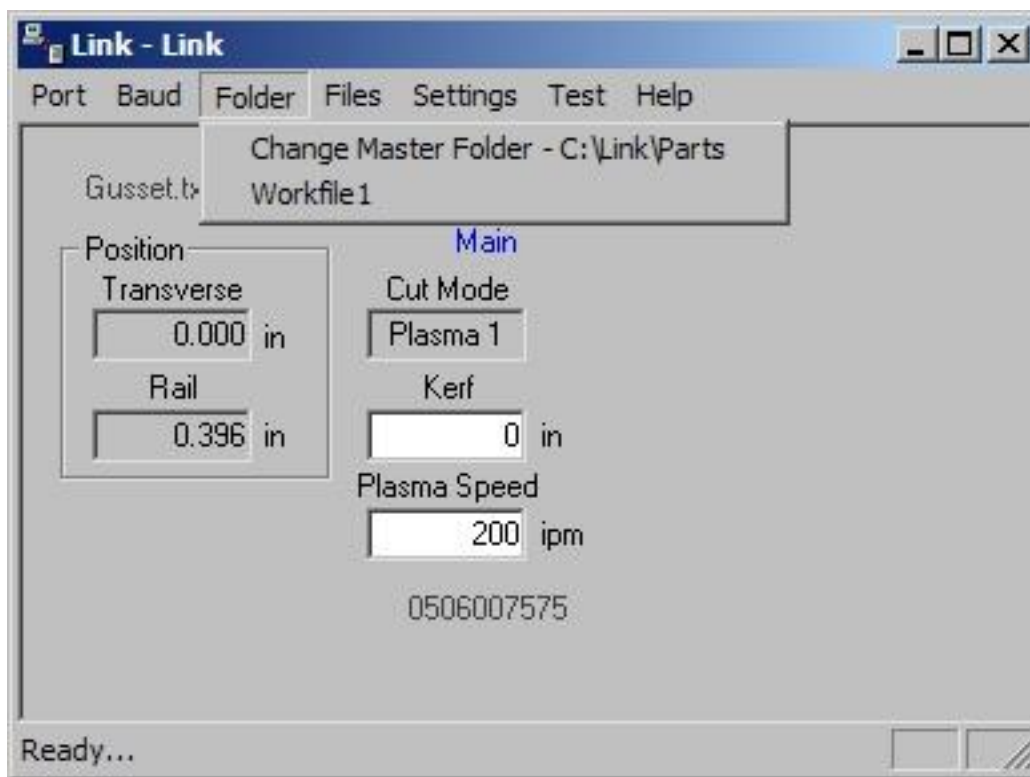
Select Files\Change Master Folder.
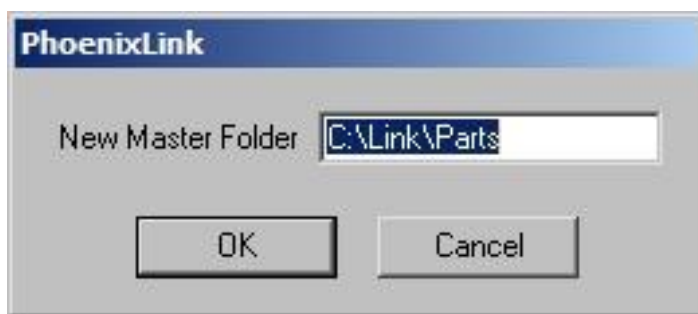
The Master file may now be changed from the current folder to the selected folder by typing in the selected path. Select OK to accept the change.

The same procedure would also apply when selecting a master folder located on a network.

For example, if the folders which contain the part programs are currently located in a folder named "Jobs" located on the PC named "R" drive, the Link.exe could be configured to the Change Master folder option to access these files.

Example path: R:\Cad\Production\Jobs
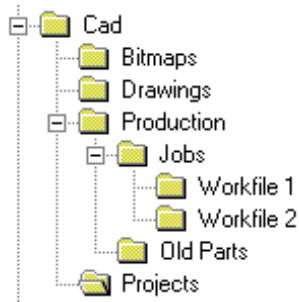
Again, start by launching the Link Software at the host computer. Select Files\Change Master Folder.
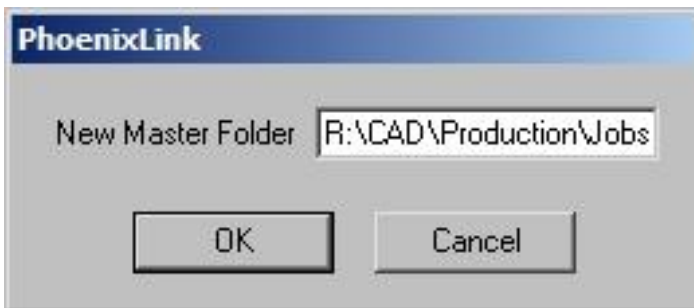
The Master file may now be changed from the current folder to the selected "Jobs" folder by typing in the path R:\Cad\Production\Jobs. Select OK to accept the change.

The final step to setup the Link software is to configure the Link software for Port, Baud, Files and Settings to match those being used at the control. It is recommended that a shortcut to the Link.exe be placed on the desktop of the host PC for ease of use.

Operating Multiple Links
To connect more than one control to the host PC without the use of the Multi Drop feature, a Link software specific to each control may be installed. Each version of Link being operated will require its own dedicated communications port on the host PC.

Start by creating individual folders for each cutting table and placing a copy of the Link.exe into each folder. Create a shortcut for each Link.exe and place the shortcut on the desktop. Using a mouse, right click on the shortcut to open the shortcut properties dialog box. Add to the shortcut target command line information to indicate which table the Link will be in communication with.

In the target command line example below, "Table1" has been added to the end of the command line to indicate the Link will be specific to communications with Table 1.
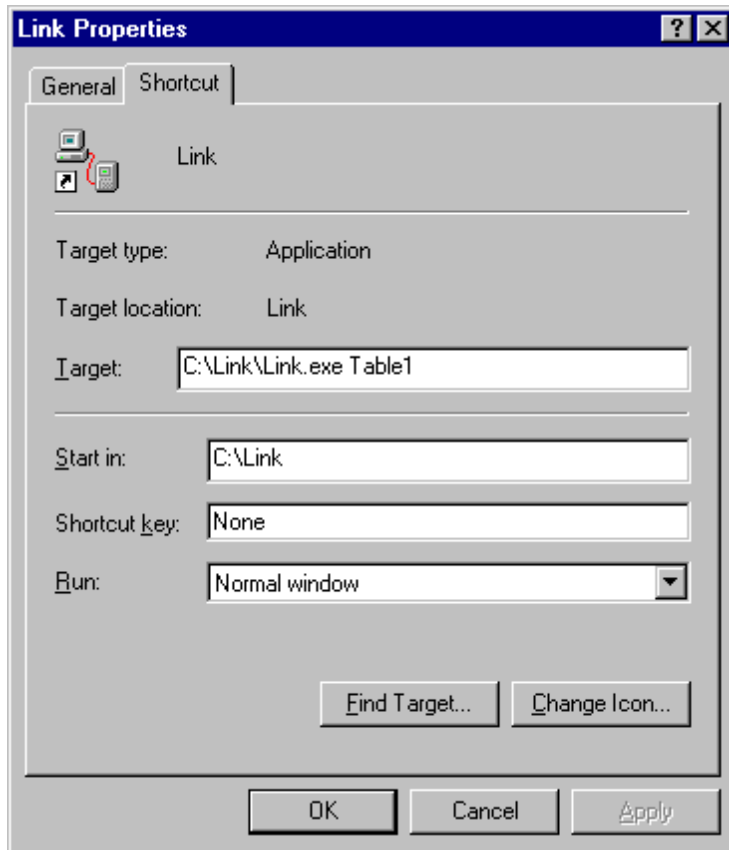
This "table" information, added to the Target command line, will then be noted in the title bar of the Link window. The Link may now be launched from the shortcut and configured specifically for this "table". When the Link is closed, a "Table1.ini" with the specific Link setup file will be saved in the folder.
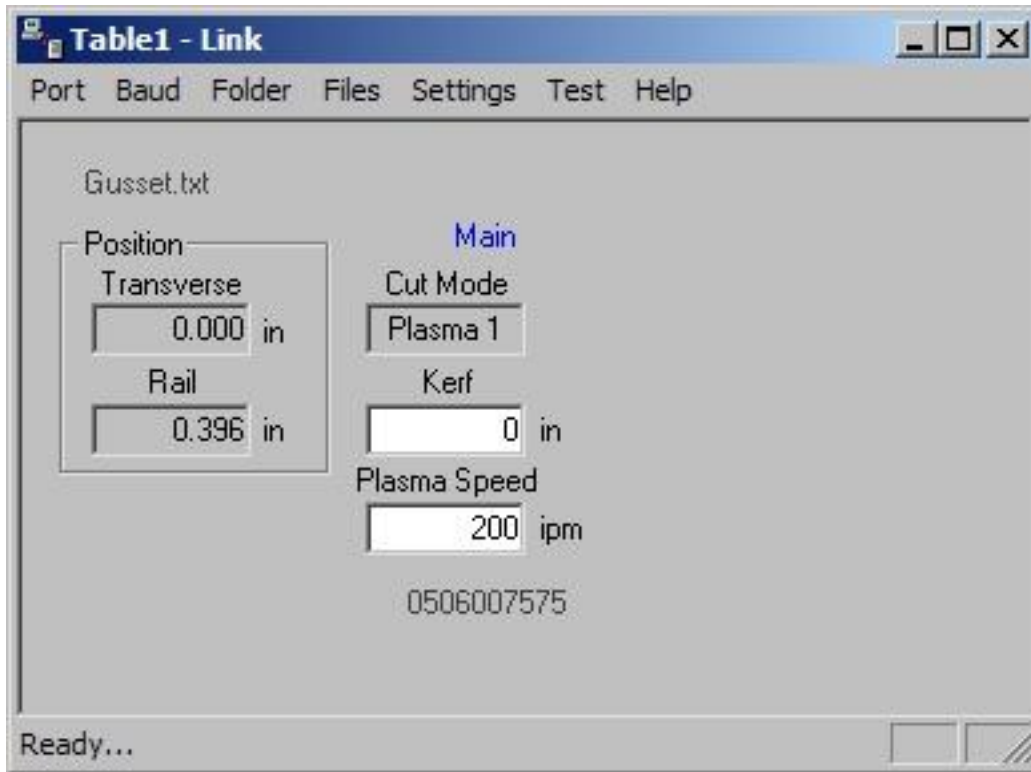
Continue to configure each additional Link for communication to each control. The separate Link files may be configured to point to the same or different master parts folders.

Hardware

Note: It is suggested for the purpose of establishing the proper setup of communications, that the control be placed next to the host computer and connected via a short communication cable. Once communications have been successfully established, the control can then be located on the cutting table and connected to the host computer via the appropriate cable or short haul modem system.

1) Configure the selected RS232/RS422 serial port on the control for operation, as described in the Serial Port information of this guide.

2) Test the control's communication port in the Diagnostic Screen to confirm proper operation of the serial port. Directions for testing of the serial port are described in the Diagnostic section of this guide.

3) Enter the control's Link setup screen to select the use of the desired communication port, select the Baud rate and select to use Phoenix Link. It is suggested to start at the lowest baud rate and increase until the maximum is achieved. Communicating at too high a speed may cause error messages to be displayed due to lost characters or information.

4) Enter the control's Special Password screen to add the file extension of the part programs being used to the current list of acceptable file extensions.

5) Load and configure the Link software at the host computer as previously described in this section.

6) Test the host computer's selected serial port through the "Test Port" feature of the Link software as outlined in the Phoenix Link software overview.

7) Connect the control to the host computer's selected communications port with the appropriate cable or modem system.

Operating Phoenix Link

1) The Phoenix Link software must be running at the host computer to communicate with your shape cutting control. Start the Link software at the host PC from the desktop shortcut or select the Windows Start Button, then select Run. From the opening prompt, type C:\Link\Parts\Link.exe (or appropriate path to the Link.exe) and select OK. The Phoenix Link window will appear. The Link software window may be minimized during operation if desired.

2) At the control, press the Files softkey and select to Upload or Download to Host. As the control is connecting to the host computer, a status display in blue text for the communication can be viewed in the lower right corner of the screen.

3) The control will initialize the port, open the port, and then try to contact the host. If this attempt at communication fails, an error message will be displayed in red. If successful, the control will download the available folder and part file names to be viewed on screen. **Note:** If the "Show Host File Names" parameter at the control has been set to "No", only folder names will be viewed.

Common Errors

Below is a listing of common errors encountered when installing a communications system.

1) The port selected at the host computer has already been assigned to another software program.

2) The host and control have been configured to different setup values.

3) The cable has been connected to the incorrect port or software has been configured to the incorrect port.

4) The selected modem or cabling system being used has swapped the transit and received signals, causing a communications failure.

5) Trying to transmit over too long a cable without a modem or using incorrect wire for the distance being traveled.

6) Trying to communicate at too high a baud rate for the modem system selected.

7) The correct file extension has not been entered at the control's Special Password screen, preventing part programs from being displayed at the control.

Error Messages

The following is a listing of common error messages and some possible causes.

Unable to Open Port (control)
The selected communications port could not be opened. The wrong port has been selected or the communications port has failed.

Unable to Open Port (host)
The selected communications port could be opened. The wrong port has been selected, the communications port has failed or another software application is using the port.

Unable to Initialize Port
The selected communications port was unable to be initialized. The wrong port has been selected, the communications port has failed or another software application is using the port.

Port Failed
The Port Failed error message will be displayed if the communications port test has failed for the selected port. This may be due to a fault with the test wire connection, incorrectly connecting to the proper transmit and receive pins location, or failure of the communications port.

Host Not Responding
This message will be displayed if the communications port has successfully opened the port, but has failed to establish communication with the Link software. This may be due to a fault with the cable connection, cable configuration or the host computer's communications port.

Communication Failed
This message will be displayed if after establishing communication with the host, an expected message from the host is not correct.

Communications Time Out
This message will be displayed if the specified amount of time allowed for a response from the host computer expires. This amount of time can be configured in the Link setup screen. This may be due to a fault with the cable connection, cable configuration or the host computer's communications port.

Checksum Error
The Checksum Error message will be displayed at the control if after a part has been uploaded or downloaded, the checksum calculated by the host and the control do not match. The Checksum calculation is performed by adding the numeric values of the ASCII codes used. This error may be due to incorrect cabling or transmitting at too high a speed for the communications system selected.

Warning: The Master Folder Selected does Not Contain any Folders
This error message will be displayed at the host computer if the selected master folder does not contain any subfolders. You may choose to add subfolders if they do not exist. If subfolders do exist, the path to the master folder may be incorrect.

For additional assistance in trouble shooting the Phoenix Link in the event of a failure, please contact your control vendor or representative.

Sensor THC

Sensor Torch Height Control Overview

Sensor™ THC is a proprietary Automated Torch Height Control system that is designed specifically for use with your shape cutting control. Sensor™ THC utilizes the most current technology available to provide superior plasma cut performance with unmatched ease of use.

During the plasma cut process, variations in the distance between the torch tip and the cut material will affect the cutting arc voltage and ultimately, the quality of the cut. Through use of an automated torch height control to maintain the appropriate cut height for the set arc voltage, we are able to obtain the optimum cut quality regardless of variations in plate positioning.

Sensor™ THC is operated as a separate closed loop servo axis on the control and has several setup parameters available to customize the system for optimal performance and individual requirements. The THC system is made up of four parts: the control, the analog input card mounted in the control, the voltage divider card and the mechanical slide with a motor to operate the slide. The voltage divider card, which would be mounted in the plasma power supply, monitors the arc voltage of the cutting process at the torch then transmits $1/40^{th}$ of this voltage to the analog input card in the control where it is multiplied up to the original value. This value is then compared to the selected Set Arc Voltage. If the values are different, the control will raise or lower the torch on the slide to correct the cut voltage. This Appendix will highlight the features which are unique to the Sensor™ THC.

For operation, this feature must first be enabled in the password machine setups. Setup parameters specific to the cut process and the THC axis will then be available for configuration.

Warning! Installation, Setup and Calibration should only be performed by trained service personnel. Extreme care should be used when installing this product.

Cut Setups

THC Voltage Offset

The THC Voltage Offset Parameter is used to offset the individual Sensor THC™ Arc Voltages from the master set Arc Voltage. This allows the individual THCs to be adjusted to compensate for consumable wear and obtain optimum cut quality.

Note: The THC Voltage Offset parameter may be automatically adjusted using the Volts per Minute parameter of the Change Consumable feature. Please refer to the Change Consumable information in this guide for additional details.

Plasma Setups

Test lifter soft key will be available to test the IHS function.

Test Lifter
Pressing the Test Lifter soft key will command the torch lifter to lower to the plate, sense the plate and retract to the pierce height

Press the Timing Diagram soft key to view the timing diagram from setups.

Retract Delay
The Retract Delay Parameter is used to specify the amount of time delay that the used between the cut off and the torch retract.

Auto Voltage Set
When enabled, the Auto Voltage Set feature is used to sample the Arc Voltage being generated when cutting at a specific cut height. Then the Arc Voltage value relative to the manual cut height sample will be used when cutting the part instead of a predetermined Arc Voltage.

Set Arc Voltage
The operator may input the desired Arc Voltage for the material being cut.

Cut Height
The Cut Height setup parameter is used to select the desired cut distance from the plate. This will set the initial cut height before arc voltage control is activated when operating in automatic mode.

Pierce Height
The Pierce Height setup parameter is used to select the desired Pierce Height.   This may be entered as a multiplication factor that is calculated times the Cut Height or an actual Pierce Height distance.

Voltage Control
This setup parameter allows the operator to select the Sensor THC to operate in Manual or Automatic mode. Manual mode will disable the torch height control, allowing the torch to cut at the specified cut height and voltage. Automatic mode allows the THC to command the torch up and down to maintain the voltage at the specified arc voltage set point.

Ignition Output
Enables use of the Ignition Output for use in igniting the plasma torch. If your plasma system requires a separate ignition signal, toggle Ignition to ON. If not, leave Ignition OFF.

Voltage Tracking Range
The Voltage Tracking Range parameter specifies the allowable variation in arc voltage from the setpoint. If the arc voltage should go above or fall below this allowable range, the system will fault and pause cutting.

IHS in Manual
The IHS in Manual setup parameter allows the operator to select whether or not to use the Initial Height Sense feature when operating the Sensor THC in manual mode.

Retract Full/Partial
Selects the retract distance to be set at Full or Partial. In the Full retract mode, the torch will retract to the Home position. In Partial retract mode, the torch will retract to the set retract distance.

Partial Retract Distance
This setup parameter is used to select the THC Retract Distance when configured for partial retract mode.

Start IHS Distance
The Start IHS Distance specifies the distance of travel for the THC to move the torch at high speed before switching to low speed and beginning Initial Height Sense. Caution should be taken when selecting this distance so that the torch does not crash into the plate.

Skip IHS Within
The Skip IHS Within feature is used to disable Initial Height Sense at pierce points if it falls within the selected distance to increase cutting productivity. The distance is measured from the end point of the cut segment to the next pierce point. If this distance falls within the selected Skip IHS Within distance, no IHS will take place.

Preflow During IHS
Selecting ON will activate Preflow during the IHS cycle.

Early Preflow if Skip IHS
Selecting ON will activate Preflow during the traverse prior to the pierce while the skip IHS feature is used.

Nozzle Contact IHS
This parameter would be set to ON to select the Sensor THC to use Contact Sense to detect the plate during the IHS cycle. It is recommended that Nozzle Contact Initial Height Sense be used when cutting light gauge material to prevent plate deflection.

Nozzle Contact During Cut
This parameter is set to ON for the Sensor THC to use the Contact Sense input to detect the plate contact during cutting. In Automatic mode, if this parameter is On and the Nozzle Contact Sense input activates, the torch will raise during the cut until the Nozzle Contact Sense input turns Off, then the Torch will return to Tracking Voltage.

Offset IHS
The Offset IHS feature is used to activate a remote probe for plate detection and Initial Height Sense. With this feature enabled, the control system will execute the Tool / Marker Offset number nine. This will move the Plasma cutting torch the distance of the offset, perform the IHS and then return the Plasma torch to the pierce location at each commanded pierce / cut on. The Z axis parameter is used to adjust for height differences between the torch and the probe.

▼	Marker Offset 9	X	1	in	Y	1	in	Z	0	in

Auto Kerf Detect
The Auto Kerf Detect feature reduces the possibility of the torch diving into the plate. When enabled, the THC will detect sudden changes in arc voltage when crossing a Kerf path and will freeze motion of the THC.

Auto Kerf Voltage Change
The Auto Kerf feature of the Sensor THC will detect a voltage change when the torch passes over a previous cut and will disable the THC to prevent the torch from diving. This setup parameter is used to specify the allowable variation from the voltage setpoint at which the THC will detect the voltage change and disable the THC.

Kerf Detect Reacquire Time
The Kerf Detect Reacquire Time determines the time limit at which the control will force the THC to adjust the THC height to meet the voltage setpoint if the Automatic Voltage Lock On has not been established after a Kerf crossing.

Note: Depending on the performance of the plasma system being used, a creep time may be required to allow for ramp up of the cut voltage after the pierce.

Marker Setups

Test lifter soft key will be available to test the IHS function.

Test Lifter
Pressing the Test Lifter soft key will command the torch lifter to lower to the plate, sense the plate and retract to the pierce height

Purge Time
Specifies the time delay from torch ignition until motion is enabled.

Start Time
Specifies the time delay from when torch completes lowering until motion is initiated at Creep Speed. Used to allow the Marker to completely transfer to the material before moving.

Sample Voltage
When enabled, the Sample Voltage feature is used to sample the Arc Voltage being recorded when cutting at a specific cut height, then that Arc Voltage value will be used when cutting the part instead of a predetermined Arc Voltage.

Set Arc Voltage
The operator may input the desired Arc Voltage for the material being cut.

Mark Height
The Mark Height setup parameter is used to select the desired cut distance from the plate. This will set the initial cut height before arc voltage control is activated when operating in automatic mode.

Start Height
The Start Height setup parameter is used to select the desired Start Height.   This may be entered as a multiplication factor that is calculated times the Start Height or an actual Start Height distance.

Voltage Control
This setup parameter allows the operator to select the Sensor THC to operate in Manual or Automatic mode. Manual mode will disable the torch height control, allowing the torch to cut at the specified cut height and voltage. Automatic mode allows the THC to command the torch up and down to maintain the voltage at the specified arc voltage setpoint.

Voltage Tracking Range
The Voltage Tracking Range parameter specifies the allowable variation in arc voltage from the setpoint. If the arc voltage should go above or fall below this allowable range, the system will fault and pause cutting.

IHS in Manual
The IHS in Manual setup parameter allows the operator to select whether or not to use the Initial Height Sense feature when operating the Sensor THC in manual mode.

Retract Full/Partial
Selects the retract distance to be set at Full or Partial. In the Full retract mode, the torch will retract to the Home position. In Partial retract mode, the torch will retract to the set retract distance.

Partial Retract Distance
This setup parameter is used to select the THC Retract Distance when configured for partial retract mode.

Start IHS Distance
The Start IHS Distance specifies the distance of travel for the THC to move the torch at high speed before switching to low speed and beginning Initial Height Sense. Caution should be taken when selecting this distance so that the torch does not crash into the plate.

Skip IHS Within

To increase cutting productivity , the Skip IHS Within feature is used to disable Initial Height Sense at pierce points if it falls within the selected distance. The distance is measured from the end point of the cut segment to the next pierce point. If this distance falls within the selected Skip IHS Within distance, no IHS will take place.

Preflow During IHS

Selecting ON will activate Preflow during the IHS cycle.

Nozzle Contact IHS

This parameter would be set to ON to select the Sensor THC to use Contact Sense to detect the plate during the IHS cycle. It is recommended that Nozzle Contact Initial Height Sense be used when cutting light gauge material to prevent plate deflection.

Process Watch

Input/Output
In addition to the standard I/O options, the Watch window may be configured to include the status of the voltage tracking for the Sensor™ THC. This will indicate when the automated voltage tracking has "Locked On" and is adjusting the torch height based on voltage.

Position
The Sensor™ THC is operated as a separate axis on the control. Position information for the THC axis may be displayed in the Watch window.

Plasma Process
Information critical to the THC operation may be added to the Lower Location. This information includes the Actual Arc Voltage, the Set Arc Voltage, Initial Cut Height and Pierce Delay.   Values for the Set Arc Voltage, Initial Cut Height and Pierce Delay maybe adjusted at the main screen to customize the cut process.

Main Cut Screen

Automatic THC Mode
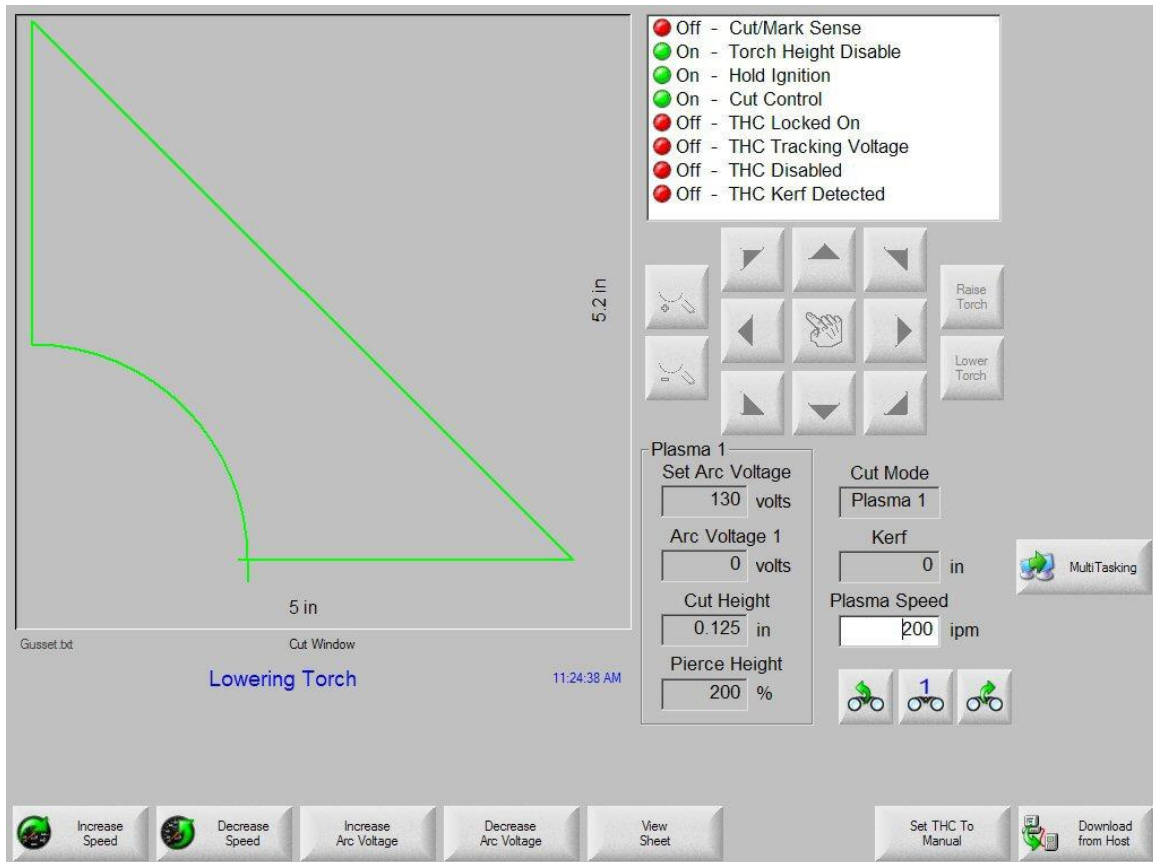
While at the main cut screen, when cutting with the Sensor™ THC in Automatic mode, three new soft keys will become available to manually increase and decrease the Arc Voltage for the cut and to switch to Manual mode.

While at the main cut screen, when cutting with the Sensor™ THC in Manual mode, three new soft keys will become available to manually raise and lower the Manual Cut Height and to switch to Automatic mode.

Sensor THC Setup

The following outlines operational setup for Sensor™ THC.

Analog Input

The Sensor™ THC requires that additional inputs, outputs and analog voltage be brought in to the control to monitor the process. These signals are communicated to the control through an analog input card that has been installed into the control. In addition to THC operations, this analog input card may also be used for operation of an optional Joystick feature and external speed pots.

Note: View screens will vary depending upon the Analog Input Card being used.

Inputs / Outputs
Single Ended inputs and outputs located on the Analog Input Card are displayed.

Analog Inputs
The Analog Input values shown in the upper right hand of the screen are the actual voltages coming into the analog card. Analog inputs are assigned to the THC Axis and the Analog input for the appropriate THC may be viewed here.

Sensor THC Axis Setups

The THC Axis screen is designed specifically for use with the Sensor™ THC.

Note: for proper operation, Sensor THC encoder counts should be approximately 20, 000 counts/inch.

Stall Force
The Stall Force Parameter allows the user to select the amount of Following Error (inches / mm) to be used as the motion limit when Homing or performing manual IHS / plate sensing. Example: If the value is set to .1 inches, the THC Axis will continue to move the axis until .1 inches of following error has been reached. This will indicate the Plate location during IHS and will indicate the top of the slide during homing.

Slide Length
This parameter is used to specify the overall motion length of the Slide mechanism being used for the THC. This information is used to set the travel limits of the slide after homing.

Home
The Home parameter is used to activate use of the Home feature for the THC Axis. Depending on the Slide mechanism used, the THC may be Homed to Hard Stop, Hard Stop w/ Current Limit or Home Switch.

Note:
If the "Home to Hard Stop Current Limited" option is selected, the CNC Nozzle Contact Enable Output should be connected to the Current Limit Input of the amplifier to reduce torque during homing.

The CNC Nozzle Contact Sense Input is used during Sensor™ THC Homing as the Home Switch Input if the "Home to Switch" option is selected.

SERCOS Sensor THC Axis

Proportional Gain	50
	Slide Length	6.5 in
	Home	to Home Switch
	Current Limit	10 %
	Home Current Limit	10 %
SERCOS Drive Address	4
	IHS Current Limit	5 %
Voltage Gain	40
Servo Error Tolerance	0.25 in
Stall Force Tolerance	0.125 in
Encoder Counts per in	26120
Encoder Polarity	⦿ Positive ○ Negative
Emulated Counts/motor rev	65536

Plasma 1

Tracking Mode	○ Normal ⦿ Special
Average Voltage Over	25 msec
Lock On Delta Limit	0 volts
Lock On Rate Limit	10
Voltage Tracking Range	50 volts

Help

Cancel

OK

8:22:49 AM

Transverse   Rail   Dual Gantry   THC

Home/ IHS Current Limit
The Home / IHS Current limit parameter allows the user to select a percentage of current limit to be used during homing and IHS functions.

Tracking Mode
The Automatic Cutting Tracking Mode allows users to use the original 'Special' mode or the new 'Normal' mode. Special mode is useful for sloped plate or other special high Lifter response requirements. The new 'Normal' mode should be used for all flat plate (less than 5-10 degrees slope) applications.

THC Speeds

Speed 0 to	100	to	250	to	500	ipm
Acceleration Rate	10		10		10	mG

Fast Deceleration Rate	100	mG	THC Acceleration Rate	50	mG
Maximum Machine Speed	500	ipm	Maximum THC Speed	600	ipm
High Jog Speed	250	ipm	THC Jog Speed	200	ipm
Medium Jog Speed	100	ipm	THC Home / Fast IHS Speed	50	ipm
Low Jog Speed	25	ipm	THC Slow IHS Speed	5	ipm
Fast Home Speed	200	ipm			
Slow Home Speed	10	ipm			
Minimum Corner Speed	80	ipm			
Limited Machine Speed	100	ipm			
Creep Speed	25	% of Cut Speed			
Torch Height Disable Speed	95	% of Cut Speed			
Distance Before THD Speed	0.25	in			
Distance After THD Speed	0.25	in			

Help

Cancel

OK

12:52:12 PM

Machine   Speeds   Ports   I / O   Sercos   Axes

THC Acceleration Rate
This parameter allows the operator to set the acceleration rate for smooth and stable movement of the Sensor™ Torch Height Control. The higher the acceleration rate, the quicker the THC will get up to speed. The lower the acceleration rate, the smoother the machine will position the cutting device. Values are entered in Milligees.

Maximum THC Speed
Enter the maximum speed for the Sensor™ THC movement in inches/millimeters per minute.

THC Jog Speed
Enter a value for the desired THC jog speed.

THC Home/Fast IHS Speed
The THC Home/Fast IHS Speed entered here is used to home the torch at the top of the slide and to quickly maneuver the torch from the selected IHS height to the plate.

THC Slow IHS Speed
The THC IHS Speed is used to retract the torch after the plate has been sensed. The torch will retract at this speed until the contact sense is lost. This determines the exact distance to the plate, regardless of any flexing of the plate. A very small speed is recommended for optimal accuracy.

Note: Due to the quick response time of the Sensor™ THC, generally there is no need for a value to be entered at the "Distance to Corner" parameter to lock or "freeze" the position of the torch. It is, however, suggested that a value be entered for the "Distance from Corner" to stabilize the torch during acceleration.

THC I/O

Analog Offset 1 - 12
The Analog Offsets 1 through 12 are used to correct for any imbalance or "zero" the incoming analog voltage to the Analog Input Card. Analog inputs are assigned to the THC Axis and the Analog Offsets for the appropriate THC Analog input may be adjusted here.

To calibrate the Analog Inputs, jumper the two pins specific to the input together and view the incoming voltage at the Diagnostics Analog I/O screen. The incoming voltage should be zero. If any voltage is displayed at the diagnostic screen, an Offset Voltage equal to the incoming voltage being read can be entered here to "zero" the incoming voltage. Please refer to the installation instructions later in this section for more details.

Sensor THC Part Program Support
Sensor™ THC offers the ability to configure THC setup parameters through part program codes.

The following parameters are available for use using EIA-274D G59 codes:

Arc Voltage
Pierce / Start Time
Pierce/ Start Height Factor
Cut / Mark Height

Setup is obtained using the following format.

Example: G59 V601 F*value*

Misc. G Code

Variable Identity
   V600 = Plasma 1 Arc Voltage
   V601 = Plasma 1 Pierce Time
   V602 = Plasma 1 Pierce Height Factor
   V603 = Plasma 1 Cut Height

   V625 = Plasma 2 Arc Voltage
   V626 = Plasma 2 Pierce Time
   V627 = Plasma 2 Pierce Height Factor
   V628 = Plasma 2 Cut Height

   V650 = Marker 1 Arc Voltage
   V651 = Marker 1 Start Time
   V652 = Marker 1 Start Height Factor
   V653 = Marker 1 Mark Height

   V675 = Marker 2 Arc Voltage
   V676 = Marker 2 Start Time
   V677 = Marker 2 Start Height Factor
   V678 = Marker 2 Mark Height

Variable Value
   The selected value for the variable
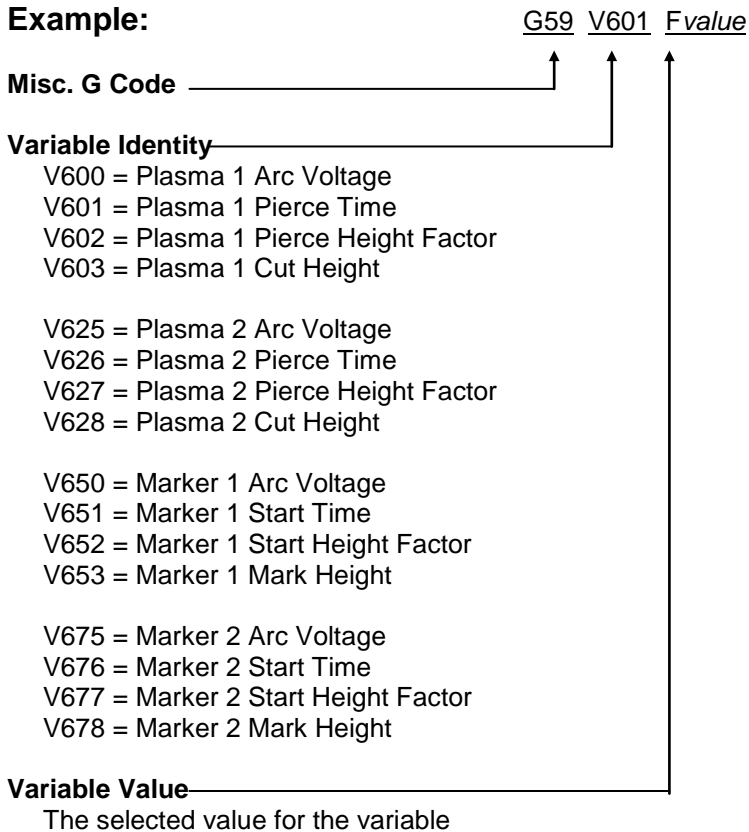
Installation and THC Interface
The Sensor ™ THC is supported through various hardware configurations to offer single and multiple
Sensor™ THC operation. Please refer to your exact CNC hardware configuration when installing the
Sensor™ THC.

Warning! Due to potentially high voltages, extreme care should be taken when working inside the
plasma power supply. Work should only be performed by trained service personnel. Please refer to
Power Supply manufacturer instructions.

Command THC

The Command® THC from Hypertherm® is an automated Torch Height Control system which adjusts the distance between the Plasma torch and the work surface for improved cut quality. Once enabled in password protected setups, operational parameters for the Command® THC may be configured at the Plasma Setups Screen for use. For additional information on the use of the Command® THC, please refer to the operating instructions provided with the THC system.

Clear Error
The Clear Error soft key allows the user to clear an error at the Command® THC control box. After the soft key has been pressed, a message will be posted on the control displaying a description of the error.

Test Cycle ON/OFF
Pressing the Test Cycle ON/ OFF soft key allows the operator to select to operate the Command®
THC in Test mode. In Test mode, the Command® THC will complete the cycle without firing the torch.

Test Lifter
Pressing the Test Lifter soft key will command the torch lifter to lower to the plate, sense the plate and
retract to its pierce height.

Press the Timing Diagram soft key to view the timing diagram from setups.
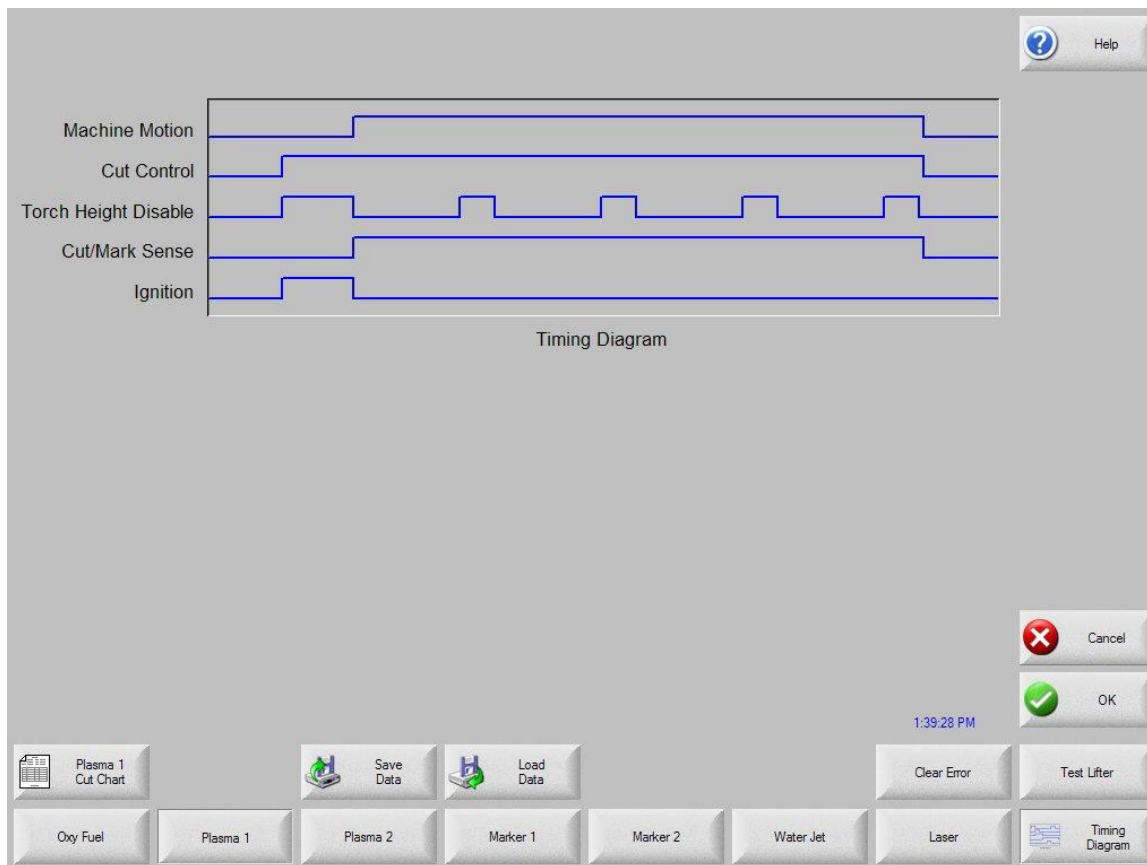
Purge Time
Specifies the time delay from torch ignition until motion is enabled if Arc On Feedback is OFF. Purge
time should be set to Zero if Arc On Feedback is ON.

Pierce Time
Specifies the time delay from when torch completes lowering until motion is initiated at Creep Speed.
Used to allow the plasma torch to completely pierce the material before moving.

Creep Time
Specifies the amount of time after piercing the part that the torch travels at creep speed. Creep Speed is determined by a setup parameter in the Speed Setup Screen and is a percentage of the programmed cut speed. After this time, the control accelerates to full cut speed.

Arc Off Time
Specifies the amount of delay to allow prior to indicating a lost cut signal. This can be useful in helping to minimize nuisance trips when traveling over previously cut paths in complex nested parts.

Stop Time
Specifies the amount of time that motion will pause at the end of a cut. This pause is advantageous for allowing the torch to completely raise and clear cut irregularities before continuing on to the next cut segment.

Accel Delay
The Accel Delay parameter delays the activation of the Automatic Voltage Control to allow for the cutting table to reach a steady cutting speed. This parameter should be set as low as possible without allowing the torch to dive excessively at the beginning of a cut.

Retract Delay Time
Specifies the time delay at the end of the cut signal will pause prior to retracting the torch.

Ignition
Enables use of the Ignition output for use in igniting the plasma torch. If your plasma system requires a separate ignition signal, toggle Ignition to ON. If not, leave Ignition OFF.

Voltage Control
This setup parameter allows the operator to select the Command® THC to operate in Manual or Automatic mode. Manual mode will disable the torch height control allowing the torch to cut at the specified cut height and voltage. Automatic mode allows the THC to command the torch up and down to maintain the voltage at the specified set point.

Retract Full/Partial
Selects the retract distance to be set at Full or Partial. In the Full retract mode, the torch will retract to the Home position. In Partial retract mode, the torch will retract to the set retract distance.

Retry On Transfer Fail
The Retry On Transfer Fail feature is used to specify the number of times the control will attempt to fire the torch in the event that the torch fails to ignite.

Transfer Time
The Transfer Time parameter specifies the amount of time used to attempt ignition of the torch. The ignition is confirmed by the Arc Sense Input (Arc on Feedback) to the control.

Set Arc Current
The Set Arc Current feature allows the user to set the arc current at the plasma supply. This feature uses the "Set Current BCD" output from the control to activate the BCD inputs at the plasma supply. EIA RS-274D part program code G59 V*value* F*value* for setting current is supported.

Corner Current Percent
The Corner Current Percent feature allows the operator to select a reduced current setting to be executed when cutting corners to improve cut quality. This value is a percentage of the Set Current (above) and is active when the Torch Height Disable Output is on.

