

BURNY™ 2.5RS/2.5Plus

Operation and Maintenance Manual

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(For use with software version 9/25/97 and later)**

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TM
/// GMC Cleveland
Motion Controls
An **IMC** Company

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2.5RS OPERATION AND MAINTENANCE MANUAL

PART 1 SYSTEM OVERVIEW

Tab Page - Part 1

SYSTEM OVERVIEW : GENERAL OPERATION SUMMARY

PART 1 SYSTEM OVERVIEW

INTRODUCTION

The Burny 2.5 RS control with the new front panel and the Burny 2.5Plus control have identical operating functions and physical layouts. The two versions of this control differ only in the appearance of the front panel and in their processor card. The processor card in the Burny 2.5Plus operates at a much higher speed. This manual covers both versions of the control with spare parts lists and drawings for both. Both front panels appear on Page PART-1:OPSUMMARY-6.

The **2.5RS** control is designed for use with optical tracing systems on a variety of 2 axis shape cutting machines. With its extensive STANDARD SHAPE LIBRARY many parts can be cut without the need for a template. In addition, the TEMPLATE TEACH UTILITY learns a part outline by tracing the template one time. Then the part may be repeated any number of times without re-tracing the template. When the **2.5RS** control is added to a tracing system, the tracer is not affected in any way and all other machine functions remain operational.

The optional RS-232/422 gives the control the ability to communicate with other devices such as CAD Systems and other RS-232 or 422 compatible devices. The **2.5RS** has the ability to prompt the operator in a second language in addition to the standard English. Current languages available are German, French, Finnish, Spanish, Swedish and Portuguese.

The **2.5RS** control has a variety of STANDARD as well as many OPTIONAL FEATURES. This manual covers all aspects of the operation, both STANDARD and OPTIONAL so certain parts of this manual may not apply to all units.

NOTE

The **2.5RS** has the ability to operate as a RS-422 device or a RS-232 device. This manual refers to the control acting as a RS-232 device except where noted.

The system has extensive SERVICE/DIAGNOSTIC UTILITIES which allow many of the operating values to be displayed and modified. In addition, all setup variables (acceleration rates, speeds, gains, etc.) are stored in non-volatile memory devices which retain the values permanently, even in the event of simultaneous battery and power failure. **Note that the Custom Auxiliary Code tables, and user programs, are not saved in non-volatile devices, but are preserved by the battery backup system.**

Several places throughout this manual will refer to a value which is entered during "INSTALLATION & SETUP". In these cases, consult the INSTALLATION section of this manual for further details. This manual describes SETUP, INSTALLATION and NORMAL procedures required for day to day operation. The **2.5RS** control can operate using either an "inch" or "metric" operating system. This selection is made during the SETUP and INSTALLATION. All prompts and system variables will switch to the selected system and appear as either "INCH" or "MILLIMETER" values. When entering values for STANDARD SHAPES,

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the part dimensions may be entered in either INCHES or MILLIMETERS regardless of the operating system selection. This allows a user who normally operates in inch values to input a metric part directly without needing to convert first. This manual is used with both inch and metric systems, therefore, dimensions will generally not be described as inches or millimeters but are assumed to be in the unit selected by the system.

SYSTEM OVERVIEW : GENERAL OPERATION SUMMARY

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2.5RS GENERAL OPERATION SUMMARY

OPSUMMARY.1 NC/TRACER SWITCHING

There is no power on/off switch on the **2.5RS CONTROL**, it is ON any time the CUTTING MACHINE HAS POWER. To use the normal TRACING/CUTTING functions of the machine without the **2.5RS CONTROL**, press the "NC RUN" button to turn off the LED located in the corner of the button. This causes the **2.5RS CONTROL** to return all control of the cutting and drive/tracer functions to the manual controls and allows normal tracer operation. Pressing the "NC RUN" button again will cause the LED to light and return control of the drives and cutting functions to the **2.5RS CONTROL**.

OPSUMMARY.2 OPTIONAL LANGUAGE FEATURE

The **2.5RS** control has an alternate language that is available as a option. The **2.5RS** normally prompts the operator in the English language. However, there are several other optional languages which can be installed in the unit (French, German, Finnish, Swedish, Spanish and Portuguese). When the alternate language feature is enabled, the control switches to the new language automatically at power-up. However, for service personnel, and in cases where the translation is not clear, the prompts may be switched back to ENGLISH. On older front panels, this may be done by pressing the "DOT" key which is directly above the RECYCLE key on the panel. On newer front panels the "SHF" and "DSPY" keys should be pressed within two seconds of each other. Pressing these keys toggles the display between English and the alternate language.

OPSUMMARY.3 AXIS DEFINITIONS

Several places in this manual refer to the X and Y axis of the machine. These are defined as:

- | | |
|---------------|--|
| X AXIS | -The main longitudinal rail axis of the machine. The direction away from the operator is defined as +X and toward the operator is defined as -X. |
| Y AXIS | -The cross or traverse axis of the machine. The direction to the left is defined as +Y and to the right as -Y. |

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OPSUMMARY.4

CUTTING SPEED CONTROL

The cutting speed is controlled by the operator using the speed dial and the "HI-LO-OFF" selector switch or by the NC programmer with the insertion of feedrate commands in the actual part program. The traverse speed used to get from one cut to the next is preset during installation. This allows the speed dial to be set at a slow speed for the cutting process and still move at a high speed to get from one part to the next.

The PROGRAMMABLE FEEDRATE option allows the feedrate to be controlled from the part program. The feedrate option must be enabled and the correct bit set in "SD62-SYS CONFIG2". See the section "SETUP AND CONFIGURATION" for programmable feedrate information. Once a program contains a programmed feedrate code, the control is automatically switched to the digital feedrate mode where the normal speed pot is now a 0-100% override control on the programmed feedrate. Pressing the feedrate button, or selecting DSPY03 displays the current digital feedrate (scaled by the 0-100% override pot) and allows the programmed value to be altered by either scrolling or entering the new feedrate on the keypad.

NOTE:

On older controls, the feedrate key is the white dot that is located between the "SHF" key and the down SCROLL arrow.

OPSUMMARY.5

JOG CONTROLS

In order to help in positioning the machine, the **2.5RS** provides a front panel jog function. The instructions below explain jog for the older style front panel as well as for the new style front panel. The figure on the following pages is for the new front panel.

SYSTEM OVERVIEW : GENERAL OPERATION SUMMARY

OPSUMMARY5.1 JOG CONTROLS - OLD STYLE FRONT PANEL

The jog operation is initiated by pressing the "II" key on the left side of the panel. When this key is pressed, the readout temporarily changes to the "SELECT JOG" prompt, and then returns to the previous display. To activate the jog function, a sequence of two keys must be entered. First, press the "II" key, then immediately press and hold the numeric key (1-9) that has an arrow which indicates the correct jog direction. The machine will jog in the selected direction at the cutting speed, as long as the number key is held, and will decel to a stop when it is released. To jog again, first press the "II" key to re-activate the jog function, then press and hold the new jog direction numeric key.

NOTE

The two key sequences described here and throughout the manual require that the second key be pressed within 2 seconds of the first. Otherwise, the double key sequence will not be done and only the second key will be read.

There is also a latched jog function which allows the machine to continue to move in the selected direction without any keys being pressed. It is selected using a similar sequence. First press the "II" key to activate the jog function, then press the "5" key to indicate that a latched jog is to be performed. Finally, press the numeric key to indicate the desired jog direction. Each key must be pressed within 2 seconds of the previous one or the sequence is interrupted. The machine begins moving in the selected direction at the speed set on the speed dial. To stop the motion, press the "0" key. ("CYCLE STOP" or "RECYCLE" may also be used to stop the latched jog operation.)

NOTE

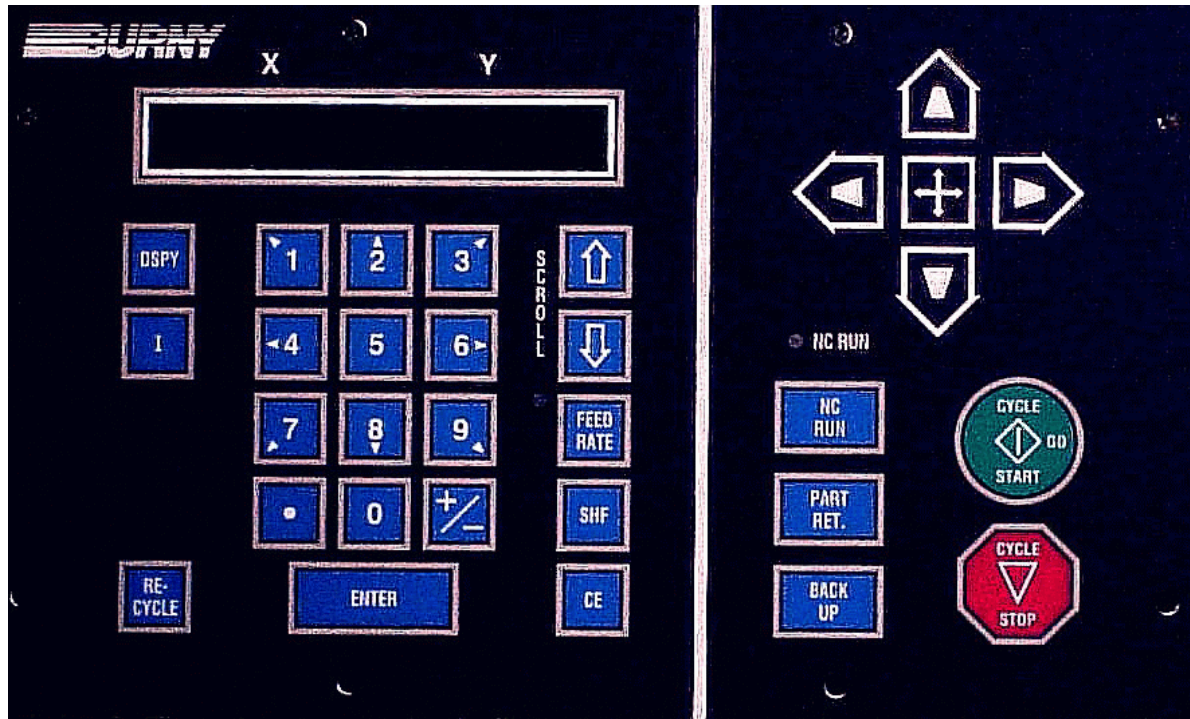
The "Latched Jog" feature may be disabled with SD62-SYS CONFIG2. See Installation documentation on SD62-SYS CONFIG2.

OPSUMMARY5.2 JOG AT MAXIMUM SPEED - OLD STYLE FRONT PANEL

A high speed jog may be initiated by a three key sequence. First press the "II" key, then press the "SHF" before the jog direction is selected. Upon pressing the number key the machine will move at the maximum traverse speed regardless of the feedrate setting, unless the feedrate is set to 0.00, which causes the machine to stop. Pressing the "SHF" also causes the SCROLL led to flash indicating high speed jog mode. Pressing "SHF" again returns to the normal jog mode.

The Max Speed Jog function only works with momentary jogs where the operator must keep the button pressed. It will not work with the latched jog.

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NEW STYLE FRONT PANEL

OPSUMMARY5.3 JOG CONTROLS - NEW STYLE FRONT PANEL

Jog is accomplished by pressing one of the keys in the upper right hand corner of the front panel. The machine jogs in the selected direction, at the cutting speed, as long as the direction key is held, and will decel to a stop when it is released. Diagonal jog is accomplished by using the latched jog function.

SYSTEM OVERVIEW : GENERAL OPERATION SUMMARY

The latched jog function allows the machine to continue to move in the selected direction without any keys being pressed. For latched jog, use the direction keys in the upper right hand corner of the front panel. First press the "LATCH JOG" then press the direction key to indicate the desired jog direction. Each key must be pressed within 2 seconds of the previous one or the sequence is interrupted. The machine begins moving in the selected direction at the speed set. To stop the motion, press "CYCLE STOP" or "RECYCLE."

NOTE

The "Latched Jog" feature may be disabled with SD62-SYS CONFIG2. See Installation documentation on SD62-SYS CONFIG2.

OPSUMMARY5.4 JOG AT MAXIMUM SPEED - NEW STYLE FRONT PANEL

A high speed jog may be initiated by a two key sequence. First press the "SHF", then press the direction key. The SCROLL led will flash indicating high speed jog mode. The machine will move at the maximum traverse speed regardless of the feedrate setting, unless the feedrate is set to 0.00, which causes the machine to stop. Pressing "SHF" again returns to the normal jog mode.

The Max Speed Jog function only works with momentary jogs. Latch Jog cannot be used with Max Speed Jog.

OPSUMMARY.6 KEYBOARD OPERATIONS

Throughout this manual the operator is instructed to enter numbers and values for the various selections. This is done using the 0-9 numeric keypad along with the "+/-" and "." (DECIMAL POINT) keys when required. If an incorrect value is entered, the clear entry key "CLR" or "CE" can be used to clear the value and allow it to be RE-ENTERED. Once the correct value is displayed, press the "ENTER" key to continue. If a negative value is required, first enter the number and then press the "+/-" key to make it negative.

2.5RS OPERATION AND MAINTENANCE MANUAL

OPSUMMARY.7 SCROLLING OPERATIONS

The **2.5RS** uses a menu system to guide the operator through the various operations. In this way, the operation is broken into a series of simple steps with a limited number of choices at each step. Usually when a menu of choices is available, the operator is told to **SELECT** the desired function and press the "ENTER" key. This selection is done by using the up and down arrow keys (located to the right of the keypad) to scroll through the displayed menu. When the correct selection is displayed, press the "ENTER" key to continue.

The "LED" indicator located below the scroll arrow keys lights when a menu of choices is available, and shows that the scroll arrow keys can be used to make the selection.

Some of the menus use numbers to further identify each item. If this is the case, the desired number may be entered rather than scrolling to get directly to the correct selection.

OPSUMMARY.8 RECYCLE KEY

After an operation is complete, or at any time during any operation, pressing the "RECYCLE" key stops the current operation, turns off all cutting functions and returns to the beginning prompting sequence.

OPSUMMARY.9 DISPLAY KEY

The "DSPY" key may be used at any time to enter the display select menu function described in the chapter "DISPLAY MODES". Pressing this key does not affect the operation of the machine in any way and so may be used at any time, even while a part is being cut. Once pressed, the current display is removed and the display select menu is presented. Select the desired display (see **SCROLLING OPERATIONS**). To exit the display mode and resume normal operation, **SELECT** display "DSPY00-EXIT MODE". When this is entered, the control returns to the operation that was active before the display function was used.

SYSTEM OVERVIEW : GENERAL OPERATION SUMMARY

OPSUMMARY.10

PART RETURN KEY

The "PART RET." key is used to return to one of 3 starting positions on a part in cases where the cut was lost or must be repeated over a portion of the part. Pressing the "PART RET." key the first time returns to the most recent pierce point on the part. Pressing the "PART RET." key a second time returns to the start point of the current part. Pressing the "PART RET." button a third time will return to the home position on the selected cutting table.

Pressing "SHF" "PART RET." returns to the table #1 0,0 home reference position.

OPSUMMARY.11

BACKUP KEY

The "BACKUP" key is also used to re-start lost cuts. When pressed, it stops the cutting process and retraces the cut path in reverse. Once the correct point is reached, releasing the key cause the program to continue forward from that point.

PART 2 SYSTEM OPERATIONS

SYSTEM OPERATIONS : FUNCTION MENU

MAIN FUNCTION SELECTION MENU

The FUNCTION SELECTION MENU is the starting point for all machine operations. At any time, during any operation, pressing the "RECYCLE" key aborts the current operation and returns to this top level of prompting.

When the "RECYCLE" key is pressed, the display sequences through:

"SELECT--FUNCTION"

"RUN- PROGRAM" (or last function selected)

"USE SCROLL--"

"-- TO SELECT"

The "RUN PROGRAM" function is the default when power is applied to the **2.5RS**. The default function then becomes the last function used. The other functions are selected with UP and DOWN scroll arrows or by pressing the appropriate number associated with that function. The selections are as follow:

| KEY | FUNCTION | DESCRIPTION |
|--------------------------------|--------------------|---|
| 1 | RUN- PROGRAM | Run the current program. |
| 2 | LOAD- STD. SHAPE | Load from STANDARD SHAPE LIBRARY. Option must be enabled. |
| 3 | LOAD- FROM RS-232 | Load from a RS-232 device. |
| 4 | STORE- TO RS-232 | Store to a RS-232 device. |
| 5 | TEACH- PROGRAM | Teach a program using a optical tracer. |
| 6 | DELETE- PROGRAM | Delete a program from program memory. |
| 7 | EDIT / NEW-PROGRAM | Create or edit a program. |
| . | STORE TO FLOPPY | Store to Floppy drive. Option must be enabled. |
| +/- | LOAD FROM FLOPPY | Load from Floppy drive. Option must be enabled. |
| 3 SHF TWO KEY SEQUENCE | LOAD/RUN RS-232 | Load from a RS-232 device and run immediately. |
| +/- SHF TWO KEY SEQUENCE | LOAD FROM FLOPPY | Load from Floppy drive and immediately Run. Floppy option must be enabled |

2.5RS OPERATION AND MAINTENANCE MANUAL

FUNCMENU.1

RUN PROGRAM

Once this function is selected, the prompt "PRGM=00000000" is displayed. At this point a different program number may be entered via the numeric keypad. The scroll keys may also be used to select a part in program memory. Press "ENTER" to select the program number.

The **2.5RS** searches program memory for a part that has been assigned that number. If the part program exists, the run prompting begins. See section "RUNNING THE PROGRAM". If the part program is not found, a "PGM NOT FOUND" error is displayed and program selection must be repeated.

FUNCMENU.2

LOAD-FROM STD SHAPE

Once this function is selected, the prompt "PRGM=00000000" is displayed. A program number is assigned to the selected GENERIC SHAPE to create a PART PROGRAM. A PART PROGRAM is a runnable program that resides in program memory. Enter a program number to be assigned to the GENERIC STANDARD SHAPE, (up to 8 digits) and then press "ENTER". The operator should select the desired shape from the following menu and go to the manual section indicated for that shape. The selection of a shape can be made either by scrolling to the desired shape or by entering the shape number on the keypad. Once the shape has been selected and the data entered, the shape is assigned the 8 digit program number for future reference.

The standard shape library contains 53 generic shapes. See the section "Standard Shapes."