Set Arc Voltage
The operator may input the desired Arc Voltage for the material being cut.

Cut Height
The Cut Height setup parameter is used to select the desired cut distance from the plate. This will set the initial cut height before Arc Voltage control is activated.

Retract Distance
This setup parameter is used to select the THC Retract Distance when configured for partial retract mode.

Pierce Height Factor
The Pierce Height Factor setup parameter is a multiplication factor that is calculated times the Cut Height to set the pierce height distance.

IHS Stall Current
The Initial Height Sense Stall Current sets the lifter downward force to detect when the torch makes contact with the plate during the IHS cycle. This is a relative factor between one (minimum) and ten (maximum). The limited stall force is always used if nozzle ohmic sense is turned off.

IHS Speed
The Initial Height Sense Speed sets the lifter downward speed during the IHS cycle. This is a relative factor between one (minimum) and ten (maximum).

Homing Speed
This setup parameter determines the retract or homing speed. This is a relative factor between one (minimum) and ten (maximum).

Nozzle Ohmic Contact
This parameter would be set to on if the Command® THC when using Ohmic Contact Sense to detect the plate during the IHS cycle.

Preflow During IHS
Selecting ON, will activate preflow during the IHS cycle.

Auto Kerf Detect
The Auto Kerf Detect feature reduces the possibility of the torch diving into the plate. When enabled, the THC will detect sudden changes in arc voltage when crossing a kerf path and will freeze the THC.

Main Cut Screen

Automatic THC Mode
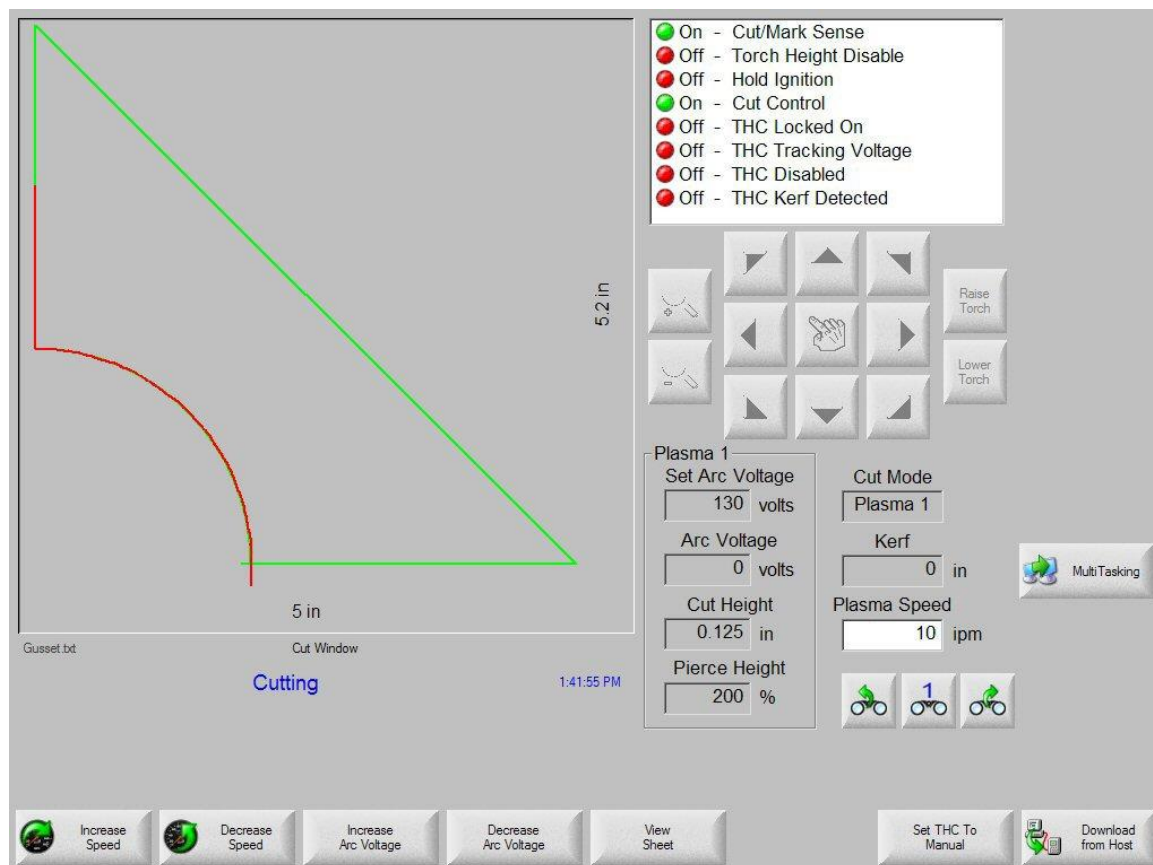
While at the main cut screen, when cutting with the Command® THC in Automatic mode, two new soft keys will become available to manually increase and decrease the Arc Voltage for the cut.

Extend
When pressed during the pierce cycle, this soft key extends the pierce timer until it is stopped either by a Set-Now or Release soft key press.

Set Now
Pressing the Set Now soft key terminates the pierce cycle and saves the new pierce time. The Set Now soft key is often used in conjunction with the Extend soft key to modify the preset pierce time.

Release
A Release soft key press will terminate a pierce cycle, but will not modify the original pierce time. The original pierce time is retained for any remaining pierces.

Manual THC Mode
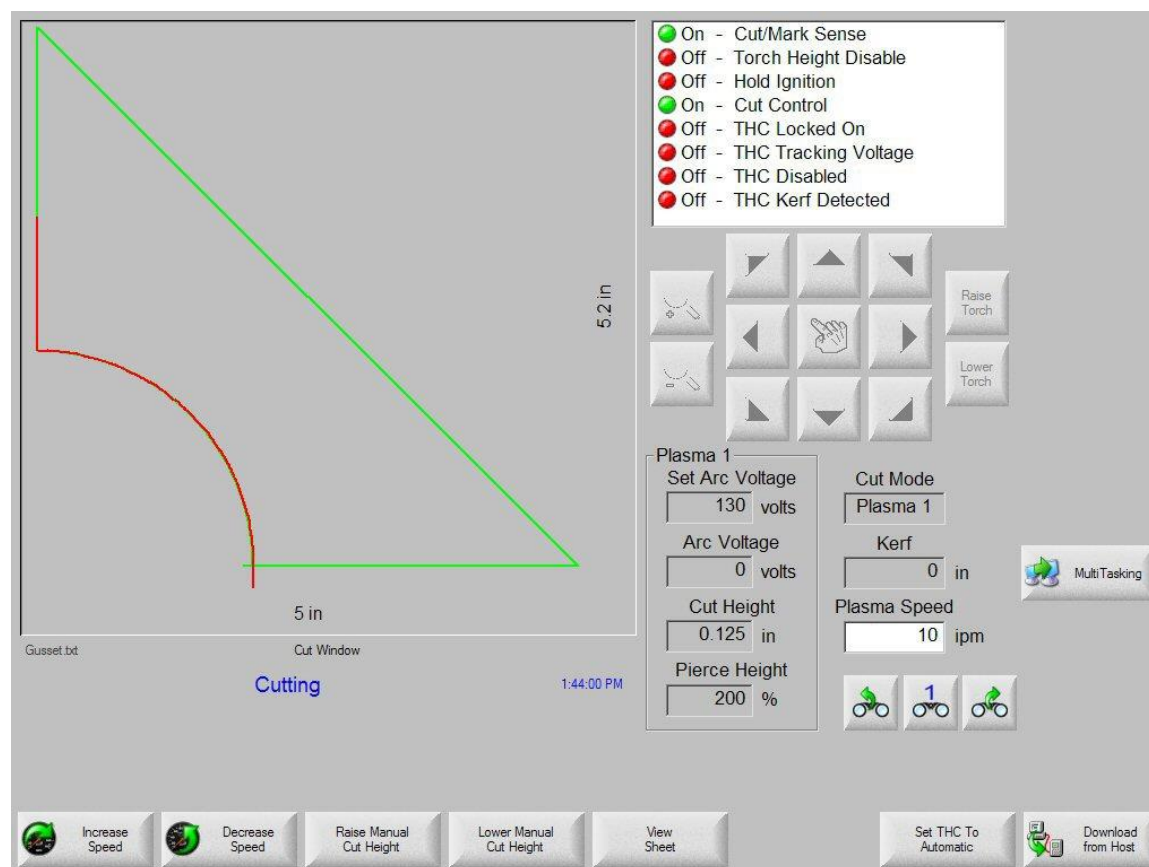
While at the main cut screen, when cutting with the Command® THC in Manual mode, two new soft keys will become available to manually raise and lower the torch cut height.

Extend
When pressed during the pierce cycle, this soft key extends the pierce timer until it is stopped either by a Set-Now or Release soft key press.

Set Now
Pressing the Set Now soft key terminates the pierce cycle and saves the new pierce time. The Set Now soft key is often used in conjunction with the Extend soft key to modify the preset pierce time.

Release
A Release soft key press will terminate a pierce cycle, but will not modify the original pierce time. The original pierce time is retained for any remaining pierces.

Diagnostics
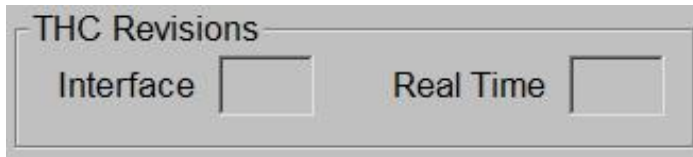
```
┌─THC Revisions──────────────────────────────┐
│                                            │
│   Interface  [        ]   Real Time  [    ]│
│                                            │
└────────────────────────────────────────────┘
```

The current Command® THC Interface and Real Time Revision Levels will be displayed at the Control Information screen when enabled.

Command THC Machine Interface

Warning! Configure the port for RS-422 operation before connecting to the Command® THC. The Command THC Link must first be enabled in Machine Setups for Type "P" controls and at the Station configuration for type "V" controls. Refer to the Serial Port section of this guide for additional information on configuring the serial port for RS-422 communication.

Port Designation
Serial communications for the Command® THC would automatically be set to the serial port which is not selected for serial communications. Example: If Serial Port 1 is designated for use as the link to the Host PC for Downloading of part programs, the HD4070® communications would be established on Serial Port 2.

Type "V" control may select the serial port designation at the Ports configuration screen.

RS-422 Connections to Command® THC with 25-pin D-type connector

Command® THC		Control	
Signal Name	**DB-9 Pin**	**Signal Name**	**DB-9 Pin**
RxD -	1	TxD -	2
TxD -	2	RxD -	3
RxD +	20	TxD +	4
TxD +	21	RxD +	7

For improved noise immunity, it is recommended that the cable shields for communication be tied to ground.   Ferrite bead with several wraps on the cable may also be used.

Motion Overview

General Motion Theory – Servo Loop Control

The following is intended to assist customers / control system users in better understanding motion theory. Note: It is <u>highly</u> recommended that any system tuning be performed by qualified service technician as incorrect tuning may cause damage to the system or personal injury.

Outline of Information
1) What is closed loop servo control?
   a) What is an Encoder?
   b) What is Following Error?
   c) What is a Position / Servo Error?
2) Determining Edge per Inch Parameter
3) Gain Term Definitions
4) Recommended Tuning Procedures

1) What is Closed Loop Servo control?
A Servo System is the means of accurately controlling electrical motors to create force. The motor output is generally connected to a gearing system to translate the rotational force of the motor into linear motion. Additionally this gearing system is used to modify the strength and speed of the motion.

Closed Loop Servo control is the continuous process of monitoring position and/or velocity commands compared to actual position and velocity and adjusting the output accordingly. A servo system without feedback devices and automatic adjustment capabilities would be referred to as Open Loop Servo control.

The drawing below outlines a typical Velocity and Position Loop System. The most important aspect of this for our motion control is the Position Loop. The process starts with the motion control providing a motion command (voltage) to the motor to move at a specific speed to a desired position. Position is tracked during the motion by means of a feedback device (Encoder) that provides both directional and distance information. Based on that feedback, the control adjusts it's motion command (voltage) to the motor to ensure that the motor is accurately positioning on the designated motion path at the correct speed.

Typical Velocity and Position Loop System
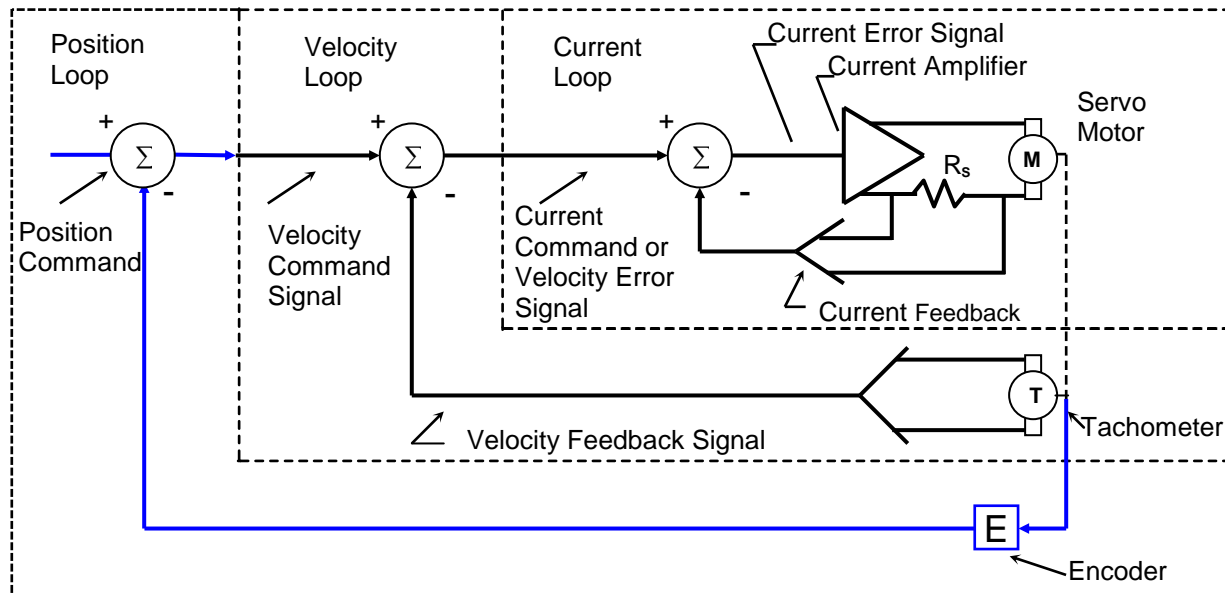
The Motion Command starts as Digital Output within the control and then is converted to a +/- 10VDC Analog Output for use by the motors. This conversion of the Motion Command within the control is referred to as the DAC (Digital to Analog Converter) Output and is performed by the Motion Control Card.   The Analog Output when it comes out of the control is sent to a drive amplifier that then steps up the voltage output to the motor and creates motion. Also, there is usually a linear relationship between the voltage sent and the machine speed (i.e. 10 volts = maximum machine speed, 5 volts = half max machine speed). Additionally, the polarity of the output (DAC Polarity +/-) to the amplifier will dictate the direction of the motor rotation. In most applications and in the following application description the feedback device is an Encoder.

1a) What is an Encoder?
Essentially, an Encoder is a feedback device that provides signal pulses as the motor turns. The diagram at the right illustrates the basic concept of an Encoder. Although this does not represent all Encoder / feedback device technology, this illustration provides a visual aid to help understand the process.

The illustration shows a disk with small holes cut out along the outer edge. The light source provides a beam of light projected downward through the holes in the disk. As the disk turns on the end of the motor shaft, the light passes through the disk creating pulses. The Receiver below the disk picks up the pulsed light source and sends that feedback to the control.
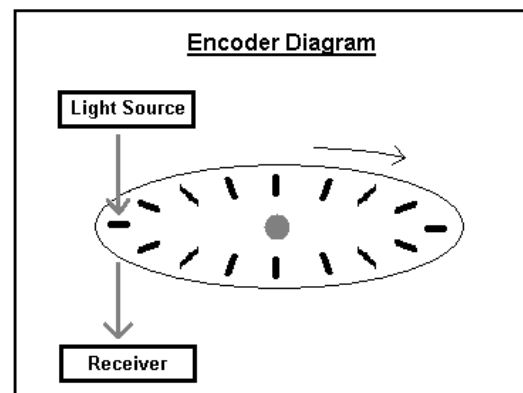
As there is a direct relationship between the rotation of the motor shaft, the Encoder Pulses and the distance of motion traveled (when the motor shaft turns) the control is able to calculate distance by counting the encoder pulses received, thus closing the Position loop. So this relationship, shown as a simplified formula would be:

Encoder Pulses x Motor Revs = Distance

The Encoder generates a Square Wave type signal as illustrated at the diagram to the right. Generally, most encoders provide two main signals (A & B) and the complements (A/ & B/).   These signals are also referred to as channels. The Compliment channels are not always used but can provide increased noise immunity when used. The rotational direction (Encoder Polarity) can be determined by the signal received (e.g. ABABA or BABAB).

Encoder Signal

Channel A
Channel $\overline{A}$

Channel B
Channel $\overline{B}$

Channel Z
Channel $\overline{Z}$
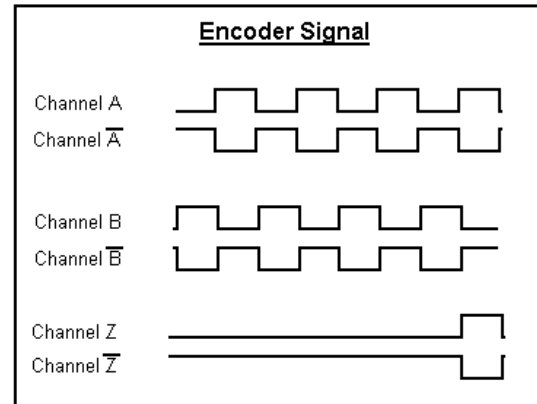
The Z signal shown here is produced only once per revolution and is often referred to as the Marker Pulse. This marker pulse is quite often used for accuracy in "Homing" routines.

The pulses generated are generally referred to as counts.   The holes in the disk are also commonly referred to as lines. You may hear someone mention that they have a 1000 line encoder. The pulses picked up by the receiver may actual be the beginning and end of each light pulse per line for each the two channels (A&B) resulting in a 4x mode encoder. Thus a 1000 line Encoder in 4x mode would produce 4000 pulses or counts per revolution of the disk/ motor. The more pulses/ counts produced by the Encoder for a given distance, the more accurate the motion will be.

1b) What is Following Error?
Following Error or Servo Error is the distance between the ideal commanded position from the control and the actual position of motion. Some Following Error is to be expected as the response of the motor can rarely ever reach the ideal command of the system due to the resistance of load being moved. It is easiest to think of this latent response as being very much like driving a car away from a stop light. For the car, it takes time for the engine to produce the force required to move the weight of the car up to the desired speed. Following Error for each axis can be selected to be viewed in the Watch Window / Status Window of the control. This is a quick reference tool for monitoring the performance of the actual machine motion as compared to the control command.

The important consideration for X/Y coordinate motion is that the response for the X and Y motion is similar. If the response is dissimilar, poor results for commanded motion will result.   An example of a dissimilar tuned response would be that when a

circular motion is commanded, an oval or elliptical motion will result as one axis out performs the other.

1c) What is a Position / Servo Error?
A Position Error or Servo Error occurs when the distance between the ideal motion position and the actual motion position exceeds a pre-defined Servo Error tolerance value. A Position Error indicates that the response from the motion command was not executed, executed too slowly or executed incorrectly. The Servo Error Tolerance is user definable value within the control and is usually set to be a value twice the noted following error during normal operation. This allows the system to operate without nuisance faults caused by temporary resistance to the motion, such as dirt on motion rails or temporary tension from motor cabling, etc.

Note: It is important to remember that in the Closed Position Loop, the output command will adjust to try and maintain the desired speed and positioning. As a result, a loss of Encoder Feedback would result in the control sending out it's maximum motion command to the motor causing it to "run away" without control. Conversely, failure of the motor to turn while feedback is enabled, will result in a position error and the command output will stop when the fault occurs.

2) Determining the Encoder Counts per Inch Parameter and Maximum Machine Speed
Remembering that the position loop uses the pulses/ counts from the encoder to calculate distance, it is important to determine how many encoder pulses are equal to a specific distance of machine motion. The control uses the Encoder Counts Per Inch/mm value as the constant to calculate distance and speed.

The Encoder Counts per Inch/mm is a calculation based on the number of pulses generated by the encoder for one revolution of the motor and how much distance is traveled from that motor motion through the gearing being used.

So this relationship shown as a formula would be:

Counts / Line x   Counts / Rev x   1 Rev / Inch =   Encoder Counts/ Inch
encoder mode e.g 4x   Pulses per Rev   gear box ratio &
                                             rack /pinion ratios

For example: The resolution of a 4X – 1000 line encoder counts both edges (lines) of channel A and channel B to equal 4 counts per line multiplied by the 1000 lines per revolution equaling 4000 counts per revolution. If the encoder revolutions per inch of travel are 1:1, we would have 4000 encoder counts per inch of travel.

4 Counts/ Line x 1000 Lines/ Rev x 1 Rev/ Inch = 4000 Encoder Counts/ Inch

Determining Maximum Machine Speed
The following information is used to establish the proper value for determining max machine speed. Multiply the max RPM of the motor by the number of inches of travel per revolution to get the resulting Maximum Machine Speed in Inches per Minute.

For example*

    4000 RPM Motors x .125 inches per rev = 500 inches per minute

*Note: Through test or calculation it is determined that the table moves 1/8 inches per revolution of the encoder.

With the Maximum Speed, Encoder Counts per Inch, DAC and Encoder polarities determined and entered into control setups, a simple test of machine motion can be made in the control Drive Diagnostics screen. This test should be made with the motors disengaged for safety. This is a basic motion test of the system and does not use gain terms or the position loop for motion. Please refer to the Speeds information in this guide for more information on this feature.

3) Gain Term Definitions

Proportional Gain
In a feedback control system the error term is acted on by the control system and it in turn alters the output. Proportional Gain is pure amplification of the error term. In a closed loop control system this is proportional to the error signal. Simply put, the output is Proportional Gain times error.

In most systems Proportional Gain is the primary tuning parameter to improve the response of the position loop.

Integral Gain
Perhaps the best understanding comes from realizing that the limit of Proportional Gain is that it cannot completely eliminate error. The system can become unstable if only Proportional Gain is used to try and eliminate all the error in a system. When the response of a system is considered satisfactory, but steady state error is excessive, the error can be further reduced by increasing system gain only for long term accumulations of error over time. Integral gain is sometimes used to compensate for static load disturbances like torque loading, gravity bias, and offset.

NOTE: This term can cause instability in a system as it has a more instant effect at the beginning of a move profile. Therefore, it is rarely used for velocity type drives. However, it can provide improved response with current type drives. Only small adjustments to Integral Gain should be made if indications of steady state error exist. In almost all applications this value is set to zero. We recommend using the Feed Forward Gain for closing following error occurring during a move profile.

Derivative Gain
Derivative Gain responds to the rate of change of the signal and can produce corrections before the error term becomes large, therefore it is useful in improving the transient response of a system. Since it opposes change in the controlled output, it can produce a stabilizing effect by damping a tendency toward oscillation. This is the reason we promote tuning by following error to the maximum Proportional Gain then setting Derivative Gain at 10% of Proportional Gain as a rule of thumb. Do not overdo Derivative Gain as it can have a detrimental effect on the overall response of the system.

Feed Forward
Acts to "push" the commanded output ahead to reduce or eliminate dynamic following error. Where dynamic following error is defined as the difference in actual position to commanded position that exists during motion. It is a more pure term than integral gain. It could be defined as the ability to correct for a "lag" in the system with an effect similar to Proportional Gain. Do not increase feed forward gain to the extreme as it can result in positive following error and excessive overshoot.

Velocity Gain
When using a current loop amplifier, the internal velocity loop in the control can be used to provide dampening without an external tachometer.

Using the internal velocity loop with a current loop amplifier can result in higher static stiffness, smoother machine motion, and less overshoot.

4) Recommended Tuning Procedures for Hypertherm Automation Motion Controls

Using the information previously provided as a core understanding of the position loop process, we can now look at tuning motion for the desired motion performance. Due to potential safety hazards and the potential possibility for machine damage from incorrect tuning, it is recommended that this operation be performed by trained and experienced personnel.

Prior to performing motion tuning, values for DAC Polarity, Encoder Polarity and maximum machine speed should be calculated and entered into control setups. Servo Error Tolerance for the axes should be set to maximum (5 inch max for X/Y motion).

Initially, it is recommended that basic tuning start with the motors disengaged from the machine to allow the user to confirm controlled motion and response of the motion axes. An initial Acceleration Rate of 10 Mg's can be used to begin the motion tuning. It is important to remember that after the motors are engaged to the machine for motion, the load requirements for each axis will change requiring additional tuning. Additionally, if the acceleration rate is increased after the initial tuning, additional adjustments to Gain tuning may be required for proper machine motion.

Procedure for Velocity Type Drives
We recommend tuning the system by performing manual moves at a slow speed with all gains set to zero with the exception of Proportional Gain. Proportional Gain should start with a small value of 10. Engage the motors to the machine frame and beginning raising the Proportional Gain to allow movement. If the axes start to vibrate or oscillate, this indicates the selected gain value is too high and should be lowered. It may also require de-tuning the response of the Drive amplifier.

Now that you have some basic control of the system, set up the Watch Window to display Position and Following Error for the selected Axes. Load and automatically "Trial" the Test Pattern simple shape from the shape library. You will be able to follow the response of the system by watching the performance of the Motor /Encoder feedback and its ability to maintain path on the control preview screen.

Systematically increase Proportional Gain until it has little or no effect on the following error or until instability becomes noticeable. Then reduce Proportional Gain to eliminate instability. Derivative Gain may be used to provide a dampening effect. For a Velocity Loop Servo Drive, Integral Gain should be set to zero. After tuning for the best response, increase Feed Forward Gain systematically to further reduce following error if necessary. It is not required that you eliminate following error but it is wise to ensure that Following Error for each axis is similar. Please Note: Feed Forward Gain will reduce steady state following error, but may cause overshoot.

It is important to note that some following error is desirable, following error terms should be nearly the same from one axis to another, and the polarity of the following error term must be the same as the direction of travel.

Finally, check the system tuning by placing a pen on the system. "Draw" the test pattern provided in the simple shape library and observe the cornering capability, arc/ circle contouring and the ability to position at the center crossings. When troubleshooting tuning issues, varying the size and trial speed can often provide valuable information through observations of the pen tracing.

After the system has been successfully tuned, adjust the Servo Error Tolerance to equal twice the normal Following Error for the axes (note: This is a common approach to setting the Servo Error Tolerance but is up to the discretion of the service agent) . This is allows the system to operate without nuisance faults caused by temporary resistance to the motion, such as dirt on motion rails or temporary tension from motor cabling, etc.

Procedure for Current Type Drives
Similar to tuning for Velocity Type Drives, the recommended tuning procedure focuses on response of the motion.   The process begins with low initial values that are increased to get a desired response. If the axes start to vibrate or oscillate, this indicates the selected gain value is too high and should be lowered. It is recommended that basic tuning start with the motors disengaged from the machine to allow the user to confirm controlled motion and response of the motion axes. Motors can then be engaged to fine tune for desired performance.

Set up the Watch Window to display Position and Following Error for the selected Axes. Load and automatically "Trial" the Test Pattern simple shape from the shape library. You will be able to follow the response of the system by watching the performance of the Motor /Encoder feedback and its ability to maintain path on the control preview screen.

Systematically increase the Velocity Gain until it has little or no effect on the following error or until instability becomes noticeable. Proportional Gain would then be used to increase the "stiffness" of response. Integral Gain can be used to improve the steady state performance. Derivative Gain may then be used to provide a dampening effect.

After tuning for the best response, increase Feed Forward Gain systematically to further reduce following error if necessary. It is not required that you eliminate following error but it is wise to ensure that Following Error for each axis is similar. Please Note: Feed Forward Gain will reduce steady state following error, but may cause overshoot.

It is important to note that some following error is desirable, following error terms should be nearly the same from one axis to another, and the polarity of the following error term must be the same as the direction of travel.

Finally, check the system tuning by placing a pen on the system. "Draw" the test pattern provided in the simple shape library and observe the cornering capability, arc/ circle contouring and the ability to position at the center crossings. When troubleshooting tuning issues, varying the size and trial speed can often provide valuable information through observations of the pen tracing.

After the system has been successfully tuned, adjust the Servo Error Tolerance to equal twice the normal Following Error for the axes (note: This is a common approach to setting the Servo Error Tolerance but is up to the discretion of the service agent) . This is allows the system to operate without nuisance faults caused by temporary resistance to the motion, such as dirt on motion rails or temporary tension from motor cabling, etc.

Motion Tuning Watch Windows

Position and Following Error may be displayed.

Command Voltage allows the user to view directional motion command voltage being sent to the amplifier for velocity type drives. This displayed voltage also equates to current being commanded for motion in current type drives. Peak voltage can be displayed for a specified amount of time.

SERCOS Interface Overview

The acronym "SERCOS" refers to **SE**rial **R**eal time **CO**mmunication **S**ystem servo drive interface. This approach to communication with the drive amplifiers is performed through use of a fiber optic ring and would replace the traditional +/- 10VDC analog output motion control card with a new fiber optic driver card. Motion commands from the amplifier to the motor are the same as in a traditional servo loop.

Developed in Europe in 1991 by a group of machine control vendors, SERCOS has been widely accepted and is approved by International standard (IEC 61491 in 1995) and European standard (EN 61491 in 1998).

Due to the expandable nature of the SERCOS interface, Mariner can support up to 12 axes of motion currently available in control software. Additional I/O modules may be added to expand the total number of digital and analog I/O.
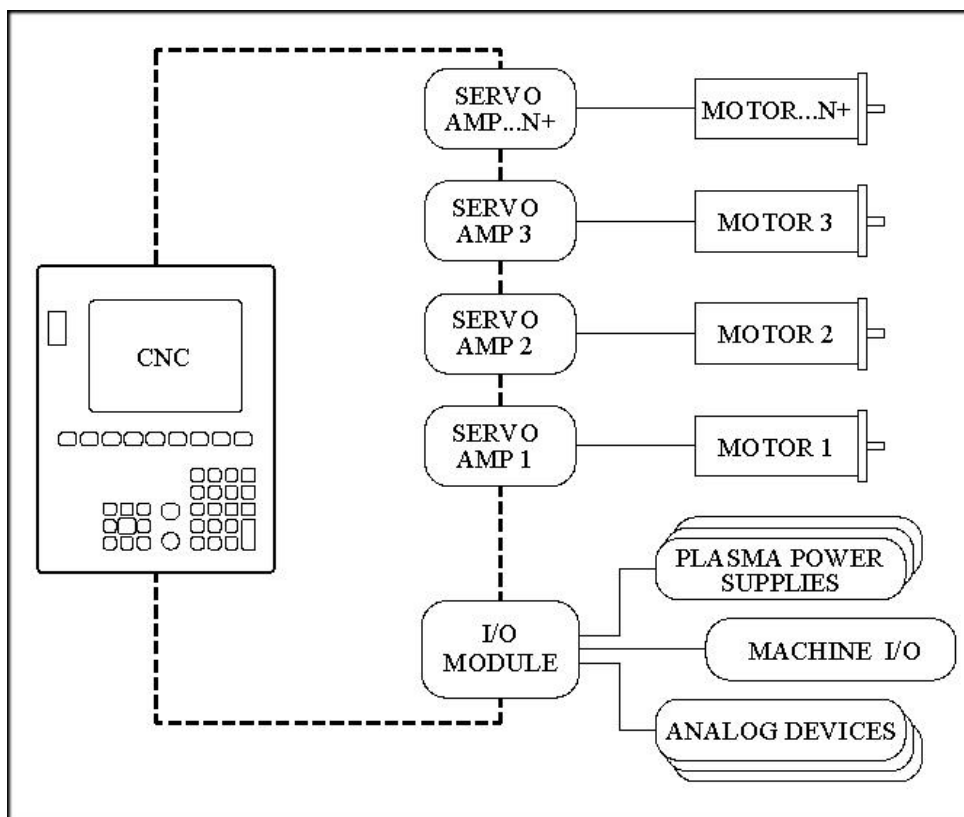
The SERCOS Drive Interface has a number of unique advantages.

1. Reduced CNC - machine interface wiring by use of a single fiber optic connector.
2. Fast 32 bit communications between the drive and CNC.
3. Improved noise immunity due to the fiber optic communication.
4. Long fiber optic cable lengths supported.
5. SERCOS is an open standard that is cross vendor compatible.

For more information on SERCOS, contact SERCOS North America at http://www.sercos.com/

SERCOS™ Interface is a registered Trademark of SERCOS North America.

ASCII Codes

This appendix provides the 128 ASCII codes (American Standard Code for Information Interchange) as defined by ANSI (American National Standards Institute) Standard X3.4-1977.

Control Codes

Hex	Dec	Character	Name	Description
00	0	^ @	NUL	Null
01	1	^A	SOH	Start of Header
02	2	^B	STX	Start of Text
03	3	^C	ETX	End of Text
04	4	^D	EOT	End of Transmission
05	5	^E	ENQ	Enquiry
06	6	^F	ACK	Acknowledge
07	7	^G	BEL	Bell
08	8	^H	BS	Backspace
09	9	^I	HT	Horizontal Tab
0A	10	^J	LF	Line Feed
0B	11	^K	VT	Vertical Tab
0C	12	^L	FF	Form Feed
0D	13	^M	CR	Carriage Return
0E	14	^N	SO	Shift Out
0F	15	^O	SI	Shift In
10	16	^P	DLE	Data Link Escape
11	17	^Q	DCI	Device Control 1
12	18	^R	DC2	Device Control 2
13	19	^S	DC3	Device Control 3
14	20	^T	DC4	Device Control 4
15	21	^U	NAK	Negative Acknowledge
16	22	^V	SYN	Synchronous Idle
17	23	^W	ETB	End Transmission Block
18	24	^X	CAN	Cancel
19	25	^Y	EM	End of Medium
1A	26	^Z	Sub	Substitute
1B	27	^[	ESC	Escape
1C	28	^\	FS	File Separator
1D	29	^]	GS	Group Separator
1E	30	^^	RS	Record Separator
1F	31	^_	US	Unit Separator
20	32		SP	Space

All Codes

Hex	Dec	Symbol	Hex	Dec	Symbol	Hex	Dec	Symbol
00	0	^ @	2B	43	+	56	86	V
01	1	^A	2C	44	,	57	87	W
02	2	^B	2D	45	-	58	88	X
03	3	^C	2E	46	.	59	89	Y
04	4	^D	2F	47	/	5A	90	Z
05	5	^E	30	48	0	5B	91	[
06	6	^F	31	49	1	5C	92	\
07	7	^G	32	50	2	5D	93	]
08	8	^H	33	51	3	5E	94	^
09	9	^I	34	52	4	5F	95	_
0A	10	^J	35	53	5	60	96	`
0B	11	^K	36	54	6	61	97	a
0C	12	^L	37	55	7	62	98	b
0D	13	^M	38	56	8	63	99	c
0E	14	^N	39	57	9	64	100	d
0F	15	^O	3A	58	:	65	101	e
10	16	^P	3B	59	;	66	102	f
11	17	^Q	3C	60	<	67	103	g
12	18	^R	3D	61	=	68	104	h
13	19	^S	3E	62	>	69	105	i
14	20	^T	3F	63	?	6A	106	j
15	21	^U	40	64	@	6B	107	k
16	22	^V	41	65	A	6C	108	l
17	23	^W	42	66	B	6D	109	m
18	24	^X	43	67	C	6E	110	n
19	25	^Y	44	68	D	6D	111	o
1A	26	^Z	45	69	E	70	112	p
1B	27	^[	46	70	F	71	113	q
1C	28	^\	47	71	G	72	114	r
1D	29	^]	48	72	H	73	115	s
1E	30	^^	49	73	I	74	116	t
1F	31	^_	4A	74	J	75	117	u
20	32		4B	75	K	76	118	v
21	33	!	4C	76	L	77	119	w
22	34	"	4D	77	M	78	120	x
23	35	#	4E	78	N	79	121	y
24	36	$	4F	79	O	7A	122	z
25	37	%	50	80	P	7B	123	{
26	38	&	51	81	Q	7C	124		
27	39	'	52	82	R	7D	125	}
28	40	(	53	83	S	7E	126	~
29	41	)	54	84	T	7F	127	←
2A	42	'	55	85	U			

Program Codes

EIA RS-274D

The control supports EIA RS-274D part programs. An EIA RS-274D program lists the sequence of Lines, Arcs, Speeds, Kerf and I/O functions used to create a part. While the user is free to program in EIA using the standard text editor, it is recommended that the *ShapeWizard*® Graphical Programming environment be used instead.

Following is a list of the EIA codes that are directly supported, mapped, or currently unsupported by the control. Mapped EIA codes are automatically converted upon program load into directly supported EIA codes. Unsupported EIA codes are ignored. All other EIA codes will generate an error.

Directly Supported EIA Codes

EIA CODE	DESCRIPTION
F*value*	Machine Speed (if Speed Override enabled)
N*value*	Line Number
(*text)*	Comments
X*value*	X Axis Endpoint or other Data
Y*value*	Y Axis Endpoint or other Data
I*value*	I Axis Integrand or Part Option Data
J*value*	J Axis Integrand or Part Option Data
O*value* S*value*	Output (1-64), State (0-Off or 1-On)
W*value* S*value*	Wait for Input (1-64), State (0-Off or 1-On)
G00	Rapid Traverse Linear Interpolation
G00 A*value*	Sets Tilt angle – A is the angle value in degrees
G00 XY*val* A*val*	Performs Linear Interpolation of Tilt angle along line segment.
G01 A*value* F*value*	Sets Tilt angle value in degrees with a speed command in RPM
G00 Xn Yn	Traverse command where n = value to move the desired axes a distance.
G00 Zx.xx Tx	Index Sensor™ THC height "Z" distance for torch "T". Manual mode only.
G00 Cxx	Move to rotate "C" position
G01 Cxx Fxx	Move to rotate "C" position with Speed "F" command in RPM
G00 C180-	Rotate Axis offset 180 degrees will continue to rotate in the proper direction
G00 C-180-	Rotate Axis offset -180 degrees will continue to rotate in the proper direction
G01 C180- Fxx	Rotate Axis offset 180 degrees with speed
G01 C-180- Fxx	Rotate Axis offset -180 degrees with speed
G01	Linear Interpolation (at Cut Speed)
G02	Clockwise Circular Interpolation
G03	Counterclockwise Circular Interpolation
G04	Preset Dwell (uses Setup Dwell Time)
G04 X*value*	Program Dwell in Seconds
G08 X*value*	Repeat Subroutine X Times
G20	Select English Units (inches)
G21	Select Metric Units (mm)
G40	Disable Kerf Compensation
G41	Enable Left Kerf Compensation
G42	Enable Right Kerf Compensation
G43 X*value*	Kerf Value

EIA CODE	DESCRIPTION
G41 D1-200	Enables Left Kerf using a Kerf Table variable
G42 D1-200	Enables Right Kerf using a Kerf Table variable
G43 D1-200	Sets the current Kerf value via the Kerf Table using prior set Left / Right Kerf
G59 D1-200Xvalue	Sets Kerf table variable from 1-200
G59 Vvalue Fvalue	Sets the Plasma Supply current through Outputs or Serial Link for Vprocess (504,514,524,534) at Fcurrent value

V504 – Current Setting Plasma 1
V514 – Current Setting Plasma 2
V524 – Current Setting Marker 1
V534 – Current Setting Marker 2

G66 Dval Bval Cval	Auto Align 3 Point Method with Long Offset Distance, Fast Speed, Slow Speed values respectively
G82	Oxy-Fuel Cut Mode
G83	Oxy-Fuel Cut Mode Contour Bevel Head
G84	Plasma Cut Mode
G85	Plasma Cut Mode Contour Bevel Head
G90	Absolute Programming Mode
G91	Incremental Programming Mode
G92	Set Axis Presets
G97	Program Repeat Pointer
G97 Tvalue	Program Repeat Pointer. Executes the repeat T times
G98	Repeat at G97, or start of program if no G97
G99	Part Options
M00	Program Stop
M01	Optional Program Stop (uses Setup Parameter)
M02	End of Program
M07	Cutting Device On
M08 Txx.xx	Cutting Device Off (Temporary Optional Time Delay from –1 to 99.99 seconds)
M09	Enable Marker 1
M10	Disable Marker 1
M11	Marker Offset 1 On
M12	Marker Offset 1 Off
M13	Enable Marker 2
M14	Disable Marker 2
M15	Cut On
M16	Cut Off
M17	Oxy Gas On
M18	Oxy Gas Off
M19	Cancel All Stations
M26	Station Select On
M27	Station Select Off
M28	CBH / Rotator(s) Disable
M29	CBH / Rotator(s) Enable
M30	End of Program (same as M02)
M31	Reset Functions (Cut Off, Marker Off, Kerf Off)
M32	Unclamp / Unlock All Stations
M32 Tvalue	Unclamp / Unlock 'T" Station, where T = 1 through 19
M33	Unclamp / Lock All Stations
M34	Clamp / Unlock All Stations
M34 Tvalue	Clamp / Unlock 'T" Station, where T = 1 through 19
M35	Clamp / Unlock All Stations Mirror
M35 Tvalue	Clamp / Unlock Mirror "T" Station, where T = 1 through 19

EIA CODE	**DESCRIPTION**
M36 T*value*	Process Select "T" where T value selects the process
	1- Plasma 1
	2- Plasma 2
	3- Marker 1
	4- Marker 2
	5- Laser
M37 T*value (1-20)*	Select Station "T" where T = 1 through 20
M38 T*value (1-20)*	Deselect Station "T" where T = 1 through 20
M40	Start of Subroutine
M40 X*value*	Start of Subroutine. Executes the repeat X times
M41	End of Subroutine
M48	Speed Override Enable
M49	Speed Override Disable
M50	Height Sensor Disable
M51 Txx.xx	Height Sensor Enable (Temporary Optional Time Delay in seconds before Enable)
M52	Height Sensor Disable and Raise Torch
M53	Height Sensor Enable and Lower Torch
M65	End of Program (same as M02) or Auto Reload
M72	Marker Offset 2 Off
M73	Marker Offset 2 On
M75	A Axis/Tilt Go to Home Command - Rapid Index
M76	C Axis/Rotate Go to Home Command - Rapid Index
M77	Go to Home position Y Axis
M78	Go to Home position X Axis
M79 T*value (1-4)*	Go To Home Position (1-4)
M90	Aligns CBH / Rotator to Tangent angle of next cut segment
M90-	Align rotator negative, when not using shortest path motion
M274	Marker Offset 3 Off
M275	Marker Offset 3 On
M276	Marker Offset 4 Off
M277	Marker Offset 4 On
M278	Marker Offset 5 Off
M279	Marker Offset 5 On
M280	Marker Offset 6 Off
M281	Marker Offset 6 On
M282	Marker Offset 7 Off
M283	Marker Offset 7 On
M284	Marker Offset 8 Off
M285	Marker Offset 8 On
M286	Marker Offset 9 Off
M287	Marker Offset 9 On
M288	Marker Offset 10 Off
M289	Marker Offset 10 On
M290	Marker Offset 11 Off
M291	Marker Offset 11 On
M292	Marker Offset 12 On
M293	Marker Offset 12 On
M301	Assigns the current X/Y position to Home Position 1
M302	Assigns the current X/Y position to Home Position 2
M303	Assigns the current X/Y position to Home Position 3
M304	Assigns the current X/Y position to Home Position 4
M305	Assigns the current X/Y position to Home Position 5
M306	Assigns the current X/Y position to Home Position 6
M307	Assigns the current X/Y position to Home Position 7

EIA CODE	DESCRIPTION
M308	Assigns the current X/Y position to Home Position 8
M309	Assigns the current X/Y position to Home Position 9
M310	Assigns the current X/Y position to Home Position 10
M311	Assigns the current X/Y position to Home Position 11
M312	Assigns the current X/Y position to Home Position 12

Mapped EIA Codes

EIA CODE	DESCRIPTION	MAPPED TO
G04 F*value*	Program Dwell	G04 X*value*
G05	Set Axis Presets	G92
G21	Linear Interpolation (at cut speed)	G01
G22	CW Circular Interpolation	G02
G23	CCW Circular Interpolation	G03
G41 K*value*	Left Kerf with Value	G41 with Kerf Value
G42 K*value*	Right Kerf with Value	G42 with Kerf Value
G97 T*Value*	Subroutine Loop	G08 X*value* and M40
G45	Lead In to Kerfed Part	G01, G02, or G03
G70	Select English Units	G20
G71	Select Metric Units	G21
G98	End of Subroutine Loop	M41
M03	Cutting Device On/Off	M07 (Oxy Fuel) or M08 as appropriate
M04	Cutting Device On	M07
M05	Cutting Device Off	M08 (Oxy Fuel)
M06	Cutting Device Off	M08
M06	Enable Marker 2	M13
M07	Disable Marker 1 or 2	M10 or M14 as appropriate
M08	Enable Marker 1	M09
M09	Disable Marker 1 or 2	M10 or M14 as appropriate
M10	Enable Marker 2	M13
M14	Height Sensor Disable	M50
M15	Height Sensor Enable	M51
M20	Cutting Device On/Off	M07 or M08 as appropriate (Plasma)
M21	Cutting Device On/Off	M07 or M08 as appropriate (Plasma)
M20	Output 9 On	O9 S1
M21	Output 9 Off	O9 S0
M22	Output 12 On	O12 S1
M23	Output 12 Off	O12 S0
M24	Wait for Input 7 On	W7 S1
M25	Wait for Input 8 On	W8 S1
M25	CBH Enable	M29
M26	Wait for Input 7 Off	W7 S0
M26	CBH Disable	M28
M27	Wait for Input 8 Off	W8 S0
M67, M02	Kerf Left	G41
M68, M03	Kerf Right	G42
M69, M04	Kerf Off	G40
M65, M70	Cutting Device On	M07
M66, M71, M73	Cutting Device Off	M08
M70	Marker Offset 1 Off	M12
M71	Marker Offset 1 On	M11
M70T01	Marker Offset 1 Off	M12
M71T01	Marker Offset 1 On	M11

EIA CODE	DESCRIPTION	MAPPED TO
M70T02	Marker Offset 2 Off	M72
M71T02	Marker Offset 2 On	M73
M70T03	Marker Offset 3 Off	M274
M71T03	Marker Offset 3 On	M275
M70T04	Marker Offset 4 Off	M276
M71T04	Marker Offset 4 On	M277
M70T05	Marker Offset 5 Off	M278
M71T05	Marker Offset 5 On	M279
EIA CODE	DESCRIPTION	MAPPED TO
M70T06	Marker Offset 6 Off	M280
M71T06	Marker Offset 6 On	M281
M70T07	Marker Offset 7 Off	M282
M71T07	Marker Offset 7 On	M283
M70T08	Marker Offset 8 Off	M284
M71T08	Marker Offset 8 On	M285
M98	End Comment	)
M99	Start Comment	(
M221	No Mirror, No Rotate	G99 X1 Y0 I0 J0
M222	Mirror Y, No Rotate	G99 X1 Y0 I0 J1
M223	Mirror X and Y	G99 X1 Y0 I1 J1
M224	Mirror X, No Rotate	G99 X1 Y0 I1 J0
M225	Mirror X/Y on -45 Deg	G99 X1 Y270 I1 J0
M226	Rotate 90 Deg CCW	G99 X1 Y90 I0 J0
M227	Mirror X/Y on +45 Deg	G99 X1 Y270 I0 J1
M228	Rotate 90 Deg CW	G99 X1 Y270 I0 J0
M245	Output 1 On	O1 S1
M246	Output 1 Off	O1 S0
M247	Output 2 On	O2 S1
M248	Output 2 Off	O2 S0
M249	Output 3 On	O3 S1
M250	Output 3 Off	O3 S0
M251	Output 4 On	O4 S1
M252	Output 4 Off	O4 S0
M253	Wait for Input 1 On	W1 S1
M254	Wait for Input 1 Off	W1 S0
M255	Wait for Input 2 On	W2 S1
M256	Wait for Input 2 Off	W2 S0
M257	Wait for Input 3 On	W3 S1
M258	Wait for Input 3 Off	W3 S0
M259	Wait for Input 4 On	W4 S1
M260	Wait for Input 4 Off	W4 S0

Unsupported EIA Codes

EIA CODE	DESCRIPTION
G30	Mirror Off
G46	Table 0 Select
G94	Feed per minute
G95	Feed per rev
G99	Freestanding G99
G103 Q*name*	Stop Current Program/ Load New Program
G201	Incremental Line In2
G202	Incremental CW Arc In2
G203	Incremental CCW Arc In2

EIA CODE	DESCRIPTION
G211	Incremental Line In3
G212	Incremental CW Arc In3
G213	Incremental CCW Arc In3
G221	Absolute Line In2
G222	Absolute CW Arc In2
G223	Absolute CCW Arc In2
G231	Absolute Line In3
G232	Absolute CW Arc In3
G233	Absolute CCW Arc In3
G240	Programmable Kerf
G247	Table 1 Select
G248	Table 2 Select
G249	Table 3 Select
G250	Table 4 Select
G276	Internal Variable Load
G277	External Variable Load
G278	X Axis Home
G279	Y Axis Home
G280	X Home Return
G281	Y Home Return
M66	PLC Control Code
M75	Ignored if not using CBH, Tilt Rotator(s)
M76	Ignored if not using CBH, Tilt Rotator(s)
M210	X Sign Toggle
M211	Y Sign Toggle
M212	X and Y Swap and Toggle
M231	Aux. State Reset
M261	Aux. Torch Master On
M262	Aux. Torch Master Off

The unsupported EIA codes previously noted are ignored when read. Some of these codes may be supported in the future. Any EIA codes that are not listed above will result in a translator error upon loading the EIA program. Known EIA codes that will not be accepted include, but are not limited to:

P*value*	Program Number
D*value*	Indexed Kerf Operations
V*value*	Internal Variable Load

EIA Comments
Comments may be placed into the part program to be displayed on screen and viewed by the operator. The comment line must first be preceded by a program stop command (EIA M00 code or ESSI 0 code).

EIA Example:

        M00 – Pauses Program
        (Comment) – Text to be displayed

ESSI

The control supports ESSI part programs as defined by the International Standards Organization in ISO 6582. An ESSI program lists the sequence of Lines, Arcs, Speeds, Kerf and I/O Functions used to create a part. While the user is free to program in ESSI using a standard text editor, it is recommended that the *ShapeWizard*® Graphical Programming environment be used instead.

While the user is free to download ESSI programs to the control, it is important to note that all Part Programs will be internally converted to EIA for execution in the control. Following is a list of the ESSI codes that are mapped into the control, or currently unsupported by the control. Mapped ESSI codes are automatically converted upon program load into directly supported EIA codes. Unsupported ESSI codes are ignored. All other ESSI codes will generate an error.

Mapped ESSI Codes

ESSI CODE	DESCRIPTION	MAPPED TO EIA
%	Start of Program	Not Used-Automatic
+/-*value…*	Line or Arc	G00, G01, G02 or G03 as appropriate
0	End Program or Stop	M02 or M00 (if 64 is End Program)
3	Start Comment	(
4	End Comment	)
5	Enable Rapid Traverse	Not Used-Automatic
6	Disable Rapid Traverse	Not Used-Automatic
7	Cutting Device On	M07
8	Cutting Device Off	M08
9	Enable Marker 1	M09
10	Disable Marker 1	M10
11	Marker Offset 1 On	M11
12	Marker Offset 1 Off	M12
11+1	Marker Offset 1 On	M11
12+1	Marker Offset 1 Off	M12
11+2	Marker Offset 2 On	M73
12+2	Marker Offset 2 Off	M72
11+3	Marker Offset 3 On	M275
12+3	Marker Offset 3 Off	M274
11+4	Marker Offset 4 On	M277
12+4	Marker Offset 4 Off	M276
11+5	Marker Offset 5 On	M279
12+5	Marker Offset 5 Off	M278
11+6	Marker Offset 6 On	M281
12+6	Marker Offset 6 Off	M280

ESSI CODE	DESCRIPTION	MAPPED TO EIA
11+7	Marker Offset 7 On	M283
12+7	Marker Offset 7 Off	M282
11+8	Marker Offset 8 On	M285
12+8	Marker Offset 8 Off	M284
13	Enable Marker 2	M13
14	Disable Marker 2	M14
15	Marker Offset 2 On	M73
16	Marker Offset 2 Off	M72
21	No Mirror, No Rotate	G99 X1 Y0 I0 J0
22	Mirror Y, No Rotate	G99 X1 Y0 I0 J1
23	Mirror X and Y	G99 X1 Y0 I1 J1
24	Mirror X, No Rotate	G99 X1 Y0 I1 J0
25	Mirror X/Y on -45 Deg	G99 X1 Y270 I1 J0
26	Rotate 90 Deg CCW	G99 X1 Y90 I0 J0
27	Mirror X/Y on +45 Deg	G99 X1 Y270 I0 J1
28	Rotate 90 Deg CW	G99 X1 Y270 I0 J0
29	Enable Left Kerf Comp	G41
30	Enable Right Kerf Comp	G42
38	Disable Kerf	G40
39+*value*	Machine Speed	F*value*
40+*value*	Programmable Kerf	G43 X*value*
41	Preset Dwell	G04
41+*value*	Program Dwell in mSec	G04 X*value*
45	Ht Sensor Enable/Lower	M53
46	Ht Sensor Disable/Raise	M52
47	Ht Sensor Enable	M51
48	Ht Sensor Disable	M50
51	CBH Enable	M29
52	CBH Disable	M28
53	Cutting Device On	M07
54	Cutting Device Off	M08
63	Reset Functions	M31
64	End Program	M02
65	End of Program/ Reload	M65
67	Ht Sensor Disable	M50
68	Ht Sensor Enable	M51
70	Select English Units (in)	G20
71	Select Metric Units (mm)	G21
79+1	Go To Home Position 1	M79 T1
79+2	Go To Home Position 2	M79 T2
79+3	Go To Home Position 3	M79 T3
79+4	Go To Home Position 4	M79 T4
81	Incremental Mode	G91
82	Absolute Mode	G90
83	Set Axis Presets	G92
90	End of Program	M02
97	Program Repeat Pointer	G97
97+*value*	Subroutine Loop	M40 X*value*
98	Repeat at 97, Subroutine loop or start of program if no 97	G97, G98 or M41 as appropriate
99	End of Program	M02

ESSI CODE	DESCRIPTION	MAPPED TO EIA
245	Output 1 On	O1 S1
246	Output 1 Off	O1 S0
247	Output 2 On	O2 S1
248	Output 2 Off	O2 S0
249	Output 3 On	O3 S1
250	Output 3 Off	O3 S0
251	Output 4 On	O4 S1
252	Output 4 Off	O4 S0
253	Wait for Input 1 On	W1 S1
254	Wait for Input 1 Off	W1 S0
255	Wait for Input 2 On	W2 S1
256	Wait for Input 2 Off	W2 S0
257	Wait for Input 3 On	W3 S1
258	Wait for Input 3 Off	W3 S0
259	Wait for Input 4 On	W4 S1
260	Wait for Input 4 Off	W4 S0
282	Marker Offset 3 On	M275
283	Marker Offset 3 Off	M274
284	Marker Offset 4 On	M277
285	Marker Offset 4 Off	M276
286	Marker Offset 5 On	M279
287	Marker Offset 5 Off	M278
288	Marker Offset 6 On	M281
289	Marker Offset 6 Off	M280
290	Marker Offset 7 On	M283
291	Marker Offset 7 Off	M282
292	Marker Offset 8 On	M285
293	Marker Offset 8 Off	M284

Unsupported ESSI Codes

ESSI CODE	DESCRIPTION
103+Name	Stop Current Program/ Load New Program
237	X Sign Toggle
238	Y Sign Toggle
239	X and Y Swap and Toggle
266	Table 1 Select
267	Table 2 Select
268	Table 3 Select
269	Table 4 Select
276	Internal Variable Load
277	External Variable Load
278	X Axis Home
279	Y Axis Home
280	X Home Return
281	Y Home Return

The unsupported ESSI codes above are ignored when read. Some of these codes may be supported in the future. Any ESSI codes that are not listed above will result in a translator error upon loading the ESSI program.

ESSI Comments
Comments may be placed in to the part program to be displayed on screen and viewed by the operator. The comment line must first be preceded by a program stop command (EIA M00 code or ESSI 0 code).

ESSI Example:

       0 – Pauses Program
       3 – Start Comment
       Comment – Text to be displayed
       4 – End Comment

Advanced Feature Codes

Kerf Table

Code	Description
G59 D1-200Xvalue	Sets kerf table variable from 1-200
G41 D1-200	Enables Left Kerf using a Kerf Table variable
G42 D1-200	Enables Right Kerf using a Kerf Table variable
G43 D1-200	Changes current kerf value via Kerf Table using previously set Left or Right kerf

Tilt / Rotator Part Codes

Code	Description
G00 A*value*	Sets Tilt angle as a preparatory command – A is the angle value in degrees
G00 XY*value* A*value*	Performs Linear Interpolation of Tilt angle along line segment.
G00 A*value* F*value*	Sets Tilt angle – Angle value in degrees with a speed command in RPM
M28	Disables Follower
M29	Enables Follower
M90	Preparatory Cmd - Aligns Rotator to Tangent angle of next cut segment
M90-	Align rotator when not using shortest path motion
M75	A axis/Tilt Goto Home Cmd - Rapid Index
G00 Cxx	Move to rotate "C" position
G01 Cxx Fxx	Move to rotate "C" position with Speed "F" command
G00 C180-	Rotate Axis align 180 degrees will continue to rotate in the proper direction
G00 C-180-	Rotate Axis align -180 degrees will continue to rotate in the proper direction
G01 C180- Fxx	Rotate Axis align 180 degrees with speed
G01 C-180- Fxx	Rotate Axis align -180 degrees with speed

Automatic Torch Spacing Program Codes

Code	Description
M32	Unclamp / Unlock All Stations
M33	Unclamp / Lock All Stations
M34	Clamp / Unlock All Stations
M34T*value*	Clamp / Unlock 'T" Station, where T = 1 through 19
M35	Clamp / Unlock All Stations Mirror
M35T*value*	Clamp / Unlock Mirror "T" Station, where T = 1 through 19
M77	Go to Home position Y Axis
M78	Go to Home position X Axis

Station Selects

Stations (Lifter / THCs) may be selected / de-selected using a EIA-274D program code with the following format.

Code	Description
M19 T*value*	Cancel All Station Selections
M37 T*value*	Select Station 1-20 (Tvalue)
M38 T*value*	De-Select Station 1-20 (Tvalue)

Additionally, these Station Select program codes may be overridden using the user selected THC inputs to the control. The feature to override the part program must be enabled at the Cutting Setup screen.

Process Selects
Process Selections may be selected using a EIA-274D program code with the following format.

Example: M36 T*value*

Misc. M Code

Valve Identity
   T1 = Plasma Process 1
   T2 = Plasma Process 2
   T3 = Marker Process 1
   T4 = Marker Process 2
   T5 = Laser Process

Station Configuration Variables
The following options are available for the station configuration

Lifter
None
Sensor THC
Command THC (w/ Serial Link)
HD4070 Integrated THC 1 or 2 (used only with the HD4070® power supply)
Other (any stand alone Lifter Station)

Power Supplies

None	HD4070 Torch 1or 2	Powermax series
Max100/ 100D	HT4001	FineLine 100
Max200	HT4100	FineLine 200
HT2000	HT4400	Other (any other Plasma system)
HD3070	HPR130	

Marker

None	ArcWriter	FineLine 100 & 200
HD4070 Torch 1or 2	HPR130	Other (any stand alone Marker)

Laser

Rofin RF 40 & 50	Rofin DC 35	Rofin TR 60	Other

Automatic Torch Spacing

The Automatic Torch Spacing feature uses codes within the part program, and designated outputs, to perform precise positioning of individual torch stations for multi-torch cutting processes.

This Feature must be enabled in Machine Setups for use. The Auto Torch Spacing Override feature in Cutting Setups must also be enabled.

In this process, the master torch station has a fixed mount to the transverse axis and the other slave torch stations have the ability to clamp to the mechanics of the transverse axis during use or lock to the gantry or beam when not in use.

For the example, below Torch 1 is the master station and Torch 2-4 are the slave stations.

Typical use is as follows:

1) Unclamp and Unlock all stations (except the first which is fixed and slides the others)
2) Go to Home Command on Transverse Axis (M77 or M78 depending on orientation)
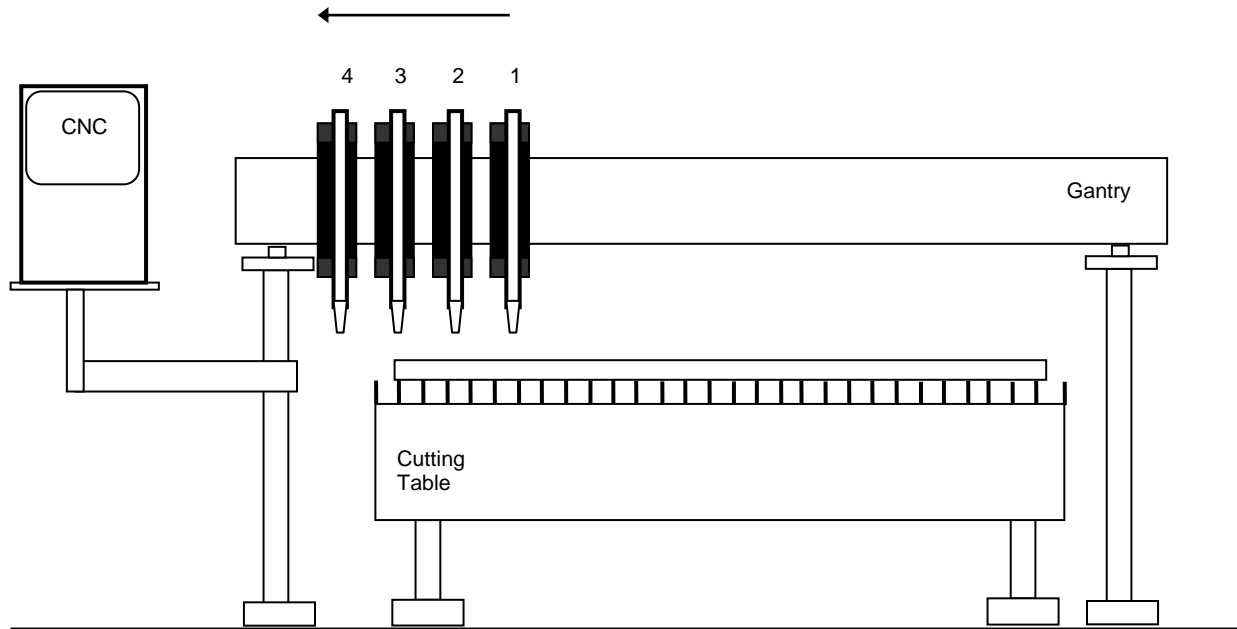
3) Clamp and Unlock all carriages and G00 index inward on transverse
   (optional command - may used to space all stations away from edge / OT switch of machine)
4) Lock and Unclamp all and G00 index to space first station (remember-first station has no
   clamping/locking on board)
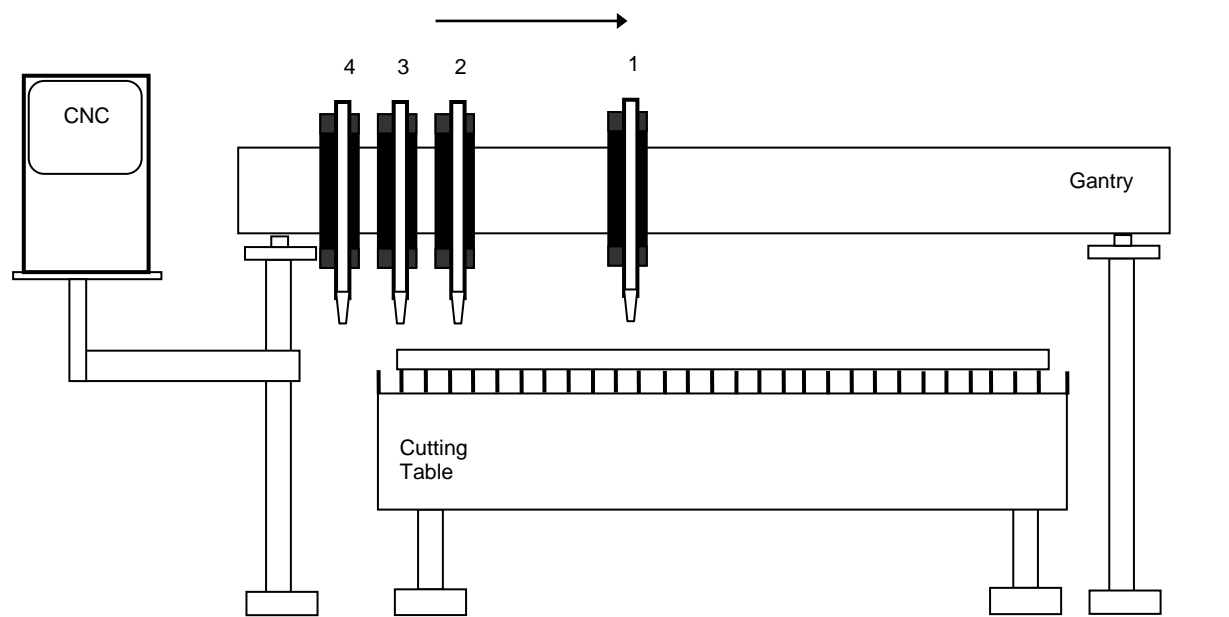
5) Unlock and Clamp next station and G00 index to space next station.
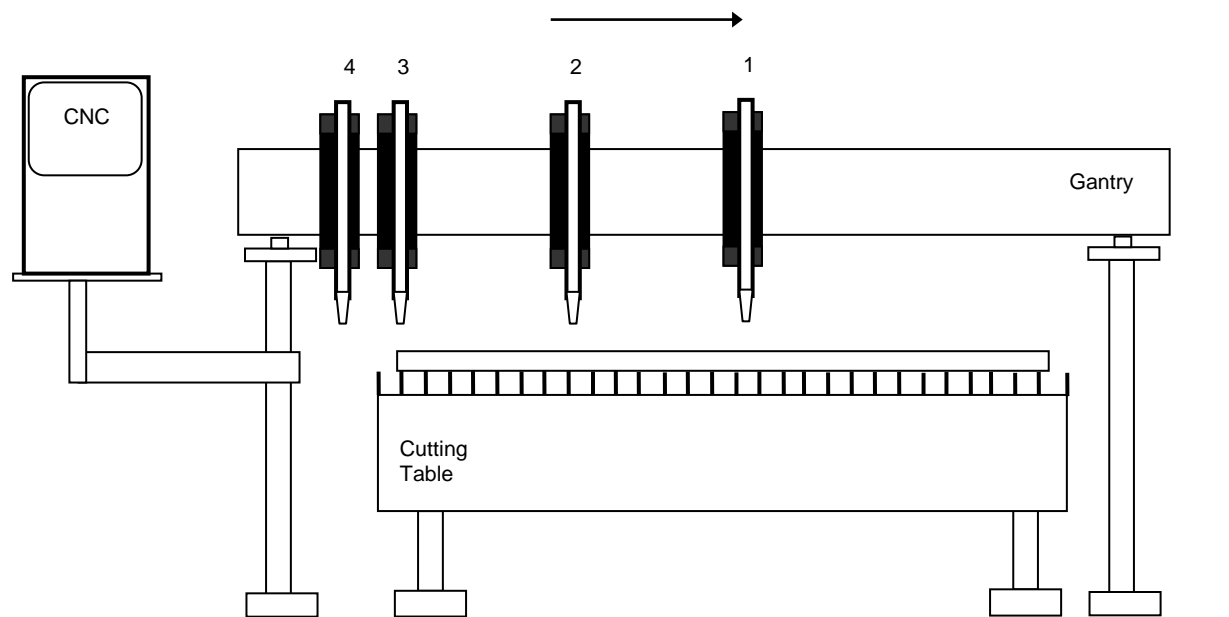
6) Repeat 5 above until as many stations as needed are spaced.

Note: Homing will also automatically include the commands necessary to push the stations to the side and lock / clamp them whenever the transverse is homed, if Auto Torch Spacing is enabled. Unclamp/ Clamp and Unlock / lock commands execute a one second delay before moving.

Automatic Torch Spacing Program Codes

Code	Description
M32	Unclamp / Unlock All Stations
M33	Unclamp / Lock All Stations
M34	Clamp / Unlock All Stations
M34T*value*	Clamp / Unlock 'T" Station, where T = 1 through 19
M35	Clamp / Unlock All Stations Mirror
M35T*value*	Clamp / Unlock Mirror "T" Station, where T = 1 through 19
M77	Go to Home position Y Axis
M78	Go to Home position X Axis
G00 Xn Yn	Traverse command where n = value to move the desired axes a distance.

Automatic Torch Spacing I/O

Station Lock 1-19	The Station lock is used to Lock the unused torch station to the gantry or beam when not in use.
Station Clamp 1-19	The Station Clamp is used to Clamp the selected torch station to the transverse axis for standard cutting.
Station Mirror 1-19	Station Clamp is used to Clamp the selected torch station to the transverse axis for mirrored cutting.

Example Part Program
Transverse axis defined as X axis
Three station cut of 20 inch vertical rip.

Code	Description
G70	English Units
G91	Incremental Mode
G99 X1 Y0 I0 J0	Axes Preset zero Scaling
M32	Unclamp / Unlock All Stations
M78	Home X Axis (move all stations to Home position)
M34	Clamp All / Unlock All
G00X2Y0	Traverse X axis 2 inches (to move off edge/ switch)
M33	Unclamp All / Lock All
G00X10Y0	Traverse X axis 10 inches (to set 10 inch space – station 1)
M34 T1	Clamp Station 1 / Unlock Station 1
G00X10Y0	Traverse X axis 10 inches (to set 10 inch space– station 2)
M34 T2	Clamp Station 2 / Unlock Station 2
G41	Left Kerf
M07	Cut On
G01 X0 Y20	Line segment (Y axis 20 inches)
M08	Cut Off
G40	Kerf Off
M02	End of Program

Sensor THC Part Program Support

Sensor™ THC offers the ability to configure THC setup parameters through part program codes.

The following parameters are available for use using EIA-274D G59 codes:

  Arc Voltage
  Pierce / Start Time
  Pierce/ Start Height Factor
  Cut / Mark Height

Setup is obtained using the following format.

Example: G59 V601 F*value*

Misc. G Code

Variable Identity
   V600 = Plasma 1 Arc Voltage
   V601 = Plasma 1 Pierce Time
   V602 = Plasma 1 Pierce Height Factor
   V603 = Plasma 1 Cut Height

   V625 = Plasma 2 Arc Voltage
   V626 = Plasma 2 Pierce Time
   V627 = Plasma 2 Pierce Height Factor
   V628 = Plasma 2 Cut Height

   V650 = Marker 1 Arc Voltage
   V651 = Marker 1 Start Time
   V652 = Marker 1 Start Height Factor
   V653 = Marker 1 Mark Height

   V675 = Marker 2 Arc Voltage
   V676 = Marker 2 Start Time
   V677 = Marker 2 Start Height Factor
   V678 = Marker 2 Mark Height

Variable Value
      The selected value for the variable
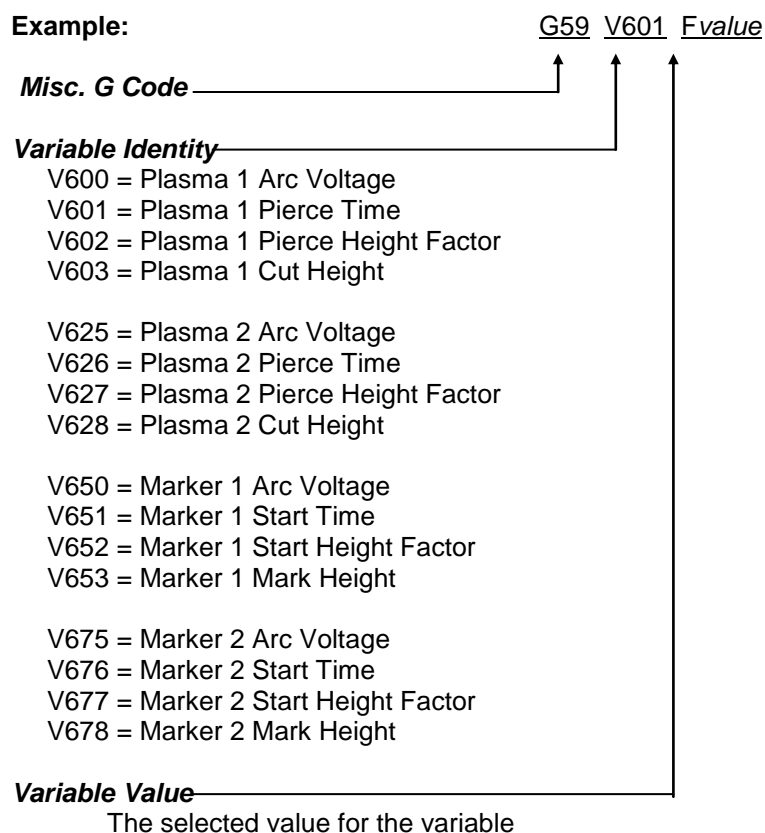
THC Index code
G00 Zx.xx Tx   Index Sensor™ THC height "Z" distance for torch "T". Manual mode only.

Sub Parts

The Sub Parts feature allows the user to call and execute a separate part file within a part program using a simple line of text.

To configure a subroutine part for use, the user must first create a folder on the control hard drive named "SUBPARTS". To create a folder on the hard drive, select to Load From Disk". With the folder location highlighted, press the "+" key to create a new folder.
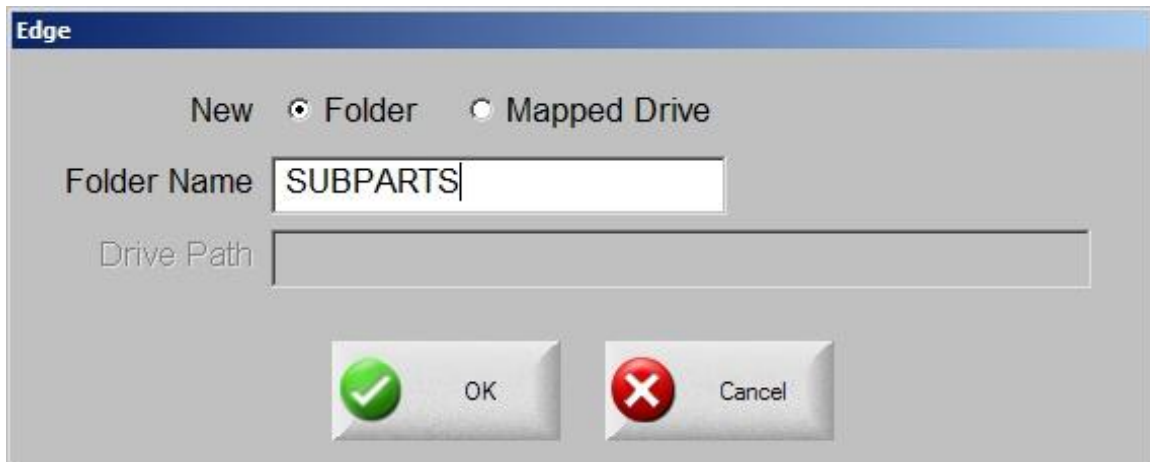
Save the desired part program in the SUBPARTS folder.

To execute the part, insert a line of code at the desire location within the part with the following format.

        PFILENAME

Start the line of code with the letter P to indicate that a Sub Part is to be executed, followed by the filename for the desired part program.

Example:

If the user were to add the Sub Part "L-Bracket" to be executed after completing a simple 5" x 5" square with a commanded traverse, the part program would appear similar to this example.

```
(Rectangle - Piece)
G20
G91
G99 X1 Y0 I0 J0
G41
M07
G01 X-5.2 Y0
G01 X0 Y5
G01 X5 Y0
G01 X0 Y-5.2
M08
G00 X.75 Y0
PL-BRACKET
G40
M02
```

When executed, the example program provided above would be represented as the original part plus the additional Sub Part, including the programmed traverse.
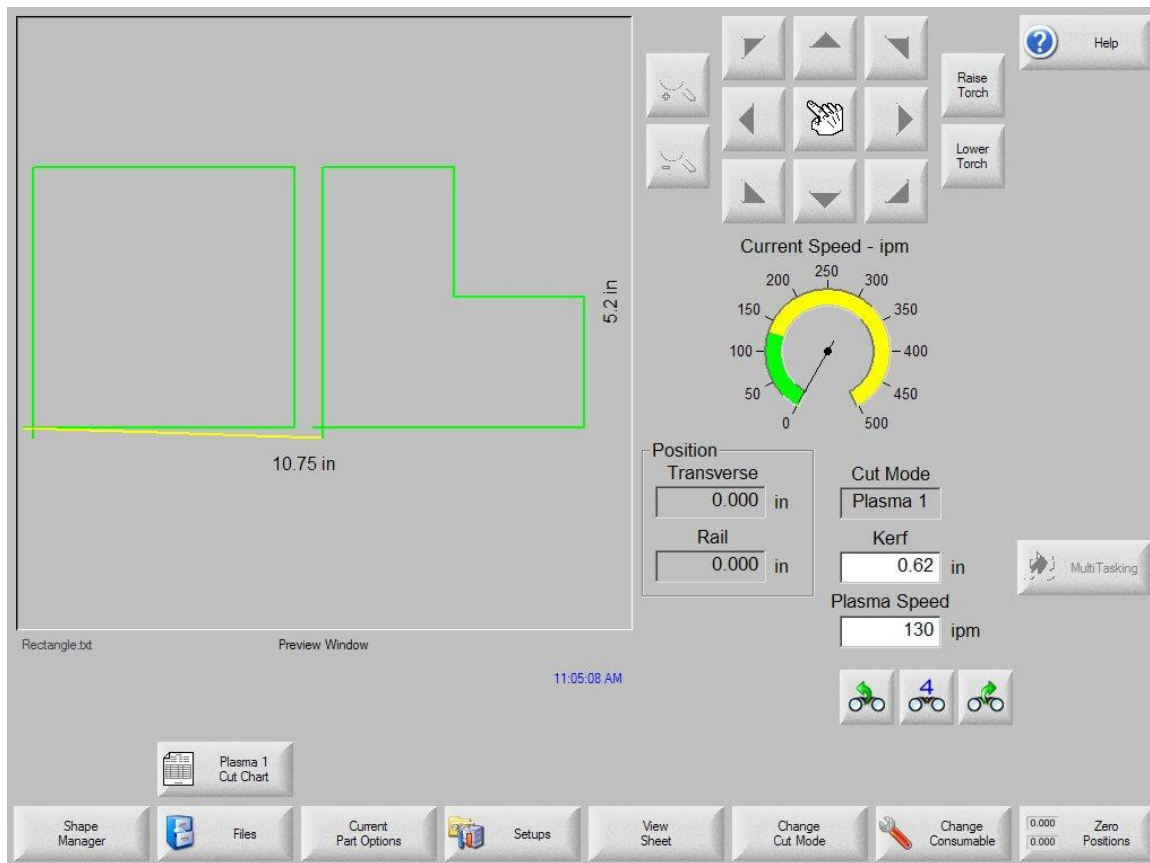
Note: Sub Parts may also contain other Sub Parts. After being translated by the control, the final text of the part will contain the complete text of the original part and Sub Part.

Marker Font Generator

The Marker Font Generator feature may be used to label or identify parts with a marking devise prior to cutting. This is accomplished by use of a simple command string within the part program code to call existing text characters (fonts) and execute marking of the selected text.

The program code uses a specific format and is structured to provide information to be used when marking. Information on the Font source location, Scale Factor, Angle, Marker Tool, Tool Offset and Text are entered as information blocks in the command string. Each section or information block in the command string is separated by a space. The format of this command code is outlined as follows:

Note: If a value is not present for a specific information block, the default values will be used. The default values are:

Font (F):	Internal	**Angle (A):**	0°	**Offset (O):**	#1
Scale (S):	One	**Marker (M):**	#1		

Example of a simple command string: **<F2 S1 A45 M2 O2 <TEST 123>**

<   The program command must begin with the "<" symbol to indicate the Marker Font Generator feature is being used.

F   The first block of information is the Font Source location. The "F" indicates "Font" and is followed by a digit to indicate the location. Number 1 indicates the internal font in the control software, number 2 indicates to use a font located on the control hard drive, and number 3 indicates to source the font to be used from diskette or USB memory. If no font is found at the selected location, the default internal font will be used. For the example given, the font location would be from the hard drive.

S   The second information block determines the scale of the text. The "S" is used to indicate "Scale" and is followed by a digit to indicate a numeric scale factor. For the example given, the Scale factor would be two or twice as large as the original font dimensions.

A   The third information block determines the angle of the text. The "A" is used to indicate "Angle" and is followed by a numeric value for the degree of angle. For the example given, the angle would be 45°.

M   The fourth information block determines the Marker Tool to be used. The "M" is used to indicate "Marker" followed by the number of the Marker Tool (Marker Enable Output) to be used. Up to two marker enables are supported.

O   The fifth information block determines which tool Offset to be used. The "O" indicates offset followed by a number indicating one of the nine different tool offsets previously configured in control setups is to be used. The example shown indicates that tool offset number two should be used.

< >   The final information block is used to specify the marker text to be executed. The text must be enclosed in the "<" and ">" marks to be valid and understood as the selected text. For the example given, the marker text executed would be "TEST 123"

Translated by the control, the example command string given above would generate the Marker Text "TEST 123" onto the plate as shown here in Shape Wizard.
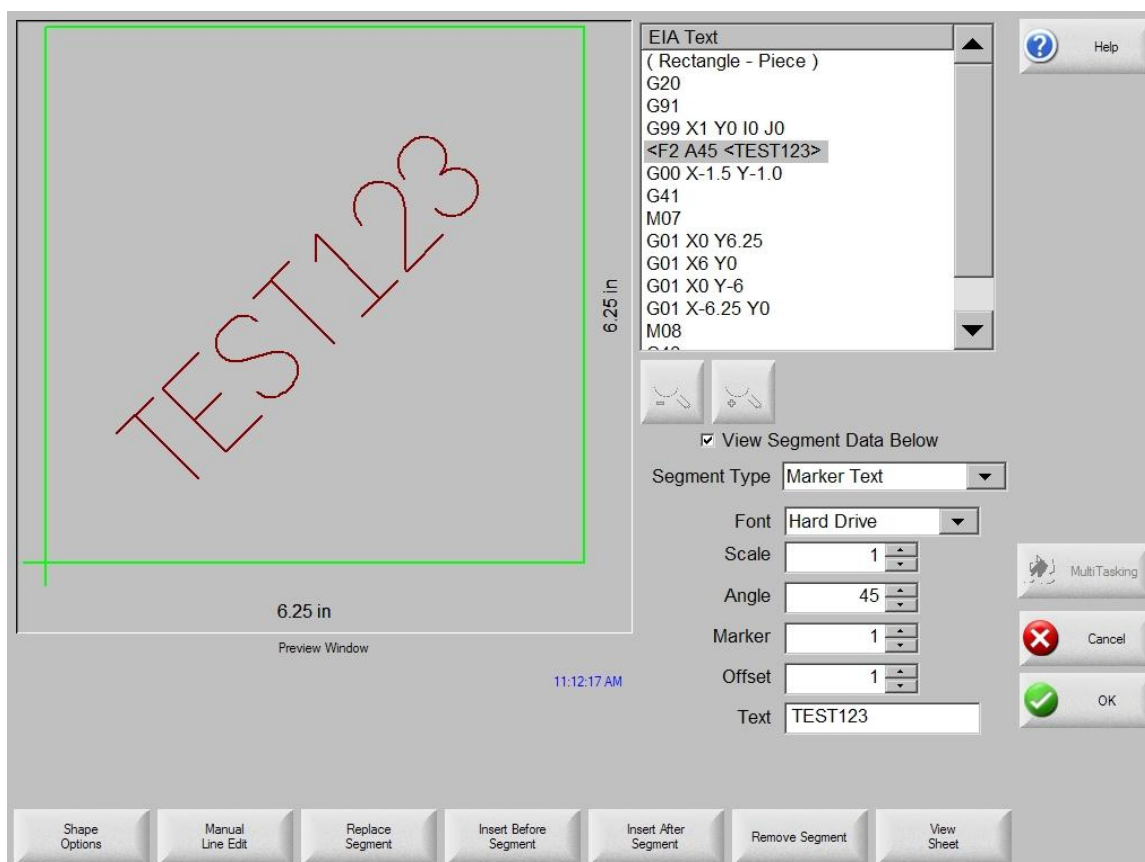
To improve the ease of use for the part program designer and control operator, the Marker Font Generator feature will always insert a traverse segment to return to the original start point at the beginning of the marking text.

Internal Fonts
The internal fonts located within the control software are 1" high and are limited to characters available on the control keypad. Alphabetical characters are limited to upper case letters only.

External Fonts
External Fonts may be loaded from a floppy disk or from the control hard drive. When generating the text, the control searches for part files to correspond to the selected character. The part file names must be based on their ASCII numeric equivalent and have a .txt file extension.

Example: For the marker text "Ab 12", the control will search for the following files to generate the text.

Text	ASCII No.	File Name
Capital A	65	Ascii65.txt
Lower Case b	98	Ascii98.txt
Space	32	Ascii32.txt
No 1	49	Ascii49.txt
No 2	50	Ascii50.txt

Please refer to the ASCII Codes section of this guide for additional ASCII code information.

Font programs may be saved on the control hard drive by creating a folder labeled "Fonts" through the "Save to Disk" feature and saving the font programs within this folder. Remember, if a corresponding part file to text requested is not found at the selected source location, the internal font file will be used.

Custom Fonts

As previously noted, customer selected custom fonts may be used when using the Marker Font Generator feature. To construct these font files, certain guidelines should be adhered to.

1) Programming format must be EIA
2) Only M09 and M10 maybe used to enable and disable the marker.
3) Only G00, G01, G02 and G03 codes may be used.
4) The program must end in an M02.
5) The proper file name must be assigned to the font program.
6) The font program <u>must</u> begin in the lower left and end in the lower right.
7) Font programs should have the consistent dimensional limits (i.e. 1' high, etc.).

Example: The letter "B" – File Name Ascii66.txt

M09
G01 X0 Y1
G01 X0.321429 Y0
G02 X0 Y-0.5 I0 J-0.25
G01 X-0.321429 Y0
M10
G00 X0.321429 Y0
M09
G02 X0 Y-0.5 I0 J-0.25
G01 X-0.321429 Y0
M10
G00 X0.571 Y0
M02
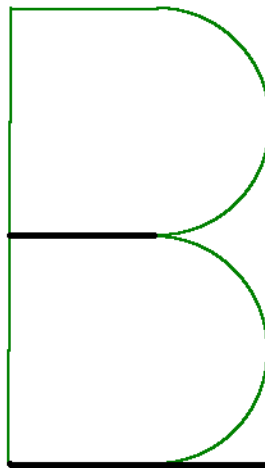
The darker lines in the drawing represent the Traverse segment and the lighter lines represent the Marking lines. You can see by this illustration that at the end of the font program, a traverse is used to continue motion to the bottom right corner.