FUNCMENU.3

LOAD-FROM RS-232

The "LOAD FROM RS-232" function is used to download a part program via the serial port into the **2.5RS** memory. Once the function is selected, the prompt "PRGM=00000000" is displayed. Enter the program number to be used to store the part program data and press "ENTER". If the PROGRAM NUMBER selected does not exist, the operator is prompted for additional information pertaining to serial communication parameters. See section SERIAL COMMUNICATIONS for further information on LOADING FROM RS-232.

If the program number requested already exists in program memory, then a special prompt appears:
"DUP PGM=#####"

If a duplicate program error is given, either enter a different number or go back and "DELETE" the existing program, then return to the "LOAD" operation.

SYSTEM OPERATIONS : FUNCTION MENU

FUNCMENU.4 LOAD CUSTOM SHAPE FROM FROM RS-232

Custom Shape Programs must be created by CMC, they are not customer programmable.

Custom Shape Programs are loaded using the same Serial loading method as normal Word address or ESSI programs. However, Program must be set to INTL for internal format type programs (this replaces the normal WADR or ESSI program format selection).

Custom Shape Programs have numeric file names (for example-- 9892.CNC). However, once the program loads, it will appear as "BDF09892" in program memory to mark it as a special Binary Data Format Custom Shape program instead of a regular part program.

To use the custom shape, you must first "RUN" the program. Select RUN and scroll down to the program number "BDF09892" and press enter. The Running process will detect that it is one of the new custom shape programs and will set it up to be used. The display will change to "GENERIC XFER OK" which indicates the file has transferred to the standard shape memory correctly.

The display then changes to the normal prompt to "LOAD xxxxxxxx". This is the normal prompt for loading a program into memory. Enter the program number that you want to create and press enter. For example: "LOAD - 00000123"

The display then goes to the Shape Selection screen, and the custom shape number will appear as the first shape. For example "SH9892-WELD". You can press Enter to select this shape, or you can use the scroll buttons or numeric keys to go through the list of standard and custom shapes. There can be more than one custom shape loaded at one time. For example, if you scroll down, the display will show Shapes 1 to Shape 53 and then go to SH9892. The custom shapes just appear as another standard shape at this point.

Enter the dimensions for the custom shape as usual, and then run the resulting part program as usual: RUN-00000123.

The normal "LOAD-FROM STD SHAPE" prompt will not access any Custom Shapes. If you run the Standard Shapes the usual way, the Custom shape will not appear in the list-- you must go through the step of Running the BDF09892 program to get the GENERIC XFER OK message to make the Custom Shape active.

FUNCMENU.5 STORE-FROM RS-232

The "STORE FROM RS-232" function is used to upload a part from program memory out the serial port to a host storage device. Once the function is selected, the prompt "PRGM=00000000" appears. Enter the program number to be STORED to the remote device.

2.5RS OPERATION AND MAINTENANCE MANUAL

FUNCMENU.6

TEACH-PROGRAM

The "TEACH" function is used along with the machines optical tracing system to "REMEMBER" an existing template and then repeat it any number of times without the template. See "TEMPLATE TEACH TRACE" section of this manual for detailed description.

FUNCMENU.7

DELETE-PROGRAM

DELETE is used to erase a part program. Once the function is selected the prompt "PRGM=00000000" appears. At this point enter the number for the program to be deleted. The scroll keys may also be used to select a part in program memory for deletion. Press "ENTER" to DELETE the program.

All programs in program memory can be deleted by entering the program number "00000000" in response to the "PRGM= XXXXXXXX" prompt. When the "ENTER" key is pressed, a verification prompt is issued to make sure the operator is aware that all programs will be erased:

"YES ERASE ALL NO"

Pressing the "+/-" key toggles between a flashing "YES" and "NO". To abort the function, press the "+/-" key so that the word "NO" is flashing and then press "ENTER". The control aborts the erase procedure and no programs are lost. To erase all the programs, press the "+/-" key so the word "YES" in the readout is flashing. Then press "ENTER". Again, since this procedure is irreversible, a second verification is given as:

"NO YOU SURE YES"

Notice that to erase all the programs, the "+/-" key must be pressed twice again. This minimizes the chances of an accidental erasure. Pressing the "ENTER" key with the "NO" flashing aborts the process. If the "YES" response is selected, the programs are erased and the readout displays:

"PROGRAMS DELETED"

FUNCMENU.8

EDIT/NEW-PROGRAM

The EDIT/NEW function allows the EDIT of a part program that resides in program memory. It may be altered in any way. The EDIT/NEW function also allows for the creation of a new part. For a detailed description of the "EDIT/NEW- PROGRAM" function see section "EDITOR".

SYSTEM OPERATIONS : FUNCTION MENU

FUNCMENU.9

STORE-TO FLOPPY

The "STORE- TO FLOPPY" selection is used to save a part program to a floppy disk. If the control has an internally mounted disk drive, the program is stored there. If the control does not have an internal disk drive, and an external portable floppy drive is connected to the serial port, the selected program is saved to the external floppy drive. See FLOPPY DRIVE in utilities section for additional information on operation.

FUNCMENU.10

LOAD FROM FLOPPY

The "LOAD FROM FLOPPY" selection is used to load part programs from a floppy disk. If the control has an internally mounted disk drive, the program is loaded from there. If the control does not have an internal disk drive, and an external portable floppy drive is connected to the serial port, the selected program is loaded from the external floppy drive. See FLOPPY DRIVE in utilities section for additional operation.

FUNCMENU.11

LOAD/RUN RS-232

Use "LOAD/RUN RS-232" to load a part program from the serial port, and immediately run that program. The **2.5RS** can also automatically delete the program after cutting, and load the next program. See "LOAD FROM RS-232" above.

FUNCMENU.12

LOAD/RUN FROM FLOPPY

Use "LOAD/RUN FLOPPY" to load a part program from a floppy. , and immediately run that program. The **2.5RS** can also automatically delete the program after cutting, and load the next program. See "LOAD FROM FLOPPY" above.

2.5RS OPERATION AND MAINTENANCE MANUAL

STANDARD SHAPE SELECTION

SHAPE.1

SHAPE SELECTION

The "LOAD- FROM STD. SHAPE" function allows the operator of the **2.5RS** to select a generic part from the STANDARD SHAPE LIBRARY and create a part program.

Press the "ENTER" key. The display changes to "LOAD- 00000000". This is the PART PROGRAM NUMBER that will be assigned to the selected GENERIC SHAPE when the part dimensions are entered. Once a program number is entered the shape selection process begins.

The **2.5RS** shape library contains 50 SHAPE PROGRAMS which are referenced by "SHAPE NUMBER". The operator must first select the desired shape from the following chart either using the scroll keys or by entering the desired number directly. Once the correct number and name are displayed, press the "ENTER" key to select the shape.

Detailed drawings of each shape are located at the end of this section. These give additional information about the various options for each shape and illustrate the required dimension inputs.

The STANDARD SHAPE programs are written in a "GENERIC" format which describes the shape of the part but leaves the part dimensions variable. Once the shape has been selected, the operator is required to answer a series of prompts which determines the final dimensions of the part. The individual shape drawings at the end of this section help to illustrate the various dimensions. These drawings should be referred to when answering the various prompts.

If a dimension is requested, use the numeric keypad along with the decimal point and "CE" or "CLR" keys to enter the desired value. Once it is correct, press "ENTER". Since the **2.5RS** can operate in either a metric or inch system, the standard units for the dimensions are those selected for the operating system during installation by "SD60". However, dimensions can be entered in either unit by using a special key sequence. In this way, an occasional metric part can be entered directly even though the system is set for inch units.

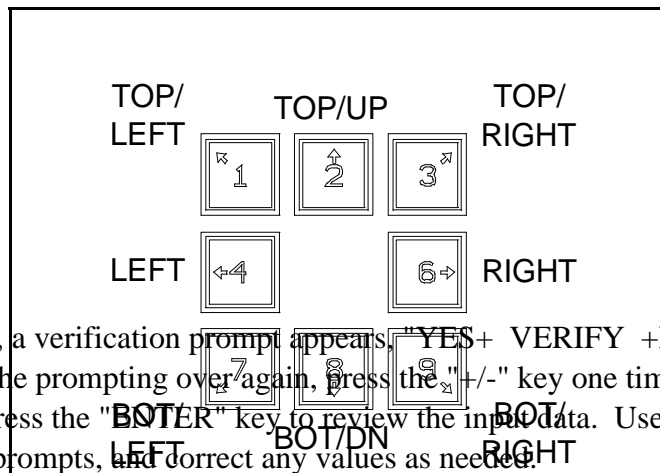
To enter a dimension in the opposite unit from the system default, press the "SHIFT" key first. The displayed value is converted to the opposite unit (inch/mm) and the number of decimal places will change (2 for inch, 1 for mm). Pressing the same key again changes the value back to the original units. This key only changes the value being entered and does not switch the units for the entire system. Each dimension must be converted individually as required.

If a count (such as number of holes) or other integer value is requested, use the numeric keypad and clear key to enter the desired number. Once the value is correct, press "ENTER".

2.5RS OPERATION AND MAINTENANCE MANUAL

If a selection such as CW/CCW, YES/NO etc. is requested the displayed response may be toggled by using the "+/-" key. Press "ENTER" when the correct response is displayed. If a start point or repeat direction is requested, use the outside row of keys on the numeric keypad 1-9 to indicate the correct corner or direction. Once the correct direction is indicated on the readout, press ENTER. Invalid entries for a particular prompt are ignored.

Start point or repeat direction:



Once all the prompts are answered, a verification prompt appears, "YES+ VERIFY +NO". To verify the input data, which starts the prompting over again, press the "+/-" key one time causing the "YES+" to begin flashing. Then press the "ENTER" key to review the input data. Use the "ENTER" key to step through the prompts, and correct any values as needed.

After all prompts have been answered correctly, the **2.5RS** creates the part program. The following prompts are displayed:

"* COMPUTING *" The input data is being processed.

"PROGRAM LOADED " The program has been created.

Press RECYCLE to return the MAIN FUNCTION MENU. Go to "RUNNING THE PART" in this manual for directions on actually running the program.

SHAPES.2 DIMENSIONS COMMON TO MOST SHAPES

In addition to the actual dimensions of the part, most of the 53 SHAPE PROGRAMS also prompt for the following:

- KERF
- SCRAP
- LEADIN
- LEADOUT

The standard shapes also prompt for a "KERF" value along with the part dimensions. Since all controls are now equipped with the optional "Dial-in-Kerf" feature (described in the RUN PROGRAM section of this manual), the value of 0.00 should be entered for the KERF prompt during the dimension entry (See exceptions below). By entering 0.00 at this point, the "Dial-in-Kerf" feature can be used when the part is actually cut to enter and adjust the kerf dimension as needed. If a KERF value other than 0.00 is entered during the dimension prompting of a standard shape, it is permanently added to the part dimensions, and the "Dial-in-Kerf" feature is bypassed when the part is cut thus the kerf cannot be adjusted and the entire part must be re-entered to change it.

NOTE

On any "Chain Cut" parts, such as the WEDGE PAIR or CHAIN RECTANGLE, the kerf must be entered along with the part dimensions during the program creation. This is due to the common side cutting and nesting which is done on these parts. Regardless of the kerf entered, the "DIAL-IN-KERF" will not function on these parts.

See also the "Dial In Kerf" section of this manual.

Most of the standard shapes also prompt for a "SCRAP" dimension (see below). This is the space left between successive rows of parts. Since the "Dial-in-Kerf" feature does not increase the part-to-part spacing, the value for "SCRAP" must allow for enough material to accommodate the anticipated KERF plus the desired amount of actual material to be left between the rows of parts.

2.5RS OPERATION AND MAINTENANCE MANUAL

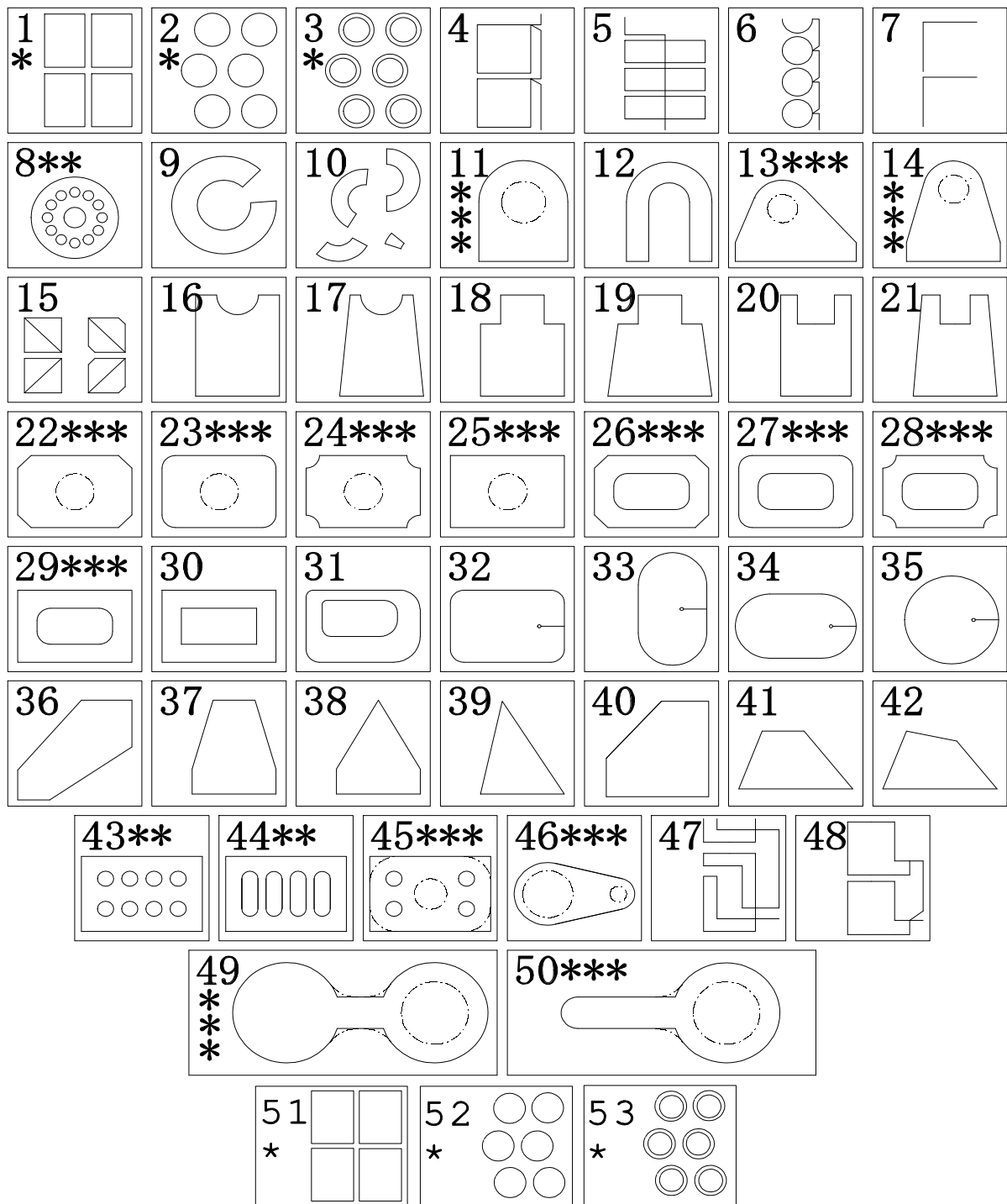
The "SCRAP" value provides the spacing between parts as they are repeated down the plate. The accuracy of this scrap dimension is just as good as the actual part itself, therefore the value can be set fairly small with good results. Typical "SCRAP" value for OXY/FUEL CUTTING can be anywhere between .1" to .5" (2.5 mm to 12 mm). Note that the "SCRAP" dimension must allow for the anticipated cutting kerf if the "Dial-in-Kerf" feature is to be used when the part is cut (see KERF description above).

The "LEADIN" dimension is the distance from the part to the pierce point. Since the piercing operation is sometimes unpredictable, the leadin dimension should be set so that the plate is pierced and the cut has stabilized before it reaches the actual part. Normal values range from .25" to 1.00" (6mm TO 25mm).

The "LEADOUT" dimension is programmable for each of the standard shapes, and causes the torch to cut away from the part before the cutting oxygen is turned off. This prevents any damage to the cut part due to the bleed off characteristics of the torch. In addition, on heavy plate cutting, the leadout move guarantees that the bottom of the part has been cut completely before the oxygen is turned off. Normal values are from .5" to 1" (12mm to 25mm).

For plasma systems, the "LEADOUT" should be adjusted to properly time the turn-off of the arc. If the leadout is too long, cut parts will fall out of the plate and cause an abrupt turn off of the torch. This will cause attempts to restart the plasma, and thus excessive wear on torch parts.

SYSTEM OPERATION : SHAPES



SHAPES.3

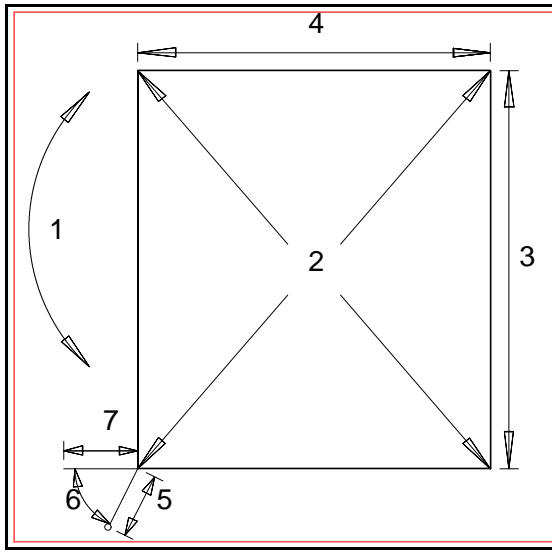
53 STANDARD SHAPES

- * Selectable start position, cw/ccw cutting, and selectable repeat mode and direction. Shapes 51, 52, and 53 are enhanced versions of shapes 1, 2, and 3.
- ** Allows selection of any number of holes.
- *** Dashed holes are optional. Corner radius values may be set to 0 for sharp corners.

2.5RS OPERATION AND MAINTENANCE MANUAL

SHAPE3.1

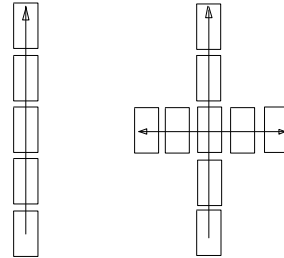
SHAPE 1 : RECTANGLE



REPEAT PATTERNS

AUTO

MANUAL



- | | | |
|-------------------------|---|-----------------------------------|
| 1. CUT DIRECTION | : | (Clockwise or Counter-clockwise) |
| 2. STARTING POSITION | : | (1 of 4 corners) |
| 3. X DIMENSION | : | (Inches or millimeters) |
| 4. Y DIMENSION | : | (Inches or millimeters) |
| 5. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 6. LEAD-IN ANGLE (DEGS) | : | (0 to 90 degrees) |
| 7. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 8. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 9. KERF DIMENSION | : | (Width of cutting tool path) |
| 10. REPEAT MODE | : | (Automatic or manual positioning) |

IF AUTO REPEAT MODE:

11. VERIFY- YES/NO

IF MANUAL REPEAT MODE:

11. Repeat direction: (1 of 4 sides)
12. VERIFY- YES/NO

NOTES:

The STARTING CORNER and REPEAT DIRECTION parameters can be directly entered with the numeric keypad. Direction arrows are provided for quick reference.

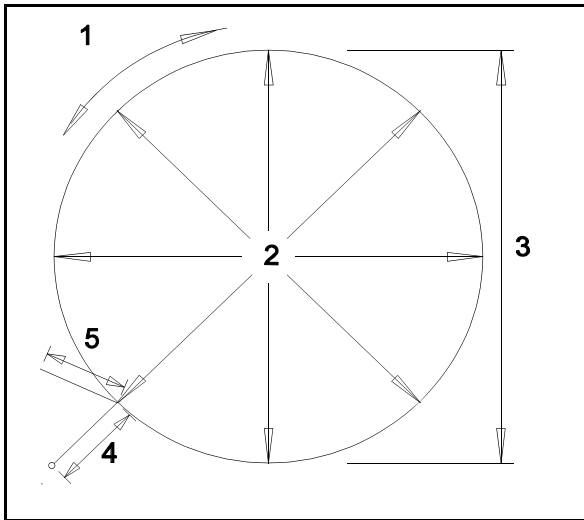
When defining the LEAD-IN ANGLE, 0 degrees is parallel to the Y axis and 90 degrees is parallel to the X axis.

The LEAD-OUT position is determined by the direction of the cut. It is either parallel to the last side cut (as shown) or 45 degrees from the last cut direction.

When running the resulting NC part program, position the torches at the STARTING CORNER of the first part, regardless of the REPEAT MODE selected. From this corner, the program moves out to the actual pierce point

SHAPES3.2

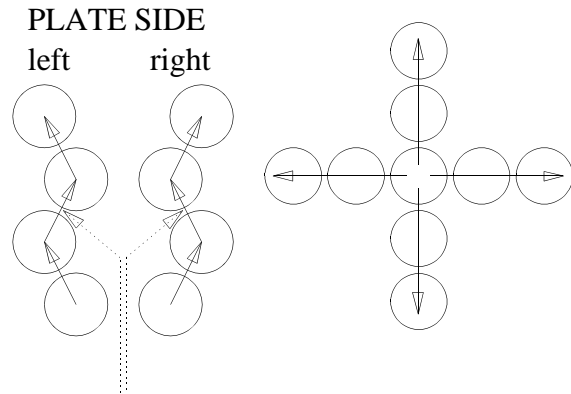
SHAPE 2 : CIRCLE



REPEAT PATTERNS

AUTO

MANUAL



60 DEGREE ANGLE TO CENTERS

- | | | |
|-----------------------|---|-----------------------------------|
| 1. CUT DIRECTION (OD) | : | (Clockwise or counter-clockwise) |
| 2. STARTING POSITION | : | (1 of 8 points) |
| 3. DIAMETER DIMENSION | : | (Inches or millimeters) |
| 4. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 5. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 6. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 7. KERF DIMENSION | : | (Width of cutting tool path) |
| 8. REPEAT MODE | : | (Automatic or manual positioning) |

IF AUTO REPEAT MODE:

9. VERIFY- YES/NO

IF MANUAL REPEAT MODE:

9. Repeat direction: (1 of 4 points)
10. VERIFY- YES/NO

NOTES:

The STARTING POSITION and REPEAT DIRECTION parameters can be directly entered with the numeric keypad. Direction arrows are provided for quick reference.

The actual LEAD-OUT position is determined by the direction of the cut. The figure above shows the LEAD-OUT position assuming a clockwise cutting direction has been selected.

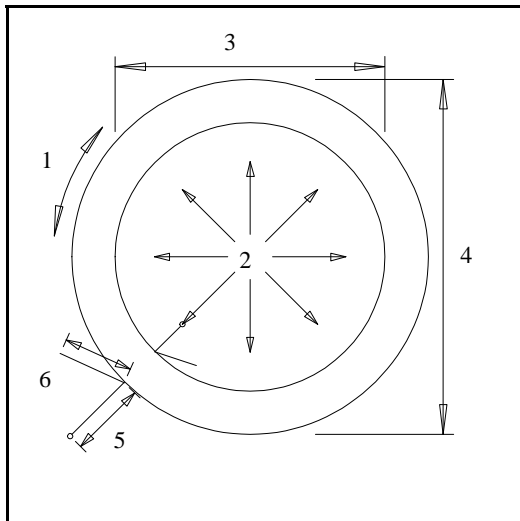
When running the resulting NC part program, position the torches at the CENTER of the first part, regardless of the REPEAT MODE selected. From this position, the program moves out to the actual pierce point.

When performing AUTO REPEAT mode operations, parts are shifted to the left and right at a 60 degree angle to minimize the amount of scrap between parts.

2.5RS OPERATION AND MAINTENANCE MANUAL

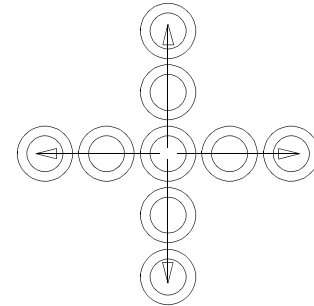
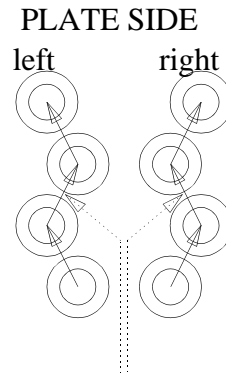
SHAPES3.3

SHAPE 3 : RING



REPEAT PATTERNS

AUTO MANUAL



- | | | |
|------------------------|---|-----------------------------------|
| 1. CUT DIRECTION (OD) | : | (Clockwise or counter-clockwise) |
| 2. STARTING POSITION | : | (1 of 8 points) |
| 3. INNER DIAMETER SIZE | : | (Inches or millimeters) |
| 4. OUTER DIAMETER SIZE | : | (Inches or millimeters) |
| 5. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 6. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 7. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 8. KERF DIMENSION | : | (Width of cutting tool path) |
| 9. REPEAT MODE | : | (Automatic or manual positioning) |

IF AUTO REPEAT MODE:

10. Verify- YES/NO

IF MANUAL REPEAT MODE:

10. Repeat direction: (1 of 4 points)
11. Verify- YES/NO

NOTES:

The CUT DIRECTION prompt defines the outer diameter cut direction. The inner direction is always opposite so that the same KERF side (LEFT/RIGHT) can be used for both cuts.

The STARTING POSITION and REPEAT DIRECTION parameters can be directly entered with the numeric keypad.

The actual LEAD-OUT position is determined by the direction of the cut. The figure above shows the LEAD-OUT position assuming a clockwise cutting direction has been selected.

When running the resulting NC part program, position the torches at the CENTER of the first part, regardless of the REPEAT MODE selected.

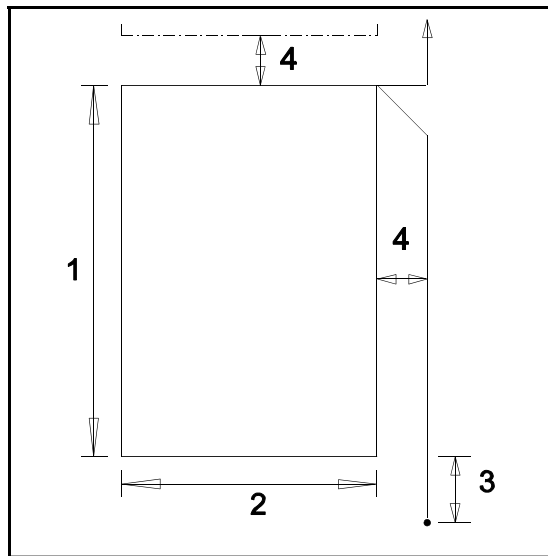
When performing AUTO REPEAT mode operations, parts are shifted to the left and right at a 60

degree angle.

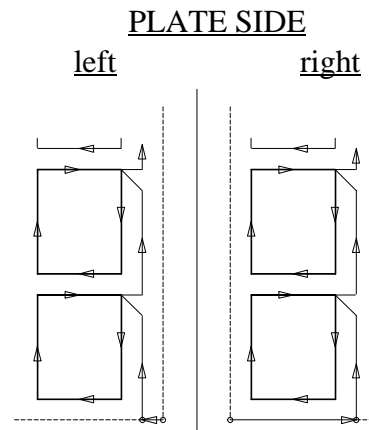
2.5RS OPERATION AND MAINTENANCE MANUAL

SHAPES3.4

SHAPE 4 : CHAIN RECTANGLE 1



REPEAT PATTERNS

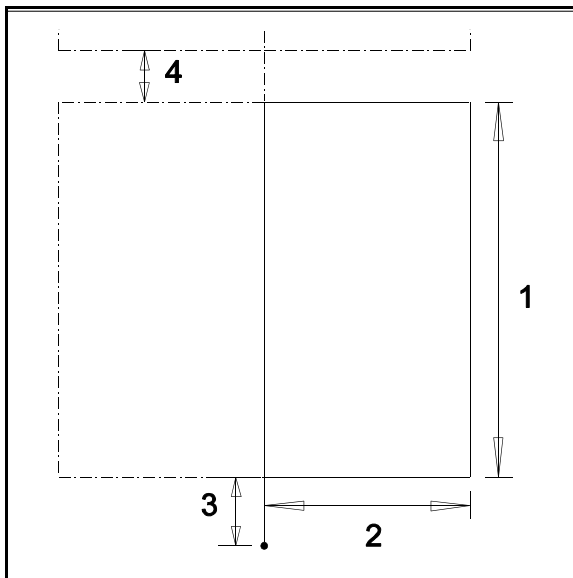
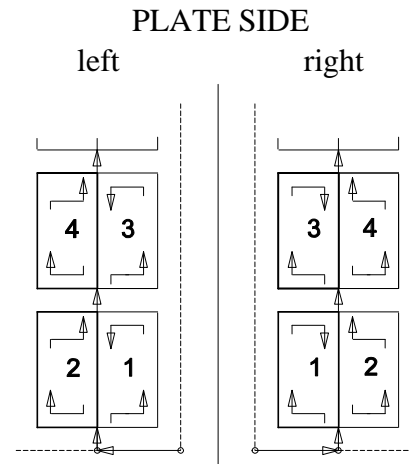


- | | | |
|----------------------|---|---------------------------------|
| 1. X DIMENSION | : | (Inches or millimeters) |
| 2. Y DIMENSION | : | (Inches or millimeters) |
| 3. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 4. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 5. KERF DIMENSION* | : | (Width of cutting tool path) |
| 6. VERIFY- YES/NO | : | (YES or NO) |

NOTE:

All chain cut parts start from the plate corner closest to the operator. The PLATE SIDE is defined through SYSTEM SETUP DATA.

* Kerf dimension must be entered here. There is no dial-in kerf at run time for this part.

SHAPES3.5**SHAPE 5 : CHAIN RECTANGLE 2****REPEAT PATTERNS**

- | | | |
|----------------------|---|---------------------------------|
| 1. X DIMENSION | : | (Inches or millimeters) |
| 2. Y DIMENSION | : | (Inches or millimeters) |
| 3. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 4. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 5. KERF DIMENSION | : | (Width of cutting tool path) |
| 6. VERIFY- YES/NO | : | (YES or NO) |

NOTES:

All chain cut parts start from the plate corner closest to the operator. The PLATE SIDE is defined through SYSTEM SETUP DATA.

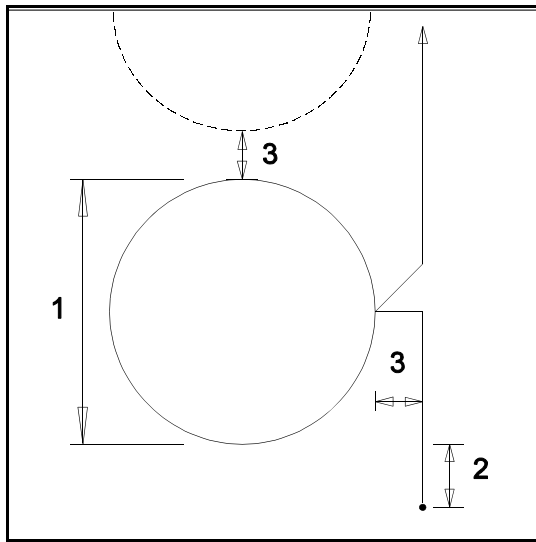
The part cutting order also depends on the PLATE SIDE value. The part closest to the corner of the plate is always cut first, as shown under REPEAT PATTERNS.

Although the REPEAT PATTERN creates parts in pairs to minimize scrap and reduce cutting time, each part is individually counted when cut.

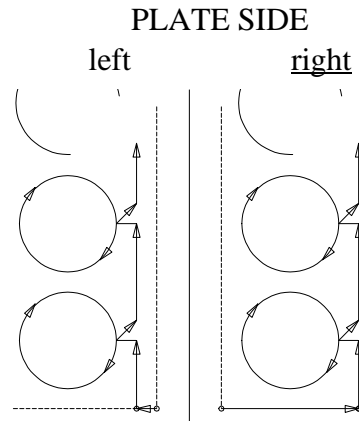
2.5RS OPERATION AND MAINTENANCE MANUAL

SHAPES3.6

SHAPE 6 : CHAIN CIRCLE



REPEAT PATTERNS



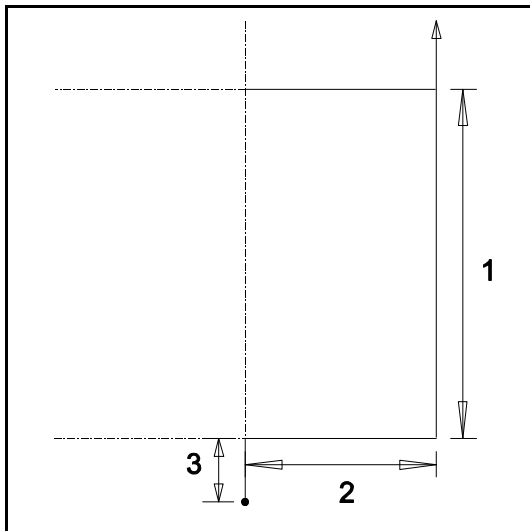
1. DIAMETER DIMENSION : (Inches or millimeters)
2. LEAD-IN DIMENSION : (Inches or millimeters)
3. SCRAP DIMENSION : (Distance between parts, in/mm)
4. KERF DIMENSION : (Width of cutting tool path)
5. VERIFY- YES/NO : (YES or NO)

NOTE:

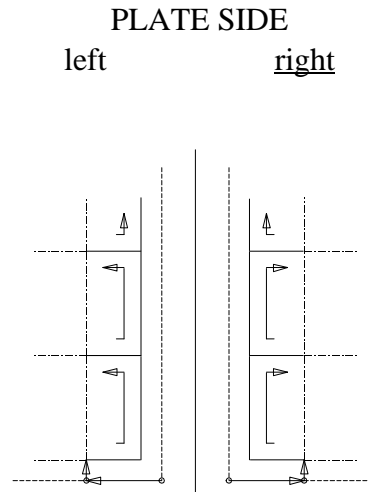
All chain cut parts start from the plate corner closest to the operator. The PLATE SIDE is defined through SYSTEM SETUP DATA.

SHAPES3.7

SHAPE 7 : RIP MODE



REPEAT PATTERNS



- 1. X DIMENSION : (Inches or millimeters)
- 2. Y DIMENSION : (Inches or millimeters)
- 3. LEAD-IN DIMENSION : (Inches or millimeters)
- 4. SCRAP DIMENSION : (Distance between parts, in/mm)
- 5. KERF DIMENSION : (Width of cutting tool path)
- 6. VERIFY- YES/NO : (YES or NO)

NOTES:

This part is designed for use with multiple torches.

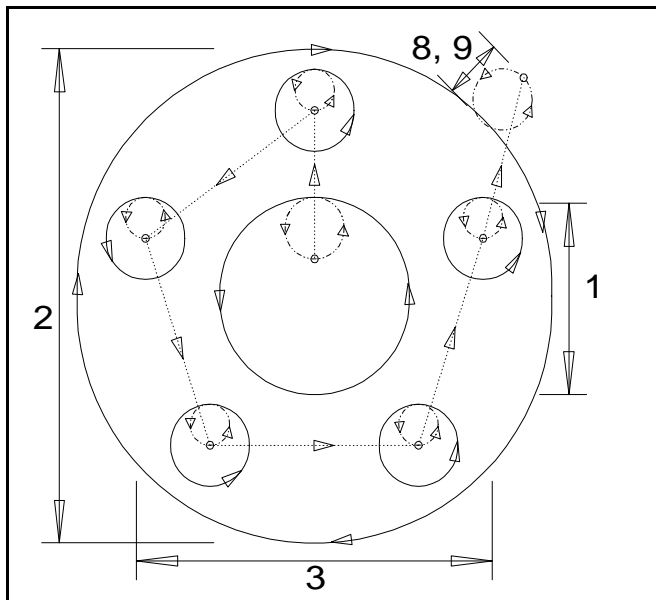
All RIP MODE cuts start at the corner of the plate closest to the operator. The PLATE SIDE is defined through SYSTEM SETUP DATA.

The cutting sequence also depends on the PLATE SIDE value. After moving away from the corner, a cut is made back towards the corner, as shown under REPEAT PATTERNS.