Note: The Burny 3/5 style of programming for the Marker Font Generator feature is also supported for the default internal font source.

Serial Messaging

The Serial Messaging feature may be used to pass commands embedded within a part program through a selected serial port to an external device. Both RS-232 and RS-422 are supported. TCP/IP protocol is not supported at this time.

Overview

Serial Messaging has a fairly basic communication protocol that has three simple formats to send ASCII codes as command strings.   During the messaging function, a status indicator for "Message Transmit", "Message Delay" or "Message Verify" will be displayed in the Watch window.

Options

1) While the selected message is sent to the external device, the part program will be temporarily suspended. After completion of the transmission, the part program will then automatically resume. No acknowledgement from the external device is required. An additional Time Delay may also be added.

2) A message is sent concurrent to execution of the part program and no delay is encountered. No acknowledge is required. No Delay Time is allowed.

3) The message is sent with a suspension of the program during transmission as in option one, but an Acknowledge from the external device (ACK) is required before the part program can continue. A Non-Acknowledge (NAK) response from the external device will prompt a retransmit of the message from the control. An optional Time Out value may be added to the program code. If no Time Out code is used in the program code the Default time out value at the Ports setup screen will be used. Additionally, an optional automatic retry feature may be enabled at the Ports setup screen.

To enable use of this feature, assign Messaging to the select port at the Ports setup screen.

After enabling Messaging, the flow control parameters to communicate with the external device will then need to be selected. The user may also select how messaging is handled for the Jogging Forward/Backward on Path. Additionally, the Retry on Time Out and Time Out parameters are available .

The following parameters must be configured for use. Hardware and flow control configuration information must match the external device.

Baud Rate
Select a communication speed from 1200 Baud to 115200 Baud

Parity
Select None, Odd or Even.

Data Bits
Select 7 or 8 Data Bits.

Flow Control
Select to use None, Xon/Xoff or Hardware.

During Jog on Path
The user may select whether messages will be sent when jogging Forward or Backward on Path while at the Pause screen.   Note: All messaging will stop when the Stop Key has been pressed or the Remote Pause input becomes active.

Note: The Message Type 21 will transmit the message concurrent to the associated motion segment during "Backup on Path".

Retry on Time Out
For the Message Type 22 (which requires an acknowledgement from the external device after the message) an automatic retransmit of the message may be sent. The user may select the number of retries allowed before faulting from a lack of response from the external device. The fault prompt "Message Error" will be displayed when in a Time Out condition.

Time Out
The Time Out value may be used for the Message Type 22 (which requires an acknowledgement from the external device after the message) if there is no Time Out value used in the command string of the program code. Refer to the Delay Time / Time Out information for more information.

Programming Code
The ASCII message string follows a unique program message format. Each command begins with a ">" character and ends with a "<" character. These characters are used as delimiters to frame the command (Message Type, Optional Format and Optional Delay Time/ Time Out) instructions for the message.

Message Information
The format of this command code is outlined as follows:

EIA Example: (>20+Format+Delay Time/Time Out<Message)

Message Command Type
>20< Direct message with Delay
>21< Direct message without Delay
>22< Message that requires Acknowledge
(see Message Command Type below)

Optional Format Value
This optional Format value allows the user to add
Line Feed and Carriage Return commands, etc.,
message string. 0,1,16,17,32,33,48,49,64,65,80,81,
96,97,112,113 are supported (see Format Value below).

Optional Delay Time/Time Out Value
Time in seconds (see Time Out Value below)

Message Text
The message content (see Message Text below)

Note: Message format is always within comment characters and the Command portion of the
program code is between the ">" Character and the "<" Character.

ESSI Example: EIA Example:
3   (>20,1,1<Message)
>20,1,1<Message
4

See below for format and delay Code information.

Note: For the example provided, the plus sign (**+**) character was used as delimiter between fields for
the command instruction. In addition to the plus sign (**+**), the hyphen (**-**), comma (**,**) or space may be
used as delimiters.

Example:
Using spaces, the EIA command would look like this: (>20 Format Timeout<Message Text)

Message Command Type

>20<   This command delays the part program until all bytes have been transmitted, then optionally waits the Delay Time, if specified.

>21<   A message is sent concurrent to execution of the part program and no delay is encountered. No acknowledge is required.

>22<   The message is sent with a suspension of the program during transmission as in option one, but an Acknowledge from the external device (ACK = Hexadecimal 06) is required before the part program can continue. A Non-Acknowledge (NAK = Hexadecimal 15) response from the external device will prompt a retransmit of the message from the control.

An optional Time Out value may be added to the program code. If no Time Out code is used in the program code the Default time out value at the Ports setup screen will be used. Additionally, an optional automatic retry feature may be enabled at the Ports setup screen.

With the automatic retry feature the message will automatically be retransmitted if no response is detected. The retry is executed after the Time Out value has elapsed. The number of retries can be defined on the Ports configuration screen.

Optional Format Value
Specialty characters for the format may be sent in addition to command string.

Specialty Characters Supported

HEX	Name	Description
01	SOH	Start of Header
02	STX	Start of Text
03	ETX	End of Text
04	EOT	End of Transmission
0A	LF	Line Feed
0D	CR	Carriage Return
	BCC	"Exclusive Or" Check Byte

Note: Checksum is always an 'Exclusive OR' of the Data ONLY as it does not include any of the 'Format' chars including the CR/LF option.

Optional Format Character Assignments

Value	Assignment
0	No Special Assignment (Must be used in the format location is a Delay is required but no Format options are required).
1	Append a Carriage Return (<CR> = Hex value OD) and a Line Feed (<LF> = Hex Value0A)
16	Append an "Exclusive OR" (<BCC>) to the end of the message.
17	Appends a combination of 16 and 1.
32	Encloses the message with Start of Text (<STX> = Hex Value 02) and End of Text (<ETX> = Hex Value 03). The <ETX> follows the message and the optional <CR><LF>> append codes but precedes the Check Byte <BCC>.
33	Appends a combination of 1 and 32.
48	Appends a combination of 16 and 32.
49	Appends a combination of 1, 16 and 32.
64	Append a Start of Header(<SOH> = Hex value 01) and a End of Transmission (<EOT> = Hex Value04) to the Message.
65	Appends a combination of 1and 64.
80	Appends a combination of 16 and 64.
81	Appends a combination of 1, 16 and 64.
96	Appends a combination of 32 and 64.
97	Appends a combination of 1, 32, and 64.
112	Appends a combination of 16, 32 and 64.
113	Appends a combination of 1, 16, 32 and 64.

Optional Delay Time/Time Out Value
The Delay Value will issue a delay in seconds at the end of the message for Message Type 20.

No delay is supported for Message Type 21.

This value also works as a Time Out value for Message Type 22. An error will be displayed if the message is not Acknowledged (ACK Hexadecimal 06) with in the specified time. If no Time Out Delay is defined in the command, the Time Out parameter on the Ports screen will be used.

The value is in a 3.2 format where a value of 5 is equal to 5.00 seconds. Accepted limits for the value is range of 0.00 to 999.99 seconds.

Message Text Content
Up to 300 data characters in each command string may be sent. The Command characters (information between and including the ">" and "<" signs) are included in this maximum.

Printable and Non- Printing ASCII codes can be used in the message string. Refer to the ASCII Code appendix of this manual for more information on ASCII codes and the Hexidecimal value.

Non-printing characters are supported by use of a two-character command and can send a Binary Code in the Range from 0-255. Double byte character to support combinations will affect the maximum length count with each pair reducing the maximum data characters by 1.   Refer to the Non-printing Character information later in this section for information on these values.

Non – Printing Characters
Non Printing Characters are supported through use of a pair of two printing codes to equal the non-printing code. This pair of characters is retained in the program code but sent as single 8-bit code when transmitted.

There are three types of character pairs and each performs a different operation based on the first character of the pair. This produces a single modified character for transmission.

Character Options

1) The "&" two-character pair clears the 0x40 bit from the 2nd character code value.
2) The "!" two-character pair clears the 0x40 bit and sets the 0x80 bit set in the 2nd character code.
3) The "$" two-character pair clears the 0xC0 bit in the 2nd character.

To transmit the single character with a value 0x01, use the two character sequence "&A". This converts the "A" value of 0x41 to 0x01 by clearing the 0x40 bit. To transmit 0x81, use "!A" or to transmit)xC1 use "$A".

Exceptions / Additions
As the "&", "!" and "$" are used as key indicators for the Non-print characters, there is a special format used when these characters are used as a print character in the message text. Simply use the character twice. "&&" = "&"

The ESSI style part program uses several unique characters which requires special two character codes to be used. For example, the message code "&K" in the part program will transmit the code value of 0x2B which is the ASCII code for the plus sign (+). In order to send the + character the code "&K" must be used.

The following are unique codes used in WORD ADDRESS and ESSI programs

Code	Code Value	Description
&'	0x20=space	At end of ESSI program
&h	0x28 = "("	To transmit "(" from WORD ADDRESS program
&i	0x29 = ")"	To transmit ")" from WORD ADDRESS program
&?	0x7F = DEL	Non-printable DELETE code
&K	0x2B = "+"	To transmit "+" from ESSI program

Non Printing Character Table

ASCII codes less than Hexidecimal 20

Code	Hex	Code	Hex	Code	Hex	Code	Hex
&@	00	&H	08	&P	10	&X	18
&A	01	&I	09	&Q	11	&Y	19
&B	02	&J	0A	&R	12	&Z	1A
&C	03	&K	0B	&S	13	&[	1B
&D	04	&L	0C	&T	14	&\	1C
&E	05	&M	0D	&U	15	&]	1D
&F	06	&N	0E	&V	16	&^	1E
&G	07	&O	0F	&W	17	&_	1F

8 bit character codes greater than Hexidecimal 80

Code	Hex	Code	Hex	Code	Hex	Code	Hex
!@	80	!H	88	!P	90	!X	98
!A	81	!I	89	!Q	91	!Y	99
!B	82	!J	8A	!R	92	!Z	9A
!C	83	!K	8B	!S	93	![	9B
!D	84	!L	8C	!T	94	!\	9C
!E	85	!M	8D	!U	95	!]	9D
!F	86	!N	8E	!V	96	!^	9E
!G	87	!O	8F	!W	97	!_	9D
!`	A0	!h	A8	!p	B0	!x	B8
!a	A1	!I	A9	!q	B1	!y	B9
!b	A2	!j	AA	!r	B2	!z	BA
!c	A3	!k	AB	!s	B3	!;	BB
!d	A4	!I	AC	!t	B4	!<	BC
!e	A5	!m	AD	!u	B5	!=	BD
!f	A6	!n	AE	!v	B6	!>	BE
!g	A7	!o	AF	!w	B7	!?	BF
$@	C0	$H	C8	$P	D0	$X	D8
$A	C1	$I	C9	$Q	D1	$Y	DD
$B	C2	$J	CA	$R	D2	$Z	DA
$C	C3	$K	CB	$S	D3	$[	DB
$D	C4	$L	CC	$T	D4	$\	DC
$E	C5	$M	CD	$U	D5	$]	DD
$F	C6	$N	CE	$V	D6	$^	DE
$G	C7	$O	CF	$W	D7	$_	DF
$`	E0	$h	E8	$p	F0	$x	F8
$a	E1	$I	E9	$q	F1	$y	F9
$b	E2	$j	EA	$r	F2	$z	FA
$c	E3	$k	EB	$s	F3	$;	FB
$d	E4	$I	EC	$t	F4	$<	FC
$e	E5	$m	ED	$u	F5	$=	FD
$f	E6	$n	EE	$v	F6	$>	FE
$g	E7	$o	EF	$w	F7	$?	FF

Automated Plasma Interface

The following information outlines features relates to automated plasma supply functions and diagnostics. These systems require communication between the CNC and the relevant plasma power supply.
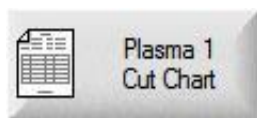
HPR and HD4070 Interface

Hypertherm Automation controls offer the additional option of interfacing directly to Hypertherm's HPR and HD4070® HyDefinition® Power Supplies for setup. Note: MicroEdge and Edge II controls can be operated in Voyager mode to add this feature. This feature has the ability to improve the ease of power supply setup and operational accuracy, while having the flexibility to fine tune the process specific to the operator's needs.

When using this advanced feature, all necessary power supply settings are transmitted from the control directly to the Plasma Supply configuring it for use via serial communications. The Plasma Supply setup is performed through the use of a Cut Chart (cut process parameter database) which is based on eight process variables. The combination of these eight process variables are tied to the settings for the cut process parameters (e.g. arc voltage, pierce delay, etc.) that are transmitted to the supply. For additional convenience, consumable part numbers for the Plasma supply are displayed at the Change Consumable screen.

This database allows the user to select factory recommended settings or amend the database for personalized settings. The Cut Chart information may be saved or loaded via the hard drive or floppy drive. The Cut Chart files containing the factory recommended settings are available from Hypertherm®.

Access to the Cut Chart data is available from the Plasma Cut Types or Marker Cut Types screen using the shift key, as indicated below. The Plasma Supply parameters must first be enabled in the password protected Station Configuration setups to allow the Cut Chart Information for the Plasma Supply to be available for use.

Note: Screen information will vary depending on THC selection.

Cut Chart

The Cut Chart Database (cut process parameters) transmitted to the power supply is based on the following eight process variables.

Material Type
The Material Type, such as Mild Steel, Stainless Steel or Aluminum, may be selected.

Current Settings
The appropriate current setting for the material thickness and material type may be selected.

Plasma / Shield Gases
The appropriate Plasma / Shield gases for the desired process may be selected.

Material Thickness
The desired material thickness may be selected.

The following are the Cut Process parameters within the database which are used to configure the process. Appropriate parameter information is transmitted to the power supply.

Cut Speed
Specifies the speed for the selected process variables.

Kerf
Specifies the amount of kerf (cutter compensation) that will be applied to the current part program.

Set Arc Voltage
The operator may input the desired Arc Voltage for the material being cut.

Cut Height
The Cut Height setup parameter is used to select the desired cut distance from the plate.

Pierce Height
The Pierce Height setup parameter is used to select the desired Pierce Height. This may be entered as a multiplication factor that is calculated times the Cut Height or an actual Pierce Height distance.

Preflow Setting
The appropriate Plasma / Shield Preflow percentages for the desired process may be selected.

Cutflow Settings
The appropriate Plasma / Shield Cutflow percentages for the desired process may be selected.

Preflow Time
Specifies the amount of time the Preflow gases are on.

Purge Time
Specifies the time delay from torch ignition until motion is enabled.

Pierce Time
Specifies the time delay from when torch completes lowering until motion is initiated at Creep Speed. Used to allow the plasma torch to completely pierce the material before moving.

Creep Time
Specifies the amount of time after piercing the part that the torch travels at Creep Speed. Creep Speed is determined by a setup parameter at the Speeds setup screen and is a percentage of the programmed cut speed. After the Creep Time is completed, the control accelerates to full cut speed.

Save Process
Pressing the Save Process soft key allows the user to save the current process settings to the Hard drive creating a custom user database based on the eight process variables selected.

Reset Process
Pressing the Reset Process soft key allows the user to reset the current settings to factory recommend factory defaults based on the eight process variables selected.

Save Cut Charts
Pressing the Save Cut Charts soft key allows the user to save the current User and Factory databases to Diskette or USB memory stick. User files are designated with a .usr file extension and the factory files are designated with a .fac file extension

Examples of user and factory file names.

>	Mild Steel-HT4400-HD4070.usr
>	Mild Steel-HT4400-HD4070.fac

Load Cut Charts
Pressing the load Cut Charts soft key allows the user to load the factory default database files which are supplied by Hypertherm in a Text file (.txt), user files (.usr) or factory files (.fac) from Diskette or USB memory stick.

Factory text file names.

Mild Steel Cut Chart Data	mschart.txt
Aluminum Cut Chart Data	alchart.txt
Stainless Steel Cut Chart Data	sschart.txt

It is recommended that the Database be updated through the control rather than the Power Supply if the serial communications link is enabled.

Test Preflow
Pressing the Test Preflow soft key performs the Test Preflow Gases feature at the Plasma supply.

Test Cutflow
Pressing the Test Cutflow soft key performs the Test Cutflow Gases feature at the Plasma supply.

Notes:
- Please refer to the power supply operators manual for complete information on the operation and setup of the Plasma supply.
- A serial communications port for the Plasma supply must first be selected at the Port configuration screen to be enable the feature for use.
- The Plasma supply parameters must first be enabled in the password protected Station Configuration screen to allow the Cut Chart Information for the Plasma supply to be available for use.
- Power Supplies equipped with the Integrated Command® THC may be used with the control setups. The Command® THC must first be enabled for use in the password protected Station Configuration Screen.

Change Consumable

When the power supply link feature has been enabled, consumable data information may be viewed at the Change Consumable screen.

I/O and Diagnostics
Power supply I/O and remote diagnostics screens are accessed through the standard Diagnostic screen after serial link communications has been established. Status for the supply Software Revisions, Gas Pressure, Usage, I/O and Remote tools will be available.

Information
Status items for the supply are available at the Information Screen.

HPR Diagnostics

HD4070 Diagnostics

Test Preflow
Pressing the Test Preflow Softkey performs the Test Preflow Gases feature at the power supply. This feature is used to set the inlet gas pressures under normal flow conditions to the recommended level.

Test Cutflow
Pressing the Test Cutflow softkey performs the Test Cutflow Gases feature at the power supply. This feature is used to set the inlet gas pressures under normal flow conditions to the recommended level.

Test HPR Gas Console
This feature provides automated test features for the HPR AutoGas console. Please contact an authorized service agent for use of these tests.

Coolant Override
Pressing the Coolant Override softkey allows to user to override a coolant error and to test the coolant pump. This is useful to bypass the error and purge the coolant line of air bubbles at initial power up.

Update Software
Pressing the Update Software softkey will initiate the process of the Software Update at the power supply. Step by step instructions will be displayed on screen to guide the user through the process.

Inputs

Off - Serial Program

Off - Plasma Start

Off - Hold Ignition

Off - Phase OK

Off - Arc Detect

Off - Pierce Complete

Off - Corner Current

Off - Redundant Start

Off - Serial ID0

Off - Serial ID1

Off - Serial ID2

Help

Cancel

OK

8:06:15 AM

| Power Supply Inputs | Power Supply Outputs | Gas Console Inputs | Gas Console Outputs | HPR Information |

Inputs

- ● Off - Error Select
- ● Off - Status Select
- ● Off - Test Preflow
- ● Off - Test Cutflow
- ● Off - Serial ID0
- ● Off - Serial ID1
- ● Off - Serial ID2

Help

Cancel

OK

8:06:42 AM

Power Supply Inputs

Power Supply Outputs

Gas Console Inputs

Gas Console Outputs

HPR Information

Outputs

	Off	-	Pilot Arc Relay
	Off	-	Marking Surge Relay
	Off	-	Pilot Arc Enable
	Off	-	Coolant Pump Motor
	Off	-	Soft Start Enable
	Off	-	CNC Error
	Off	-	CNC Rampdown Error
	Off	-	Igniter
	Off	-	Contactor
	Off	-	CNC Machine Motion
	Off	-	CNC Not Ready for Start
	Off	-	Spare Relay

Help

Cancel

OK

8:07:04 AM

| Power Supply Inputs | Power Supply Outputs | Gas Console Inputs | Gas Console Outputs | HPR Information |

Outputs

Note: Similar to the standard Output Diagnostic screen, the output screen shows the current status of the listed supply outputs. Note: Outputs for the supply cannot be activated through the diagnostic screen.

Serial Communication Interface

RS-422C Connections to HPR™ CNC Interface

Control (male)		Supply (male)	
Signal Name	DB-9 Pin	Signal Name	DB-37 Pin
TxD-	2	RxD-	1
RxD-	3	TxD-	2
TxD+	4	RxD+	20
RxD+	7	TxD+	21

RS-422C Connections to HD4070® CNC Interface

Control (male)		Supply (male)	
Signal Name	DB-9 Pin	Signal Name	DB-37 Pin
TxD-	2	RxD-	2
RxD-	3	TxD-	1
TxD+	4	RxD+	21
RxD+	7	TxD+	20

Multiple Supplies
The Serial Communication Link supported by the CNC can also be extended to multiple power supplies.

This unique feature is implemented through the use of the serial link and I/O points. It is assumed that the all systems are configured similarly and will be used simultaneously. If any of the selected power supplies has a fault, the fault must be cleared before the cut can begin.

Specific hardware and software versions for both the control and the power supply are required. Please refer to the power supply manual for additional information on operation and installation.

Inputs and Outputs

Raise 1-4 and Lower 1-4
The Raise / Lower inputs will be used to control the Integrated Command™ THC lifters on multi-dropped supplies for the selected process.

Note: When using this feature with the Sensor™ THCs rather than the Integrated Command™ THCs, the Sensor™ THC Torch Raise and Torch Lower commands for the selected process may be made through the software softkeys or through the use of these external inputs to the control.

Cut Sense 1-4
THC Cut Sense Input (arc on feedback) is used to verify that the plasma torch or marker tool has established the arc for the selected torch. This indicates to the control that motion can begin.

Ready to Fire PS 1-4
This signal is an output from each supply and is used in multiple plasma systems. It notifies the CNC that the THC has completed the IHS cycle and Preflow is complete. This indicates that the torch is ready to fire. On the supply this signal is used along with the CNC Plasma Sync Input. The CNC Hold Ignition output is connected to the supply "CNC Plasma Sync" inputs. When all configured supplies return active "Ready to Fire" signals, the "Hold Ignition" signals are removed.

Hold Ignition
The Hold Ignition Output is used to delay ignition of the external plasma supply and allow the individual supplies to complete Preflow and IHS before torch ignition. For this application, the Hold Ignition would be tied to the Plasma Sync Inputs for multi-dropped supplies.

Reduce Current
Used with the supply to switch the plasma to low current mode. This signal is functionally different from the Torch Height Disable Output in that it is not active during the initial torch ignition, pierce, and accelerate to speed after Plasma Start. For this application, the Reduced Current output would be tied to the Corner Hold Inputs for multi-dropped power supplies.

The Corner Current Parameter located on the Plasma Setup Screen, is a user defined value for setting the percentage of the corner current.

NOTE HD4070®: Proper mult-drop operation requires a Rev C or higher Breakout board in the HD4070® as well as Rev K or higher control software in the HD4070®.

RS-422 Multidrop Interface to Multiple power supplies
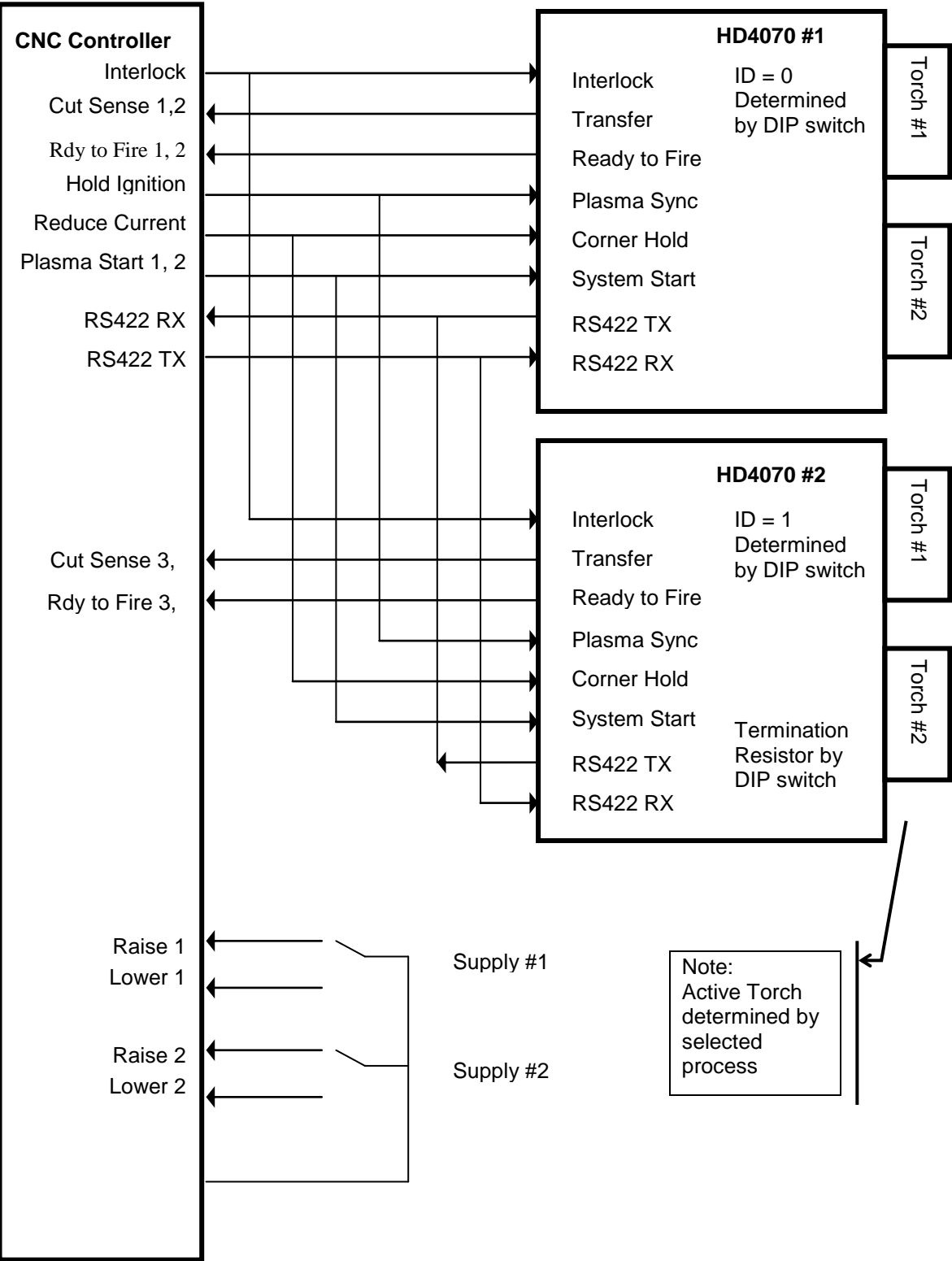
HPR and HD4070 Part Program Support
The same Cut Chart data which is used at the Cut Chart setup screen may also be used within a part program to configure the power supply for use. This code is used to select the set point for each variable.

It is not necessary to have a line of code for each Cut Chart variable within a part program. Only those variables which are changing need be inserted into the part program (e.g. Material Thickness or Material Type).

Part program codes for the power supply should be grouped together at the beginning of the program. The three variables which may be set through the part program are Material Type, Current Setting and Material Thickness.

Cut parameters for the power supply may be configured using the EIA-274D G59 code with the following format.

Example: G59 V503 F5

Misc. G Code

Variable Identity

    V503 – Material Type Plasma 1
    V513 – Material Type Plasma 2
    V523 – Material Type Marker 1
    V533 – Material Type Marker 2

    V504 – Current Setting Plasma 1
    V514 – Current Setting Plasma 2
    V524 – Current Setting Marker 1
    V534 – Current Setting Marker 2

    V507 – Material Thickness Plasma 1
    V517 – Material Thickness Plasma 2
    V527 – Material Thickness Marker 1
    V537 – Material Thickness Marker 2

Variable Value

    V503, V513, V523, V533 – Material Type

        1 = Mild Steel
        2 = Stainless Steel
        3 = Aluminum

    V504, V514, V524, 534 – Current Setting

7 = 7A	70 = 70A
10 = 10A	80 = 80A
15 = 15A	100 = 100A
18 = 18A	130 = 130A
30 = 30A	200 = 200A
45 = 45A	

Variable Value (continued)

V507, 517, 527, 537 – Material Thickness

1 = None	16 = .048" & 1.2mm	31 = 3/8" & 10mm
2 = 28GA	17 = 16GA	32 = 7/16" & 11mm
3 = .015" & .38mm	18 = .060" & 1.5mm	33 = 1/2"& 12mm
4 = 27GA	19 = 1/16" & 1.6mm	34 = 9/16" & 14mm
5 = .016" & .4mm	20 = 14GA	35 = 5/8" & 15mm
6 = 26GA	21 = .075" & 2mm	36 = 3/4" & 19mm
7 = .018" & .5mm	22 = 3/32" & 2.4mm	37 = 7/8" & 22mm
8 = 24GA	23 = 12GA	38 = 1" & 25mm
9 = .024" & .6mm	24 = .105" & 2.5mm	39 = 1 1/8" & 29mm
10 = 22GA	25 = 1/8" & 3mm	40 = 1 1/4" & 32mm
11 = .030" & .8mm	26 = 10GA	41 = 1 3/8" & 35mm
12 = 20GA	27 = .135" & 3.5mm	42 = 1 1/2" & 38mm
13 = .036 & .9mm	28 = 3/16" & 5mm	43 = 1 3/4" & 44mm
14 = .040" & 1.0mm	29 = 1/4" & 6mm	44 = 2" & 50mm
15 = 18GA	30 = 5/16" & 8mm	

HD3070 Auto Gas Interface

This section outlines information specific to Hypertherm's HD3070® Auto Gas Interface.   The Auto Gas screen is available from the Cut Types screen.

Note: The Auto Gas feature must first be enabled at the Special Password screen and is designed for use with the **six** valve autogas console only

The top of the Auto Gas screen lists the valve parameter settings for the HD3070®. Valve settings for the 3070® Auto Gas console are documented in the HD3070® manual.   When the values are set, these become the current setting and the operator can choose to save the file to the diskette, USB memory or hard drive.

The settings at the supply are updated at control power up, whenever the settings are changed at this screen or through commands in a part program. Supply settings are also updated if power is lost and re-enabled at the power supply. There may be a brief delay as these power supply settings are communicated from the control to the power supply.

Save Data
Pressing the Save Data softkey will allow the operator to save the current Autogases setting to diskette, USB memory or hard drive for future use.

Load Data
Pressing the Load Data softkey will allow the operator to Load stored Autogases setting from diskette, USB memeory or hard drive for use.
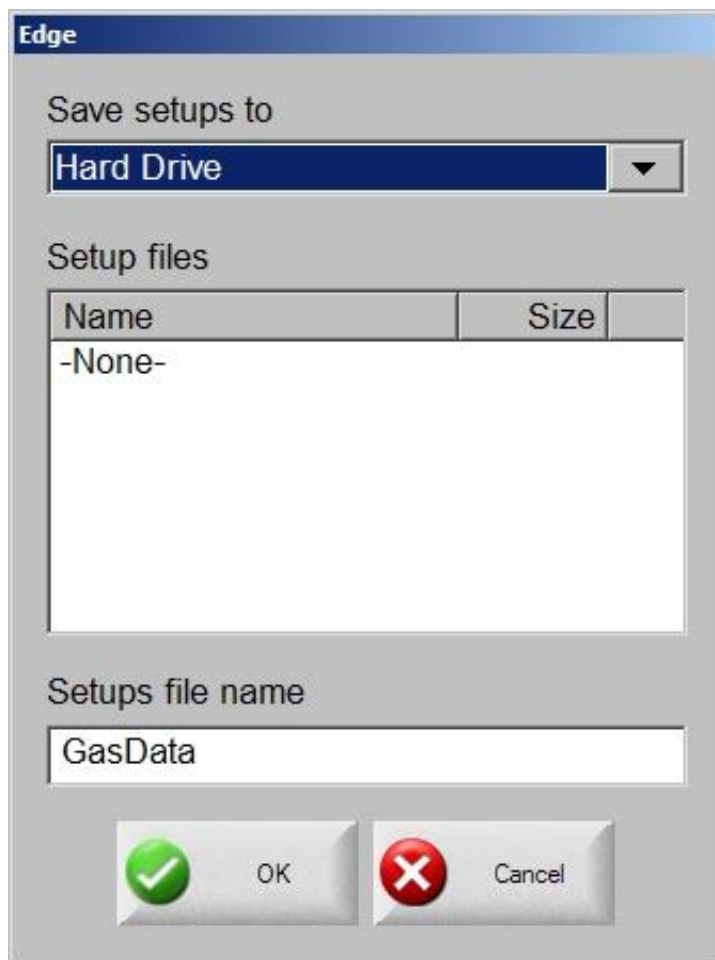
If you save the data, a file is created with G59 codes with the selected valve settings. Here is an example of the data file where all percentages are set to zero.

G59 V65 B0
G59 V66 B0
G59 V67 B0
G59 V68 B0
G59 V69 B0
G59 V70 B0
G59 V71 B0

Test Cutting Gases
Pressing the Test Cutting Gases softkey allows the operator to test the HD3070® Cut Gases.

Test Preflow Gases
Pressing the Test Preflow Gases softkey allows the operator to test the HD3070® Preflow Gases.

HD3070 Auto Gas I/O
The Interface to the HD3070® Auto Gas console is made through use of Single Ended and BCD (Binary Coded Decimal) inputs. The BCD style of interface allows for exact settings by use of multiple inputs being active at any time. The active BCD input values are summed together to obtain the exact set point.

These I/O points are wired in the same fashion as our other Single Ended I/O points. The following I/O points are supplied for use with the HD3070® Auto Gas Console

Inputs
Gas Control Read Complete
Gas Control Error

Outputs

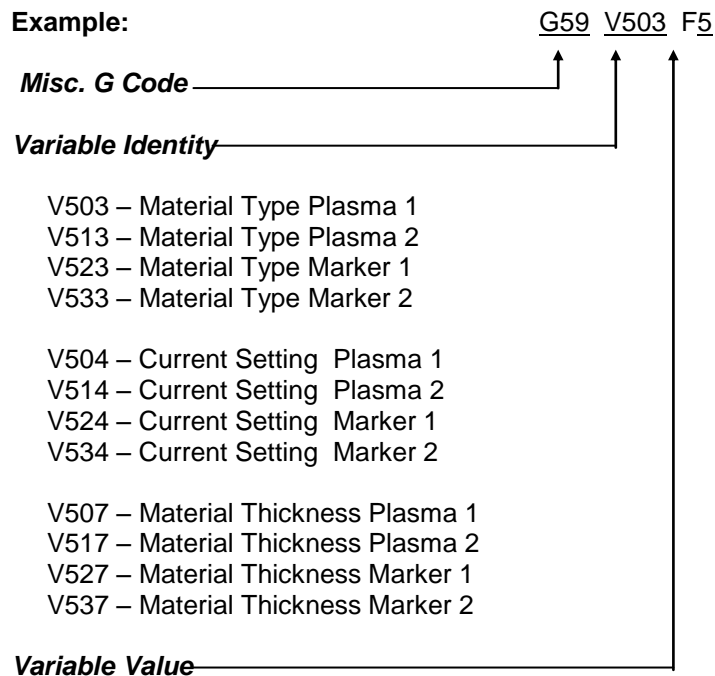|	
Gas Control Write	Remote Test Operate
Remote Test Preflow	Remote Air Plasma
Remote H35/ N2 Plasma	Remote O2 Plasma
Gas Flow Set 1-100 (BCD)	Valve Select 1-8 (BCD)

HD3070 Part Program Support
The same valve setting data which is used at the Auto Gas setup screen may also be used within a part program to configure the HD3070® for use. This code is used to select the valve and indicate the valve set point.

Using a EIA-274D G59 code with the following format.

Example: G59 V65 B5

Misc. G Code

Valve Identity
   V65 = Preflow Shield Gas - Valve 1
   V66 = Preflow Shield Gas - Valve 2
   V67 = Cut Shield Gas - Valve 3
   V68 = Cut Shield Gas - Valve 4
   V69 = Cut Plasma Gas - Valve 5
   V70 = Cut Plasma Gas - Valve 6
   V71 = Remote Plasma Gas Type

Valve Value
   For Valves V65 – V70
      A whole integer is used to set the desired percentage value.
   For Valve 71
      0 = Oxygen
      1 = H35/N2
      2 = O2
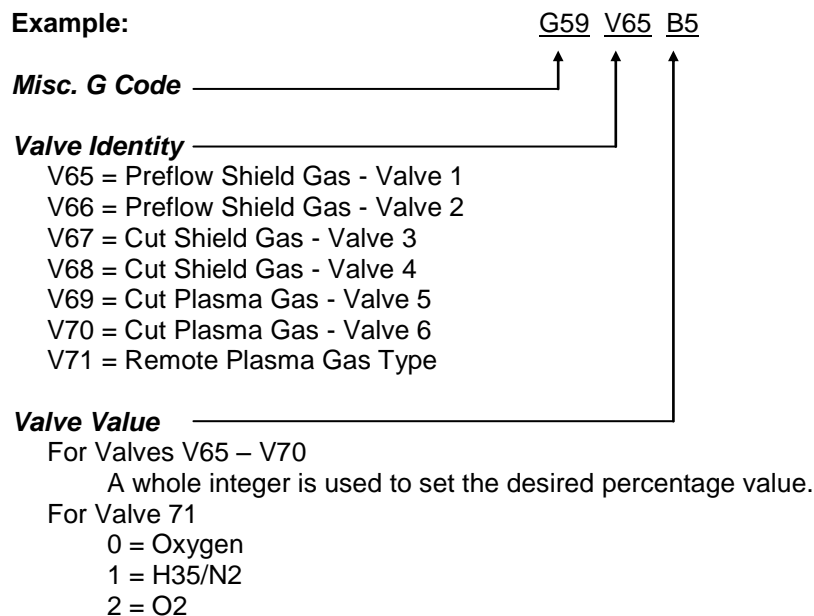
For the example given, the part program code (G59 V65 B5) would set the Autogas Preflow Shield Gas valve to 5%. Multiple G59 codes can be used to set and adjust the all desired valves.

FineLine Overview

Hypertherm Automation controls offer the additional option of interfacing directly to INNERLOGIC's FineLine Power Supply for setup via a user selected RS-422 serial port. This advanced feature transmits all necessary power supply settings from the control directly to the FineLine power supply configuring it for use.

The power supply setup is performed through the use of a Cut Chart (cut process parameter database) which is based on eight process variables. The combination of these eight process variables are tied to the settings for the cut process parameters (e.g. arc voltage, pierce delay, etc.) that are transmitted to the supply. For additional convenience, consumable part numbers for the FineLine are displayed at the Change Consumable screen.

This database allows the user to select factory recommended settings or amend the database for personalized settings. The Cut Chart information may be saved or loaded via the hard drive or floppy drive. Specialized Cut Chart files containing the factory recommended settings are available from the control vendor.

The Power Supply parameter must first be enabled in the password protected Station Configuration setups to allow the Cut Chart Information for the feature to be enabled for use. Once selected at the Station Configurations screen, the port must then be selected for communications on the Ports setup screen and the selected port must then be configured as RS-422. For more information on configuration of the port, refer to the Ports information section of this guide.

Station Configuration (example)

Access to the FineLine Cut Chart data is available from the Plasma Cut Types or Marker Cut Types screen using the shift key, as indicated below.

Note: Screen information will vary depending on THC selection.

Cut Chart

The Cut Chart Database (cut process parameters) transmitted to the power supply is based on the following eight process variables.

Material Type
The Material Type, such as Mild Steel, Stainless Steel or Aluminum, may be selected.

Current Settings
The appropriate current setting for the material thickness and material type may be selected.

Plasma / Shield Gases
The appropriate Plasma / Shield gases for the desired process may be selected.

Material Thickness
The desired material thickness may be selected.

The following are the Cut Process parameters within the database which are used to configure the power supply. Appropriate parameter information is transmitted to the power supply.

1) Material Type – Mild Steel, Stainless Steel, Aluminum, or Mild Steel (Cold Rolled).
2) Thickness
3) Set Current
4) Pierce Delay
5) Set Preflow Pressure
6) Set Plasma Gas type
7) Set Plasma Pressure
8) Set Shield Gas Type
9) Set Shield Pressure
10) Set Process (Cut/Mark)

The following items are stored in the Cut Chart Data file and will be automatically updated on the control.

Cut Speed
Specifies the speed for the selected process variables.

Kerf
Specifies the amount of kerf (cutter compensation) that will be applied to the current part program.

Preflow Time
Specifies the amount of time the Preflow gases are on.

Purge Time
Specifies the time delay from torch ignition until motion is enabled.

Pierce Time
Specifies the time delay from when torch completes lowering until motion is initiated at Creep Speed. Used to allow the plasma torch to completely pierce the material before moving.

Creep Time
Specifies the amount of time after piercing the part that the torch travels at Creep Speed. Creep Speed is determined by a setup parameter at the Speeds setup screen and is a percentage of the programmed cut speed. After the Creep Time is completed, the control accelerates to full cut speed.

Database Features

Save Process
Pressing the Save Process soft key allows the user to save the current process settings to the Hard drive creating a custom user database based on the eight process variables selected.

Reset Process
Pressing the Reset Process soft key allows the user to reset the current settings to factory recommend factory defaults based on the eight process variables selected.

Save Cut Charts
Pressing the Save Cut Charts soft key allows the user to save the current User and Factory databases to Diskette or USB memory stick. User files are designated with a .usr file extension and the factory files are designated with a .fac file extension

Examples of user and factory file names.

    Mild Steel-Fineline200-Fineline200.usr
    Mild Steel- Fineline200-Fineline200.fac

Load Cut Charts
Pressing the load Cut Charts soft key allows the user to the factory default database files which are supplied by Hypertherm as a user files (.usr) or factory files (.fac) from Diskette or USB memory stick.

It is recommended that the Database be updated through the control rather than the Power Supply if the serial communications link is enabled.

Test Preflow
Pressing the Test Preflow soft key performs the Test Preflow Gases feature at the HD4070® Power supply.

Test Cutflow
Pressing the Test Cutflow soft key performs the Test Cutflow Gases feature at the HD4070® Power supply.

Notes:
- Please refer to the power supply operators manual for complete information on the operation and setup of the FineLine Power Supply.
- The FineLine Power Supply parameters must first be enabled in the password protected Station Configuration Screen to allow the Cut Chart Information for the FineLine to be available for use.
- Serial communications for the FineLine Power supply are established on the user select communication port. The port must be configured for RS-422 operation.

Change Consumable

When the FineLine feature has been enabled, consumable data information may be viewed at the Change Consumable screen.

FineLine Part Program Support
The same Cut Chart data which is used at the Cut Chart setup screen may also be used within a part program to configure the FineLine for use. This code is used to select the set point for each variable.

It is not necessary to have a line of code for each Cut Chart variable within a part program. Only those variables which are changing need be inserted into the part program (e.g. Material Thickness or Material Type).

Part program codes for the FineLine should be grouped together at the beginning of the program. The three variables which may be set through the part program are Material Type, Current Setting and Material Thickness.