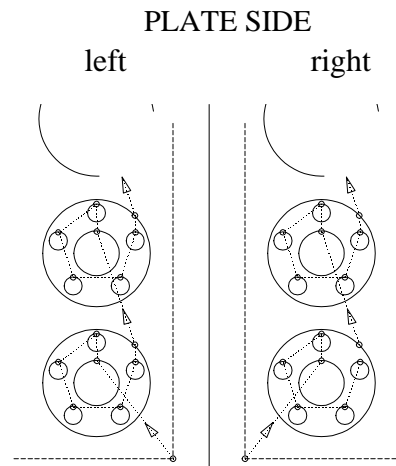
2.5RS OPERATION AND MAINTENANCE MANUAL

SHAPES3.8

SHAPE 8 : FLANGE



REPEAT PATTERN



1. INNER DIAMETER SIZE : (Inches or millimeters)
2. OUTER DIAMETER SIZE : (Inches or millimeters)
3. BOLT CENTER DIAMETER : (Inches or millimeters)
4. BOLT HOLE DIAMETER : (Inches or millimeters)
5. NUMBER OF BOLTS : (Count, 0 to 99)
6. KERF DIMENSION : (Width of cutting tool path)
7. SCRAP DIMENSION : (Distance between parts, in/mm)
8. LEAD-IN DIMENSION : (Inches or millimeters)
9. LEAD-OUT DIMENSION : (Inches or millimeters)
10. VERIFY- YES/NO : (YES or NO)

NOTES:

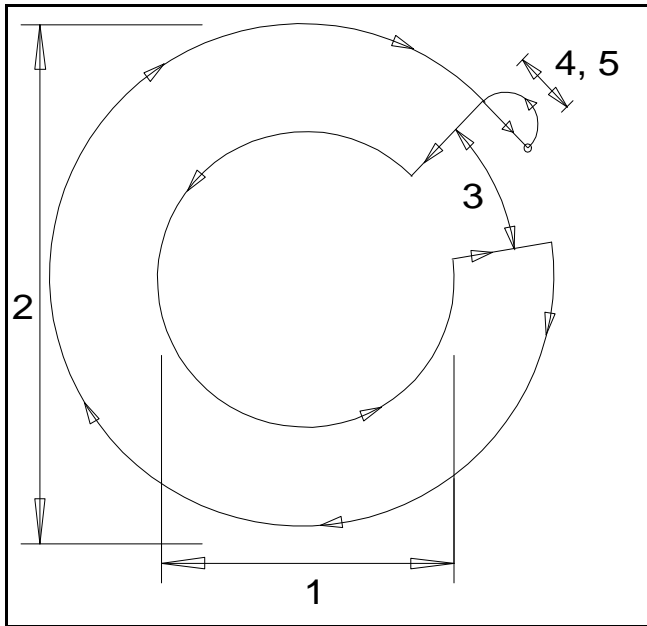
If an INNER DIAMETER of 0 is defined, no center hole is cut.

If the NUMBER OF BOLTS is defined as 0, no bolt holes are cut.

Only the INNER DIAMETER and the OUTER DIAMETER cuts use the LEAD-IN DIMENSION as the diameter of the circular lead-in. The lead-in distance for the bolt holes is automatically set to 1/2 of the BOLT HOLE DIAMETER value.

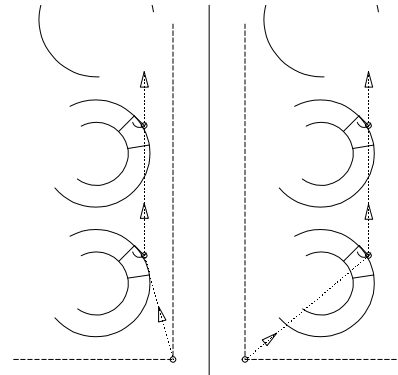
SHAPES3.9

SHAPE 9 : SPLIT RING



REPEAT PATTERNS

PLATE SIDE
left right



- | | | |
|------------------------|---|---------------------------------|
| 1. INNER DIAMETER SIZE | : | (Inches or millimeters) |
| 2. OUTER DIAMETER SIZE | : | (Inches or millimeters) |
| 3. SPLIT DEGREES | : | (Degrees) |
| 4. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 5. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 6. KERF DIMENSION | : | (Width of cutting tool path) |
| 7. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 8. VERIFY- YES/NO | : | (YES or NO) |

NOTES:

The starting position is always at the 45 degree position as shown.

The ending position is determined by the SPLIT DEGREES value.

The actual spacing between parts is based on the assumption that SPLIT DEGREES is less than 135 degrees. If not, the scrap between parts may be excessive. Therefore smaller arc segments should be cut using shape 10, RING DEGREES..

2.5RS OPERATION AND MAINTENANCE MANUAL

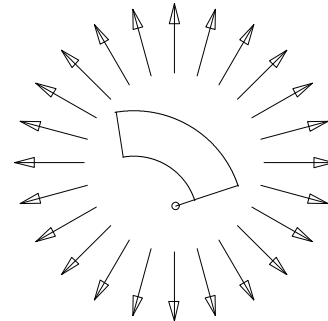
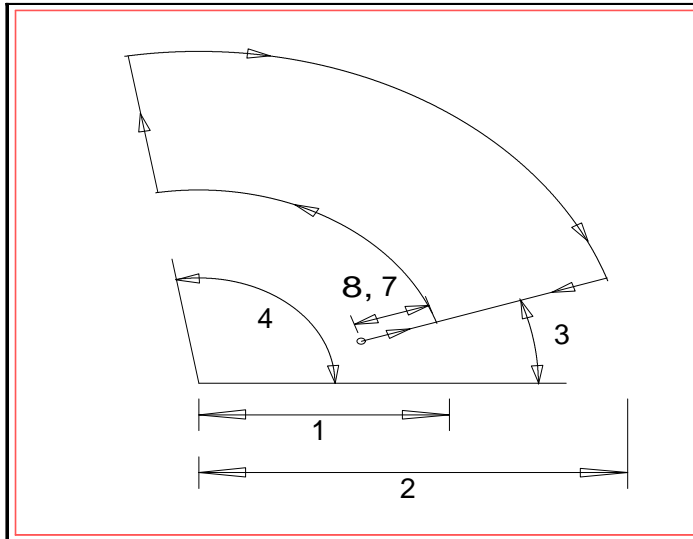
SHAPES3.10

SHAPE 10 : RING DEGREES

REPEAT PATTERNS

MANUAL REPEAT

ALL DIRECTIONS ALLOWED



1. INSIDE RADIUS SIZE : (Inches or millimeters)
2. OUTSIDE RADIUS SIZE : (Inches or millimeters)
3. STARTING DEGREES : (Degrees)
4. ENDING DEGREES : (Degrees)
5. CROSS REPEAT DISTANCE : (Y distance to next part)
6. RAIL REPEAT DISTANCE : (X distance to next part)
7. LEAD-IN DIMENSION : (Inches or millimeters)
8. LEAD-OUT DIMENSION : (Inches or millimeters)
9. KERF DIMENSION : (Width of cutting tool path)
10. VERIFY- YES/NO : (YES or NO)

NOTES:

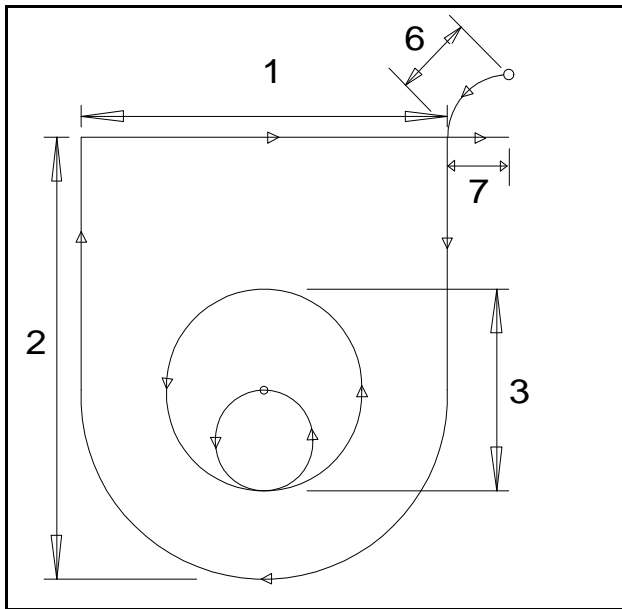
The STARTING DEGREES and ENDING DEGREES values represent angular position with respect to the Y axis (0 degrees is parallel to the Y axis and 90 degrees is parallel to the X axis).

The REPEAT DISTANCE parameters define the distance from the start of one part to the next. These values must be large enough to provide the necessary SCRAP between parts.

When running the resulting NC part program, the machine moves from the starting corner to the pierce point defined by the LEAD-IN DIMENSION.

SHAPES3.11

SHAPE 11 : STRAIGHT LUG

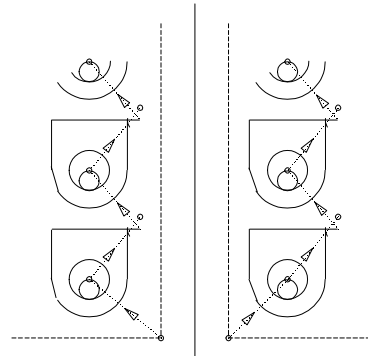


REPEAT PATTERNS

PLATE SIDE

left

right



- 1. WIDTH DIMENSION : (Inches or millimeters)
- 2. HEIGHT DIMENSION : (Inches or millimeters)
- 3. HOLE DIAMETER : (Inches or millimeters)
- 4. KERF DIMENSION : (Width of cutting tool path)
- 5. SCRAP DIMENSION : (Distance between parts, in/mm)
- 6. LEAD-IN DIMENSION : (Inches or millimeters)
- 7. LEAD-OUT DIMENSION : (Inches or millimeters)
- 8. VERIFY- YES/NO : (YES or NO)

NOTES:

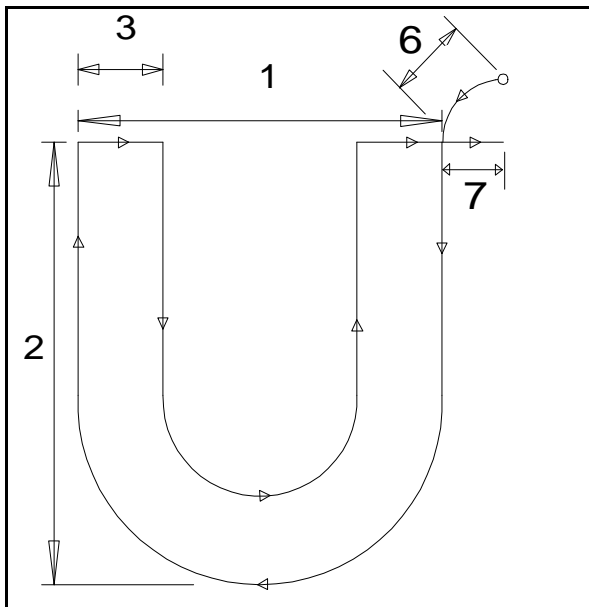
If a HOLE DIAMETER of 0 is defined, no center hole is cut.

The lead-in distance for the center hole is automatically set to 1/2 of the HOLE DIAMETER value.

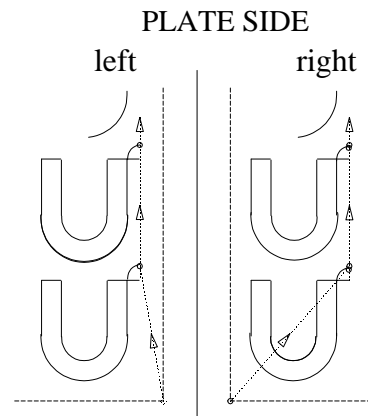
2.5RS OPERATION AND MAINTENANCE MANUAL

SHAPES3.12

SHAPE 12 : LUG FRAME



REPEAT PATTERNS



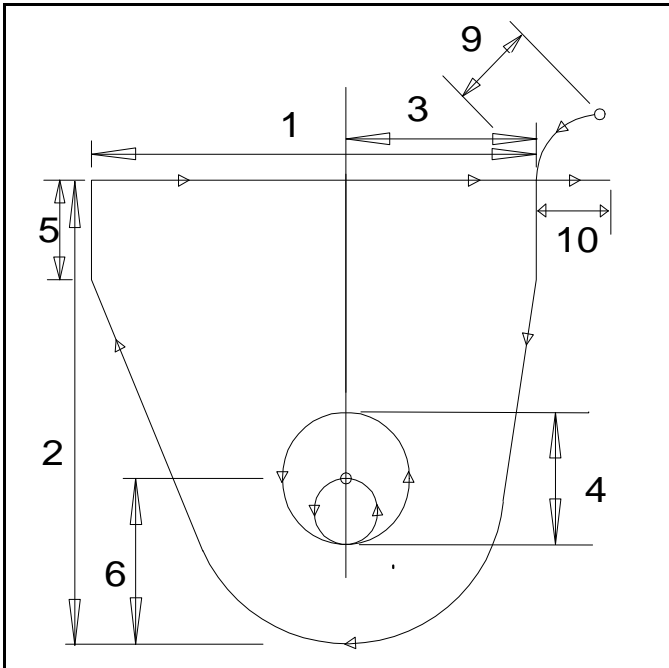
- | | | |
|------------------------|---|---------------------------------|
| 1. WIDTH DIMENSION | : | (Inches or millimeters) |
| 2. HEIGHT DIMENSION | : | (Inches or millimeters) |
| 3. THICKNESS DIMENSION | : | (Inches or millimeters) |
| 4. KERF DIMENSION | : | (Width of cutting tool path) |
| 5. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 6. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 7. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 8. VERIFY- YES/NO | : | (YES or NO) |

NOTES:

The only difference between parts created with LEFT PLATE or RIGHT PLATE enabled occurs in the traverse move to the first pierce point.

SHAPES3.13

SHAPE 13 : SLANT LUG

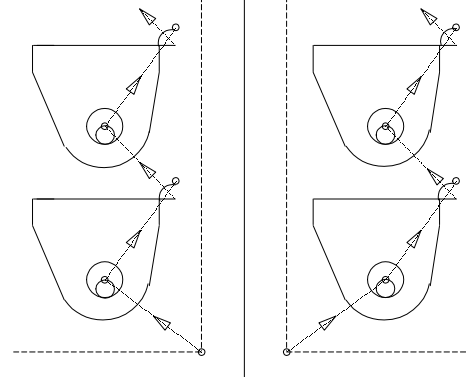


REPEAT PATTERNS

PLATE SIDE

left

right



- | | | |
|------------------------|---|---------------------------------|
| 1. WIDTH DIMENSION | : | (Inches or millimeters) |
| 2. HEIGHT DIMENSION | : | (Inches or millimeters) |
| 3. BOLT HOLE CENTER | : | (Inches or millimeters) |
| 4. HOLE DIAMETER | : | (Inches or millimeters) |
| 5. SHOULDER HEIGHT | : | (Inches or millimeters) |
| 6. RADIUS DIMENSION | : | (Inches or millimeters) |
| 7. KERF DIMENSION | : | (Width of cutting tool path) |
| 8. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 9. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 10. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 11. VERIFY- YES/NO | : | (YES or NO) |

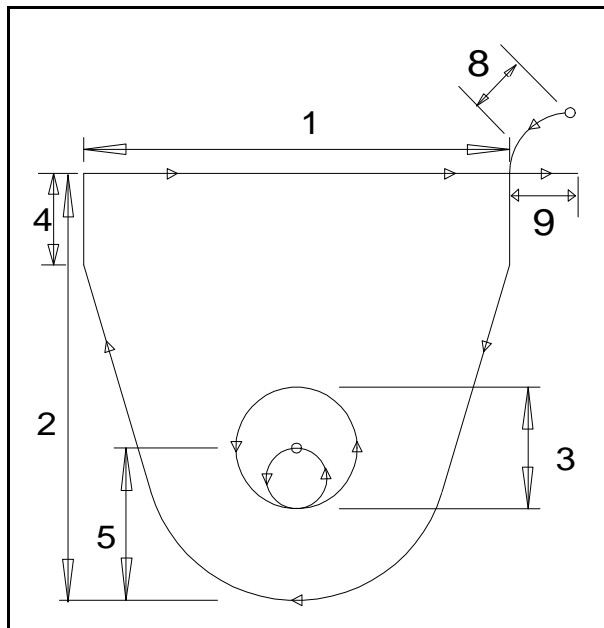
NOTES:

If a HOLE DIAMETER of 0 is defined, no center hole is cut.

2.5RS OPERATION AND MAINTENANCE MANUAL

SHAPES3.14

SHAPE 14 : LIFT LUG

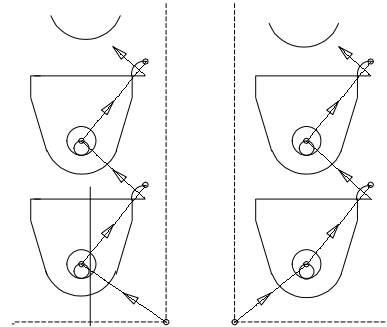


REPEAT PATTERNS

PLATE SIDE

left

right



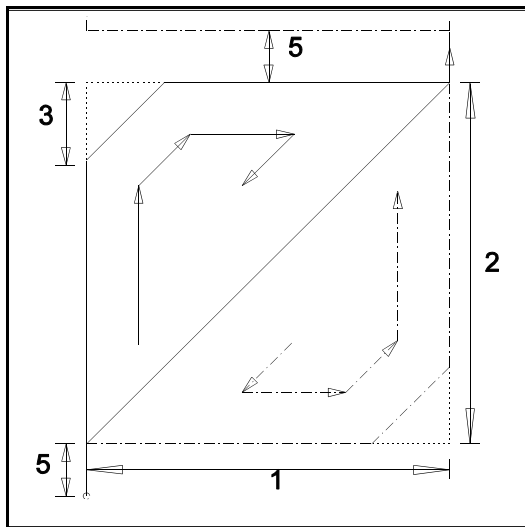
- | | | |
|-----------------------|---|---------------------------------|
| 1. WIDTH DIMENSION | : | (Inches or millimeters) |
| 2. HEIGHT DIMENSION | : | (Inches or millimeters) |
| 3. HOLE DIAMETER | : | (Inches or millimeters) |
| 4. SHOULDER HEIGHT | : | (Inches or millimeters) |
| 5. RADIUS DIMENSION | : | (Inches or millimeters) |
| 6. KERF DIMENSION | : | (Width of cutting tool path) |
| 7. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 8. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 9. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 10. VERIFY- YES/NO | : | (YES or NO) |

NOTES:

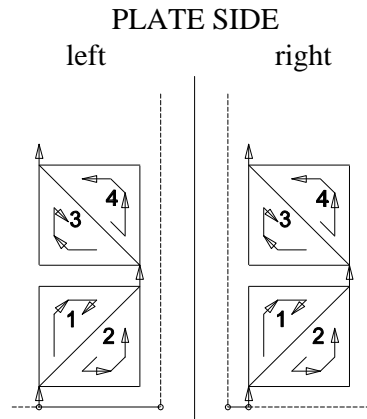
If a HOLE DIAMETER of 0 is defined, no center hole is cut.

SHAPES3.15

SHAPE 15 : WEDGE PAIR



REPEAT PATTERNS



- 1. WIDTH DIMENSION : (Inches or millimeters)
- 2. HEIGHT DIMENSION : (Inches or millimeters)
- 3. BEVEL LENGTH : (Inches or millimeters)
- 4. KERF DIMENSION : (Width of cutting tool path)
- 5. SCRAP DIMENSION : (Distance between parts, in/mm)
- 6. VERIFY- YES/NO : (YES or NO)

NOTES:

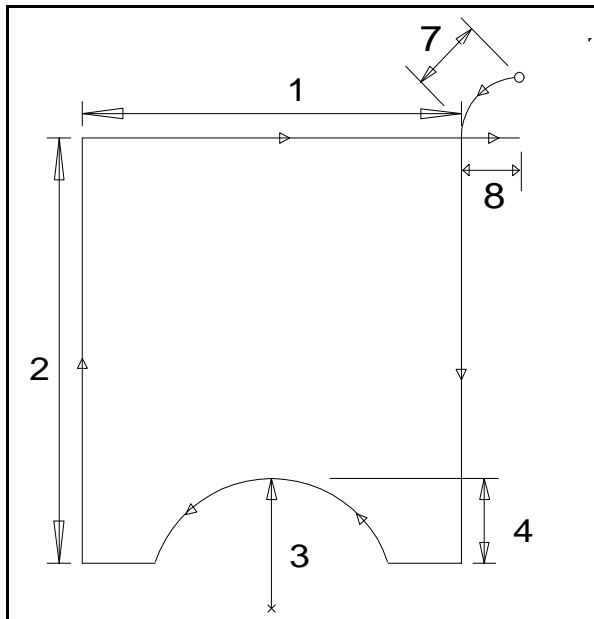
If a BEVEL LENGTH of 0 is defined, no bevel is cut at the corners. Only sharp, 90 degree corners are cut.

This shape creates a special 4 part repeat sequence to minimize the amount of scrap. However, any number of parts may be cut since each of the 4 is counted as a separate part.

2.5RS OPERATION AND MAINTENANCE MANUAL

SHAPES3.16

SHAPE 16 : STRAIGHT PIPE SUPPORT

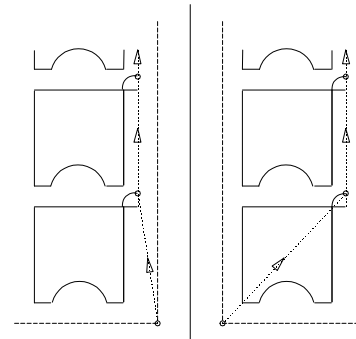


REPEAT PATTERNS

PLATE SIDE

left

right



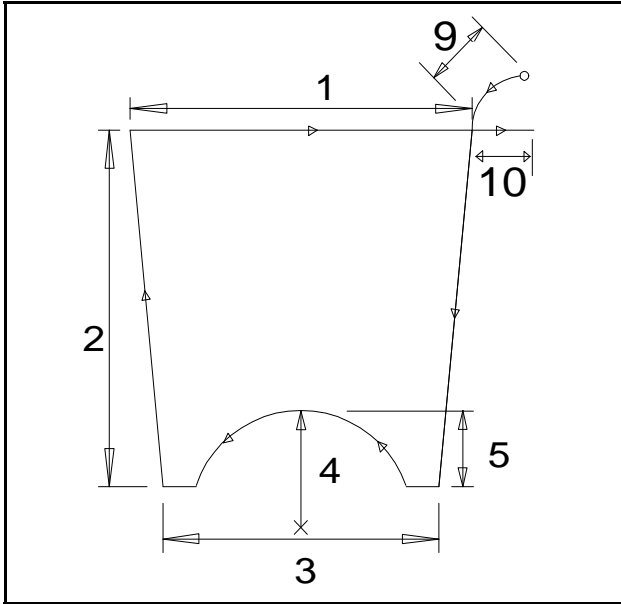
- | | | |
|-----------------------|---|---------------------------------|
| 1. WIDTH DIMENSION | : | (Inches or millimeters) |
| 2. HEIGHT DIMENSION | : | (Inches or millimeters) |
| 3. RADIUS DIMENSION | : | (Inches or millimeters) |
| 4. ARC DEPTH | : | (Inches or millimeters) |
| 5. KERF DIMENSION | : | (Width of cutting tool path) |
| 6. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 7. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 8. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 9. VERIFY- YES/NO | : | (YES or NO) |

NOTES:

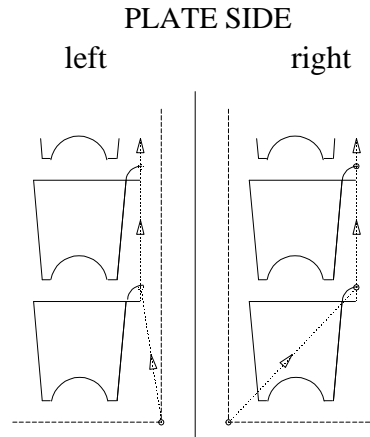
The only difference between parts created with LEFT PLATE or RIGHT PLATE enabled occurs in the traverse move to the first pierce point.

SHAPES3.17

SHAPE 17 : SLANT PIPE SUPPORT



REPEAT PATTERNS



- | | | |
|-----------------------|---|---------------------------------|
| 1. BASE WIDTH | : | (Inches or millimeters) |
| 2. HEIGHT DIMENSION | : | (Inches or millimeters) |
| 3. TOP WIDTH | : | (Inches or millimeters) |
| 4. RADIUS DIMENSION | : | (Inches or millimeters) |
| 5. ARC DEPTH | : | (Inches or millimeters) |
| 6. KERF DIMENSION | : | (Width of cutting tool path) |
| 7. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 8. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 9. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 10. VERIFY- YES/NO | : | (YES or NO) |

NOTES:

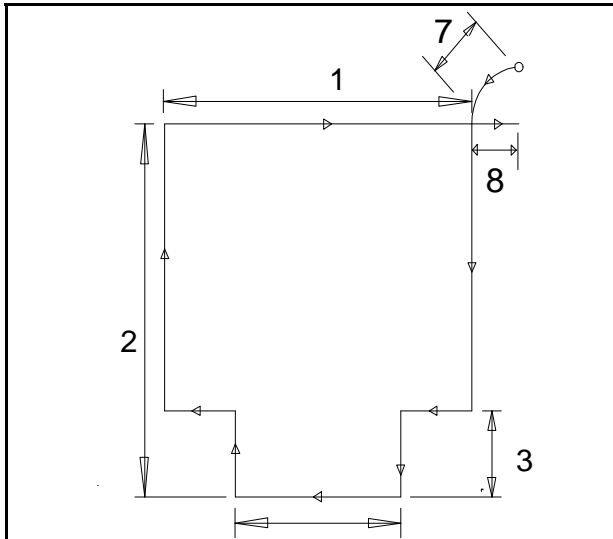
Like others, this part is cut with the BASE at the upper position. As a result, the prompts used to label the top and sides assume the part is rotated 180 degrees.

The only difference between parts created with LEFT PLATE or RIGHT PLATE enabled occurs in the traverse move to the first pierce point.

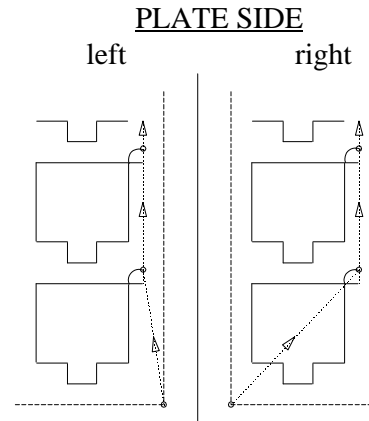
2.5RS OPERATION AND MAINTENANCE MANUAL

SHAPES3.18

SHAPE 18 : VERTICAL PROJECTION



REPEAT PATTERNS



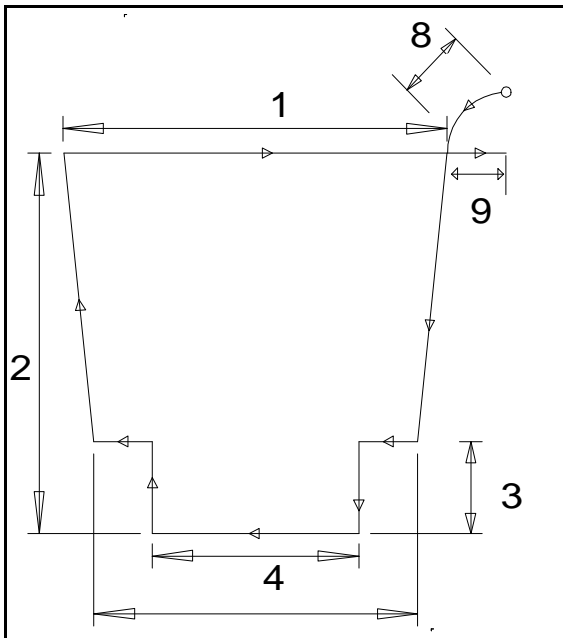
- | | | |
|-----------------------|---|---------------------------------|
| 1. WIDTH DIMENSION | : | (Inches or millimeters) |
| 2. HEIGHT DIMENSION | : | (Inches or millimeters) |
| 3. COLLAR HEIGHT | : | (Inches or millimeters) |
| 4. COLLAR WIDTH | : | (Inches or millimeters) |
| 5. KERF DIMENSION | : | (Width of cutting tool path) |
| 6. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 7. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 8. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 9. VERIFY- YES/NO | : | (YES or NO) |

NOTES:

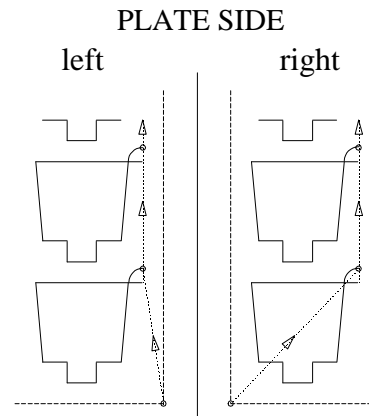
The only difference between parts created with LEFT PLATE or RIGHT PLATE enabled occurs in the traverse move to the first pierce point.

SHAPES3.19

SHAPE 19 : SLANT PROJECTION



REPEAT PATTERNS



- | | | |
|-----------------------|---|---------------------------------|
| 1. BASE WIDTH | : | (Inches or millimeters) |
| 2. HEIGHT DIMENSION | : | (Inches or millimeters) |
| 3. COLLAR HEIGHT | : | (Inches or millimeters) |
| 4. COLLAR WIDTH | : | (Inches or millimeters) |
| 5. TOP WIDTH | : | (Inches or millimeters) |
| 6. KERF DIMENSION | : | (Width of cutting tool path) |
| 7. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 8. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 9. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 10. VERIFY- YES/NO | : | (YES or NO) |

NOTES:

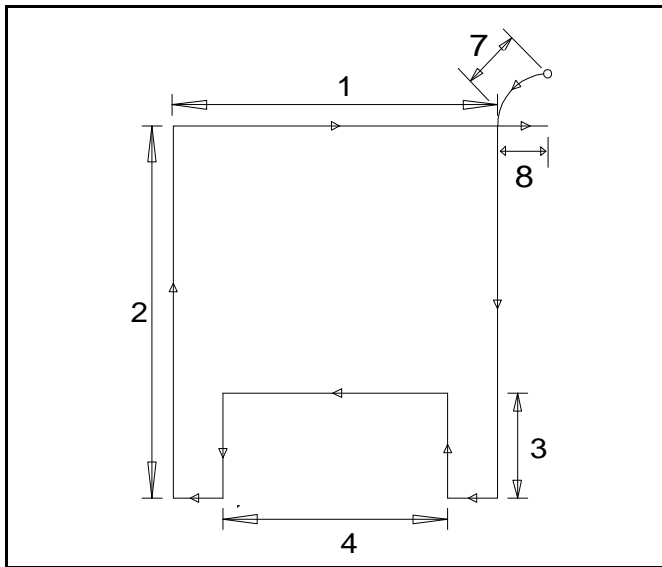
Like others, this part is cut with the BASE at the upper position. As a result, the prompts used to label the top and sides assume the part is rotated 180 degrees.

The only difference between parts created with LEFT PLATE or RIGHT PLATE enabled occurs in the traverse move to the first pierce point.

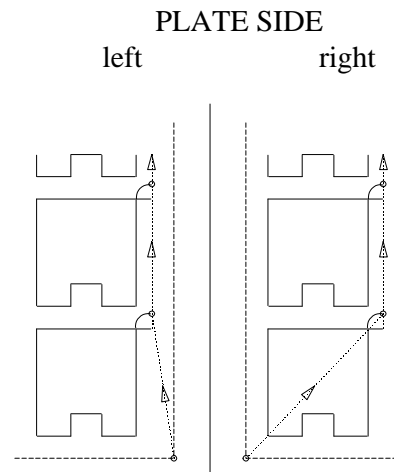
2.5RS OPERATION AND MAINTENANCE MANUAL

SHAPES3.20

SHAPE 20 : VERTICAL SLOT



REPEAT PATTERNS



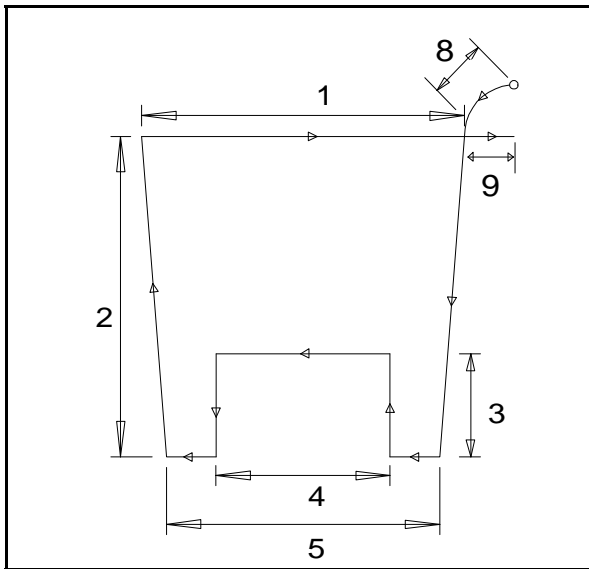
- | | | |
|-----------------------|---|---------------------------------|
| 1. WIDTH DIMENSION | : | (Inches or millimeters) |
| 2. HEIGHT DIMENSION | : | (Inches or millimeters) |
| 3. COLLAR HEIGHT | : | (Inches or millimeters) |
| 4. COLLAR WIDTH | : | (Inches or millimeters) |
| 5. KERF DIMENSION | : | (Width of cutting tool path) |
| 6. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 7. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 8. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 9. VERIFY- YES/NO | : | (YES or NO) |

NOTES:

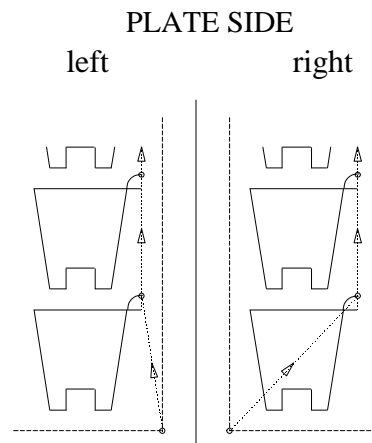
The only difference between parts created with LEFT PLATE or RIGHT PLATE enabled occurs in the traverse move to the first pierce point.

SHAPES3.21

SHAPE 21 : SLANT SLOT



REPEAT PATTERNS



- | | | |
|-----------------------|---|---------------------------------|
| 1. BASE WIDTH | : | (Inches or millimeters) |
| 2. HEIGHT DIMENSION | : | (Inches or millimeters) |
| 3. COLLAR HEIGHT | : | (Inches or millimeters) |
| 4. COLLAR WIDTH | : | (Inches or millimeters) |
| 5. TOP WIDTH | : | (Inches or millimeters) |
| 6. KERF DIMENSION | : | (Width of cutting tool path) |
| 7. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 8. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 9. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 10. VERIFY- YES/NO | : | (YES or NO) |

NOTES:

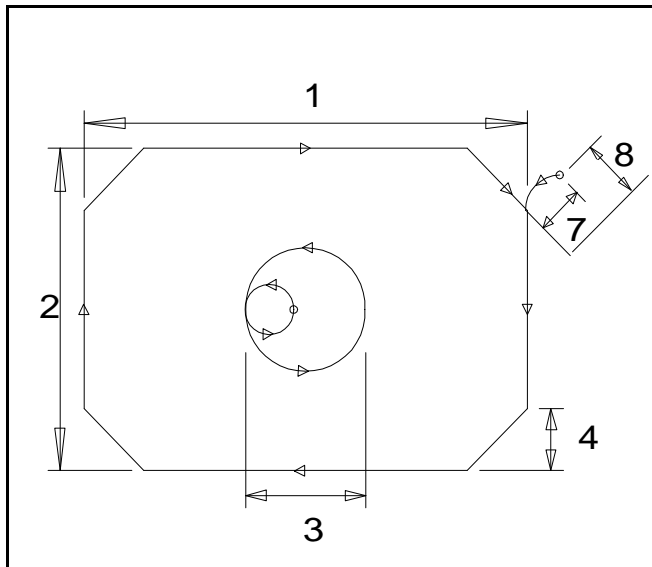
Like others, this part is cut with the BASE at the upper position. As a result, the prompts used to label the top and sides assume the part is rotated 180 degrees.

The only difference between parts created with LEFT PLATE or RIGHT PLATE enabled occurs in the traverse move to the first pierce point.