Cut parameters for the FineLine may be configured using a EIA-274D G59 code with the following format.
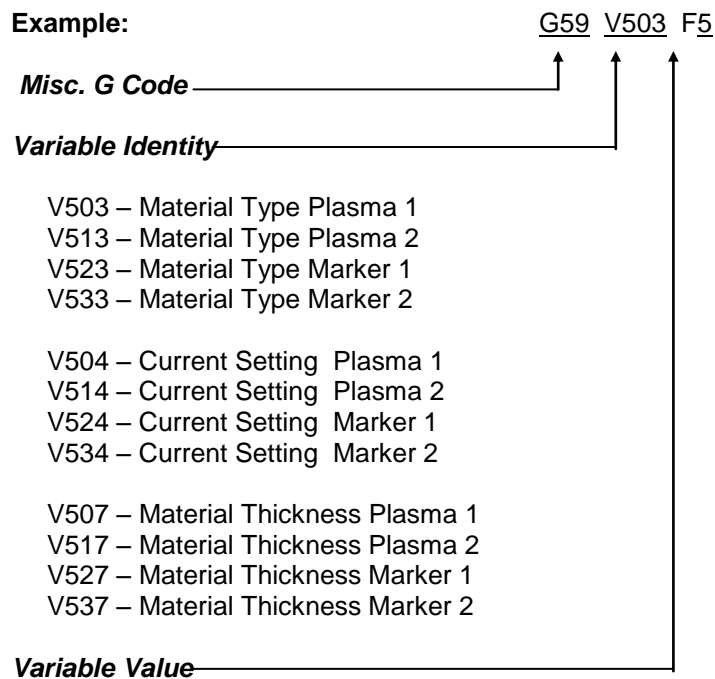
Example: G59 V503 F5

Misc. G Code

Variable Identity

   V503 – Material Type Plasma 1
   V513 – Material Type Plasma 2
   V523 – Material Type Marker 1
   V533 – Material Type Marker 2

   V504 – Current Setting Plasma 1
   V514 – Current Setting Plasma 2
   V524 – Current Setting Marker 1
   V534 – Current Setting Marker 2

   V507 – Material Thickness Plasma 1
   V517 – Material Thickness Plasma 2
   V527 – Material Thickness Marker 1
   V537 – Material Thickness Marker 2

Variable Value

   V503, V513, V523, V533 – Material Type

      1 = Mild Steel
      2 = Stainless Steel
      3 = Aluminum

   V504, V514, V524, 534 – Current Setting

8 = 8A	50 = 50A
9 = 9A	70 = 70A
10 = 10A	100 = 100A
30 = 30A	200 = 200A

Variable Value *(continued)*

V507, 517, 527, 537 – Material Thickness

1 = None	16 = .048" & 1.2mm	31 = 3/8" & 10mm
2 = 28GA	17 = 16GA	32 = 7/16" & 11mm
3 = .015" & .38mm	18 = .060" & 1.5mm	33 = 1/2"& 12mm
4 = 27GA	19 = 1/16" & 1.6mm	34 = 9/16" & 14mm
5 = .016" & .4mm	20 = 14GA	35 = 5/8" & 15mm
6 = 26GA	21 = .075" & 2mm	36 = 3/4" & 19mm
7 = .018" & .5mm	22 = 3/32" & 2.4mm	37 = 7/8" & 22mm
8 = 24GA	23 = 12GA	38 = 1" & 25mm
9 = .024" & .6mm	24 = .105" & 2.5mm	39 = 1 1/8" & 29mm
10 = 22GA	25 = 1/8" & 3mm	40 = 1 1/4" & 32mm
11 = .030" & .8mm	26 = 10GA	41 = 1 3/8" & 35mm
12 = 20GA	27 = .135" & 3.5mm	42 = 1 1/2" & 38mm
13 = .036 & .9mm	28 = 3/16" & 5mm	43 = 1 3/4" & 44mm
14 = .040" & 1.0mm	29 = 1/4" & 6mm	44 = 2" & 50mm
15 = 18GA	30 = 5/16" & 8mm	

Serial Ports

Both serial ports provided are shipped in the RS-232C wiring configuration. To change either port to
an RS-422 configuration requires changing a jumper setting on the Serial Isolation Board located
inside the control on the back panel. Simply locate the appropriate jumper for the desired port at the
bottom of the board and move the jumper from the RS-232C position to the RS-422 position, which is
clearly marked on the board.

Warning! Configure the port for RS-422 Operation before connecting RS-422 compatible devises.

The serial ports in the control are specifically designed to operate with a standard nine pin serial port
connector. Specifications for these ports are as follows:

Channel Type	Optically Isolated RS-232C or RS-422.
Information Code	ASCII (American Standard Code for Information Interchange).
Baud Rate	User selectable up to 115.2K baud.
Number of Start Bits	1
Number or Stop Bits	1
Word Length	User selectable 7 or 8 bits.
Parity	User selectable None, Even or Odd.
Data Synchronization	XON (Control-Q) / XOFF (Control-S).
Time Out	User selectable in one-second increments.
Transmit Delay	User selectable in one one/hundredths of a second increments.
Rear Panel Connector	IBM-PC/AT compatible 9-pin D-type female.

Control RS-232C DB-9 Pinout

Pin	Signal Name	Description
1	Shield	Chassis Ground
2	TxD	Transmit Data to External Device
3	RxD	Receive data from External Device
4		No Connection
5	Common	Ground
6		No Connection
7		No Connection
8		No Connection
9		No Connection

RS-232C Connections to Host PC with 9-pin D-type connector

Host PC		Control	
Signal Name	**DB-9 Pin**	**Signal Name**	**DB-9 Pin**
Shield	1	Shield	1
RxD	2	TxD	2
TxD	3	RxD	3
Common	5	Common	5

RS-232C Connections to Host PC with 25-pin D-type connector

Host PC		Control	
Signal Name	**DB-25 Pin**	**Signal Name**	**DB-9 Pin**
Shield	1	Shield	N/C
RxD	3	TxD	2
TxD	2	RxD	3
Common	7	Common	5

Control RS-422 DB-9 Pinout

Pin	Signal Name	Description
1	Shield	Chassis Ground
2	TxD-	Transmit Data - to External Device
3	RxD-	Receive Data - from External Device
4	TxD+	Transmit Data + to External Device
5	Common	Ground
6		No Connection
7	RxD+	Receive Data + from External Device
8		No Connection
9		No Connection

RS-422C Connections to Host PC with 9-pin D-type connector

Host PC		Control	
Signal Name	**DB-9 Pin**	**Signal Name**	**DB-9 Pin**
Shield	1	Shield	N/C
RxD-	3	TxD-	2
TxD-	2	RxD-	3
RxD+	7	TxD+	4
TxD+	4	RxD+	7
Common	5	Common	5

RS-422 Connections to Host PC with 25-pin D-type connector

Host PC		Control	
Signal Name	**DB-25 Pin**	**Signal Name**	**DB-9 Pin**
Shield	1	Shield	N/C
RxD -	3	TxD -	2
TxD -	2	RxD -	3
RxD +	14	TxD +	4
TxD +	16	RxD +	7
Common	7	Common	5

Serial Port Jumpers

The following Jumper selections for proper operation of the Rev D serial communication card.

Jumper Settings

Location	Designation	Description
J3	AMD	Port A Multidrop .
J2	BMD	Port B Multidrop
J6	AHST	Port A Host
J5	BHST	Port B Host
J8	ATR	Port A Termination Resistor
J7	BTR	Port B Termination Resistor
J9	RS-232 / RS-422	RS-232 / RS-422 selection jumper
J10	RS-232 / RS-422	RS-232 / RS-422 selection jumper

Definitions

Multi-drop	Used to enable / disable the multi-drop feature for communication to multiple controls through one link program..
Host	Used to configure the card as a host serial card for multi-drop. Requires additional Hardware.
Termination Resistor	The Termination Resistor is used to add resistance to the communications system for the end controls in a multi-drop system.

RS- 232 / 422 Configuration
The jumpers on J9 and J10 would be placed in position for RS-232 or RS-422 for operation on the appropriate port. Selection may very slightly depending on control type.

Serial Isolation card (selected models)
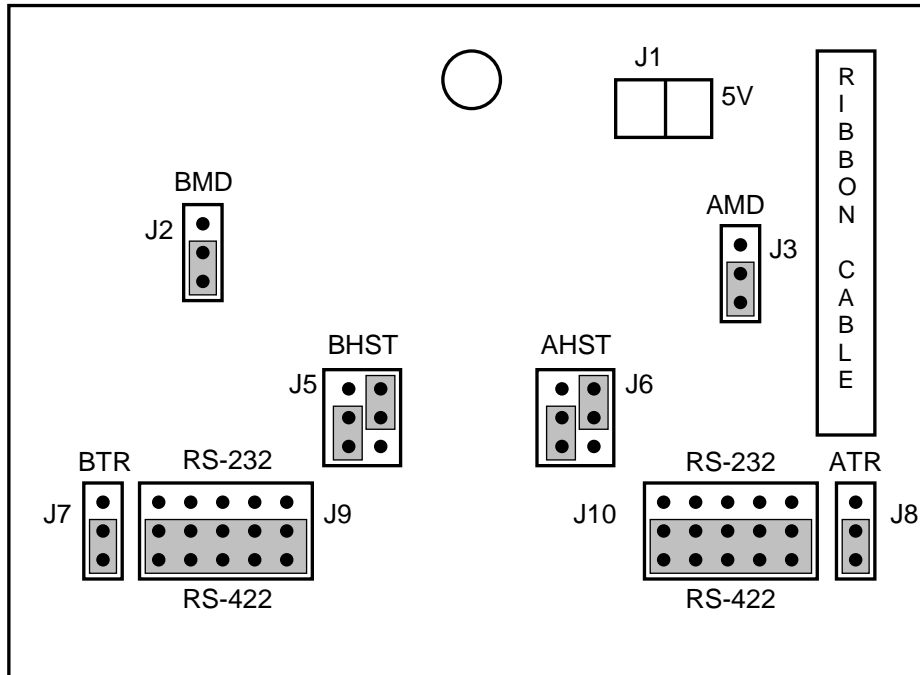
Automatic DXF Import

DXF Import Overview

Hypertherm Automation controls offer two styles of automated DXF import. The first DXF feature allows the CAD designer to prepare the DXF file with a specific format that includes the location of pierces, pierce order and direction. When loaded into the control an EIA format part program will be created for use at the control.

Also offered is a fully automatic DXF import feature that allows the control operator to select lead style and length. The CNC Auto DXF software will automatically place the lead in and lead out based on the operator selections and create an EIA format part program ready for use and the CNC.

Loading DXF Files
To load a DXF file, access the Files Load screen and select the source location and file.
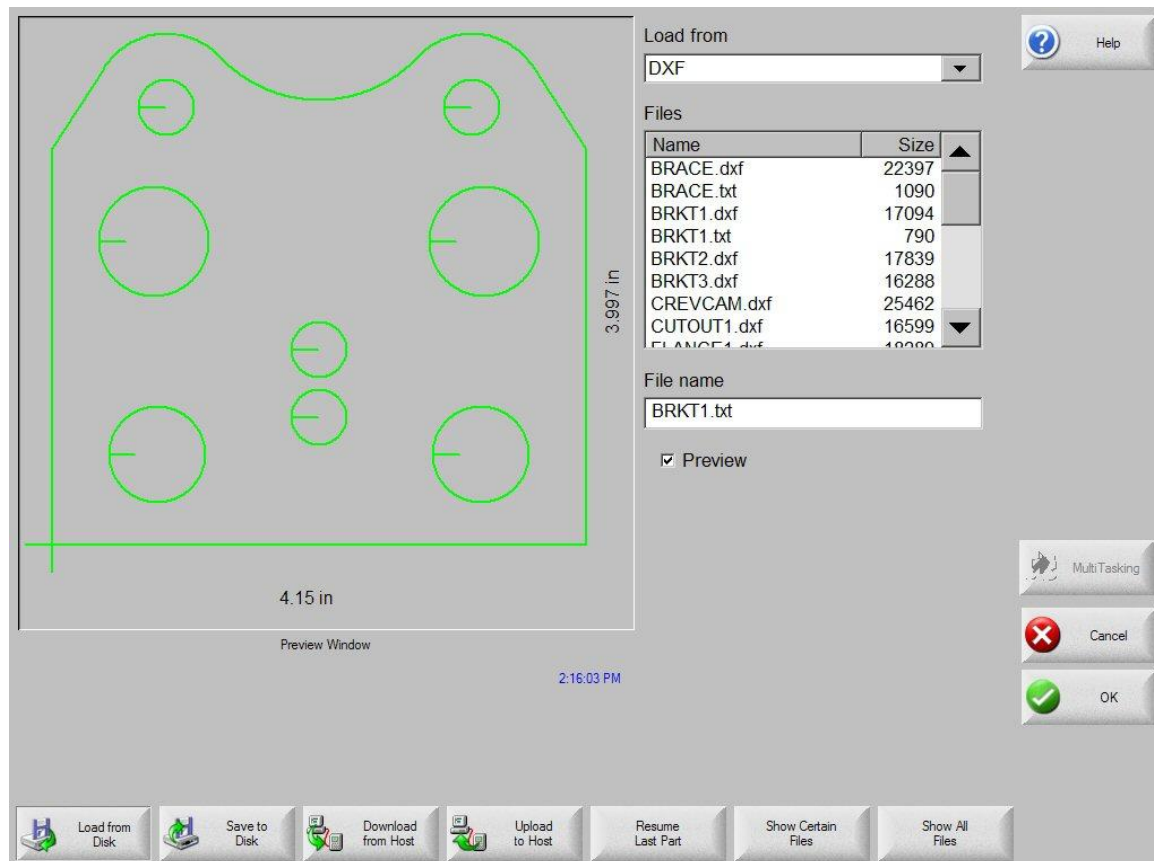
If the file has been formatted following the rules for prepared files including the lead in and direction, the control will detect this and translate the file for use.   See Prepared DXF files.

If the file contains no pierce or lead in /out information, the user will be prompted through use of the auto import feature. See Raw DXF files

Note: To load DXF files the DXF extension must first be added to the Special Setups screen.

Raw DXF Files

If the DXF file is detected as having no pierce information, the operator will be given the option to use a Hyper DXF fully automated translation tool to import the file and add lead in and lead out information.
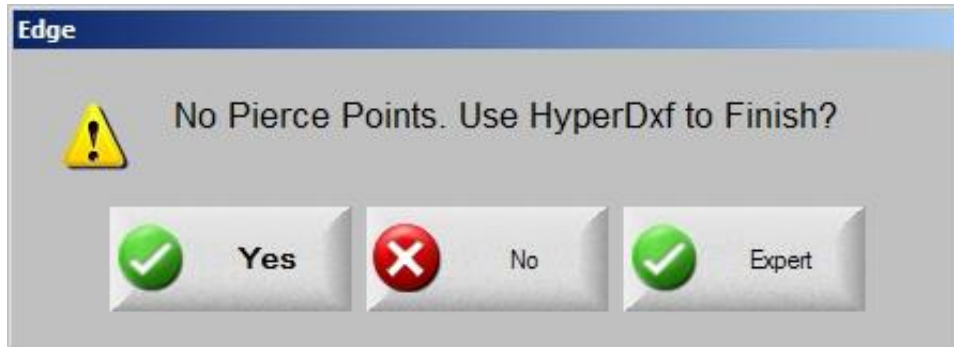
If the user selects YES, a configuration screen will be displayed to define lead in/ lead out format.
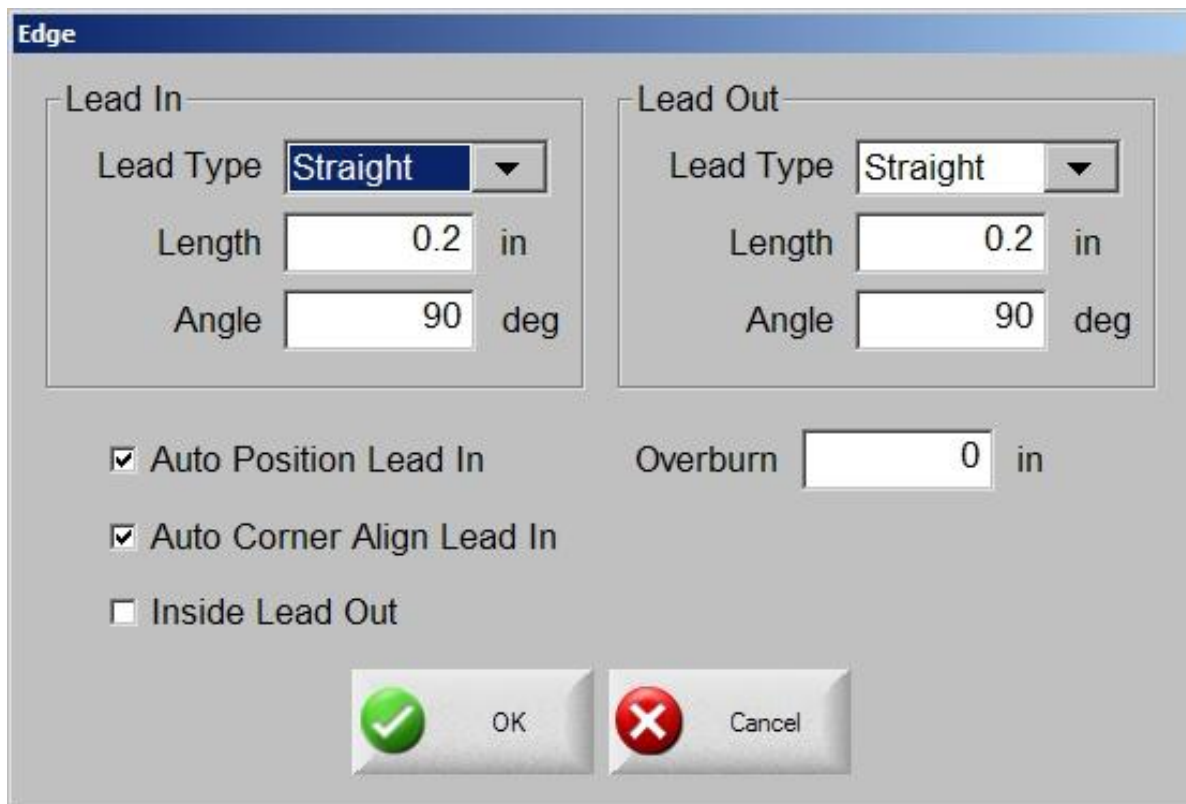
Lead Type
The user may select a Straight or Radius lead in or lead out.

Length / Radius
The lead in or lead out length or radius may be selected.

Angle
Angle in degrees for lead in or lead out may be selected.

Auto Position Lead In
When selected, the software will attempt to find a suitable corner to position the lead in.

Auto Corner Align Lead In
When selected, the software will attempt to find a suitable corner to position the lead in.

Inside Lead Out
This selection allows the user to select if lead out is used on both internal and external cuts.   When not selected lead outs will be added to external cuts only.

Overburn
Overburn will provide a continued overlapping cut in the lead in/ lead out area of a hole.

After import, an EIA part program with a .txt extension will be created and placed in the source folder. Note the BRKT1.dxf and BRKT1.txt in the following example.
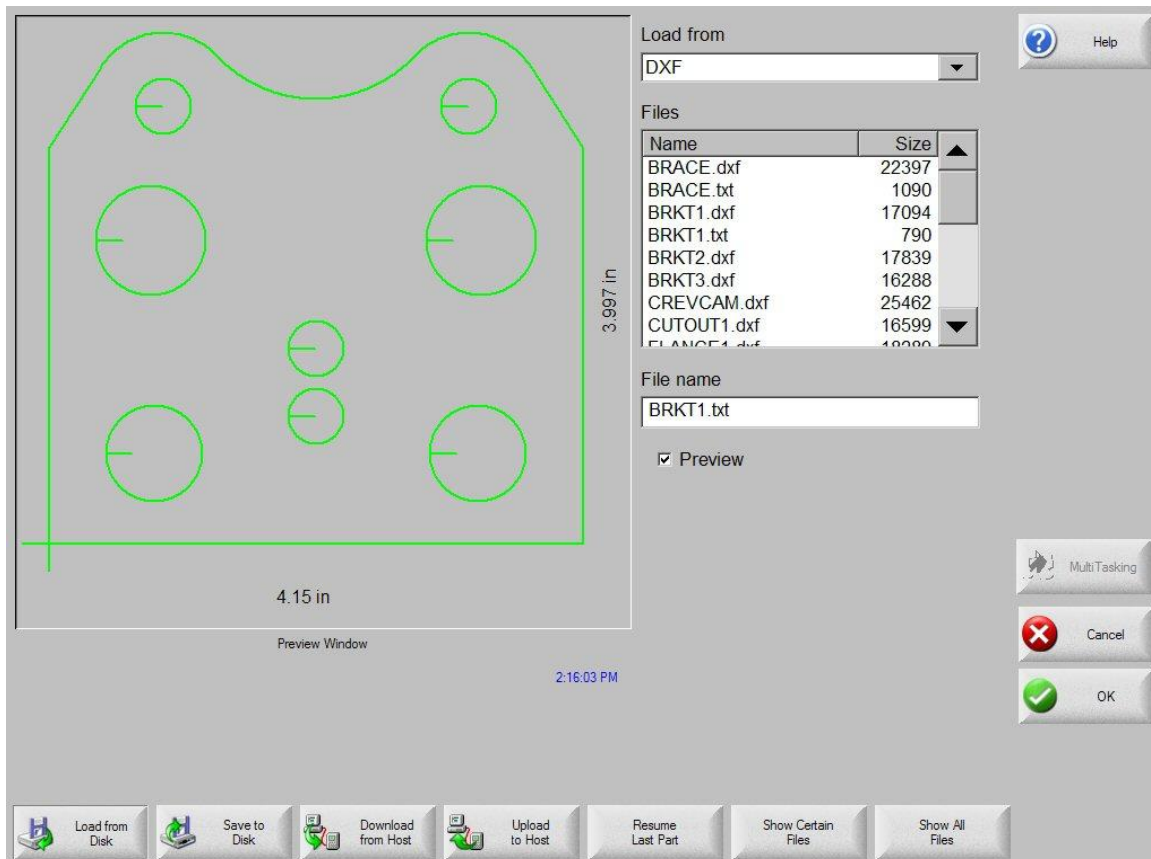
Prepared DXF Files

The DXF Translator software is designed to allow the control to load and translate into an EIA format part program a DXF style drawing created in Autocad™ or Autocad LT™. For the control to load and understand the CAD file, certain guidelines must be adhered to when creating the drawing. The Optional DXF Translation feature is enabled through a password provided by your control supplier.

Drawing Format
There should be nothing on the Cut Layer except Lines, Arcs, Circles and Text commands. Do not put dimensions or notes on the same Layer as Cut data.

Elliptical segments, Squares and Polylines are not supported. They should be sectioned into short arcs or line segments. You can use the ACAD EXPLODE command to convert POLYLINES into segments.

The end angles of two arcs from any intersection point are not allowed to be within the same quadrant.

Text commands determine Cut Sequence, and determine path through multi-segment Intersections. Text commands are placed on the drawing with the Text feature of your CAD program. Size of the text is not important. Location of the text is extremely important. A Left Justified position for the text must be used. Text commands must be "SNAPPED" to the appropriate intersection or pierce points.

Text commands are used to indicate Pierce Points and Cut Direction. Note that the directional commands should <u>ONLY</u> be used when more than one exit path exists at an intersection of segments to determine the direction of the next line segment.

Text Commands
1   Used to indicate the first pierce point (subsequent pierce points proceed in numerical order)
+   Indicates a Counter-Clockwise circle
-    Indicates a Clockwise circle

Directional Commands
R   Indicates the next segment's direction (if Line) or ending angle (if arc) is 350° to 10°
RU Indicates the next segment's direction (if Line) or ending angle (if arc) is 0° to 45°
UR Indicates the next segment's direction (if Line) or ending angle (if arc) is 45° to 90°
U   Indicates the next segment's direction (if Line) or ending angle (if arc) is 80° to 100°
UL Indicates the next segment's direction (if Line) or ending angle (if arc) is 90° to 135°
LU Indicates the next segment's direction (if Line) or ending angle (if arc) is 135° to 180°
L   Indicates the next segment's direction (if Line) or ending angle (if arc) is 170° to 190°
LD Indicates the next segment's direction (if Line) or ending angle (if arc) is 180° to 225°
DL Indicates the next segment's direction (if Line) or ending angle (if arc) is 225° to 270°
D   Indicates the next segment's direction (if Line) or ending angle (if arc) is 260° to 280°
DR Indicates the next segment's direction (if Line) or ending angle (if arc) is 270° to 315°
RD Indicates the next segment's direction (if Line) or ending angle (if arc) is 315° to 360°

Traverses are automatically determined between pierce points and need not be entered on the CAD drawing.
The following is a basic Bolt Hole Rectangle with the Lead-in and Lead-out for the rectangle as part of the top and side line segments. The numbers indicate the order of the pierces and the "+" sign indicates a Counter-Clockwise rotation for the circles.

Example:
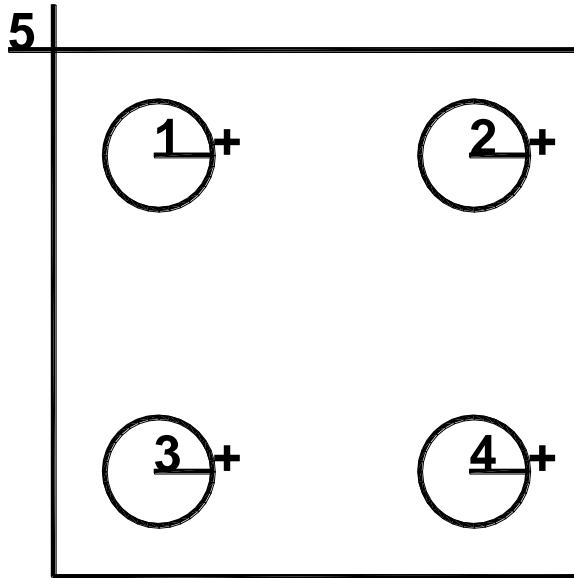
If the Lead-in and Lead-out were made up as additional line segments added to the top and side line segments, additional text would be required to indicate which direction the next line segment should take as part of the part program.

Example:
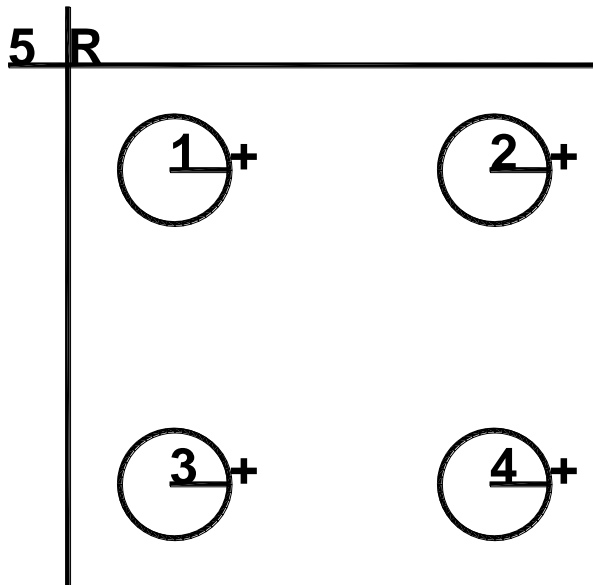
In this example, the Letter "R" has been snapped to the intersection of the four line segments to indicate that the next line segment after Lead-in (pierce 5) would be the segment which is located at 350 to 10 degrees and then to the other connected segments on the square. After the left side (vertical) cut segment has been executed, no additional text is required to indicate which line should

be cut. Since the Lead-in and the first cut segment have already been executed the Lead-out segment would be the only segment left available.

Comments:
- There should be nothing on the Cut Layer except Lines, Arcs, Circles and Text / Directional commands.
- Line segments must be connected to complete the cut path.
- If multiple line segments or arcs need to be repeated, each line segment should be drawn rather than copied and pasted.
- Features for Marking are not available at this time.
- No Traverse lines are required. All lines in the CAD drawing are assumed to be cut lines.
- Left Kerf is assumed.

MicroEdge

Overview

The *MicroEDGE™* PC based motion control from Hypertherm® Automation is specifically for the metal cutting industry. This control package provides a unique combination of flexible table configurations, expandable features and an unparalleled ease of use.

MicroEDGE™ utilizes our proprietary Graphical User Interface (GUI) and *SoftMotion* Technology with motion control operation of up to four axes with 24 I/O signals.

This product offers a unique approach to the motion control market by allowing custom configuration the final package by adding a PC style Monitor, Keyboard and Mouse.

Additional features such as Joystick, Speed Pots, Integrated Sensor™ THC, networking, CAD/CAM Software, Nesting Software provide unlimited combinations of options for increased productivity.

Operation and maintenance of automated equipment involves potential hazards. Personnel should take precautions to avoid injury. This equipment should only be opened by trained service personnel.

MicroEDGE™
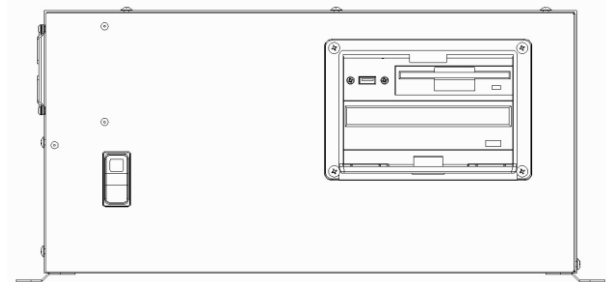
Rear View
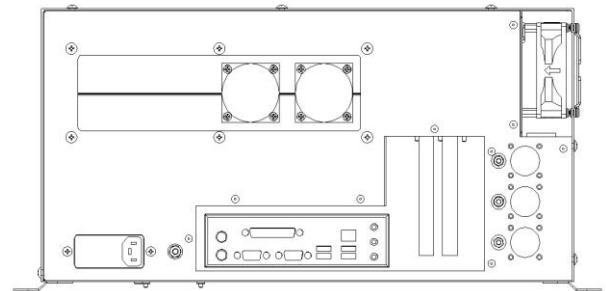
Keyboard Layout
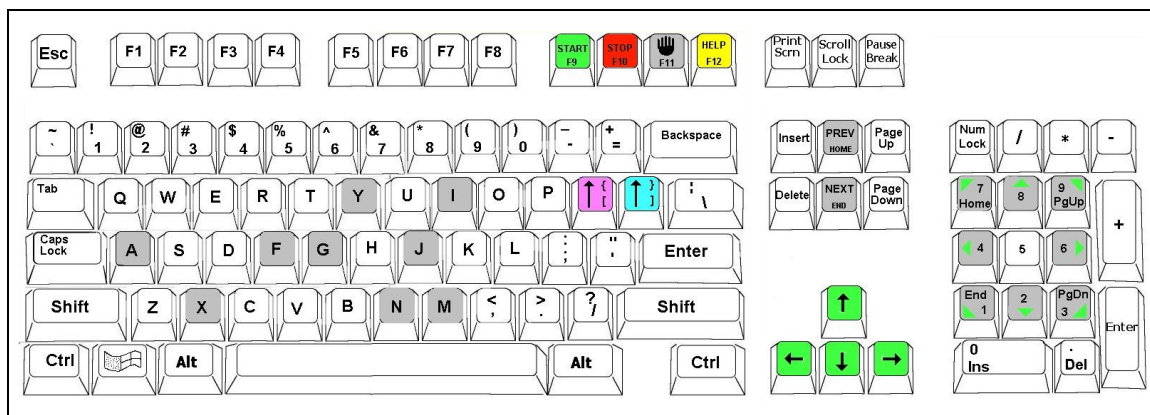
Typical Keyboard Layout

Keyboard Functions
Function Keys F1-F8 are equivalent to the soft keys on the display screen.
Function Key F9 is equivalent to the START key.
Function Key F10 and Pause Key are equivalent to the STOP key.
Function Key F11 is equivalent to the MANUAL MODE key.
Function Key F12 is equivalent to the HELP key.
Arrow direction keys are used for manual motion.
The HOME key is equivalent to the PREV field key.
The END key is equivalent to the NEXT field key.
The [key is equivalent to the purple arrow shift key.
The] key is equivalent to the blue arrow shift key.
The Esc key is equivalent to the CANCEL key.
To exit the control software press Alt F4.
To switch between applications press Alt Tab.

A color coded key cap sticker set is provided to allow easy reference to the keys used by the control software.

System Requirements

Monitor Requirements (CRT or LCD)
Standard VGA capable 1240 x780 analog monitors or better with 15 pin High Density D-sub connector. Touch screen displays are also supported.

Keyboard Requirements
Standard 101/ 104 Key PS/2 or USB Compatible Keyboard

Optional Mouse Requirements
PS/2 or USB Compatible Mouse

THC, Joystick & Speedpots
Optional features for two Sensor THC, one Joystick and two Speedpots are offered.

Note: Use of some monitors and other devices may require loading of a device driver for operation. Many standard device drivers are located in the C:\CABS or C:\CABS\I386 folders.

Machine Interface

The MicroEDGE™ shape cutting control is an extremely versatile product offering up to four configurable axes of motion, configurable I/O locations and a convenient table interface for ease of installation. The control features may also be expanded through use of optional analog and network interface cards.
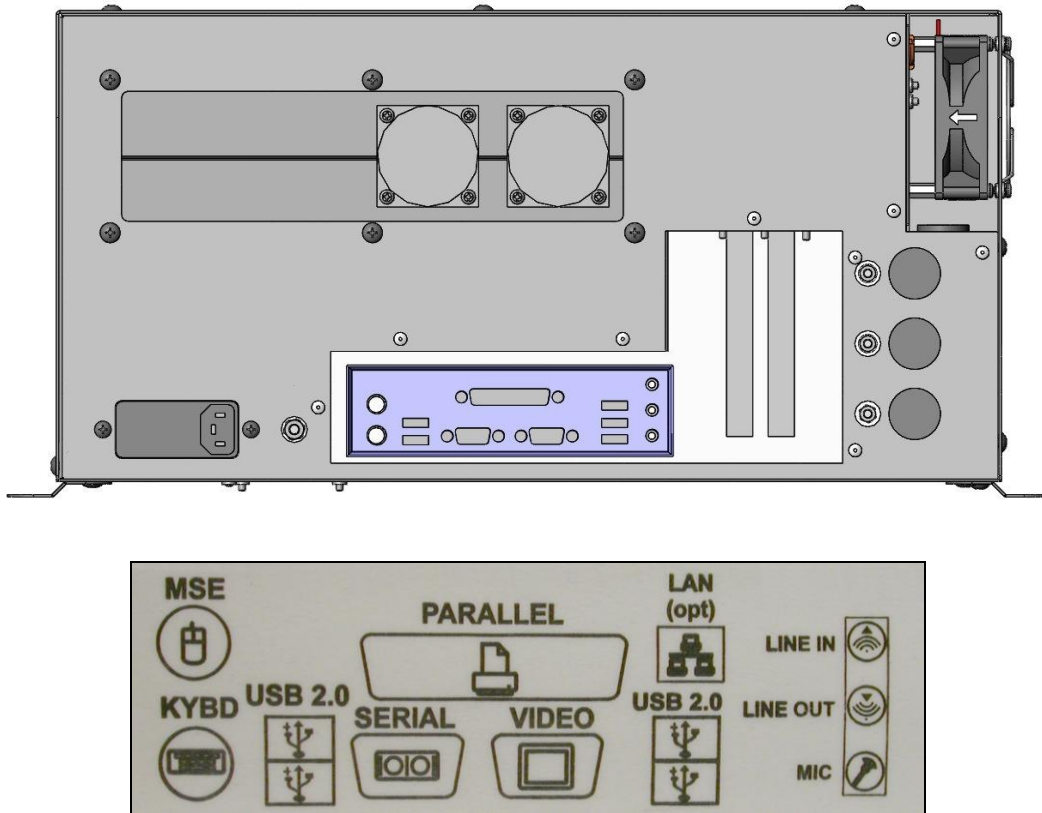
The rear panel of the control has several cable connectors to connect the control to power, I/O and communication ports. These connectors are clearly labeled as to their function.

AC Input
The AC power cable is inserted into the AC power connector and plugged into a standard 3-way 110 or 220 volt outlet. The control has a universal AC input power module that allows the user to plug into either voltage without changing additional jumpers. In addition, the AC Power connector contains an integral fuse receptacle and line filter.

A remote communications link can be connected to one of the two serial ports and an external ground (PE) lug for earth grounding of the unit is also provided.

Serial Port
Please refer to the Ports Information section of the Installation Guide for additional information on configuration of Serial ports for communication. Note: Serial ports for the MicroEDGE are not optically isolated. Appropriate grounding or after market port isolator or protocol converter to add optical isolation is recommended.

I/O Configuration

The cables that connect the control to the cutting machine are attached to the I/O (Input/Output), and the DRIVE/ENCODER connectors. For the purposes of this guide Single Ended I/O is referred to as Type "P" configuration.

The information provided here is the basic information for connection of the shape cutting control to the cutting table. Each machine interface will vary slightly based on the cutting table configuration and features. Additionally, I/O pinout information may vary slightly based on the configuration of the selected I/O and their locations. Changes to the I/O configuration may be made in the password protected I/O screen. All controls are shipped with the default selection of Inputs and interface locations for the selected control Interface (I/O) configuration. Installation and service should only be performed by a qualified service technician.

I/O Connector The I/O connector is a standard sex circular CPC connector from AMP. This connector was specifically chosen for its rugged industrial design and its metal insulation characteristics for EMI/RFI noise immunity.

In the single ended I/O scheme, a ground is provided on the I/O pin. The advantage to single ended I/O is that it takes one pin for each point versus two for the double-ended I/O scheme, thus increasing the total number of I/O points available to the user.

I/O Mating Connector
Connector AMP #208470-1
Backshell AMP #208945-8
Sockets (16-18 ga) AMP #66101-3
Sockets (20-24 ga) AMP #66105-3
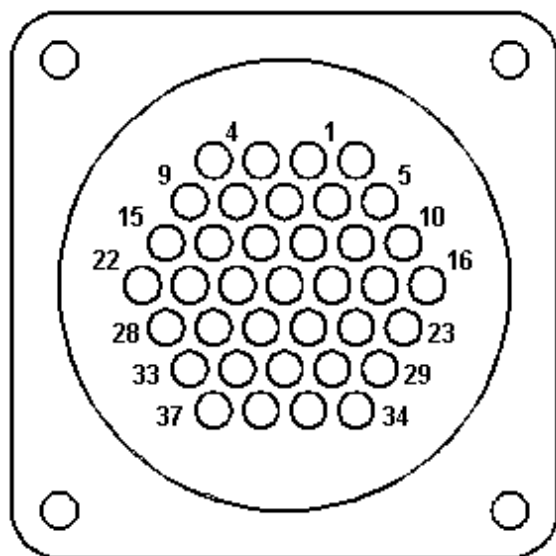
I/O Interface

Connecting single ended I/O to the control. These examples assume a +24V power supply has been connected across pins 34 and 36 of the control, or that the optional internal +24V power supply has been installed.
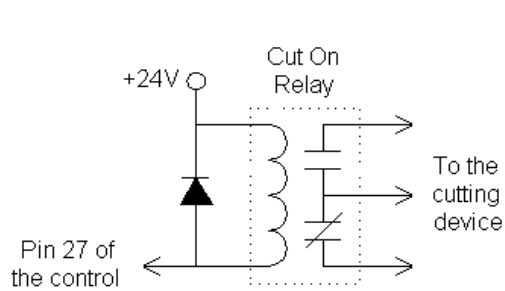
Output tied to external Cut On   **Input tied to Cut Sense Relay**
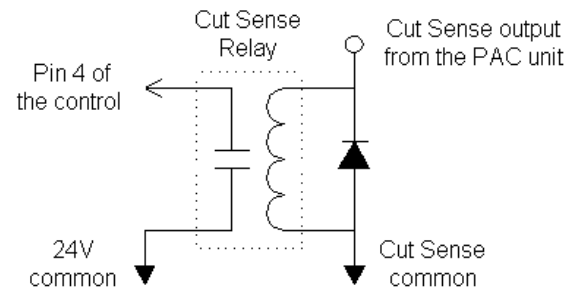
Examples of possible circuits
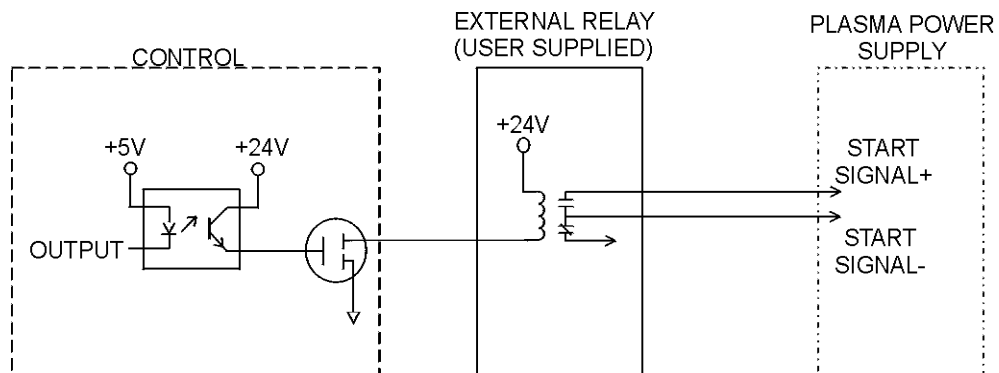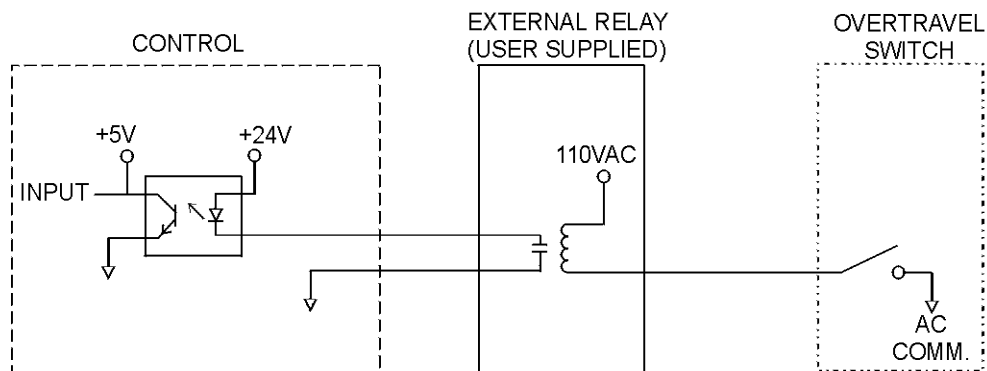
Output

Input

Single Ended I/O Pinout
The Single Ended I/O offers 12 outputs which are rated at 24VDC for up to 1-amp loads and 12 inputs rated for 24VDC.

Pin	I/O	Description
1	Input 1	Torch Up Sense
2	Input 2	Torch Down Sense
3	Input 3	Preheat Sense or X -Overtravel Switch
4	Input 4	Cut Sense
5	Input 5	Tracer on Path or Z Home Switch
6	Input 6	Spare or Y -Overtravel Switch
7	Input 7	Spare
8	Input 8	Spare or Remote Pause
9	Input 9	X Home Switch
10	Input 10	X Overtravel Switch or X +Overtravel Switch
11	Input 11	Y Home Switch
12	Input 12	Y Overtravel Switch or Y +Overtravel Switch
13	N/C	No Connection
14	+24 VDC	+ I/O Power Supply
15	+24 VDC	+ I/O Power Supply
16	N/C	No Connection
17	24V Common	I/O Power Supply Common
18	24V Common	I/O Power Supply Common
19	N/C	No Connection
20	N/C	No Connection
21	Output 1	Torch Up
22	Output 2	Torch Down
23	Output 3	Ignition Control
24	Output 4	Torch Height Disable/Dual Grid Control
25	Output 5	CNC/Tracer
26	Output 6	Marker Enable
27	Output 7	Cut Control
28	Output 8	Spare
29	Output 9	Spare or Low Preheat
30	Output 10	Preheat Control
31	Output 11	Key Press Indicator or Motion Indicator
32	Output 12	Spare or Plasma Select
33	I/O Shield	Chassis Ground
34	+24 VDC	+I/O Power Supply
35	+24 VDC	+I/O Power Supply
36	24 V Common	I/O Power Supply Common
37	24 V Common	I/O Power Supply Common

Drive/Encoder Connector

The Drive/Encoder connector is a reverse sex circular CPC connector from AMP. This connector was specifically chosen for its rugged industrial design and its metal insulation characteristics for EMI/RFI noise immunity.

NOTE: For optimum noise immunity, cable shields may be tied externally to the control enclosure or to the metal AMP connectors.