2.5RS OPERATION AND MAINTENANCE MANUAL

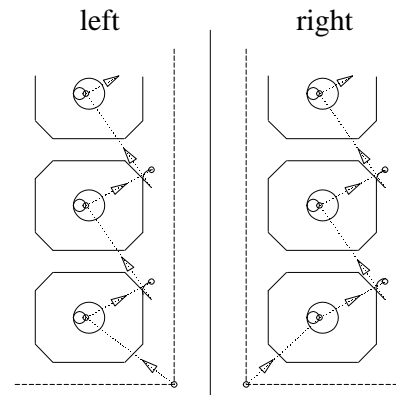
SHAPES3.22

SHAPE 22 : OCTAGON



REPEAT PATTERNS

PLATE SIDE

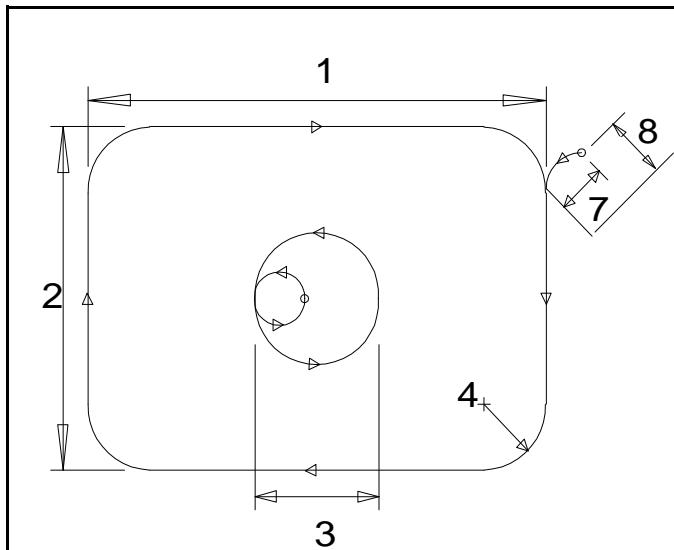


- | | | |
|-----------------------|---|---------------------------------|
| 1. WIDTH DIMENSION | : | (Inches or millimeters) |
| 2. HEIGHT DIMENSION | : | (Inches or millimeters) |
| 3. HOLE DIAMETER | : | (Inches or millimeters) |
| 4. BEVEL LENGTH | : | (Inches or millimeters) |
| 5. KERF DIMENSION | : | (Width of cutting tool path) |
| 6. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 7. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 8. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 9. VERIFY- YES/NO | : | (YES or NO) |

NOTE:

If a HOLE DIAMETER of 0 is defined, no center hole is cut.

SHAPES3.23 SHAPE 23 : SQUARE, CORNER RADIUS IN

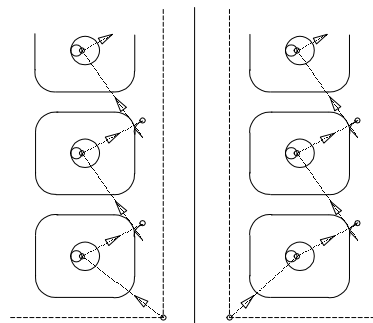


REPEAT PATTERNS

PLATE SIDE

left

right



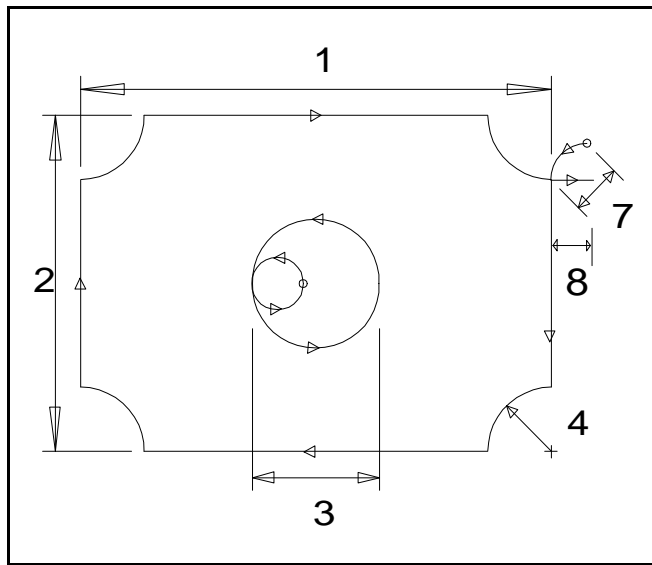
- | | | |
|-----------------------|---|---------------------------------|
| 1. WIDTH DIMENSION | : | (Inches or millimeters) |
| 2. HEIGHT DIMENSION | : | (Inches or millimeters) |
| 3. HOLE DIAMETER | : | (Inches or millimeters) |
| 4. ARC RADIUS | : | (Inches or millimeters) |
| 5. KERF DIMENSION | : | (Width of cutting tool path) |
| 6. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 7. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 8. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 9. VERIFY- YES/NO | : | (YES or NO) |

NOTE:

If a HOLE DIAMETER of 0 is defined, no center hole is cut.

2.5RS OPERATION AND MAINTENANCE MANUAL

SHAPES3.24 SHAPE 24 : SQUARE, CORNER RADIUS OUT

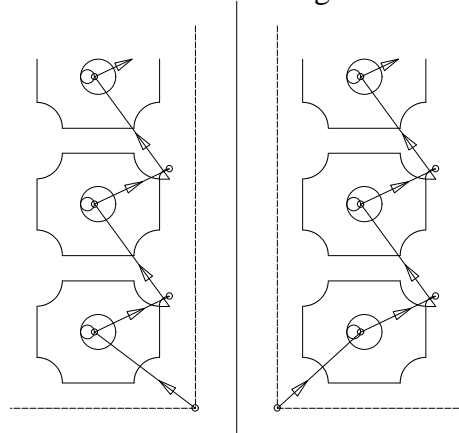


REPEAT PATTERNS

PLATE SIDE

left

right



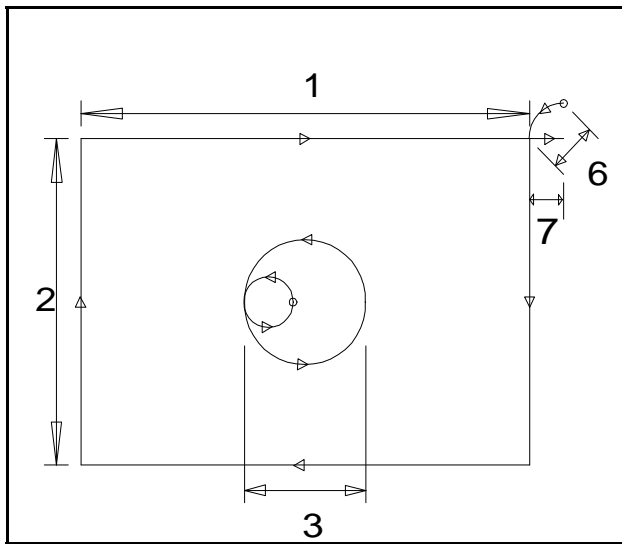
- | | | |
|-----------------------|---|---------------------------------|
| 1. WIDTH DIMENSION | : | (Inches or millimeters) |
| 2. HEIGHT DIMENSION | : | (Inches or millimeters) |
| 3. HOLE DIAMETER | : | (Inches or millimeters) |
| 4. ARC RADIUS | : | (Inches or millimeters) |
| 5. KERF DIMENSION | : | (Width of cutting tool path) |
| 6. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 7. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 8. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 9. VERIFY- YES/NO | : | (YES or NO) |

NOTES:

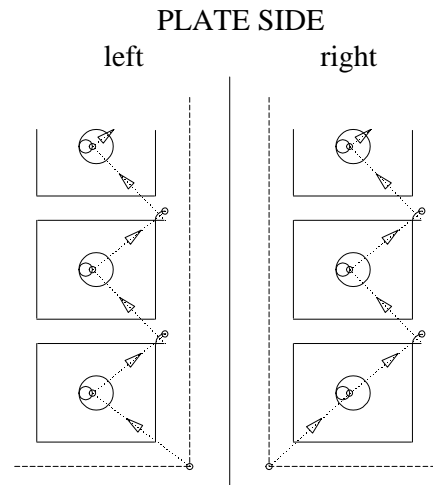
If a HOLE DIAMETER of 0 is defined, no center hole is cut.

SHAPES3.25

SHAPE 25 : SQUARE WITH HOLE



REPEAT PATTERNS



- | | | |
|-----------------------|---|---------------------------------|
| 1. WIDTH DIMENSION | : | (Inches or millimeters) |
| 2. HEIGHT DIMENSION | : | (Inches or millimeters) |
| 3. HOLE DIAMETER | : | (Inches or millimeters) |
| 4. KERF DIMENSION | : | (Width of cutting tool path) |
| 5. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 6. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 7. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 8. VERIFY- YES/NO | : | (YES or NO) |

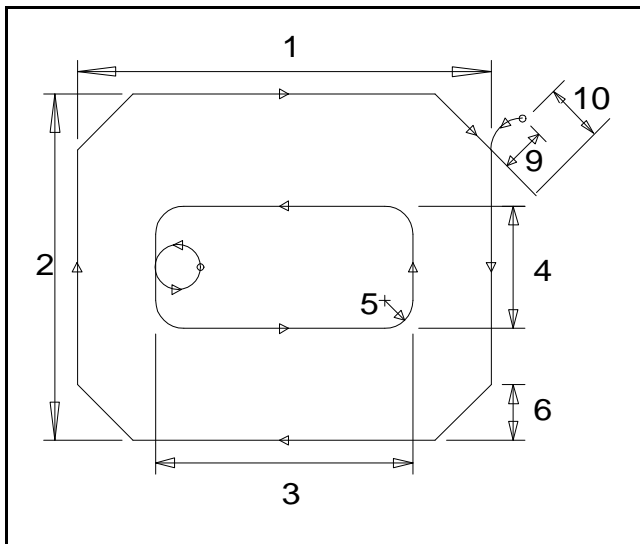
NOTES:

If a HOLE DIAMETER of 0 is defined, no center hole is cut.

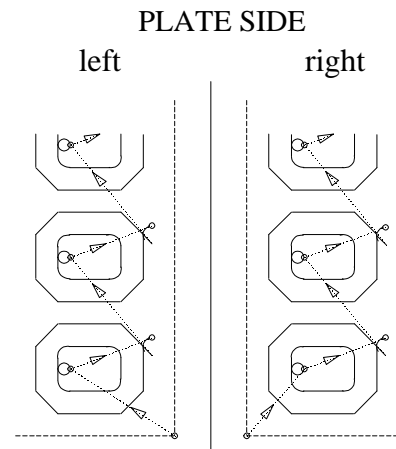
2.5RS OPERATION AND MAINTENANCE MANUAL

SHAPES3.26

SHAPE 26 : OCTAGONAL FRAME



REPEAT PATTERNS



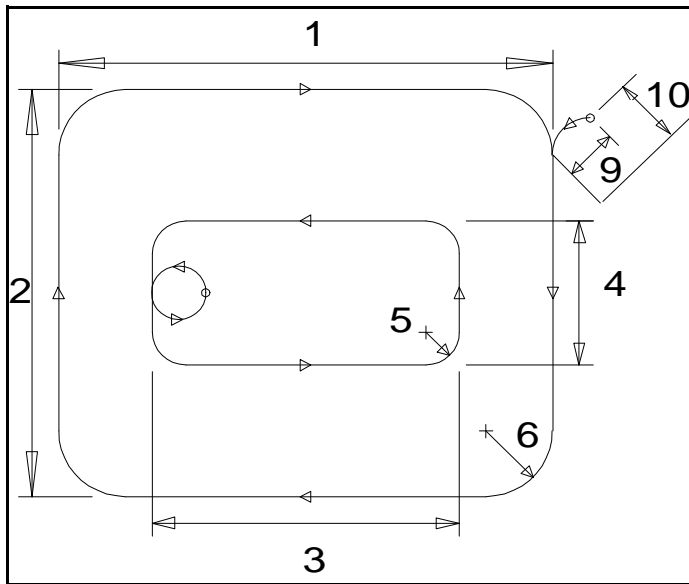
- | | | |
|------------------------|---|---------------------------------|
| 1. OUTSIDE WIDTH | : | (Inches or millimeters) |
| 2. OUTSIDE HEIGHT | : | (Inches or millimeters) |
| 3. INSIDE WIDTH | : | (Inches or millimeters) |
| 4. INSIDE HEIGHT | : | (Inches or millimeters) |
| 5. INSIDE RADIUS | : | (Inches or millimeters) |
| 6. BEVEL LENGTH | : | (Inches or millimeters) |
| 7. KERF DIMENSION | : | (Width of cutting tool path) |
| 8. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 9. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 10. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 11. VERIFY- YES/NO | : | (YES or NO) |

NOTES:

The only difference between parts created with LEFT PLATE or RIGHT PLATE enabled occurs in the traverse move to the first pierce point.

SYSTEM OPERATION : SHAPES

SHAPES3.27 SHAPE 27 : FRAME, CORNER RADIUS IN

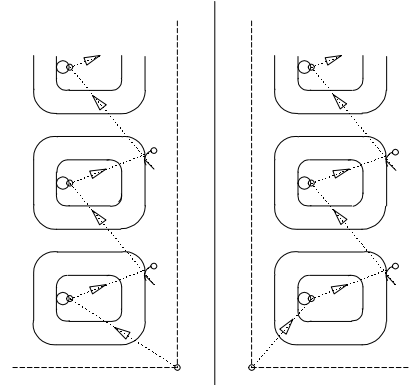


REPEAT PATTERNS

PLATE SIDE

left

right



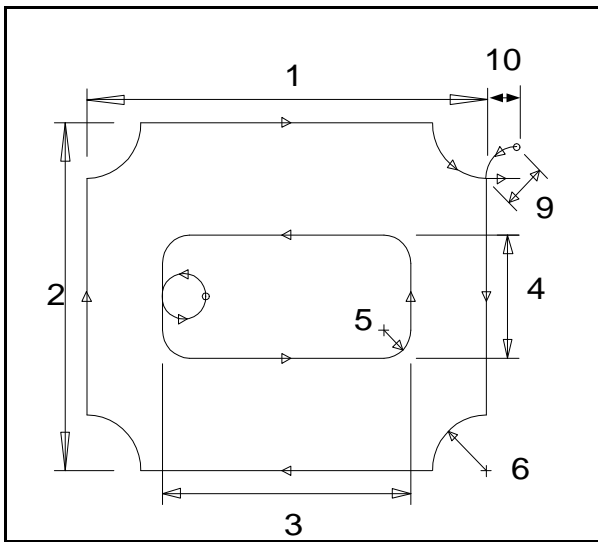
1. OUTSIDE WIDTH : (Inches or millimeters)
2. OUTSIDE HEIGHT : (Inches or millimeters)
3. INSIDE WIDTH : (Inches or millimeters)
4. INSIDE HEIGHT : (Inches or millimeters)
5. INSIDE RADIUS : (Inches or millimeters)
6. ARC RADIUS : (Inches or millimeters)
7. KERF DIMENSION : (Width of cutting tool path)
8. SCRAP DIMENSION : (Distance between parts, in/mm)
9. LEAD-IN DIMENSION : (Inches or millimeters)
10. LEAD-OUT DIMENSION : (Inches or millimeters)
11. VERIFY- YES/NO : (YES or NO)

NOTES:

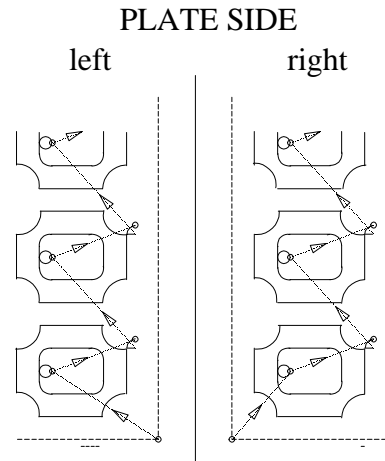
The only difference between parts created with LEFT PLATE or RIGHT PLATE enabled occurs in the traverse move to the first pierce point, as shown.

2.5RS OPERATION AND MAINTENANCE MANUAL

SHAPES3.28 SHAPE 28 : FRAME, CORNER RADIUS OUT



REPEAT PATTERNS



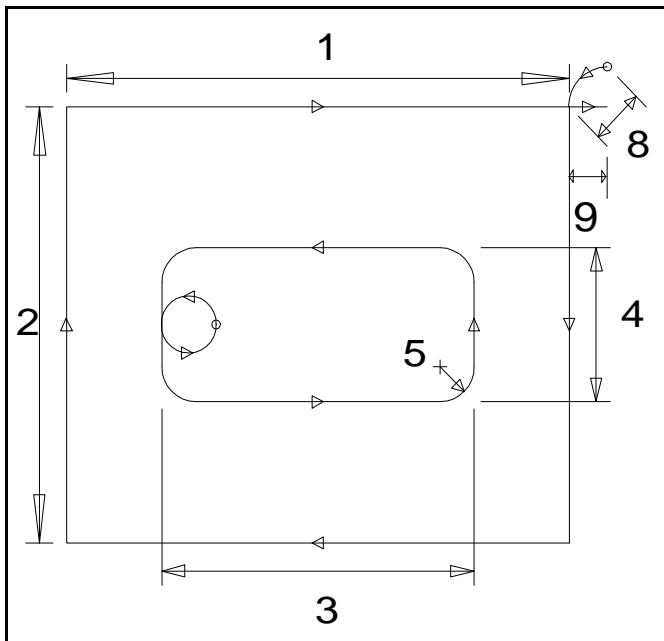
- | | | |
|------------------------|---|---------------------------------|
| 1. OUTSIDE WIDTH | : | (Inches or millimeters) |
| 2. OUTSIDE HEIGHT | : | (Inches or millimeters) |
| 3. INSIDE WIDTH | : | (Inches or millimeters) |
| 4. INSIDE HEIGHT | : | (Inches or millimeters) |
| 5. INSIDE RADIUS | : | (Inches or millimeters) |
| 6. ARC RADIUS | : | (Inches or millimeters) |
| 7. KERF DIMENSION | : | (Width of cutting tool path) |
| 8. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 9. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 10. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 11. VERIFY- YES/NO | : | (YES or NO) |

NOTES:

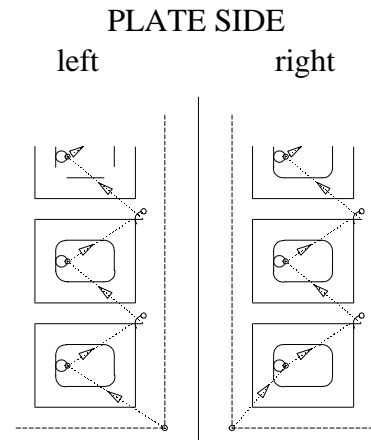
The only difference between parts created with LEFT PLATE or RIGHT PLATE enabled occurs in the traverse move to the first pierce point, as shown.

SHAPES3.29

SHAPE 29 : SQUARE FRAME



REPEAT PATTERNS



- | | | |
|-----------------------|---|---------------------------------|
| 1. OUTSIDE WIDTH | : | (Inches or millimeters) |
| 2. OUTSIDE HEIGHT | : | (Inches or millimeters) |
| 3. INSIDE WIDTH | : | (Inches or millimeters) |
| 4. INSIDE HEIGHT | : | (Inches or millimeters) |
| 5. INSIDE RADIUS | : | (Inches or millimeters) |
| 6. KERF DIMENSION | : | (Width of cutting tool path) |
| 7. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 8. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 9. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 10. VERIFY- YES/NO | : | (YES or NO) |

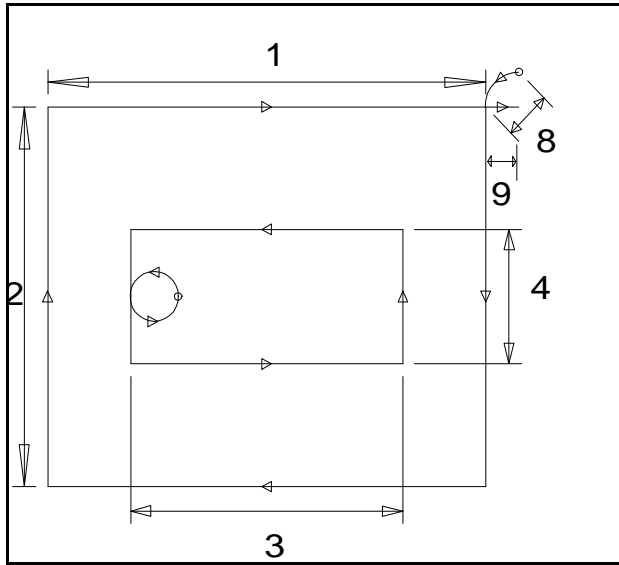
NOTES:

The only difference between parts created with LEFT PLATE or RIGHT PLATE enabled occurs in the traverse move to the first pierce point, as shown.

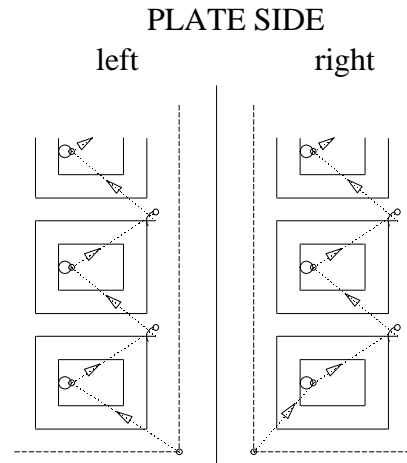
2.5RS OPERATION AND MAINTENANCE MANUAL

SHAPES3.30

SHAPE 30 : RECTANGULAR FRAME



REPEAT PATTERNS

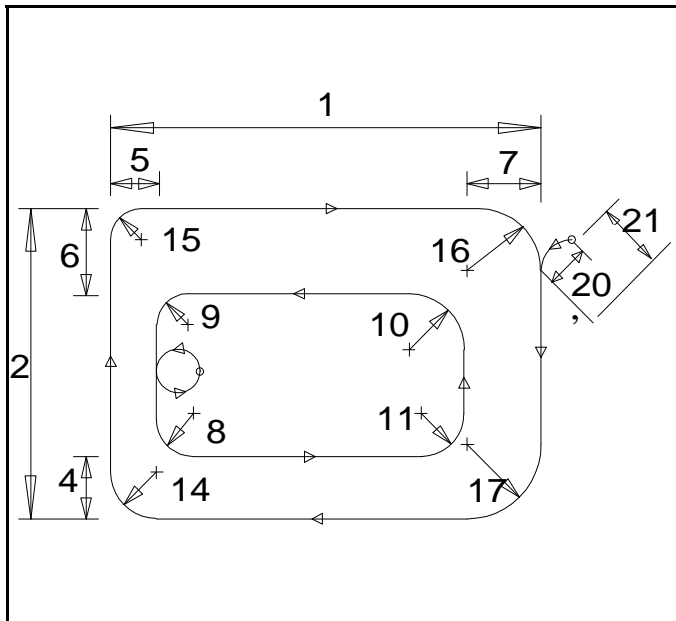


- | | | |
|-----------------------|---|---------------------------------|
| 1. OUTSIDE WIDTH | : | (Inches or millimeters) |
| 2. OUTSIDE HEIGHT | : | (Inches or millimeters) |
| 3. INSIDE WIDTH | : | (Inches or millimeters) |
| 4. INSIDE HEIGHT | : | (Inches or millimeters) |
| 5. KERF DIMENSION | : | (Width of cutting tool path) |
| 6. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 7. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 8. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 9. VERIFY- YES/NO | : | (YES or NO) |

NOTES:

The only difference between parts created with LEFT PLATE or RIGHT PLATE enabled occurs in the traverse move to the first pierce point, as shown.

SHAPES 31 : UNIVERSAL FRAME

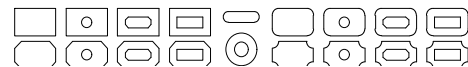
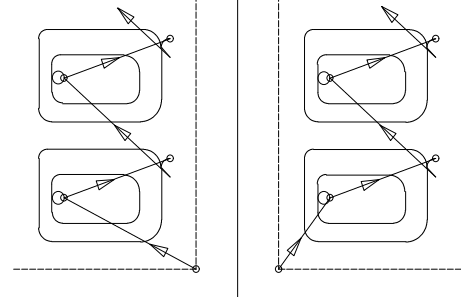


REPEAT PATTERNS

PLATE SIDE

left

right



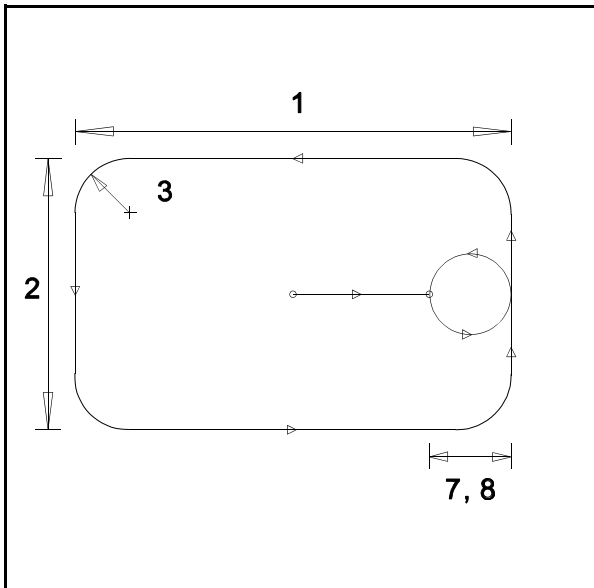
EXAMPLE SHAPES

- | | | |
|---------------------------------------|---|---------------------------------|
| 1. WIDTH DIMENSION | : | (Inches or millimeters) |
| 2. HEIGHT DIMENSION | : | (Inches or millimeters) |
| 3. SYMMETRY ¹ | : | (YES or NO) |
| 4. BOTTOM THICKNESS ¹ | : | (Inches or millimeters) |
| 5. LEFT THICKNESS ¹ | : | (Inches or millimeters) |
| 6. TOP THICKNESS ¹ | : | (Inches or millimeters) |
| 7. RIGHT THICKNESS ¹ | : | (Inches or millimeters) |
| 8. B-LEFT INNER RADIUS ¹ | : | (Inches or millimeters) |
| 9. T-LEFT INNER RADIUS ¹ | : | (Inches or millimeters) |
| 10. T-RIGHT INNER RADIUS ¹ | : | (Inches or millimeters) |
| 11. B-RIGHT INNER RADIUS ¹ | : | (Inches or millimeters) |
| 12. BEVEL CORNERS ² | : | (YES or NO) ² |
| 13. CONVEX ² | : | (YES or NO) ² |
| 14. B-LEFT OUTER RADIUS | : | (Inches or millimeters) |
| 15. T-LEFT OUTER RADIUS | : | (Inches or millimeters) |
| 16. T-RIGHT OUTER RADIUS | : | (Inches or millimeters) |
| 17. B-RIGHT OUTER RADIUS | : | (Inches or millimeters) |
| 18. KERF DIMENSION | : | (Width of cutting tool path) |
| 19. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 20. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 21. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 22. VERIFY- YES/NO | : | (YES or NO) |

NOTES:

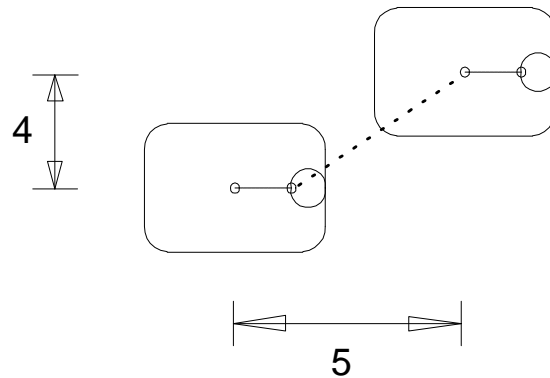
- When SYMMETRY:YES is selected, values for THICKNESS, INNER RADIUS and OUTER RADIUS are automatically pre-loaded from 4, 8 and 14 to define a symmetrical part.
- The CONVEX prompt line only appears when BEVEL CORNERS:NO is selected.

2.5RS OPERATION AND MAINTENANCE MANUAL



SHAPES 32: RECTANGULAR HOLE

REPEAT PATTERNS
MANUAL REPEAT
ALL DIRECTIONS ALLOWED



- | | | |
|-----------------------|---|---|
| 1. WIDTH DIMENSION | : | (Inches or millimeters) |
| 2. HEIGHT DIMENSION | : | (Inches or millimeters) |
| 3. CORNER RADIUS | : | (Inches or millimeters) |
| 4. X MOVE DISTANCE | : | X distance to next hole (Inches or millimeters) |
| 5. Y MOVE DISTANCE | : | Y distance to next hole (Inches or millimeters) |
| 6. KERF DIMENSION | : | (Width of cutting tool path) |
| 7. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 8. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 9. VERIFY- YES/NO | : | (YES or NO) |

NOTES:

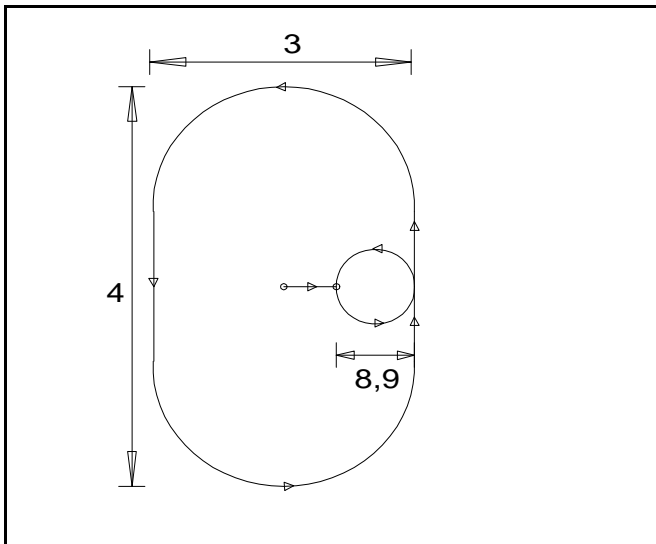
The X and Y MOVE DISTANCE values are used to define the "center to center" distance between holes. From this center position, the program moves the machine to the pierce point determined by the LEAD-IN DIMENSION.

LEAD-IN DIMENSION must be less than the WIDTH DIMENSION.

For the first hole, the torch should be positioned by the user.

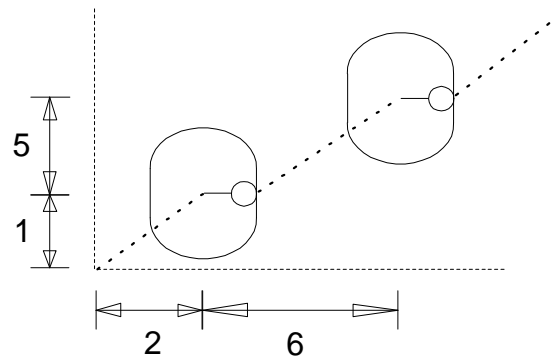
SHAPES3.33

SHAPE 33 : VERTICAL HOLE



REPEAT PATTERN

MANUAL REPEAT
ALL DIRECTIONS ALLOWED



- | | | |
|-----------------------|---|-------------------------------|
| 1. X START | : | (Inches or millimeters) |
| 2. Y START | : | (Inches or millimeters) |
| 3. SLOT WIDTH | : | (Inches or millimeters) |
| 4. SLOT HEIGHT | : | (Inches or millimeters) |
| 5. X MOVE DISTANCE | : | (Rail distance to next hole) |
| 6. Y MOVE DISTANCE | : | (Cross distance to next hole) |
| 7. KERF DIMENSION | : | (Width of cutting tool path) |
| 8. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 9. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 10. VERIFY- YES/NO | : | (YES or NO) |

NOTES:

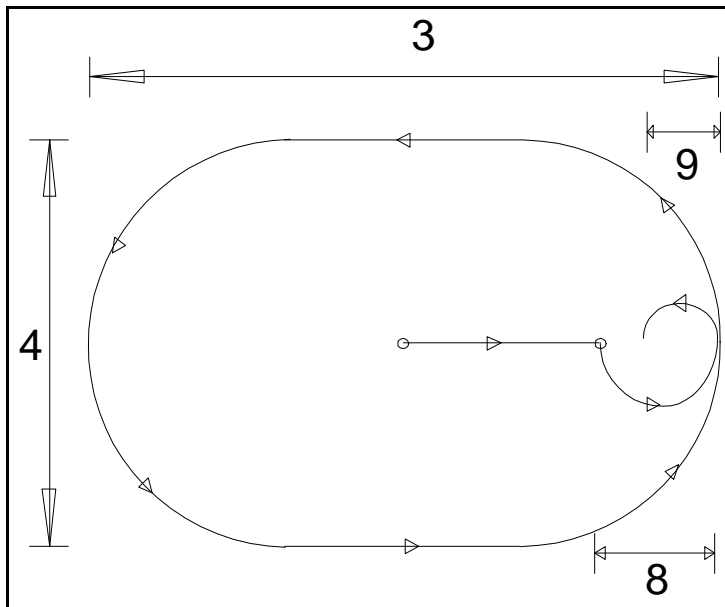
The X and Y START values are used to define the center to center distance between holes. From this center position, the program moves the machine to the pierce point determined by the LEAD-IN DIMENSION.

LEAD-IN DIMENSION must be less than the SLOT HEIGHT.

2.5RS OPERATION AND MAINTENANCE MANUAL

SHAPES3.34

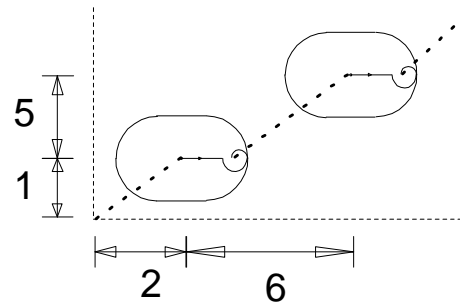
SHAPE 34 : HORIZONTAL HOLE



REPEAT PATTERN

MANUAL REPEAT

ALL DIRECTIONS ALLOWED

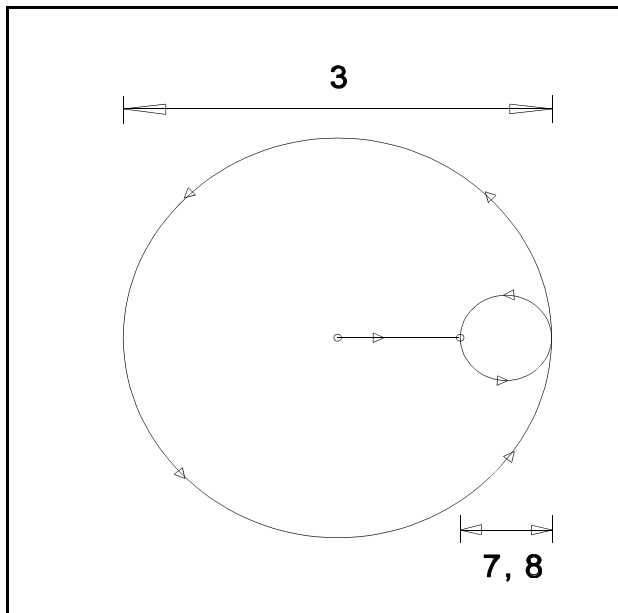


- | | | |
|-----------------------|---|-------------------------------|
| 1. X START | : | (Inches or millimeters) |
| 2. Y START | : | (Inches or millimeters) |
| 3. SLOT WIDTH | : | (Inches or millimeters) |
| 4. SLOT HEIGHT | : | (Inches or millimeters) |
| 5. X MOVE DISTANCE | : | (Rail distance to next hole) |
| 6. Y MOVE DISTANCE | : | (Cross distance to next hole) |
| 7. KERF DIMENSION | : | (Width of cutting tool path) |
| 8. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 9. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 10. VERIFY- YES/NO | : | (YES or NO) |

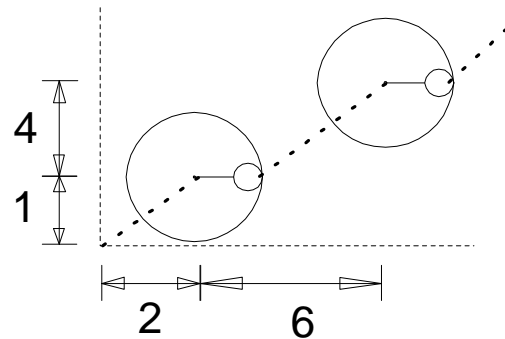
NOTES:

The X and Y START values are used to define the center to center distance between holes. From this center position, the program moves the machine to the pierce point determined by the LEAD-IN DIMENSION.

LEAD-IN DIMENSION must be less than the SLOT HEIGHT.