Drive/Encoder Mating Connector and Cable
Connector AMP #208472-1
Backshell AMP #208945-8
Pins (16-18 ga) AMP #66099-3
Pins (20-24 ga) AMP #66103-3
Cabling: Use Belden # 9504 or equivalent for encoder signals
Cabling: Use Belden # 9501 or equivalent for drive signals
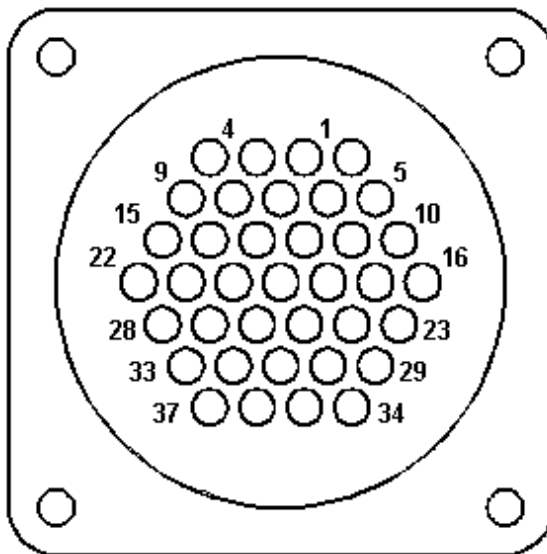
Axes Assignments

Axes	Axes Assignment
1 (X)	Transverse or Rail
2 (Y)	Transverse or Rail
3 (Z)	Dual Gantry, CBH, Rotate or THC
4 (W)	CBH, Tilt or THC

Drive/Encoder Pinout

Pin	Description
2	Encoder Power Supply Input (+5V or +12V*)
3	Encoder Power Supply Common
7	Encoder Power Supply Shield
8	

***NOTE**: For Rev A + B MCC's +12V Encoders require a switch to be set on the interface board.

X Axis	Y Axis	Description
4	1	Encoder Power Output
8	6	Encoder Power Common
9	5	Encoder Channel A input
14	11	Encoder Channel /A Input
15	10	Encoder Channel B Input
21	17	Encoder Channel /B Input
22	16	Encoder Channel Z Input
28	23	Encoder Channel /Z Input
13	12	Encoder Shields
24	26	Drive Enable In (relay contact)
25	27	Drive Enable Out (relay contact)
37	34	Drive Power Input (+12 or +15)
33	29	Servo Output ($\pm$ 10V)
32	30	Drive Power Common
36	35	Drive Power Input (-12 or –15)
20	18	Servo Output Common
19	31	Drive/Servo Shield

Drive/Encoder Pinout (For 3 and 4 Axes units)

Pin	Description
2	Encoder Power Supply Input (+5V or +12V)
3	Encoder Power Supply Common
7	Encoder Power Supply Shield

Z Axis	W Axis	Description
4	1	Encoder Power Output
8	6	Encoder Power Common
9	5	Encoder Channel A input
14	11	Encoder Channel /A Input
15	10	Encoder Channel B Input
21	17	Encoder Channel /B Input
22	16	Encoder Channel Z Input
28	23	Encoder Channel /Z Input
13	12	Encoder Shields
24	26	Drive Enable In (relay contact)
25	27	Drive Enable Out (relay contact)
37	34	Drive Power Input (+12 or +15)
33	29	Servo Output ($\pm$ 10V)
32	30	Drive Power Common
36	35	Drive Power Input (-12 or –15)
20	18	Servo Output Common
19	31	Drive/Servo Shield

THC and Joystick Interface

MicroEdge® has dedicated connectors for THC 1, THC and Joystick / Speedpots.

Series 1 PCI Analog Card

Note: The Analog Card will be designated as PCI-AIC Rev A in the Control Information Diagnostic screen.

Board Marking PCI Analog 1 Part # PCBS-0074

THC 1

Pin #	Designation	Description
1	Common	Common
2	Input 5 +	Nozzle Contact Sense + (Relay Contact)
3	Input 5 –	Nozzle Contact Sense - (Relay Contact)
4	Output 1 +	Nozzle Contact Enable + (Relay Contact)
5	Output 1 –	Nozzle Contact Enable - (Relay Contact)
6	Analog Input 1 +	THC +
7	Analog Input 1 –	THC –
8	Output 2 +	Hold Ignition (Relay Contact)
9	Output 2 –	Hold Ignition (Relay Contact)
Ground Stud		Shield

Mating Connector
Connector AMP #206708-1
Backshell AMP #206966-1
Sockets (20-24 ga) AMP #66105-3
Cabling: Use Belden # 9504 or equivalent

THC 2

Pin #	Designation	Description
1	Common	Common
2	Input 6 +	Nozzle Contact Sense + (Relay Contact)
3	Input 6 –	Nozzle Contact Sense – (Relay Contact)
4	Output 3 +	Nozzle Contact Enable + (Relay Contact)
5	Output 3 –	Nozzle Contact Enable – (Relay Contact)
6	Analog Input 2 +	THC +
7	Analog Input 2 –	THC –
8	Output 4 +	Hold Ignition (Relay Contact)
9	Output 4 –	Hold Ignition (Relay Contact)
	Ground Stud	Shield

Mating Connector
Connector AMP #206708-1
Backshell AMP #206966-1
Sockets (20-24 ga) AMP #66105-3
Cabling: Use Belden # 9504 or equivalent

Joystick

Pin #	Designation	Description
1	Input 1	Joystick UP
2	Input 2	Joystick DWN
3	Input 3	Joystick LT
4	Input 4	Joystick RT
5	Common	Common
6	Analog Input 3 +	Speed Pot 1
7	Analog Input 3 –	Speed Pot 1
8	Analog Input 4 +	Speed Pot 2
9	Analog Input 4 –	Speed Pot 2
	Ground Stud	Shield

Note: Joystick inputs are activated by passing the Common signal (pin 5) to the desired input.
Analog inputs for the speedpots are rated at 0 - +10VDC

Mating Connector
Connector AMP #206708-1
Backshell AMP #206966-1
Sockets (20-24 ga) AMP #66105-3
Cabling: Use Belden # 9504 or equivalent

THC and Joystick Cable Grounding
Cable shields should be tied to the external PE studs for optimum noise immunity.

Sensor™ THC

This section refers to following hardware configuration. *Note*: The Analog Card will be designated as Rev 0 in the Control Information Diagnostic screen.

Series 1 PCI Analog Card (Board Marking PCBS-0073)   Part # PCBS-0074
Series 3 Voltage Divider Card   Part # PCBS-0061

Instructions
If the voltage divider card has not been installed in the plasma power supply, mount the card in an accessible location away from high electrical noise areas. Wire the VDC to the appropriate signal inside the power supply as outlined in the following pinout information

Voltage Divider Card Pinout (Series 3)

Divider PCB - 2C Connector J1

Pin #	Description
1	85 -265 VAC Power Input (47-63Hz)
2	285 -265 VAC Neutral Input

Mating Connector
2C Phoenix Connector – Phoenix Part # 1840366

Divider PCB - 8C Connector J2 To Control

Pin #	Description
1	+24 VDC Common
2	+24 VDC
3	Nozzle Contact Sense
4	Nozzle Contact Enable
5	+24 VDC Common
6	Analog Out +
7	Analog Out –
8	E Ground

Mating Connector
8C Phoenix Connector – Phoenix Part # 1803633

Divider PCB - 5C Connector J3 to Power Supply / Table

Pin Number	Description
1	Ground (Chassis Ground)
2	Electrode (Plasma DC –)
3	Work (Plasma DC +)
4	NC
5	Shield (Nozzle Contact)

Mating Connector
Terminal Connections

Control & Cable Pinout for Sensor™ THC

I/O Configuration Type "P"

Note: A 9C Amp connector is provided on the back of the control (I/O Type "P") for interfacing.

Control 9C **Analog Pin #**	**Description**	**Divider J2** **Pin #**
1	24V Common	1
2	Nozzle Contact Sense +	2
3	Nozzle Contact Sense –	3
4	Nozzle Contact Enable +	4
5	Nozzle Contact Enable –	5
6	Analog +	6
7	Analog –	7
8	Hold Ignition +	N/A (direct to power supply)*
9	Hold Ignition –	N/A (direct to power supply)*
Ground Stud	Shield	No Connection

Analog Mating Connector
Connector AMP # 206708-1
Backshell AMP #206966-1
Sockets #66105-3 (20-24 ga)

VDC Mating Connector
8C Phoenix Connector – Phoenix Part # 1803633

Cable
Belden #9505 or equivalent

* **Note**: It is recommended that the Hold Ignition input be wired to the Power Supply through an external relay for noise immunity. Please refer to Instructions from the supply manufacturer for details on connection to the Hold Ignition Input.

MicroEdge™

Calibration

Series 1 Analog Card

Note: The Series 1 Analog Card will be designated as Rev 0 in the Control Information Diagnostic screen.

Board Marking PC-012-1098 Rev. B   Part # PCBS-0010-B

After the voltage divider card and control cabling have been connected, the system is ready to be calibrated for use.

Analog Offset: To adjust the Analog Offset, place a jumper on the Analog In signals on the Analog input card or at the 9C connection for the Analog Input Card located at the back of the control. The analog input voltage would then be viewed at the I/O Diagnostics screen to read any incoming voltage for the THC. If any voltage is displayed at the diagnostic screen, an Offset Voltage equal to the incoming voltage being read can be entered at the Password protected Analog I/O screen to correct for any imbalance and "zero" the incoming voltage

Example: If an incoming Analog Input Voltage is reading .1 volts, simply enter .1 at the Analog Offset and correct the imbalance.

Edge Ti

Overview

The Edge Ti shape cutting control is an extremely versatile product offering up to four configurable axes of motion, built-in Servo Amplifiers and configurable I/O. Use of built in relay contacts for I/O increases interface options and minimizes external interface components.

Hypertherm Automation PC based CNC controls for the shape cutting industry utilize our proprietary Graphical User Interface (GUI), and *SoftMotion* Technology to increase productivity, reduce operational costs while providing unsurpassed operational flexibility. The control features may be further expanded through use of integrated Sensor™ THC interface and networking

Touch Screen
The 15" display used in the Edge Ti is a patented IntelliTouch Surface Wave technology which provides precise drift free touch accuracy and unsurpassed clarity. Pure glass construction with tiny transducers on the back of the touch screen preserves color purity and works even if scratched. There is no known wear out mechanism as there are no layers, coatings or moving parts. IntelliTouch technology has been tested by the supplier for more than 50 million touches in one location without failure.

THC, Joystick & Speedpots
Features for Joystick and Speedpots are offered as standard. Optional features for integrated Sensor THC are available.

Edge Ti™
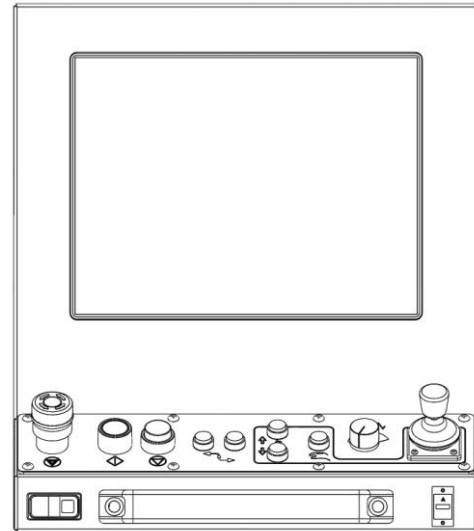
Rear View
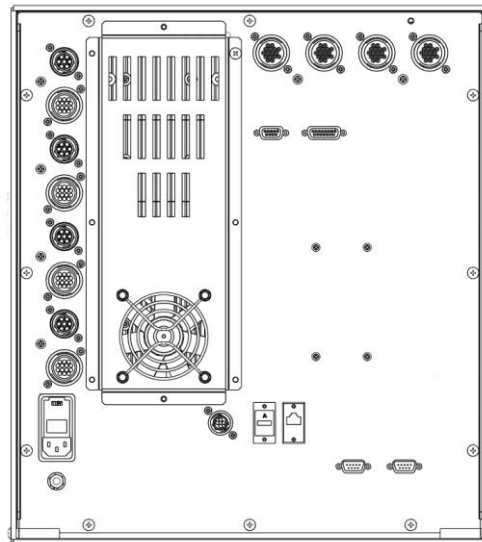
Note: Use of some devices such as USB memory devices may require loading of a device driver for operation. Many standard device drivers are located in the C:\CABS or D:\CABS\I386 folders.

Operation and maintenance of automated equipment involves potential hazards. Personnel should take precautions to avoid injury. This equipment should only be opened by trained service personnel.

Machine Interface

The information provided here is the basic information for connection of the shape cutting control to the cutting table. Each machine interface will vary slightly based on the cutting table configuration and features. Additionally, I/O pinout information may vary slightly based on the configuration of the selected I/O and their locations. Changes to the I/O configuration may be made in the password protected I/O screen. All controls are shipped with a default selection of Inputs and interface locations for the selected control Interface (I/O) configuration. Installation and service should only be performed by a qualified service technician.

The rear panel of the control has several cable connectors to connect the control to power, I/O and communication ports. These connectors are clearly labeled as to their function.

AC Input
The AC power cable is inserted into the AC power connector and plugged into a standard 3-way 115 or 230 volt outlet. The AC Power connector contains an integral fuse module and line filter. AC input power can be selected by the user by changing position of the fuse module so that the selected voltage is displayed.
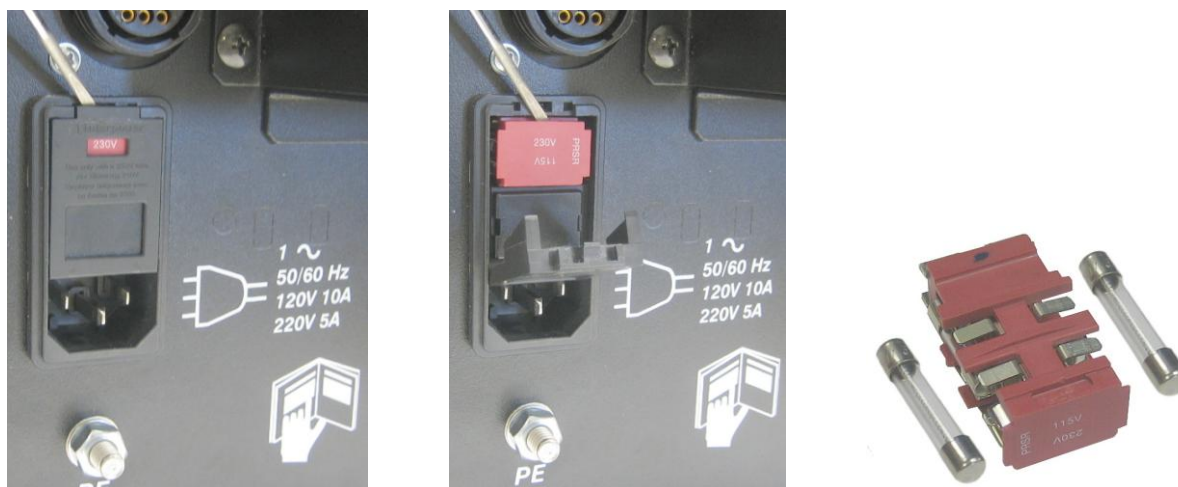
⚠️ *WARNING!* Ensure proper orientation of fuse module for input power before applying power to the CNC. Component damage could occur with incorrect voltage setting.

Recommended AC Fuses
Different fuse ratings are recommended based on incoming voltage selected.

Voltage Input: 120Vac uses 8 amp (slow blow)   Littlefuse part #313008
Voltage Input: 220Vac uses 5 amp (slow blow)   Littlefuse part #313005
Size: ¼" x 1¼" or 5mm x 20MM fuse can be used

Serial Port
Please refer to the Ports Information section of the Installation Guide for additional information on configuration of Serial ports for communication.

A remote communications link can be connected to one of the two serial ports and an external ground (PE) lug for earth grounding of the unit is also provided.

I/O Configuration

The Edge – Ti provides several options for I/O interfacing with built in circuitry providing interface flexibility and reducing the need for external components. Inputs are through optoisolators and outputs are through relays. Contacts for both normally closed and normally open outputs are available for use.
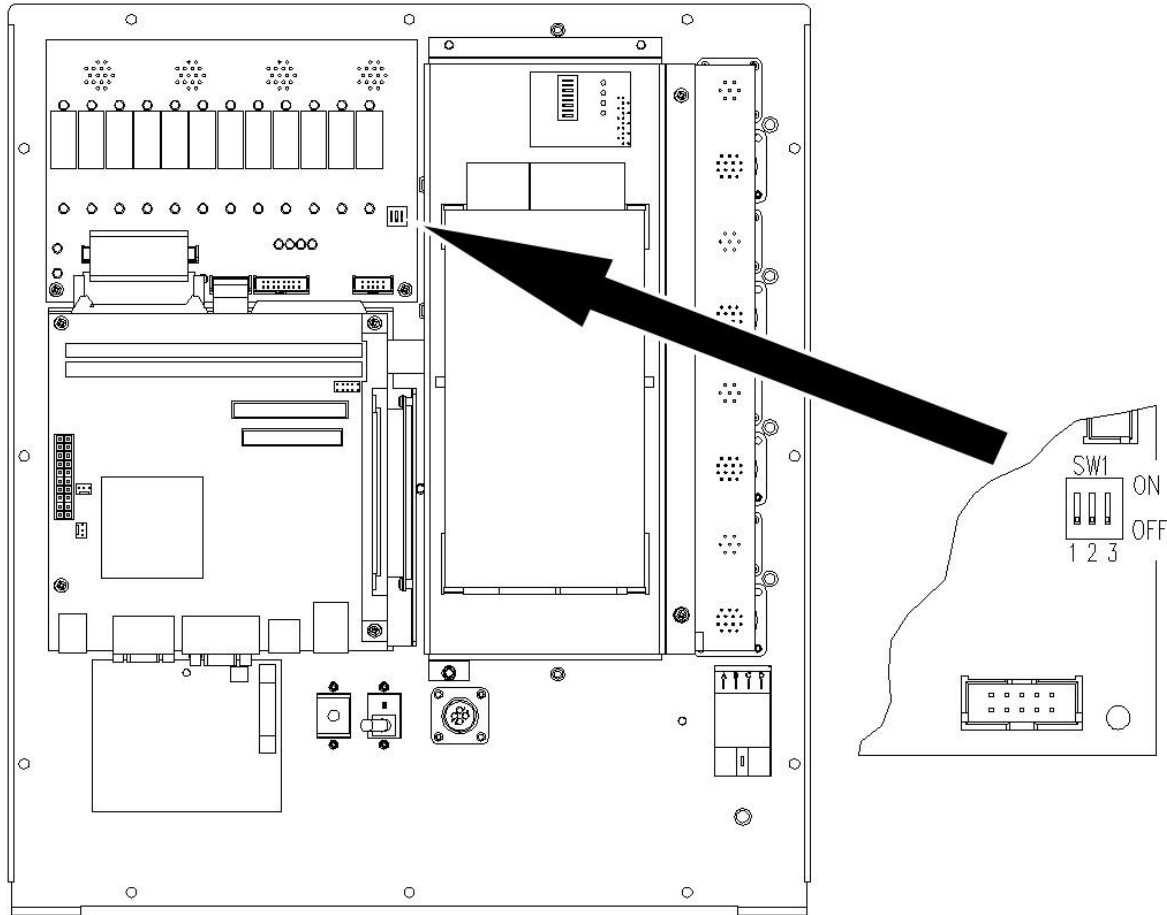
Input Mode
Note that the inputs have two different modes that are selectable using DIP switch SW1-3. When this switch is OFF the inputs are in the sourced input mode and an external voltage source of between 12V and 24V is required to activate each input.

When DIP switch SW1-3 is ON, the inputs are all in the dry contact mode and require an external switch to common to activate the inputs. The logic states sensed by the CNC are reversed between the two input modes.

In a sourced input circuit, an inactive input will produce a logic low and an active input will produce logic high. In dry contact mode these logic levels are reversed with an inactive input producing logic high and an active input producing a logic low.

Switch SW1-3

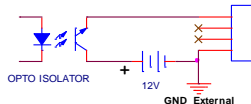| Input Mode	SW1-3
Dry Contact	On
12Vdc or 24Vdc Sourced	Off

I/O Interface

The following illustration shows the details of connecting the I/O to common circuitry. All outputs are relay contacts rated at 1 AMP 250VAC maximum

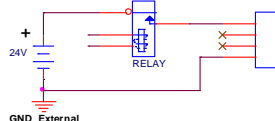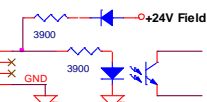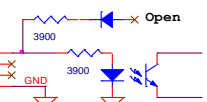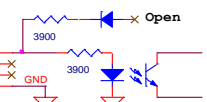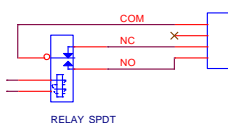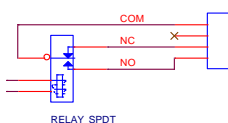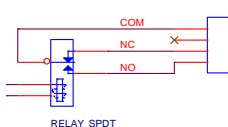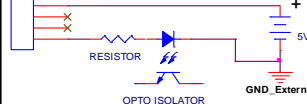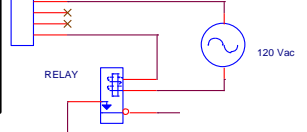**WARNING!** Do not exceed 24Vdc or 10mA into any optoisolator input. Use care to observe the correct signal polarities or damage may occur! Do not exceed 250 Vac or 1 Amp through any relay output.

I/O Pinout
Three inputs and three outputs are provided per connector

Connector I/O 1-3

Pin#	Signal
1	OUT1 Common
2	OUT1 Normally Closed
3	OUT1 Normally Open
4	OUT2 Common
5	OUT2 Normally Closed
6	OUT2 Normally Open
7	OUT3 Common
8	OUT3 Normally Closed
9	OUT3 Normally Open
10	IN1
11	IN1 Common
12	IN2
13	IN2 Common
14	IN3
15	IN3 Common
16	Cable Shield

Connector I/O 4-6

Pin#	Signal
1	OUT4 Common
2	OUT4 Normally Closed
3	OUT4 Normally Open
4	OUT5 Common
5	OUT5 Normally Closed
6	OUT5 Normally Open
7	OUT6 Common
8	OUT6 Normally Closed
9	OUT6 Normally Open
10	IN4
11	IN4 Common
12	IN5
13	IN5 Common
14	IN6
15	IN6 Common
16	Cable Shield

Connector I/O 7-9

Pin#	Signal
1	OUT7 Common
2	OUT7 Normally Closed
3	OUT7 Normally Open
4	OUT8 Common
5	OUT8 Normally Closed
6	OUT8 Normally Open
7	OUT9 Common
8	OUT9 Normally Closed
9	OUT9 Normally Open
10	IN7
11	IN7 Common
12	IN8
13	IN8 Common
14	IN9
15	IN9 Common
16	Cable Shield

Connector I/O 10-12

Pin#	Signal
1	OUT10 Common
2	OUT10 Normally Closed
3	OUT10 Normally Open
4	OUT11 Common
5	OUT11 Normally Closed
6	OUT11 Normally Open
7	OUT12 Common
8	OUT12 Normally Closed
9	OUT12 Normally Open
10	IN10
11	IN10 Common
12	IN11 (shared w/ lifter Lower limit input)
13	IN11 Common
14	IN12 (shared w/ lifter Upper limit input)
15	IN12 Common
16	Cable Shield

Shared Inputs
Note that general inputs #11 and #12 are shared with the Lifter Interface Limit Switch inputs. These inputs can only be used as general purpose inputs if they are **NOT** used by the Lifter limit switches.

If you are using the Lifter Interface and limit switches are connected to these inputs you must set DIP switches SW1-1 and SW1-2 to ON and you should not connect to inputs #11 and #12. Note that the standard Hypertherm Lifter does not use limit switches and the DIP switches SW1-1 & SW1-2 should be OFF so that inputs #11 and #12 can be used.

Switch SW1-1 and SW1-2

Input Mode	SW1-1	SW1-2
Lifter Limit Switch Enabled	On	On
Lifter Limit Switch Disabled	Off	Off

I/O Mating Connector
The I/O connector is a standard sex circular CPC connector from AMP
Connector AMP 16C #206037-1
Backshell AMP #206070-1
Sockets 20-24AWG AMP #66105-3

I/O Setup Screen
The I/O setup screen is used to define inputs, outputs and their logic state.

Note: The input logic for the first twelve I/O would need to be inverted for Dry Contact Mode Inputs so that logic state is shown correctly for operational mode. An Inputs Inverted parameter has been provided for this purpose.

Front Panel I/O
Edge TI has dedicated I/O for operation of front panel switches. NOTE: For proper operation, these inputs should not be reassigned.

Input #	Description
24	Front Panel Start
25	Front Panel Stop
26	Front Panel Forward on Path
27	Front Panel Forward on Path
28	Raise Torch 1
29	Lower Torch 1
30	Front Panel Manual
31	Front Panel E-Stop

Lifter Interface

Edge Ti offers the option of an integrated Torch Height Control. The lifter interface connector is provided for this use. Lower Limit, Upper Limit and Breakaway inputs are sinking inputs to Field Common. Please refer to Sensor™ PHC manual for additional information.

Lifter Pinout (9 Pin Dsub)

Pin#	Description
1	Field +12VDC
2	Lower Limit (shared w/ general input 11)
3	Upper Limit (shared w/ general input 12)
4	Breakaway (Torch Collision)
5	Field Common
6	Field Common
7	Plate Contact -12Vdc
8	Plate Contact Sense
9	Plate Contact Common

Shared Inputs
Note that general inputs #11 and #12 are shared with the Lifter Interface Limit Switch inputs. These inputs can only be used as general purpose inputs if they are **NOT** used by the Lifter limit switches.

If you are using the Lifter Interface and limit switches are connected to these inputs you must, close DIP switches SW1-1 and SW1-2 and you should not connect to inputs #11 and #12. Note that the standard Hypertherm Lifter does not use limit switches and that the DIP switches SW1-1 & SW1-2 should be left open so that inputs #11 and #12 can be used.

Switch SW1-1 and SW1-2

Input Mode	SW1-1	SW1-2
Lifter Limit Switch Enabled	On	On
Lifter Limit Switch Disabled	Off	Off

Mating Connector
Use Hypertherm cable CABL-0207 or recommended 9 Pin Dsub (or equivalent)

Connector AMP #205204-3
Backshell Northern Technology #C88000209
Pins AMP #1-66506-0
Cabling: Use Belden # 9540 or equivalent

Plasma Interface

A plasma interface is provided as standard for Edge TI. This feature is used in conjunction with a Plasma Interface Module to provide connections at the Plasma Supply. Inputs and outputs are dry contact mode. Arc voltage is assigned to Analog Input 5. Please refer to Sensor™ PHC manual for additional information.

Plasma Interface Pinout (15 Pin Dsub)

Pin#	Description
1	Field +12VDC
2	Field +12VDC
3	Plasma Start Output (Cut Control)
4	Plasma Start Output (Cut Control)
5	Hold Ignition Output
6	Hold Ignition Output
7	Transfer Input (Cut Sense)
8	Transfer Input (Cut Sense)
9	Field Common
10	Field Common
11	Field Common
12	Field Common
13	Field Common
14	Electrode Arc Voltage (–)
15	Work Arc Voltage (+)

Mating Connector
Use Hypertherm cable CABL-0208 or recommended 15 Pin Dsub (or equivalent).

Connector AMP #205206-1
Backshell Northern Technology #C88000207
Pins AMP #1-66506-0
Cabling: Use Belden # 9541

External Interlock

An external interlock is provided to remotely disable servo power.

Interlock Pinout

Pin#	Description
1	Interlock Relay Coil
2	GND
3	GND
4	+24VDC (50 milliamps maximum)

Additional Notes:
1. For Servo Drive Amplifiers to operate, Pin 1 must be connected to GND Pin 2, typically through a remote mushroom type switch. If no remote switch is to be used, connect pin 1 to pin 2 with a jumper or the servo drives will not power on.
2. 24VDC is provided for use to activate the digital inputs only in the case where sourced inputs are selected, it must not be used for any other auxiliary purpose.

Mating Connector
Connector AMP #206060-1
Backshell AMP #206062-3
Sockets 20-24AWG AMP #66105-3

Motor Encoder Connections
Edge Ti supports DC brush and brushless motors. Switch SW1 on the drive interface can be used to select motor type being used. Please note the location and setting in the following illustration.

Drive Type selection on Axes Setup screen must be set to CURRENT mode.
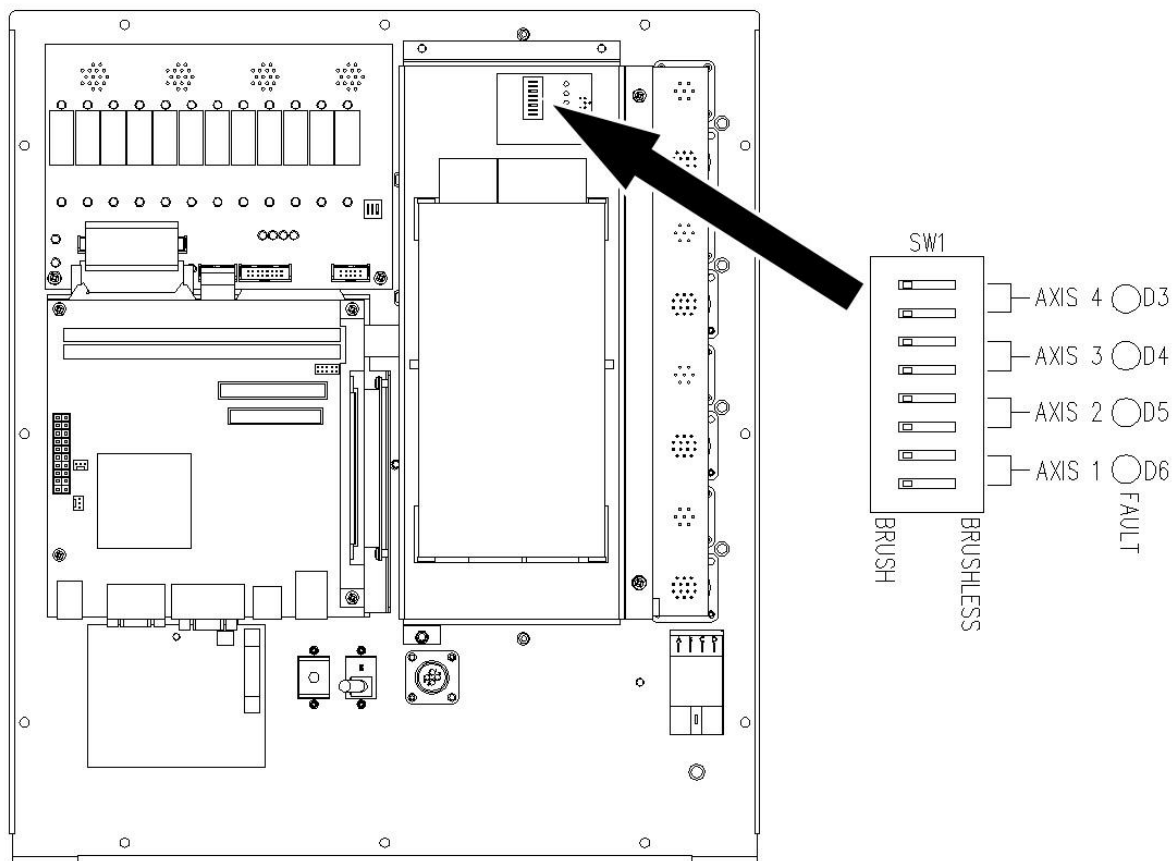
Motor Requirements

250 Watts (each amplifier, 1,000 watts total)
70 VDC Bus
4 Amps Continuous, 6 Amps Peak (for 2 seconds)
+5VDC differential encoders
Brushless motors also require Hall Effect sensors phased at 120 degrees

Axes Assignments

Axes	Axes Assignment
1 (X)	Transverse or Rail
2 (Y)	Transverse or Rail
3 (Z)	Dual Gantry, CBH, or THC
4 (W)	CBH, or THC

Motor Power Pinout

Pin#	Description
1	Brushless Motor-A or Brush +
2	Brushless Motor-B or Brush -
3	Brushless Motor-C
4	Brake + (24VDC, 250ma max)
5	Brake -
6	Cable Shield
7	No Connect

Additional Notes:
1. Brake output is limited to 250ma total. This output is only used on the THC vertical axis.

Drive Motor Mating Connector
Connector AMP #211399-1
Backshell AMP #206966-1
Sockets 16-18AWG AMP #66101-3
Cabling: Use Belden # 9552 or equivalent for brushed motor signals
Cabling: Use Belden # 9553 or equivalent for brushless motor signals

Encoder Pinout:
1   Encoder +5V
2   Encoder GND
3   Encoder Channel A
4   Encoder Channel A/
5   Encoder Channel B
6   Encoder Channel B/
7   Encoder Channel Z
8   Encoder Channel Z/
9   +V Hall Out (6V @ 30MA max)
10   Hall GND
11   Hall - A
12   Hall - B
13   Hall - C
14   Cable Shield

Additional Notes:
1. Only 5 Volt encoders are supported.
2. Hall Sensors are used with Brushless motors only.
3. Inside the Edge Ti, dipswitches are used to select Brush or Brushless mode, 2 switches per axis. Can mix Brushed and Brushless if switches are set properly.
4. For optimum noise immunity, cable shields may be tied externally to the control enclosure.

Encoder Mating Connector
Connector AMP #206044-1
Backshell AMP #206070-1
Pins (20-14AWG) AMP #66103-3
Cabling: Use Belden # 9504 or equivalent for brushed motor signals
Cabling: Use Belden # 9507 or equivalent for brushless motor signals

Reminder: Drive Type selection on Axes Setup screen must be set to CURRENT mode.

Optional Motor Information

MOTOR SPEC		
PARAMETERS	UNITS	VALUE
TORQUE CONSTANT	N-M/A	0.18
	IN-LB/A	1.56
VOLTAGE CONSTANT	V/kRPM	16
RESISTANCE	Ohm	0.14
INDUCTANCE	mH	0.45
CONT. STALL TORQUE	N-M	1.65
	IN-LB	14.6
CONT. STALL CURRENT	A	9.35
PEAK TORQUE	N-M	4.95
PEAK CURRENT	A	28.1
BACK EMF VOLTAGE	V	128
NO LOAD MAX SPEED	RPM	4000
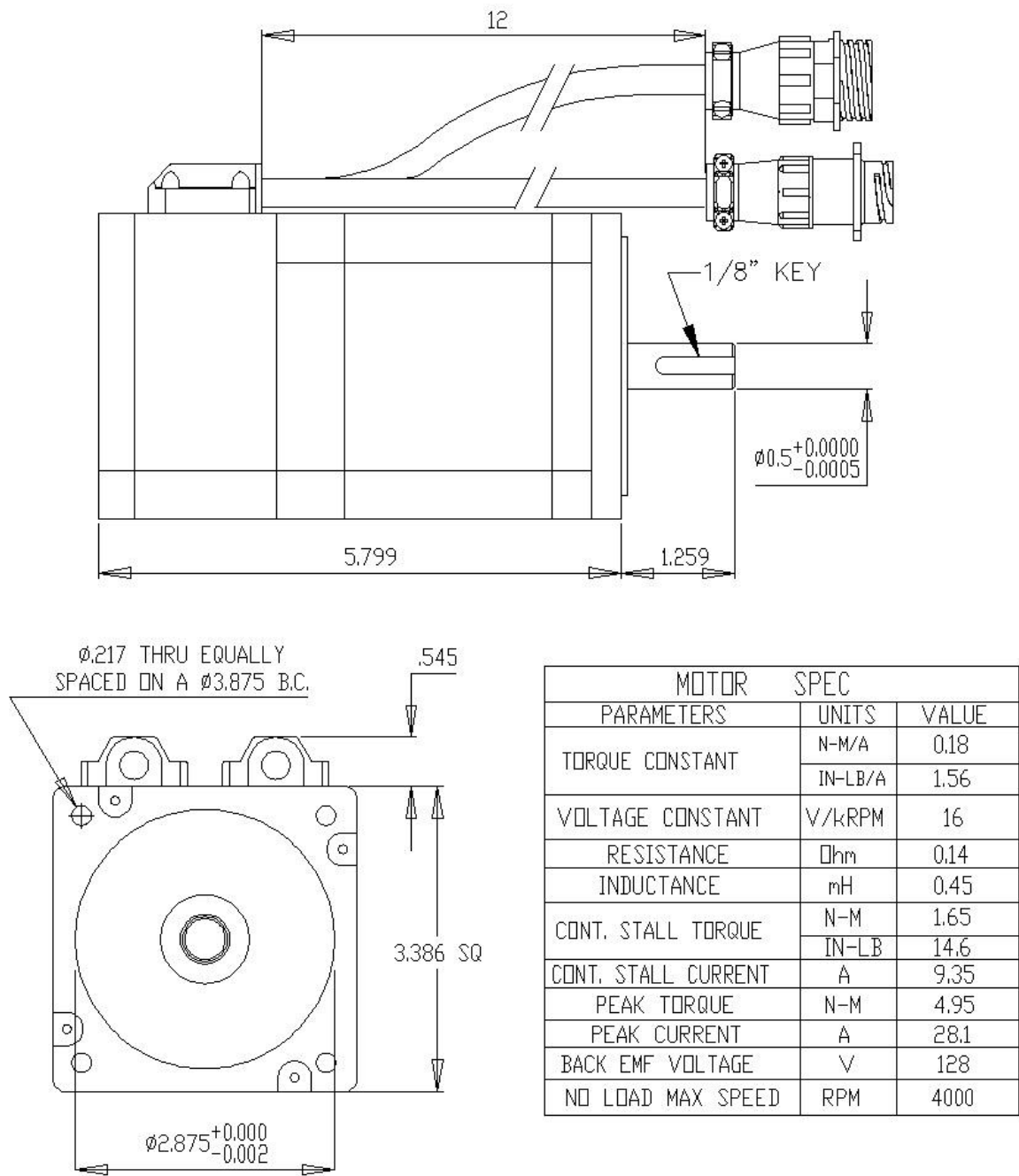
Optional Lifter Assembly Information

Plasma Interface

Start Output
(contact closure)

+12V Output
50mA Max

Hold Output +
Hold Output -

Common for
12V Output

Signals
Enter Here

High Voltage
Enter Here

-Transfer Input

+Transfer Input

Work Connection
(positive ground)

Connect Negative
Electrode Voltage
Here.

DANGER
HIGH VOLTAGE
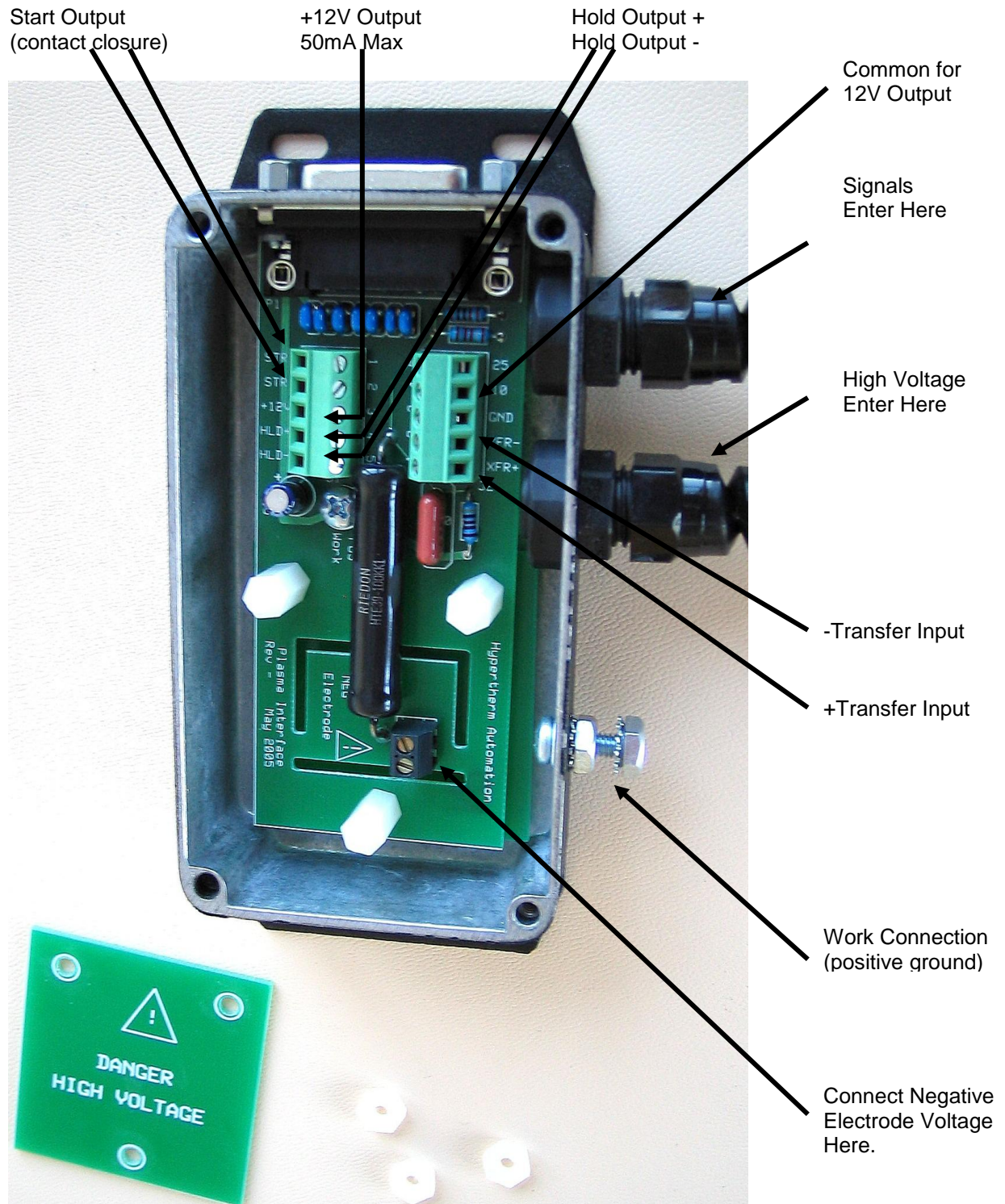
Plasma Interface Assembly Mounting
Mount the plasma interface assembly close to the plasma power supply for easy connection of arc
voltage and signal wires between the units. The unit can be mounted in any position and can be
mounted directly to the back or inside of the power supply. The mounting holes are sized for #6 or
M3 fasteners. See Below

⚠ **NOTE: For reliable operation the ground terminal must be connected to the plasma
power supply positive ground. This connection provides the grounded positive arc voltage
sense point.**

SLOTS FOR #6
OR M3 SCREWS

⚠ *WARNING*!
Connect to WORK
(positive ground)

Optional Lifter Assembly

All Cable Connections
exit top cover

Torch Magnetic
Breakaway

All Lifter components, including
Motor and Brake, are fully
enclosed
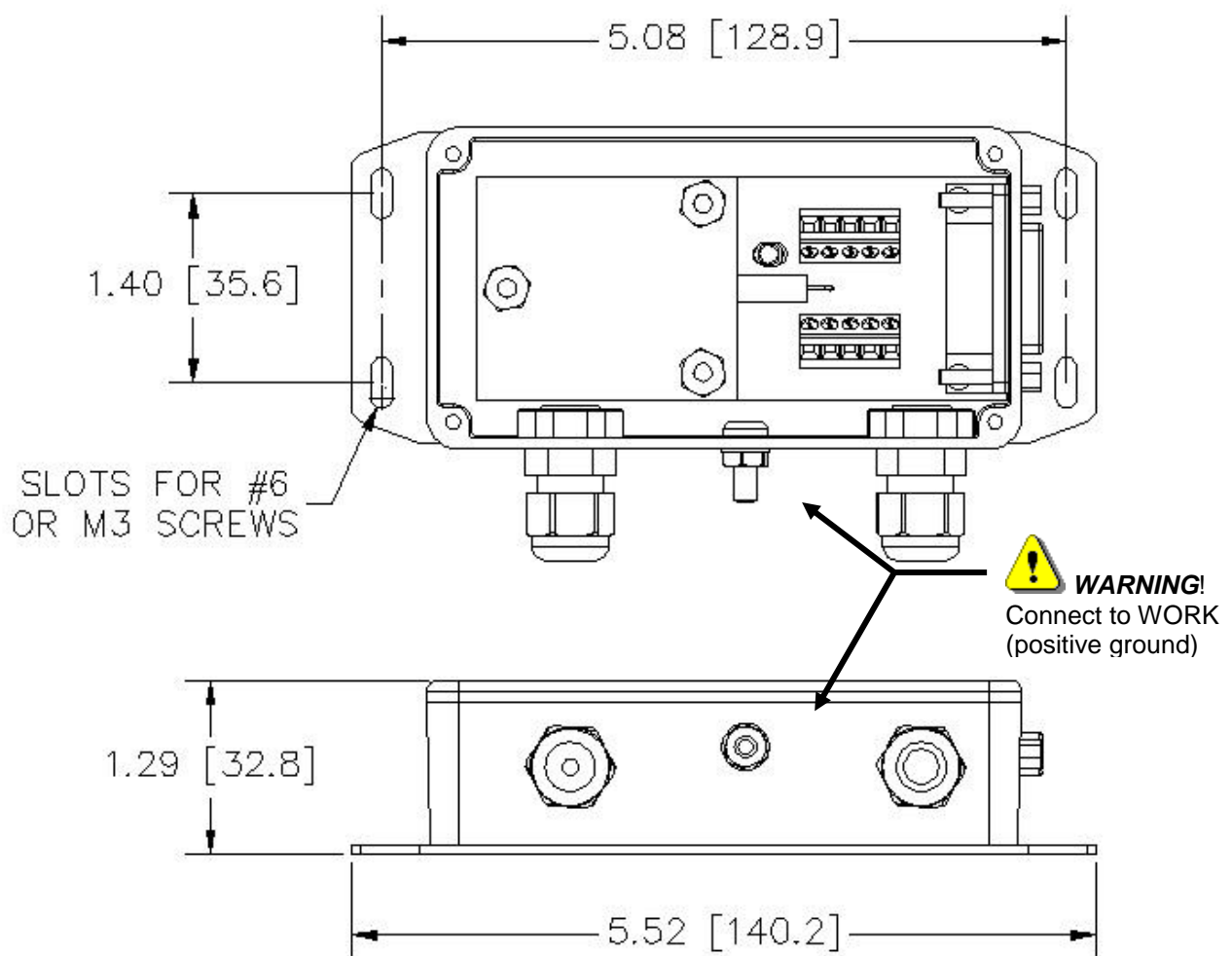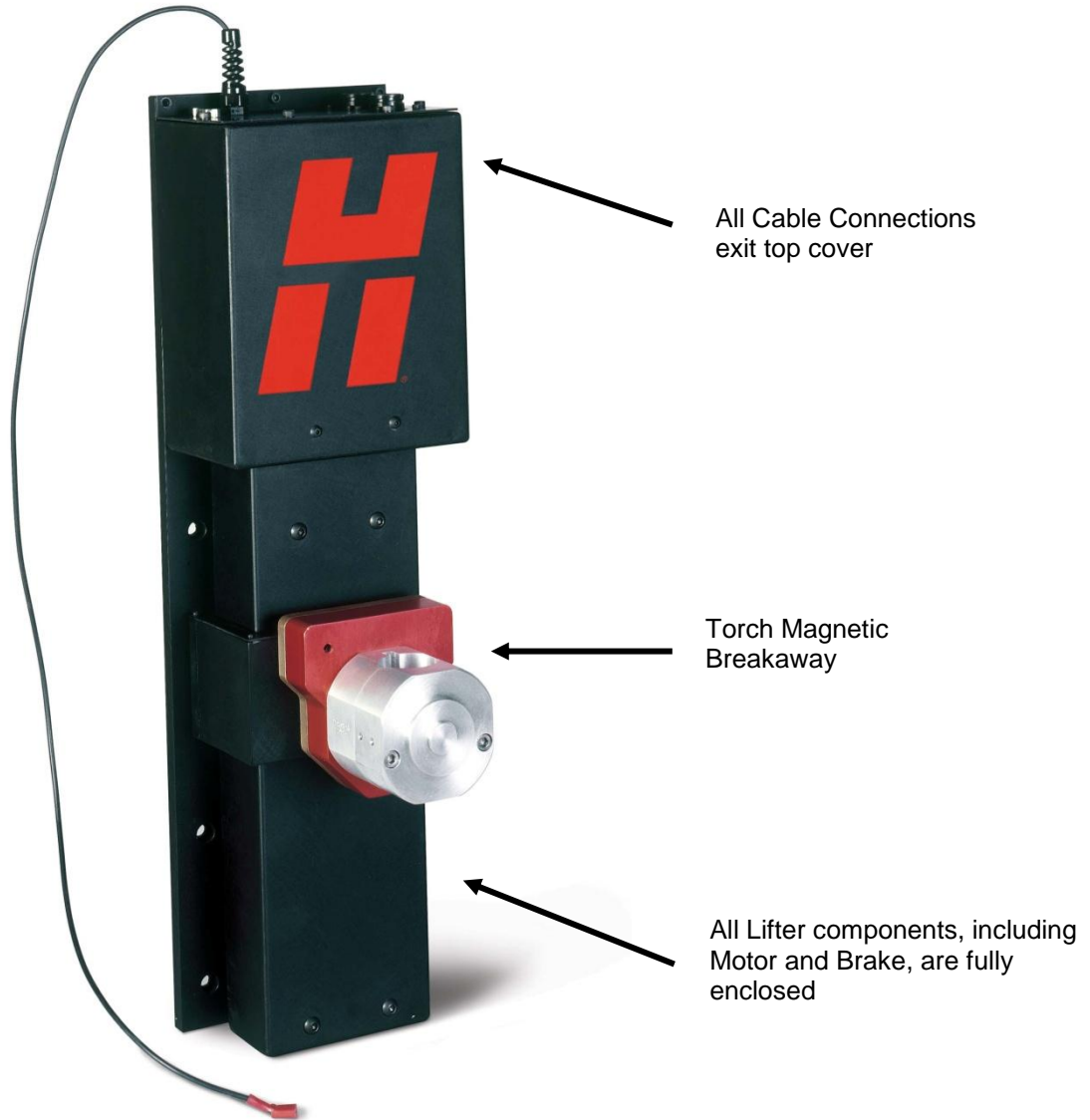
Lifter Assembly Mounting
Mount the lifter assembly on the cutting table. The lifter should be mounted to take the maximum advantage of the vertical travel range. Typically the bottom of the lifter should be between 6 and 8 inches above the cutting table. If required the torch breakaway gap set-screw can be adjusted to change the clamping force. For normal operation this adjustment is preset at the factory.

⚠ **NOTE: For reliable operation the ground must be connected**.

GROUND STUD
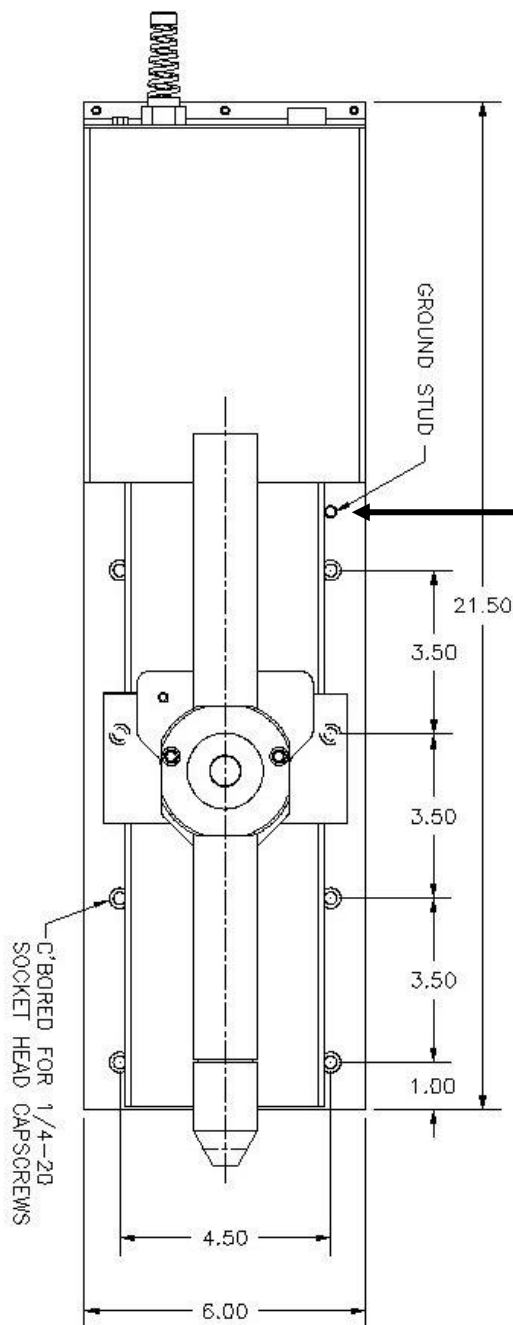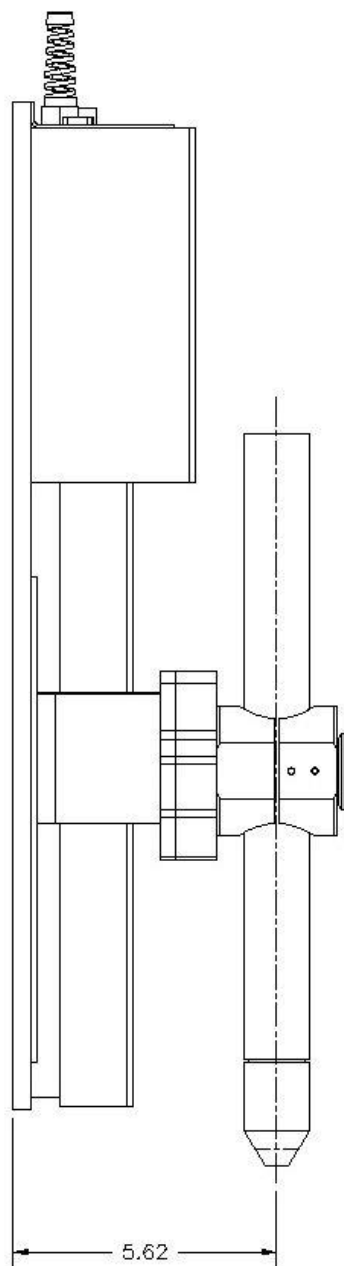
⚠ *WARNING!*
Connect Ground Here

21.50

3.50

3.50

3.50

1.00

C'BORED FOR 1/4-20
SOCKET HEAD CAPSCREWS

5.62

4.50

6.00

Torch Breakaway Assembly
The torch breakaway (MECO-0234) should be mounted to the lifter as shown in figure below.

⚠ **CAUTION**: *The breakaway uses extremely strong magnets to clamp the two halves of the breakaway unit together. Extra care should be used when mating the two halves of the breakaway*.

Hold the breakaway at a 45 degree angle to the mounting plate and carefully place the lower alignment pin into the mating depression on the breakaway back plate. Slowly angle the breakaway toward the back plate, being careful not to get your fingers pinched between the two halves. Once installed, it will be nearly impossible to separate the two halves without the leverage provided by the mounting block and torch.
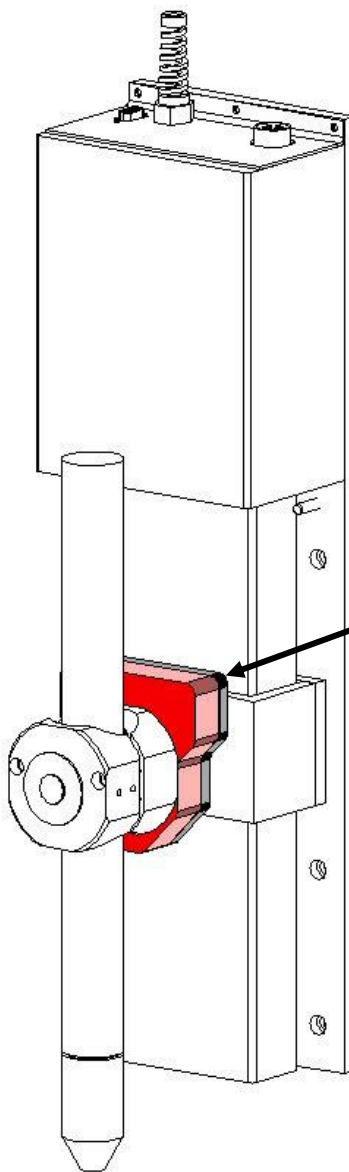
⚠ **WARNING!**
Pinch Point: Use Caution when mating two halves of Torch Breakaway Assembly.

Torch Mounting Block Kit
Mount the torch mounting block kit to the lifter torch breakaway assembly. See below.

The mounting blocks are available in three sizes as listed.

- PN = MECO-0108   Torch Mounting Block 1 3/4" diameter
- PN = MECO-0109   Torch Mounting Block 2" diameter
- PN = MECO-0130   Torch Mounting Block 1 3/8" diameter

Breakaway
Mounting Plate

Torch Breakaway

Torch Mounting Clamp
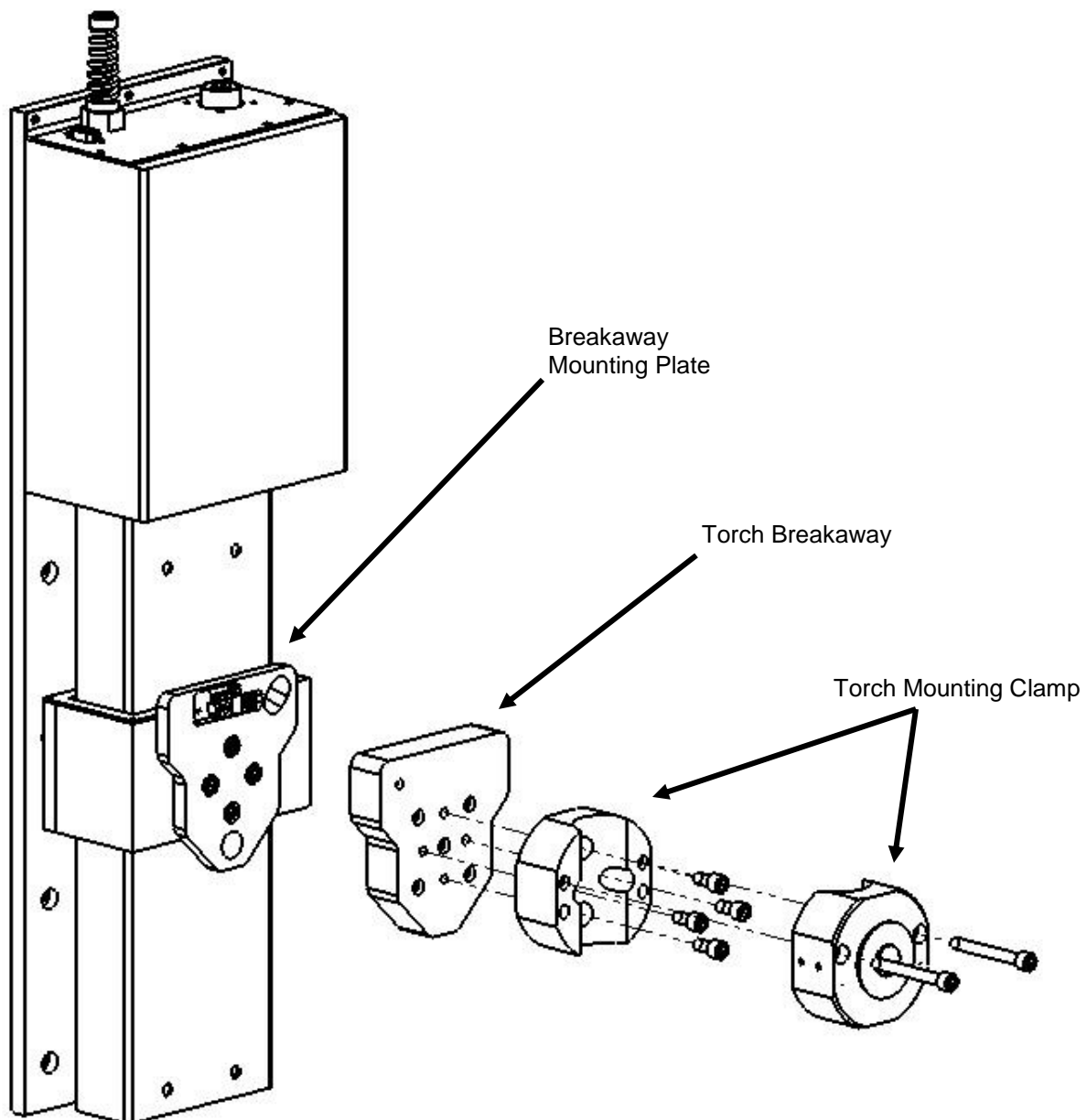
Grounding Requirements

⚠️ **WARNING!**

To ensure personal safety, proper operation and to reduce electromagnetic interference (EMI), the PHC system must be properly grounded.

Power cord grounding

The PHC control module must be properly grounded through the power cord according to national or local electrical codes.

Protective earth ground

Install protective earth (PE) grounding cables to the PHC components as shown below. Grounding must comply with national or local electrical requirements.

Note: The PE (Ground) cables must be supplied by the customer.

Ground Lifter
Assembly Here

WORK Connection
(positive ground)
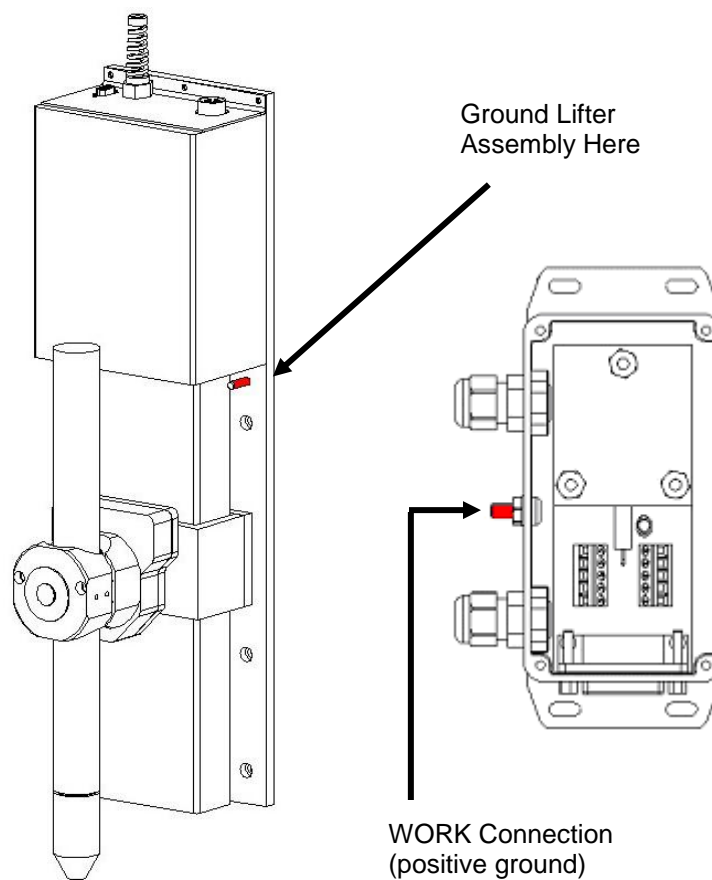
Voyager III

Overview

The Voyager III™ PC based CNC control for the metal cutting industry utilizes our proprietary Graphical User Interface (GUI) and *SoftMotion* Technology. Voyager III provides the user with increased performance and greater operational flexibility utilizing a 15" touch screen display, 2.4Ghz Intel processor, proprietary operational software and a unique SERCOS/Analog machine interface. Common applications for Voyager class controls include: bevel head systems, multiple Sensor Torch Height Controls and other advanced systems requiring more than four axes for machine interfacing.

Touch Screen

The 15" display used in the Voyager III is a patented IntelliTouch Surface Wave technology which provides precise drift free touch accuracy and unsurpassed clarity. Pure glass construction with tiny transducers on the back of the touch screen preserves color purity and works even if scratched. There is no known wear out mechanism as there are no layers, coatings or moving parts. IntelliTouch technology has been tested by the supplier for more than 50 million touches in one location without failure.

THC, Joystick & Speedpots

Optional features for Sensor THC, Joystick and Speedpots are offered.

Note: Use of some devices such as USB memory devices may require loading of a device driver for operation. Many standard device drivers are located in the C:\CABS or D:\CABS\I386 folders.

Operation and maintenance of automated equipment involves potential hazards. Personnel should take precautions to avoid injury. This equipment should only be opened by trained service personnel.
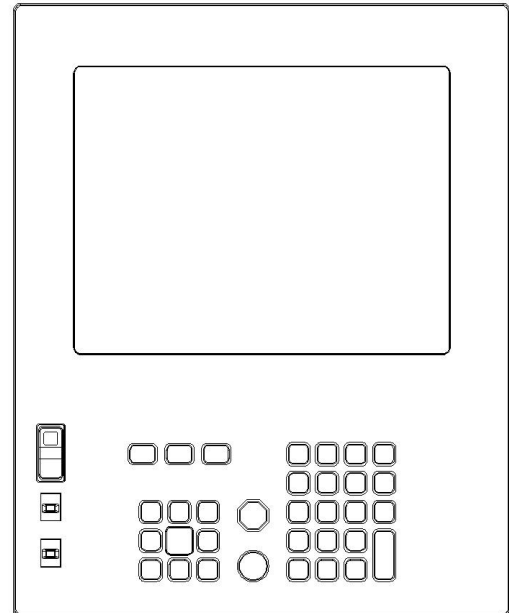
Rear View
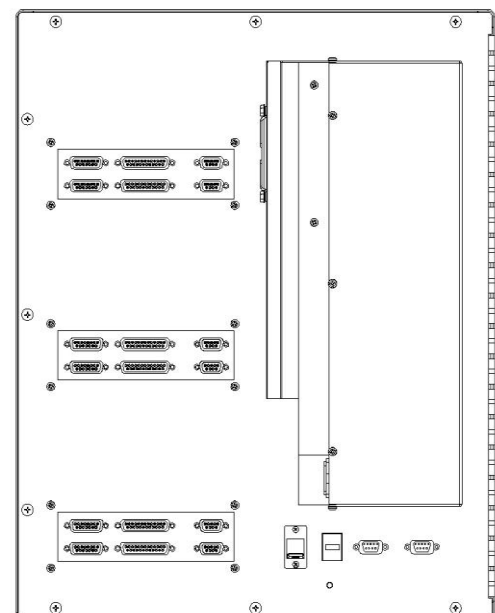
Voyager III incorporates a unique machine interface designed by Hypertherm Automation to convert SERCOS (Serial Real Time Communication) to a traditional analog interface. For those not familiar with SERCOS, it is a fiber optic communication ring for commanding motion and controlling I/O that is available from many drive suppliers.

This new interface approach allows Voyager III to offer three styles of machine interface, increasing system flexibility for wiring and features.

Interface options:

1) The standard configuration of Voyager III uses SERCOS internally but provides a traditional and familiar analog machine interface on the back of the CNC.

2) Standard SERCOS interface with a fiber optic cable connected to SERCOS amplifiers and I/O.

3) The new SERCOS to Analog conversion card (part # ASSY-0191) is mounted externally using fiber optic communications to the card. The card then provides a traditional analog interface output to motion amplifiers and I/O.

Each interface card offers two axes of motion, thirty-two (16/16) 24VDC positive logic inputs and outputs, plus two analog inputs for Speedpot and Sensor THCs.

The information contained in this section is intended to provide the basic information for connection of the Voyager III™ Shape Cutting Control to the cutting table. Each machine interface will vary slightly based on the cutting table configuration and features. Additionally, I/O pinout information may vary slightly based on the configuration of the selected I/O and their locations. Changes to the I/O configuration may be made in the password protected I/O screen. All controls are shipped with the default selection of Inputs and interface locations for the selected control Interface (I/O) configuration. Installation and service should only be performed by a qualified service technician. For more information regarding the I/O process definitions, please refer to the Setups section of this guide.

Setups

Drive Type
The manufacturer of the SERCOS style drive being used would be selected. This allows proper operation and tuning parameters to be available. SMCC is the default setting for Voyager III.

Update Rate
The update rate for the ring may be selected for motion and I/O. One millisecond is the default setting for Voyager III.

Baud Rate
Communication rate for the ring may be selected. 16 Mbaud is the default setting for Voyager III.

Light Level
The user has the ability to adjust the intensity of the light pulses used on the fiber optic ring. This feature is used to compensate for diminished signal due to issues such as ring distance. Low is the default setting for Voyager III

Drive I/O
The user may select to use I/O options directly supported on the Drive Amplifier. Options are None, Overtravel and Home Switches only or All I/O. Note: The Drive I/O will populate the general purpose I/O (both analog and digital) in order from the lowest SERCOS drive axis to the highest SERCOS drive axis. All I/O is the default setting for SMCC / Voyager III interface.

RECO I/O at Address 50
This parameter is set to Yes if the Indramat RECO I/O module is being used to expand the total number of I/O being used on the standard fiber optic ring. Note: The RECO I/O will populate the general purpose I/O (both analog and digital) following all drive I/O. The default setting for Voyager III is NO.

HTA I/O at Address 70
This parameter is set to Yes if one of the SERCOS to Analog cards is set to be used for I/O expansion.

Common Status Messages

Starting Up Drives on SERCOS Ring. Phase 1 -4
This is a status message to indicate the SERCOS ring power up and will advance through phases 1-4. Failure to reach phase 4 indicates a problem with power up. Cycle power to initiate SERCOS phase up again. If the system repeatedly fails to enable the SERCOS ring, contact your vendor for assistance.

SERCOS Ring not Running. Restart Ring?
This status message indicates the SERCOS ring is currently not running. You may see this when a command such as a motion command is requested but the RING was not enabled. Restart of the ring is recommended.

Updating SMCC software.....
After a control software update, the SERCOS to Analog card software may also be updated at restart of SERCOS ring. It is important not to interrupt this update sequence.

SERCOS Ring Not Running. Please Check Power, Status of LEDs on Drives and I/O Modules, Fiber Optic Ring Connections and SERCOS Baud Rate.
This status message indicates the SERCOS ring is not running after power up. It is recommended to check hardware and parameters then restart the ring by power cycle.

New Setups May Require Restarting SERCOS Ring to Take Effect. Restart SERCOS Ring?
When changes are made to system configuration that affect the SERCOS ring operation, you may be prompted to restart the ring. Restart of the ring is recommended.

SERCOS Drives Not Enabled and Ready. Please Check Drive are Enabled and Ready with No Errors.
This status message indicates the SERCOS ring is not running due to a missing enable signal. First check that the Control Enable Disabled softkey is correct. The softkey should read DISABLE CONTROL. Then check status of ring hardware or external drives to ensure there are no errors displayed.

Machine Interface

I/O Configuration Type "V" (Positive Logic Single Ended I/O)
Connecting single ended I/O to the control. The control provides +24V power on pins 22, 23 & 24 (+24 VDC) and pins 9, 10, 11 &12 (24 VDC Common) on the I/O connector.

Output tied to external Cut On   **Input tied to Cut Sense Relay**
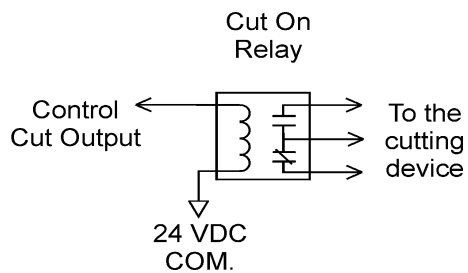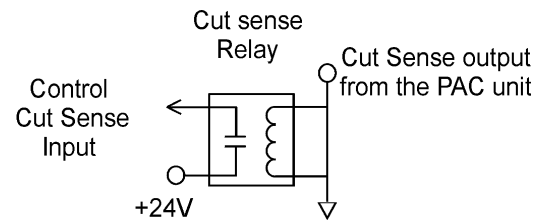
Cut On
Relay

Control
Cut Output

To the
cutting
device

24 VDC
COM.

Cut sense
Relay

Cut Sense output
from the PAC unit

Control
Cut Sense
Input

+24V

Examples of possible circuits

Output

Input

Single Ended I/O Pinout
The Single Ended I/O offers up to 48 outputs which are rated at 24VDC for up to 1-amp loads and 32 inputs rated for 24VDC as standard

I/O Connector

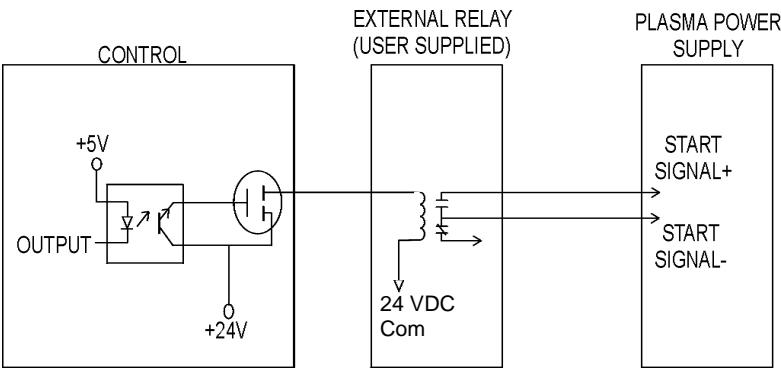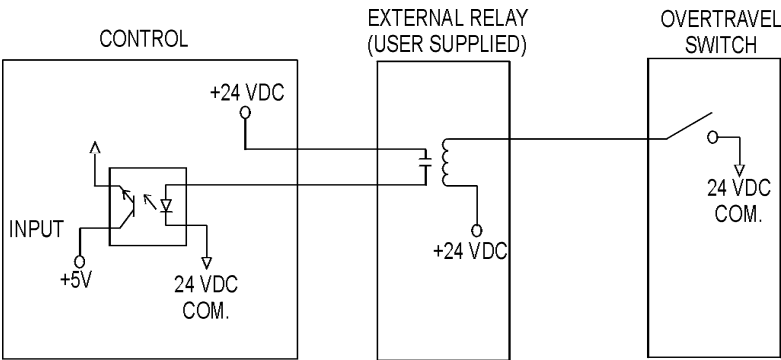| Pin	Description
1	Output 1
2	Output 2
3	Output 3
4	Output 4
5	Output 5
6	Output 6
7	Output 7
8	Output 8
9	+24 VDC Common
10	+24 VDC Common
11	+24 VDC Common
12	+24 VDC Common
13	Watchdog Contact
14	Input 1
15	Input 2
16	Input 3
17	Input 4
18	Input 5
19	Input 6
20	Input 7
21	Input 8
22	+24 VDC
23	+24 VDC
24	+24 VDC
25	Watchdog Contact

Note: Wiring pattern continues incrementally for I/O 9-16, 17- 24, 25-32, 33-40, 41-48

Mating Connector
Connector: 25C D-Sub Amp # 207464-2 or equivalent
Backshell: Amp #748676-3 or equivalent
Pins: Amp #5-66506-9 (20-24 AWG) or equivalent

Axes	Connector Location*	Axes Assignment
1	Axis 0	X- Transverse or Rail
2	Axis 1	Y- Transverse or Rail
3	Axis 2	Dual Gantry, CBH, Rotate or THC
4	Axis 3	CBH, Tilt or THC
5	Axis 4	Rotate or THC
6	Axis 5	Tilt or THC

Note: Markings on backdoor machine interface for Axes are zero based.

Drive/ Encoder Pinout

Pin	Description
1	Channel A Input
2	Channel B Input
3	Channel Z Input
4	Encoder Power Output (5 VDC supplied as standard)
5	Field Common
6	Servo Output ($\pm$ 10V)
7	Drive Enable In (relay contact)
8	Field Common
9	Channel /A Input
10	Channel /B Input
11	Channel /Z Input
12	Field Common
13	Field Common
14	Servo Output Common
15	Drive Enable Out (relay contact)

Note: Cable Shields should be connected to chassis ground.

Drive/ Encoder Input Mating Connector
Connector: 15C D-Sub Amp # 25206-3 or equivalent
Backshell: Amp #748676-2 or equivalent
Pins: Amp #5-66506-9 (20-24 AWG) or equivalent

Note: Wiring pattern continues for additional Axes

Analog Connection Pinout

Note on analog connector: For opertional flexibility, inputs and outputs have a shared logic and are provided in both positive logic (+24VDC) and negative logic (24VDC common).

In this application shared I/O means that a single I/O assignment is offered at three locations.

Example: Output 15 could be assigned as the I/O connector a Nozzle Contact Enable. Once assigned in software, this output signal would be available as:

- A positive logic output on second I/O connector Pin 20
- A positive logic output on analog connector Pin 7
- A negative logic output on analog connector Pin 8

Analog 1

Pin #	Designation	Description
1	Analog 1 +	Analog Input (0-10VDC)
2	Analog 1 -	Analog Common
3	+24VDC	
4	Duplicate Input 15	Positive logic shared input 15
5	Field Common	
6	Alternate Input 15	Negative logic shared input 15
7	Duplicate Output 15	Positive logic shared output 15
8	Alternate Output 15	Negative logic shared output 15
9	Field Common	

Note: Wiring pattern continues for Analog 2-6
Assignable shared I/O locations are 15, 16, 31, 32, 47, 48

Mating Connector
Connector: 9C D-Sub Amp # 205204-4 or equivalent
Backshell: Amp #748676-1 or equivalent
Pins: Amp #5-66506-9 (20-24 AWG) or equivalent

Sensor THC Interface

Analog 9C		Divider J2
Pin #	Description	Pin #
5	24V Common	1
6	Nozzle Contact Sense	3
8	Nozzle Contact Enable	4
1	Analog In+	6
2	Analog In–	7
Chassis	Shield	No Connection

Mating Connector
Connector: 9C D-Sub Amp # 205204-4 or equivalent
Backshell: Amp #748676-1 or equivalent
Pins: Amp #5-66506-9 (20-24 AWG) or equivalent
Cable Belden #9505 or equivalent

Note: Wiring pattern continues for Analog 2-6

It is recommended that the Hold Ignition Input be wired to the Power Supply through an external relay from the I/O connector. Please refer to instructions from supply manufacturer for details on connection to the Hold Ignition Input.

Voltage Divider Card Pinout (Series 3)
Part # PBS-0061

Divider PCB - 2C Connector J1

Pin #	Description
1	85 -265 VAC Power Input (47-63Hz)
2	85 -265 VAC Neutral Input

Mating Connector
2C Phoenix Connector – Phoenix Part # 1840366

Divider PCB - 8C Connector J2 to Control Analog Connector

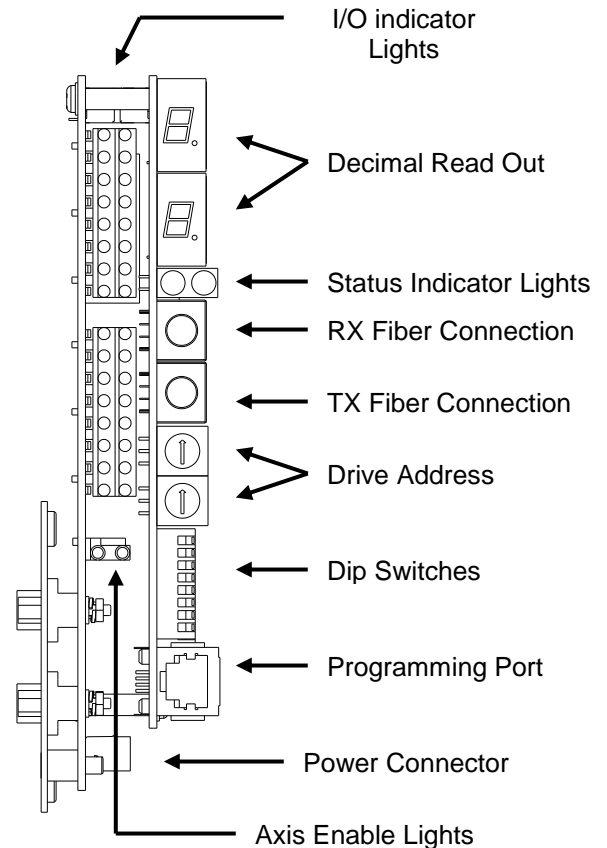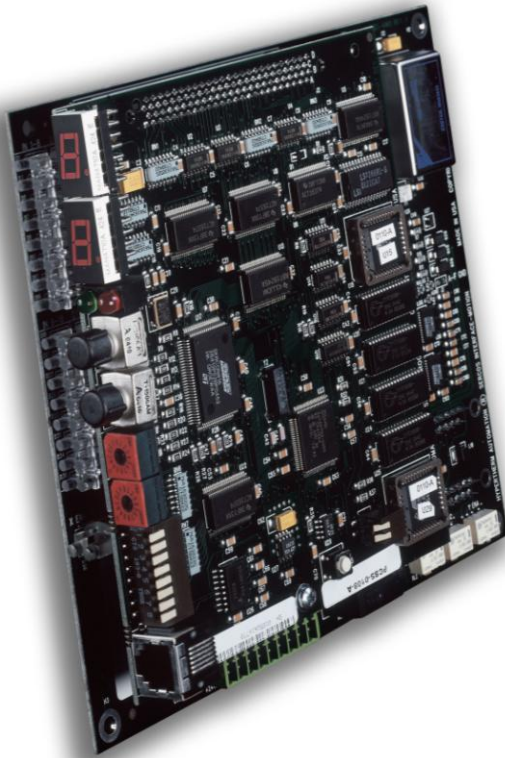| Pin #	Description
1	+24 VDC Common
3	Nozzle Contact Sense
4	Nozzle Contact Enable
6	Analog Out +
7	Analog Out –
8	E Ground

Mating Connector
8C Phoenix Connector – Phoenix Part # 1803633

Divider PCB - 5C Connector J3 to Plasma Supply / Table

Pin #	Description
1	Ground (Chassis Ground)
2	Electrode (Plasma DC –)
3	Work (Plasma DC +)
4	NC
5	Shield (Nozzle Contact)

SERCOS to Analog Conversion Card

I/O indicator Lights

Decimal Read Out

Status Indicator Lights

RX Fiber Connection

TX Fiber Connection

Drive Address

Dip Switches

Programming Port

Power Connector

Axis Enable Lights

Decimal Read Out
The 7 segment display indicates SERCOS ring phases status 1-4. Additionally, the 2 decimal points in the 7 segment display indicate phase condition for the SERCOS ring and are on immediately after CNC boot up and reset. They remain on until the ring is successfully phased up to phase 4. After that the decimal points remain off even if the ring drops from phase 4. With this approach, if the SERCOS ring is not running, you can determine if the ring has ever made it to phase 4 during that power on cycle. This assumes the card has not been reset or lost power.

Status Indicator Lights
A Red and Green light are provided to indicate status of the SERCOS ring. Red indicates a Fault and Green indicates a RUN status.

Drive Address Rotary Hex Switches
Factory settings are as follows:
For Axes 1 and 2: SW1 = 0, SW2 = 1
For Axes 3 and 4: SW1 = 0, SW2 = 3
For Axes 5 and 6: SW1 = 0, SW2 = 5
For Axes 7 and 8: SW1 = 0, SW2 = 7
For Axes 9 and 10: SW1 = 0, SW2 = 9
For Axes 11 and 12: SW1 = 0, SW2 = B

Note: Markings on backdoor machine interface for Axes are zero based.

Address Rotary Hex Switches (for I/O only)
For I/O Expansion Interface (no Axes being used): SW1 = 7, SW2 = 0

Programming Port
This is for factory use only. Used when E2 code is displayed (see error codes below).

Dip Switch Settings

Fiber Optic Light Level:
Location SW3
Low Level (0-15 meters): 1 = OFF, 2 = OFF
Medium Level (15-30 meters): 1 = ON, 2 = OFF   (Default setting)
High Level (30-45 meters): 1 = OFF, 2 = ON
MAximum Level (>45 meters): 1 = ON, 2 = ON

Baud Rate:
Location SW3
16 MBAUD 3 = ON, 4 = ON (Default setting)
8 MBAUD 3 = ON, 4 = OFF
4 MBAUD 3 = OFF, 4 = ON
2 MBAUD 3 = OFF, 4 = OFF

Reserved:
Location SW3
5 = OFF, 6 = OFF, 7 = OFF, 8 = OFF

Flash Write Jumpers (not present on later revisions):
Location SW4
1 = ON, 2 = ON

Reset Button (not present on later revisions) :
SW5 – Press to reset card

Error Codes:
E1 Display Code = "Voltage or Temperature Error Detected!"
Displayed if voltage or temperature sensors on Field Interface board indicate an error. Please check power supply, wiring and connections.

E2 Display Code = "Bad Checksum for SMCC Software!"
Displayed if checksum for SERCOS Slave Flash Program is not correct. Program needs to be reloaded using the Serial Port connection.

E3 Display Code = "Wrong Interface Board Detected for Selected SERCOS Address!"
Displayed if the selected SERCOS Slave Address/SERCOS Slave mode does not match the Field Interface functionality. For example, using an HPR Field Interface with a SERCOS Slave card set to Drive Address 1-12 is not possible, since these are axes SERCOS addresses only, not peripheral I/O SERCOS addresses.

Mariner

Overview

Mariner ™ offers motion control operation of up to 12 axes with 1024 I/O signals with SERCOS™ Interface, providing a high degree of flexibility in operation and table configurations. This control system supports Multiple Sensor™ Torch Height Controls, Tilt/Rotate, Dual Tilt/Rotate and Dual Transverse motion axes along with direct communication to Hypertherm's HD3070® HyDefinition® Autogas Console, HD4070® HyDefinition® and HPR™ Plasma systems. A unique Laser process screen directly integrates to Hypertherm's *FAST*Laser head. This product uses type "V" software.

Mariner™

Touch Screen

The 15" display used in the Mariner control is a patented IntelliTouch Surface Wave technology which provides precise drift free touch accuracy and unsurpassed clarity. Pure glass construction with tiny transducers on the back of the touch screen preserves color purity and works even if scratched. There is no known wear out mechanism as there are no layers, coatings or moving parts. IntelliTouch technology has been tested by the supplier for more than 50 million touches in one location without failure.

THC, Joystick & Speedpots

Features for Sensor THC, Joystick and Speedpots are provided as standard. Connection and operation information is provided in the Operators and Installation Guide provided with this product.

Note: Use of some devices such as USB memory devices may require loading of a device driver for operation. Many standard device drivers are located in the C:\CABS or D:\CABS\I386 folders.

Operation and maintenance of automated equipment involves potential hazards. Personnel should take precautions to avoid injury. This equipment should only be opened by trained service personnel.
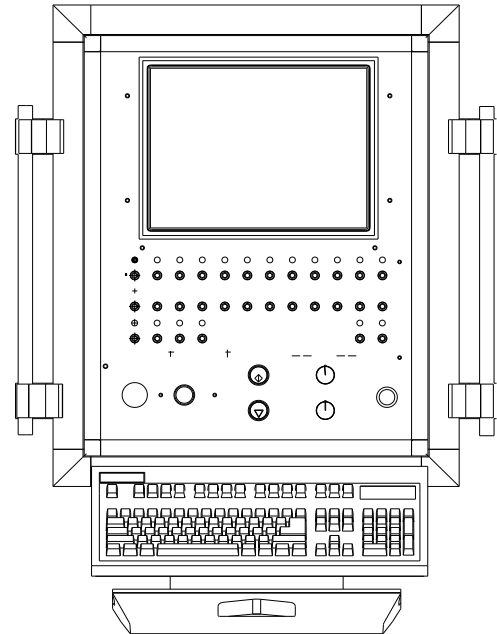
The Mariner™ Shape Cutting Control is designed with all machine interface connections passing through the pedestal mount at the base of the enclosure. Motion and I/O are supported via the fiber optic communication ring of the SERCOS Interface™.

The information contained in this section is intended to provide the basic information for connection of the Mariner™ Shape Cutting Control to the cutting table. Each machine interface will vary slightly based on the cutting table configuration and features.

AC Input Pinout

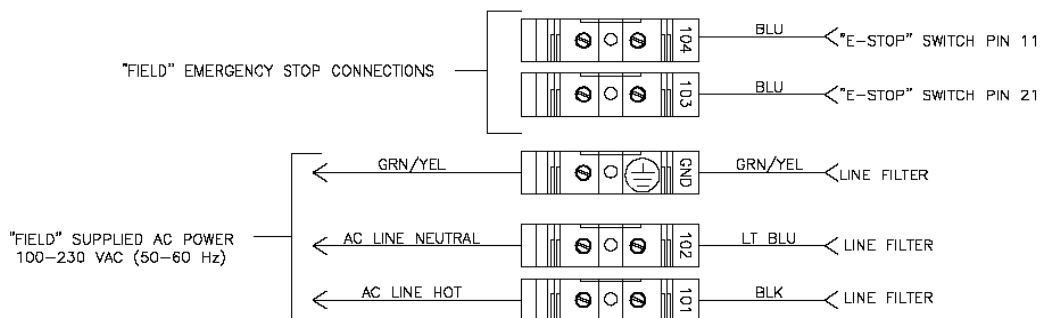| TB connector	Description
101	110VAC or 220VAC Input (Hot)
102	110VAC or 220VAC Input (Neutral)
	AC Power Ground

Recommended Wire
14 AWG or greater

E-Stop
The E-stop Switch provides normally open contacts rated at 20VAC/500mA minimum to 250VAC/6A maximum.

TB connector	Description
103	Contact Closure
104	Contact Closure

Diagram Location Din-02

SERCOS Motion and I/O

As noted previously, Motion and I/O are supported via the fiber optic communication ring of the SERCOS Interface™. Digital and Analog I/O are supported.

Motion is controlled through address assignments for the axes. Inputs and Outputs work on a similar assignment in SERCOS and may be mapped at the I/O configuration screen.

Details for wiring the motion and I/O are specific to the specific SERCOS hardware being used. Please refer to the appropriate supplier for interfacing information.

Networking

This information is provided to assist in the connection of the control to a customer's local area network and some of the issues that may arise due to that connection. This list is by no means all inclusive but attempts to shed some light on the process. Because there are many different network systems, the general connection rules may need to be altered by a qualified network technician on a case by case basis.

Network Operating System

The Network functions involve operational knowledge of Windows® XP operating system and should only be performed by qualified personnel.

The Hypertherm Automation controllers are designed to work with Microsoft Windows XP based network operating systems.

In each case, the control uses the Local Admin account and has the Computer Name "CNC" , User Name "administrator" with a password of "1396". No additional user accounts should be added in order to maintain the performance of the cnc.

The controller is set up at the factory to automatically log into the local machine, "CNC" as the Administrator. It is important that the "local" logon takes place because they system needs to have Administrative rights on the local machine. Network connections can then be mapped to a share on the host network using whatever user name the customer provides, if the network mapping is set to re-establish on power up when it is created, then it will automatically be setup when the control is turned on. If it is necessary to change the user names and/or password you may have to go to the registry editor to make these changes. The appropriate keys are located in:

HKEY_LOCAL_MACHINE->Software->Microsoft->Windows NT->CurrentVersion->WinLogon

Configuring the Network Interface (nic)

There are several things that you need to be aware of in order to make the control work on the network. Setting these up will usually involve attaching a keyboard and mouse to the controller. Before you begin you need to know:

A. Will you be using a DHCP Server on the network?
a. If NOT using a DHCP Server what are the TCP/IP network settings

1. IP address: _____
2. NetMask: _____
3. Gateway: _____
4. DNS: _____

NOTE: It is highly recommended that the DHCP Server method be used as it will ensure that the above parameters are set correctly.

A. Will the controller be part of a Windows Domain or Workgroup?
B. What is the name of the Domain or Workgroup?
C. Has the "operator" user and password been added to the server?
D. If using a Domain – you will need an administrator, or a user and password which allows joining a new computer to the Domain. (It is not necessary to join the local area network Domain in order to use a network share – in fact the network connection is simplified if the controller is set up to be part of a workgroup!)

 In the following steps when you need to enter a name or number, do NOT include the quotes " !

1. Be sure to create a user account on your network file server (Windows Server).
    a.   The user name may be set as desired, for example: "operator"
    b.   The password as desired for the new user name, for example: "1396"

2. Attach the keyboard and mouse to the controller, and plug the fiber optic card into the fiber to copper converter box, if the fiber connection is to be used.

3. Plug the LAN cable into the network connector on the converter box or to the controller as appropriate.

4. Turn on power to the controller.

5. When the controller is up and running press ALT+F4 to go back to the Windows desktop.

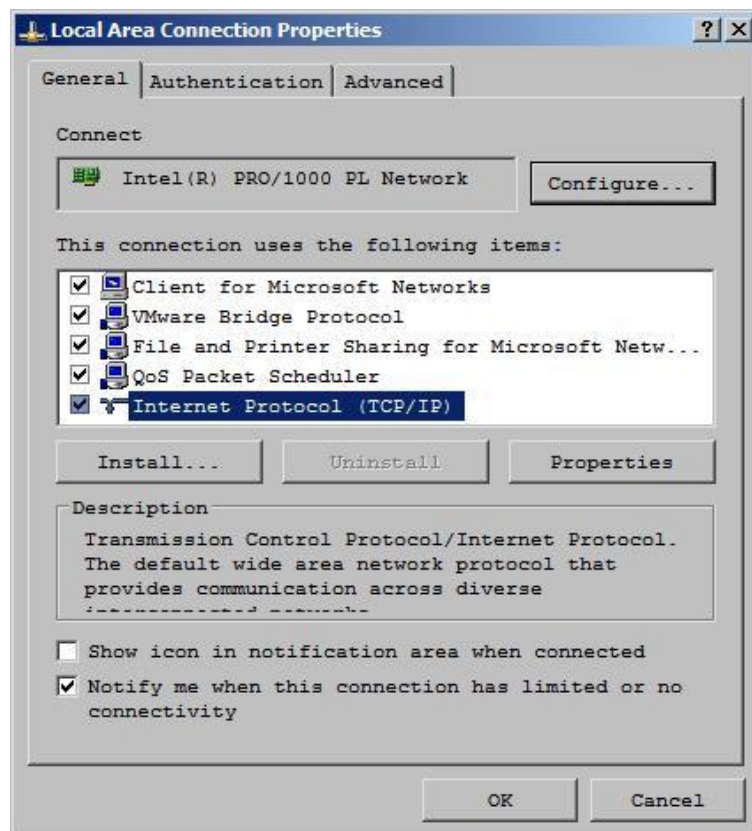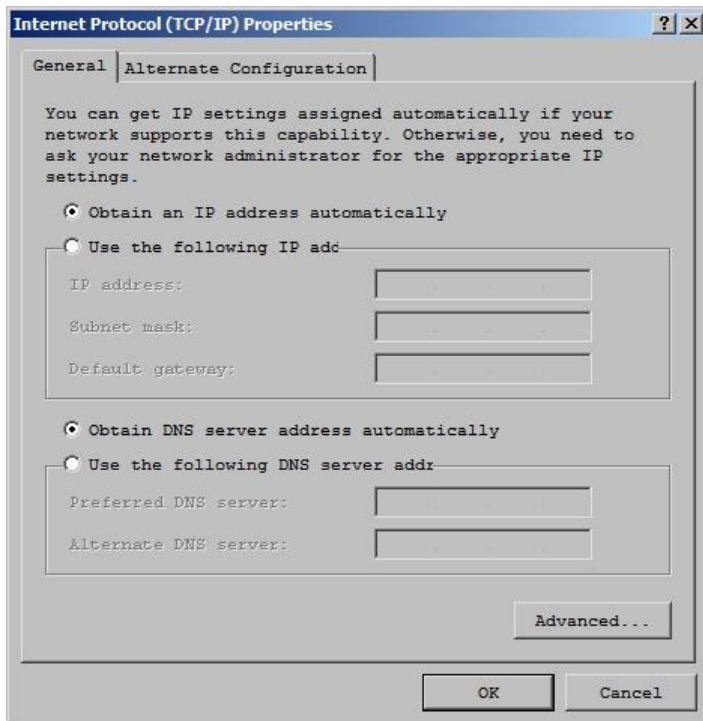6. From the start menu select Settings->Network Connections.
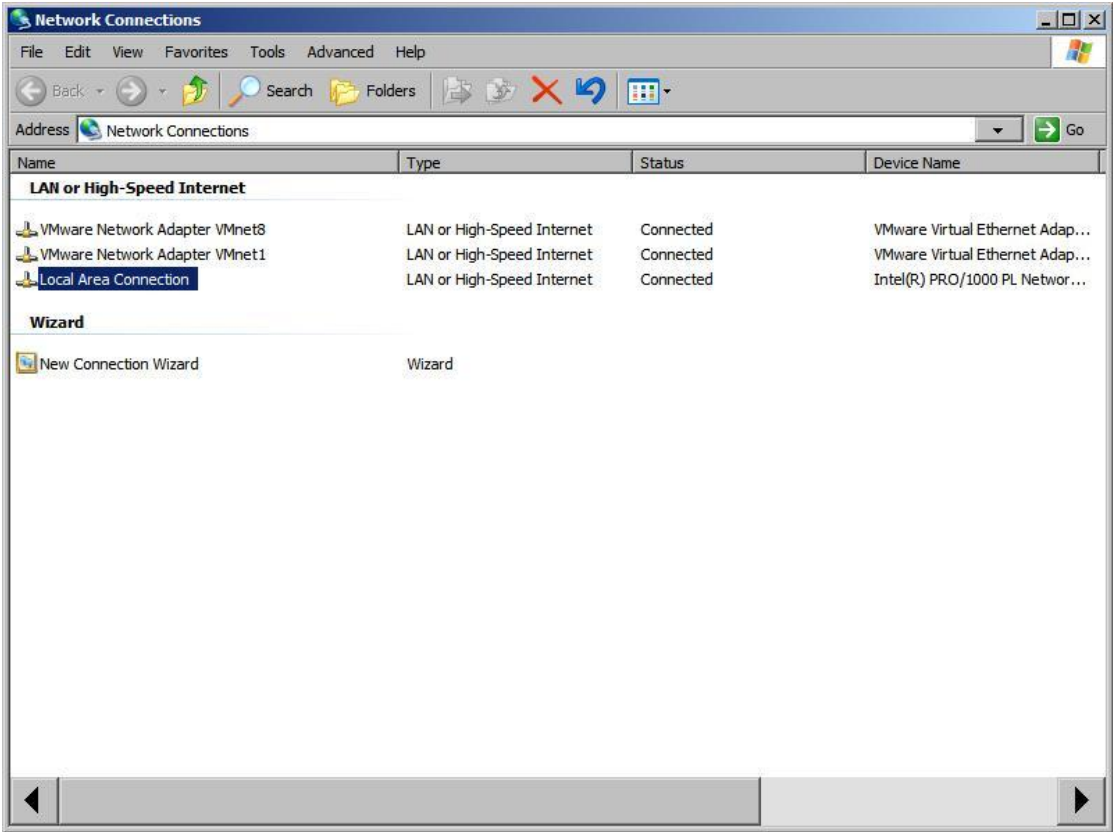
7. Double Click on the network interface connected to your LAN.
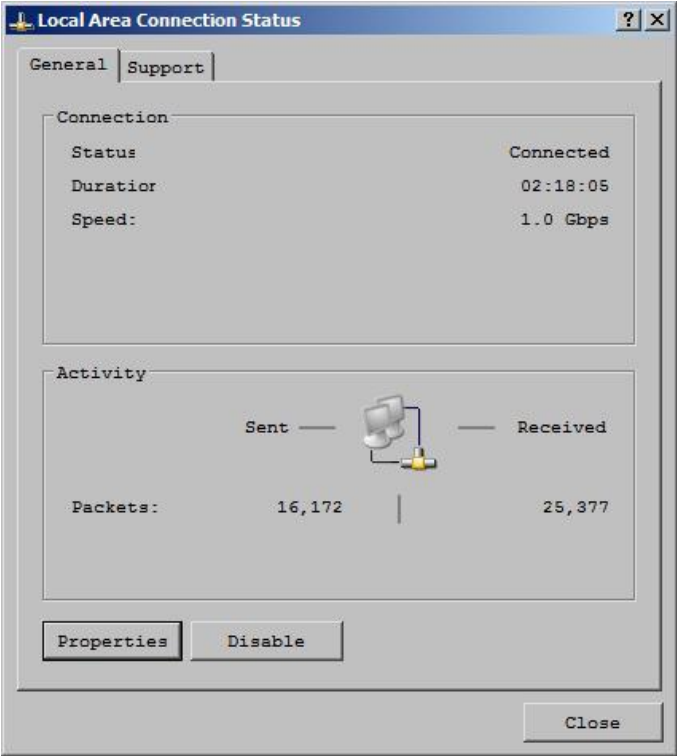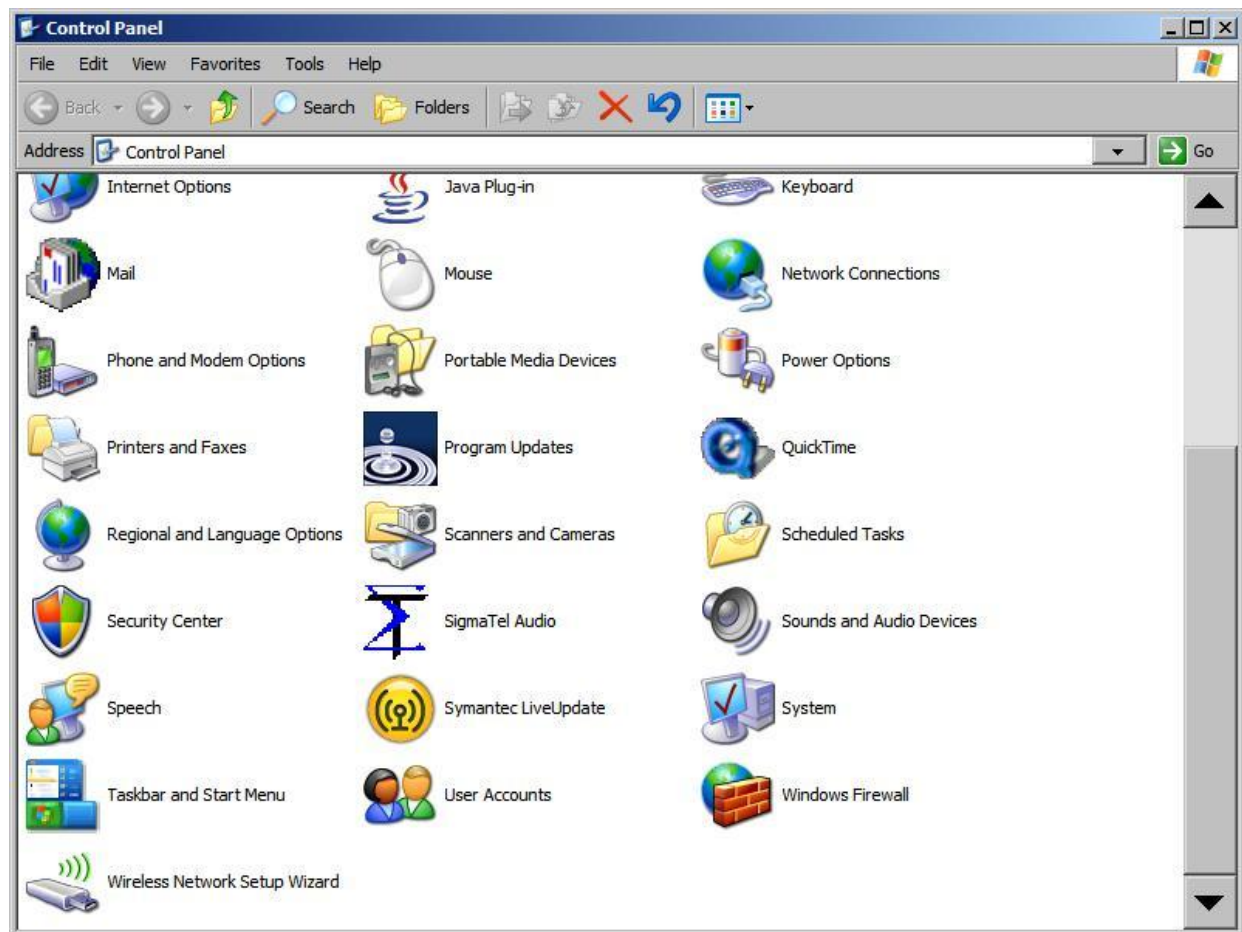
8. Click on Properties.

9. Scroll down to the Internet Protocol (TCP/IP) item and Double Click it.

10. If you are using a DHCP Server, then make sure that the IP address and DNS Server addresses are set to automatic.   (This is the recommended mode!)
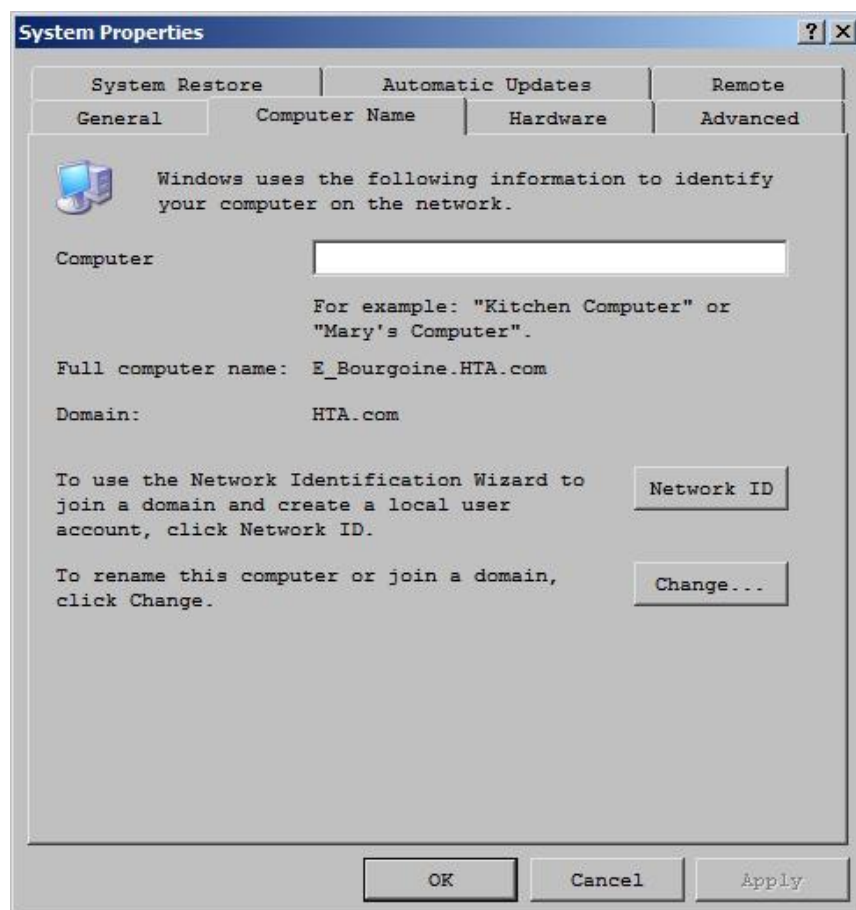
11. If you are NOT using DHCP then you will need to carefully make these entries   manually.
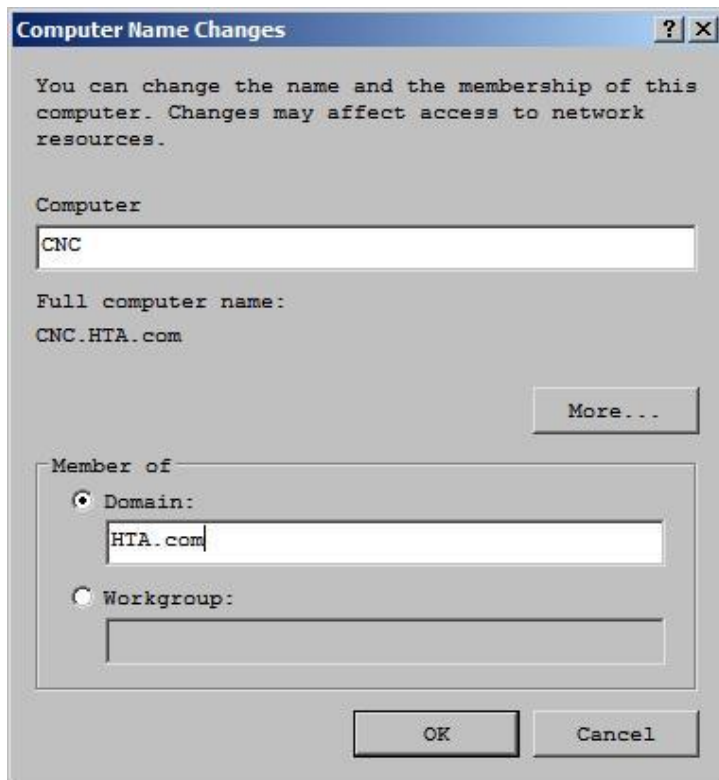
12. Go to the windows "Control Panel"

13. Double click on the "System"

14. Select the "Computer Name" tab

15. Click on the "Change" button.

16. The computer name should be listed as CNC

17. Select either Domain or Workgroup, and enter the appropriate name. The recommendation is that
     the controller be set up to be a member of a workgroup! If the network is Domain based, that is
     addressed when mapping the individual shares for file sharing.

18. Press the OK button to continue.

19. If joining a Domain, you will be asked for a name and password of an account to add to the Domain.
          This is the name and password of an administrator who can add or change accounts on
     your server.

20. You should see a message welcoming you to the Domain!

21. If joining a Workgroup FROM a Domain you will be prompted for a username and password for someone that can remove the control from a pre-existing Domain (ie. HTA.com). In this case you should use User name: cnc\administrator
Password: 1396

22. You will see a message welcoming you to the Workgroup!

23. Power down the controller and restart. When you power up the control it will be connected to the network, and you will be logged onto the "LOCAL MACHINE" as the Administrator. THIS IS NOT THE SAME AS BEING AN ADMINISTRATOR ON THE NETWORK. At this point the control is

attached to the network and has an appropriate address. But the control is NOT "logged onto" the network.

map a connection to the "share" on the network.

24. Start the controller and use Alt-F4 to get back to the start prompt.

25. Click on Start then Windows Explorer (NOT Internet Explorer !)
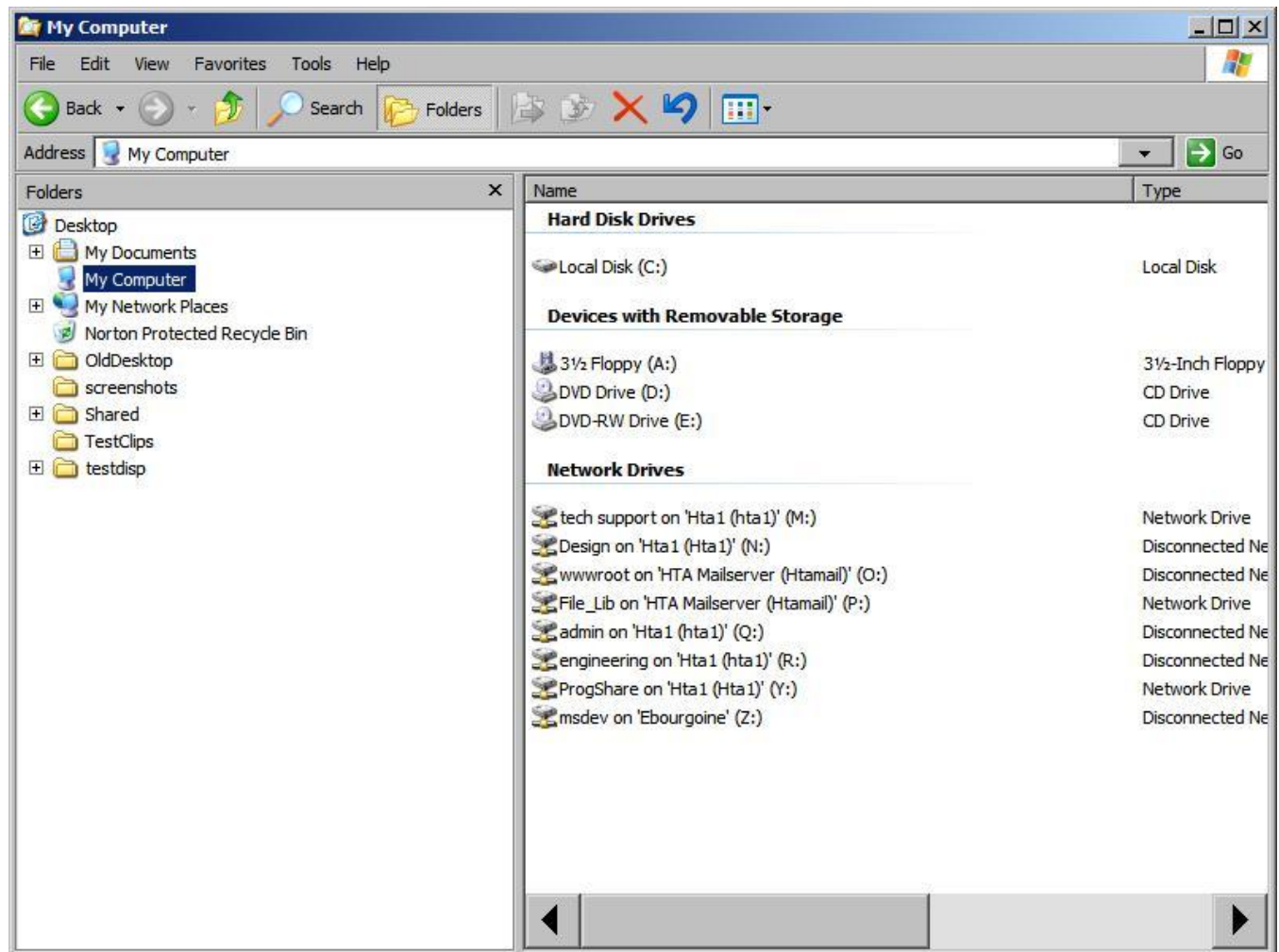
26. Select the MyComputer entry in the left pane.

27. Left clicking on the Map Network Drive give the following screen where a drive letter can be assigned to a share.
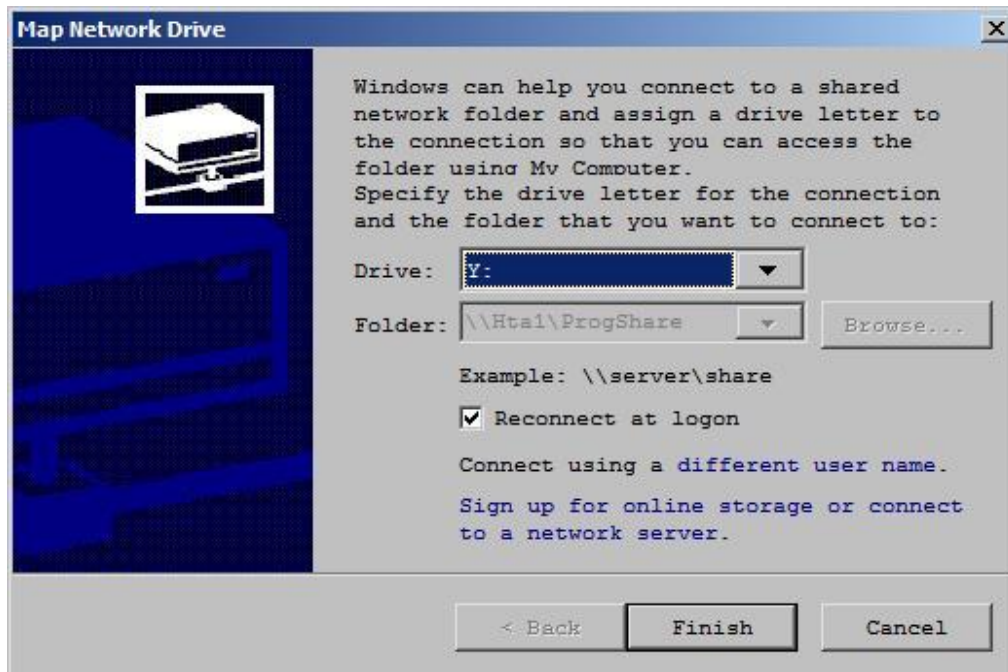
28. Pick the desired Driver letter and the UNC path to the desired network share, be sure that the "Reconnect at logon" box is checked.

29. When you press ok, then Finish, you may be given a prompt for a user name and password to connect with.


30. You will now be able to access the share from within the control software by using the drive mapping function accessible after pressing the "FILES" button on the main screen.

Hardware Considerations:

If the controller was purchased from Hypertherm Automation with the networking option included, it will be shipped with a 3COM "fiber optic" network card installed. The operating system will also be setup to use DHCP to obtain the required TCP/IP address. This setup allows the controller to automatically obtain all the needed network settings when it is turned on, and connected to a network which includes a DHCP server.

The advantage of this approach is that it eliminates the need for a network administrator to keep manual records of assigned IP addresses and ensures that the address, netmask, DNS server, and gateway addresses are automatically set to be compatible with the customer's network.

If the customers network does NOT support DHCP (a situation that is becoming rare) then it will be necessary to go into the network setting screen and change the TCP/IP settings by hand in order to make the control compatible with the customer's network. Making changes here will involve putting a keyboard and mouse on the controller and accessing the Windows XP network setup parameters.
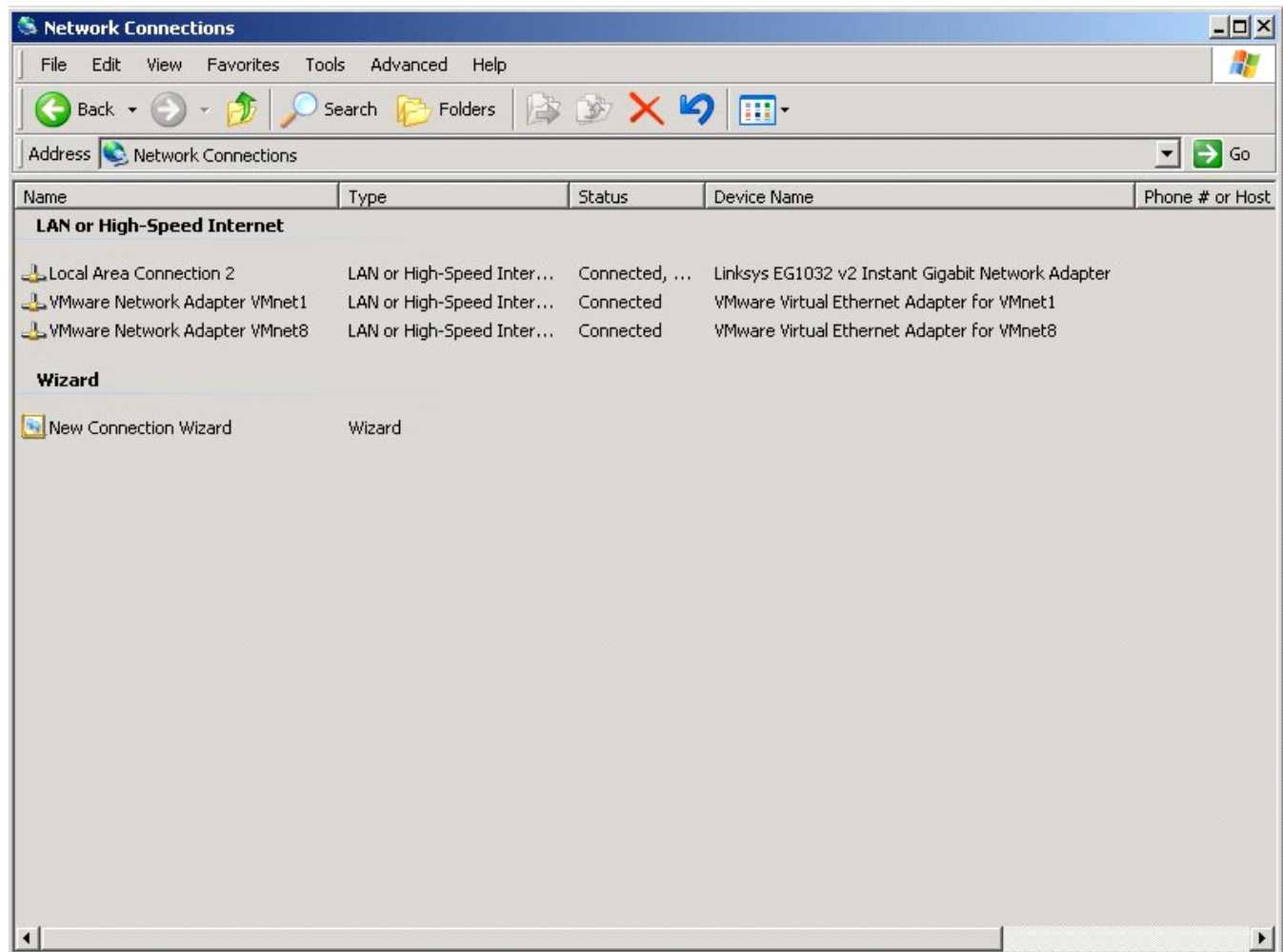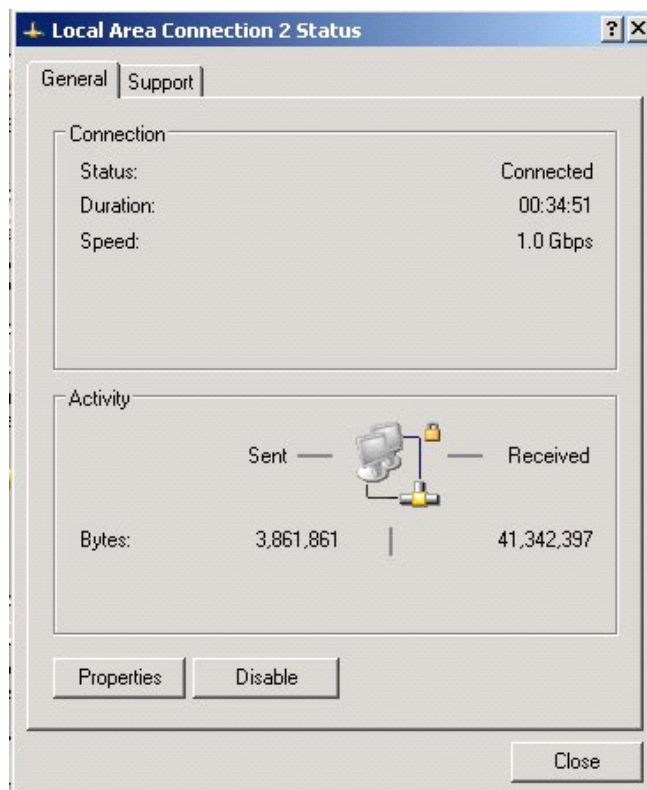

Select any listed network adapters that **are NOT being used** and double click.
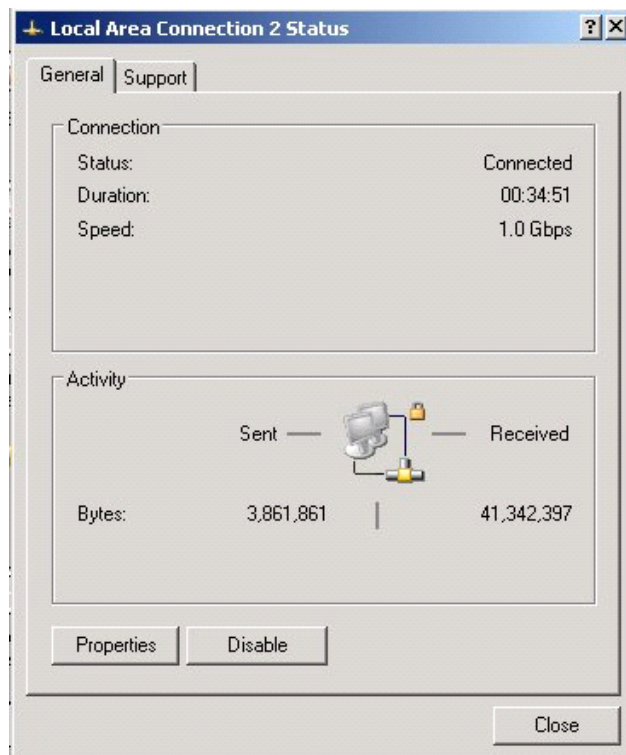
Click on the "Disable" button to stop Windows from trying to service these unused adapters

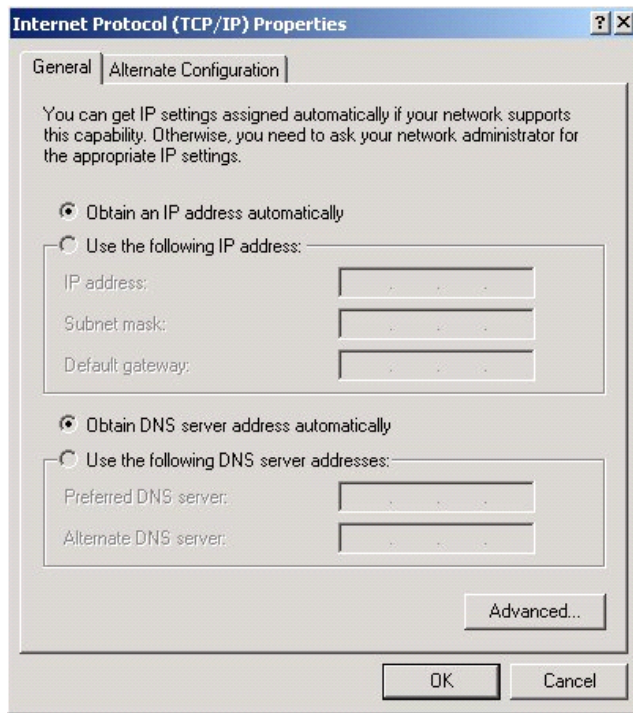Select the Network adapter that **is being used** and double click on it.

Then Click on the "Properties" Button

You will now see a screen for setting the connection properties for the adapter actually being used for the network connection.
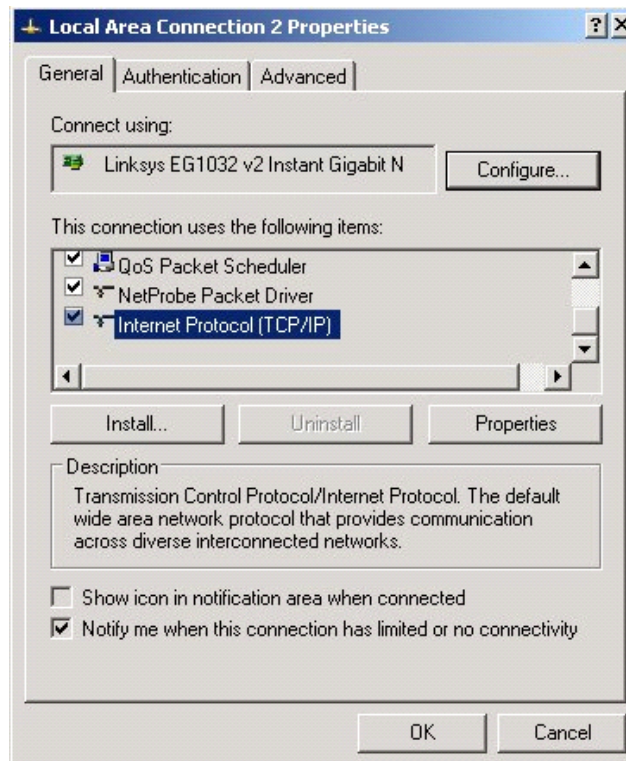
Scroll down and select the Internet Protocol (TCP/IP) entry. Then click on "Properties"

To use DHCP to assign the network parameters leave the settings set to obtain automatically.

If a DHCP is NOT available, or if the intent is NOT to utilize one, then specify the needed address information. Note that in this case you MUST provide a valid IP address (not used elsewhere in the network) and the appropriate netmask and DNS Server address, as shown below. **NOTE: These settings are EXAMPLES and NOT the ones to use for YOUR network.**
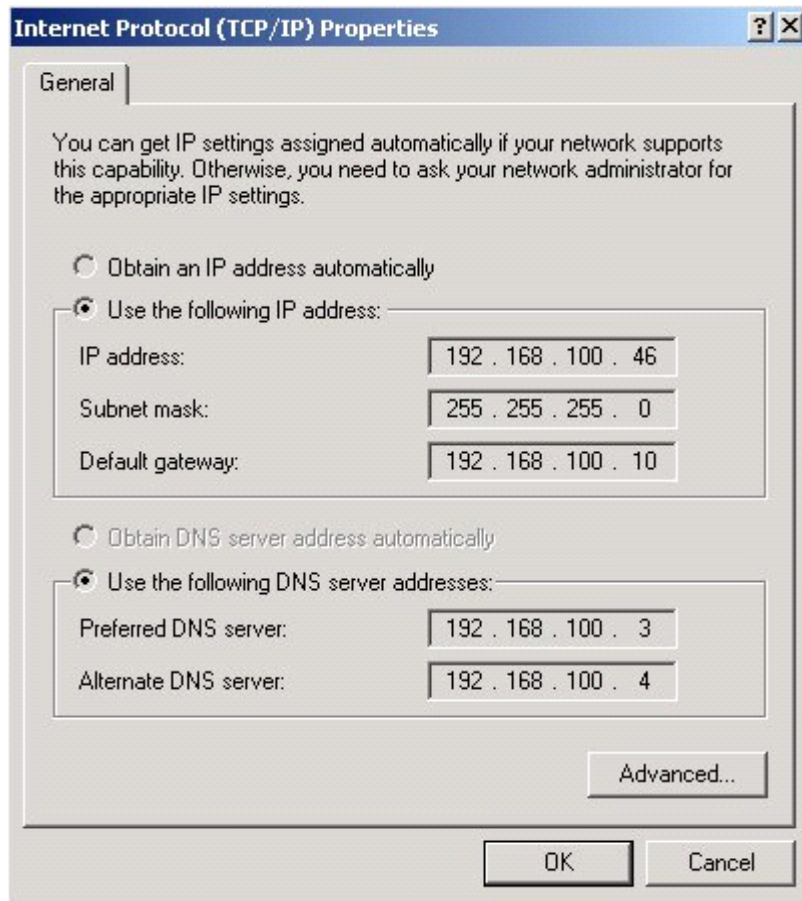
Once the needed entries are made double check that only one network card is active and reboot the system.

In some cases it may be desirable to install an alternative networking method, such as a wireless interface card. We have not tested these alternate systems here but other customers have reported some degree of success with them. In any event, if a different network card is installed in the system then you MUST either remove the existing network card, or disable it. If a networking card is setup for DHCP operation, and is NOT connected to a DHCP server, then it will cause significant delays in the startup process and may lead to other problems.

The general rule should be that there is only ONE active network interface installed in the controller at any time.