SHAPES3.35**SHAPE 35 : CIRCULAR HOLE****REPEAT PATTERNS**

MANUAL REPEAT
ALL DIRECTIONS ALLOWED



- | | | |
|-----------------------|---|-------------------------------|
| 1. X START | : | (Inches or millimeters) |
| 2. Y START | : | (Inches or millimeters) |
| 3. DIAMETER DIMENSION | : | (Inches or millimeters) |
| 4. X MOVE DISTANCE | : | (Rail distance to next hole) |
| 5. Y MOVE DISTANCE | : | (Cross distance to next hole) |
| 6. KERF DIMENSION | : | (Width of cutting tool path) |
| 7. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 8. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 9. VERIFY- YES/NO | : | (YES or NO) |

NOTES:

The X and Y MOVE DISTANCE values are used to define the center to center distance between holes. From this center position, the program moves the machine to the pierce point determined by the LEAD-IN DIMENSION.

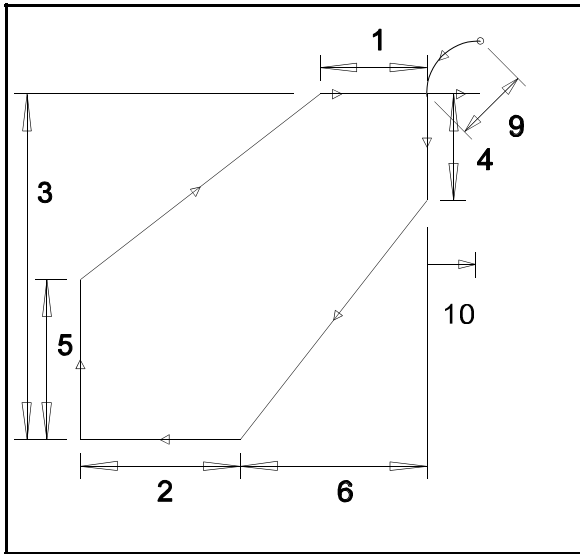
LEAD-IN DIMENSION must be less than the DIAMETER DIMENSION.

For the first hole, the torch should be positioned to center of the hole by the operator.

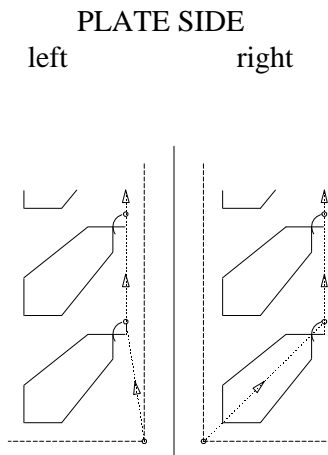
2.5RS OPERATION AND MAINTENANCE MANUAL

SHAPES3.36

SHAPE 36 : BEAM SUPPORT



REPEAT PATTERNS



- | | | |
|------------------------|---|---------------------------------|
| 1. BASE WIDTH | : | (Inches or millimeters) |
| 2. TOP WIDTH | : | (Inches or millimeters) |
| 3. HEIGHT DIMENSION | : | (Inches or millimeters) |
| 4. LEFT SHOULDER | : | (Inches or millimeters) |
| 5. RIGHT SHOULDER | : | (Inches or millimeters) |
| 6. LEFT OFFSET | : | (Inches or millimeters) |
| 7. KERF DIMENSION | : | (Width of cutting tool path) |
| 8. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 9. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 10. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 11. VERIFY- YES/NO | : | (YES or NO) |

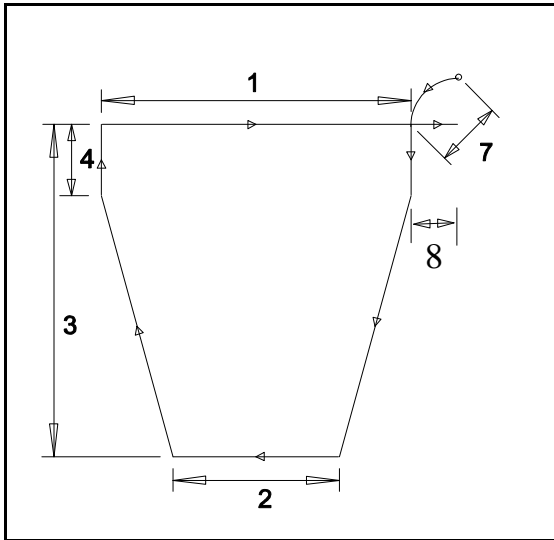
NOTES:

Like others, this part is cut with the BASE at the upper position. As a result, the prompts used to label the top and sides assume the part is rotated 180 degrees.

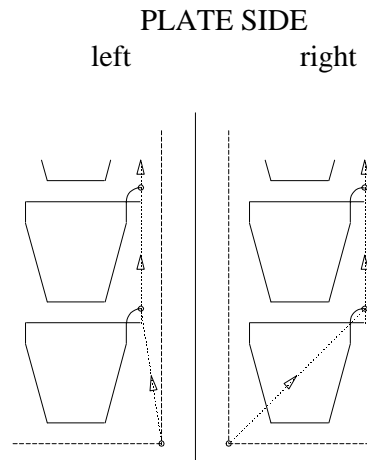
The only difference between parts created with LEFT PLATE or RIGHT PLATE enabled occurs in the traverse move to the first pierce point, as shown.

SHAPES3.37

SHAPE 37 : TRUSS SUPPORT



REPEAT PATTERNS



- | | | |
|-----------------------|---|---------------------------------|
| 1. BASE WIDTH | : | (Inches or millimeters) |
| 2. TOP WIDTH | : | (Inches or millimeters) |
| 3. HEIGHT DIMENSION | : | (Inches or millimeters) |
| 4. SHOULDER HEIGHT | : | (Inches or millimeters) |
| 5. KERF DIMENSION | : | (Width of cutting tool path) |
| 6. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 7. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 8. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 9. VERIFY- YES/NO | : | (YES or NO) |

NOTES:

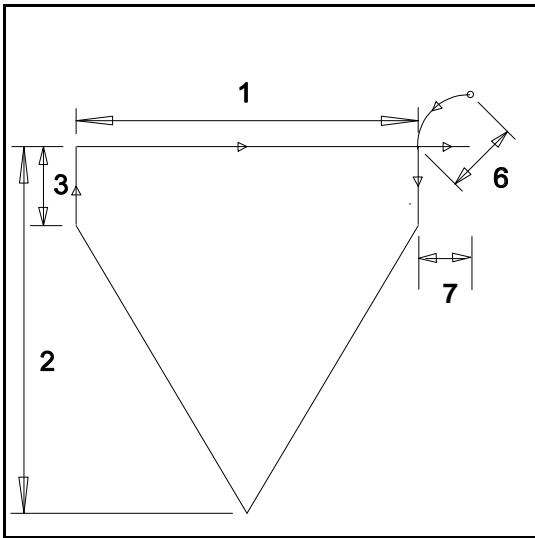
Like others, this part is cut with the BASE at the upper position. As a result, the prompts used to label the top and sides assume the part is rotated 180 degrees.

The only difference between parts created with LEFT PLATE or RIGHT PLATE enabled occurs in the traverse move to the first pierce point, as shown.

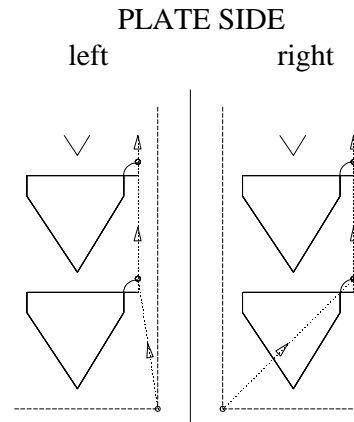
2.5RS OPERATION AND MAINTENANCE MANUAL

SHAPES3.38

SHAPE 38 : ANGULAR TRUSS



REPEAT PATTERNS



- | | | |
|-----------------------|---|---------------------------------|
| 1. BASE WIDTH | : | (Inches or millimeters) |
| 2. HEIGHT DIMENSION | : | (Inches or millimeters) |
| 3. SHOULDER HEIGHT | : | (Inches or millimeters) |
| 4. KERF DIMENSION | : | (Width of cutting tool path) |
| 5. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 6. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 7. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 8. VERIFY- YES/NO | : | (YES or NO) |

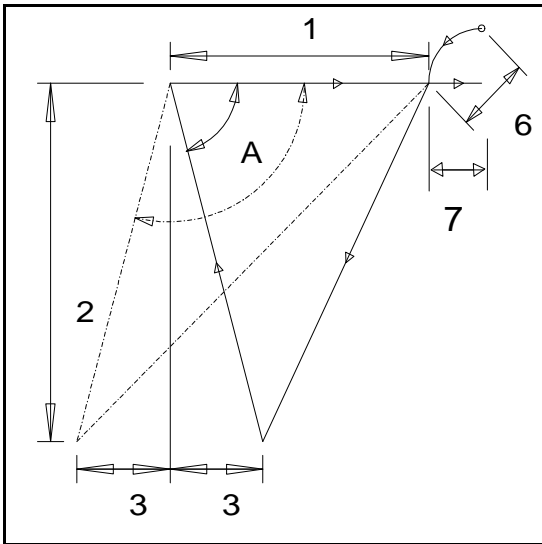
NOTES:

Like others, this part is cut with the BASE at the upper position.

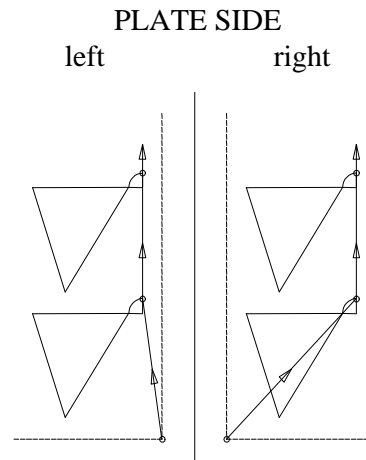
The only difference between parts created with LEFT PLATE or RIGHT PLATE enabled occurs in the traverse move to the first pierce point, as shown.

SHAPES3.39

SHAPE 39 : TRIANGLE



REPEAT PATTERNS



- | | | |
|-----------------------|---|---------------------------------|
| 1. BASE WIDTH | : | (Inches or millimeters) |
| 2. HEIGHT DIMENSION | : | (Inches or millimeters) |
| 3. LEFT OFFSET | : | (Inches or millimeters) |
| 4. KERF DIMENSION | : | (Width of cutting tool path) |
| 5. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 6. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 7. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 8. VERIFY- YES/NO | : | (YES or NO) |

NOTES:

Like others, this part is cut with the BASE at the upper position. However the LEFT OFFSET is actually on the left side of the part as shown.

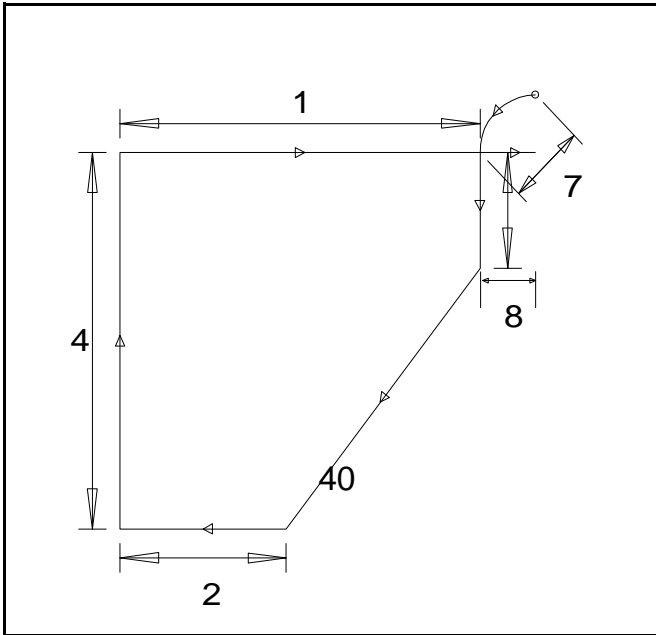
When LEFT OFFSET is greater than 0, angle "A" is greater than 90 degrees and when it is less than 0, angle "A" is less than 90 degrees.

The only difference between parts created with LEFT PLATE or RIGHT PLATE enabled occurs in the traverse move to the first pierce point, as shown.

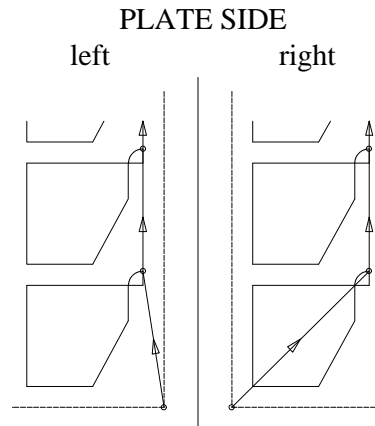
2.5RS OPERATION AND MAINTENANCE MANUAL

SHAPES3.40

SHAPE 40 : BEVELED RECTANGLE



REPEAT PATTERNS



- | | | |
|-----------------------|---|---------------------------------|
| 1. BASE WIDTH | : | (Inches or millimeters) |
| 2. TOP WIDTH | : | (Inches or millimeters) |
| 3. LEFT HEIGHT | : | (Inches or millimeters) |
| 4. RIGHT HEIGHT | : | (Inches or millimeters) |
| 5. KERF DIMENSION | : | (Width of cutting tool path) |
| 6. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 7. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 8. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 9. VERIFY- YES/NO | : | (YES or NO) |

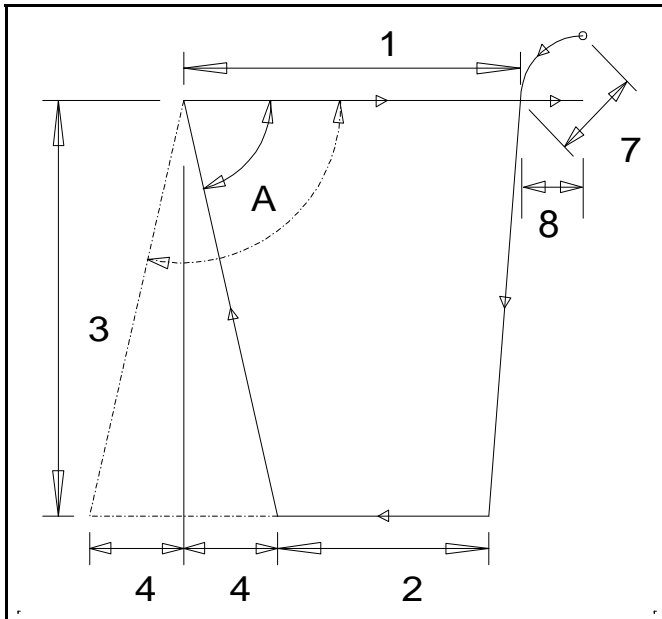
NOTES:

Like others, this part is cut with the BASE at the upper position. As a result, the prompts used to label the top and sides assume the part is rotated 180 degrees.

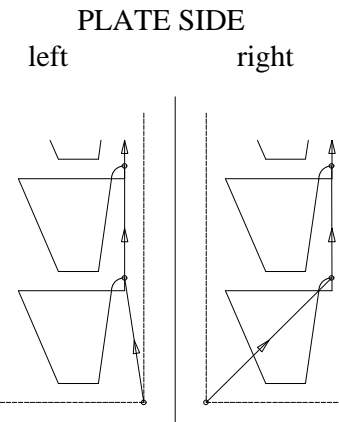
The only difference between parts created with LEFT PLATE or RIGHT PLATE enabled occurs in the traverse move to the first pierce point, as shown.

SHAPES3.41

SHAPE 41 : TRAPEZOID



REPEAT PATTERNS



- | | | |
|-----------------------|---|---------------------------------|
| 1. BASE WIDTH | : | (Inches or millimeters) |
| 2. TOP WIDTH | : | (Inches or millimeters) |
| 3. HEIGHT DIMENSION | : | (Inches or millimeters) |
| 4. LEFT OFFSET | : | (Inches or millimeters) |
| 5. KERF DIMENSION | : | (Width of cutting tool path) |
| 6. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 7. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 8. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 9. VERIFY- YES/NO | : | (YES or NO) |

NOTES:

Like others, this part is cut with the BASE at the upper position and the TOP at the lower position. However the LEFT OFFSET is actually on the left side of the part as shown.

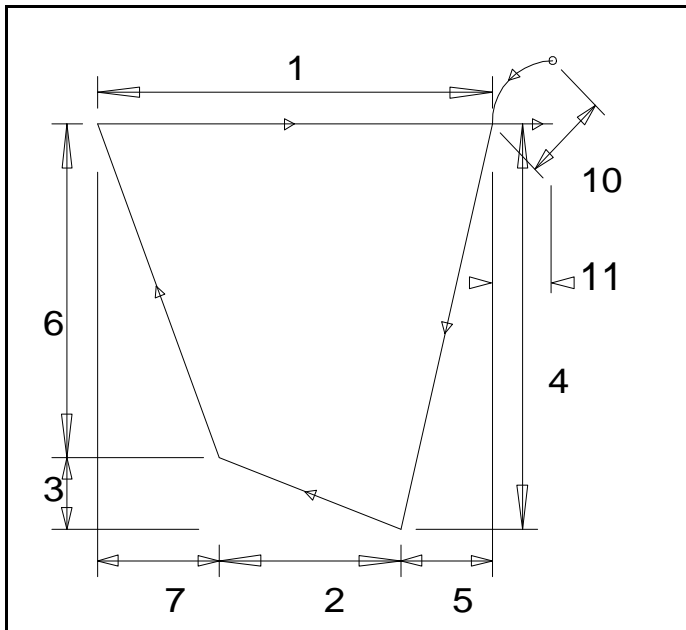
When LEFT OFFSET is greater than 0, angle "A" is greater than 90 degrees and when it is less than 0, angle "A" is less than 90 degrees.

The only difference between parts created with LEFT PLATE or RIGHT PLATE enabled occurs in the traverse move to the first pierce point, as shown.

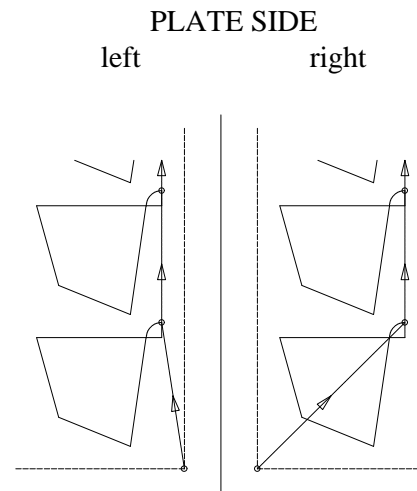
2.5RS OPERATION AND MAINTENANCE MANUAL

SHAPES3.42

SHAPE 42 : QUAD SIDE



REPEAT PATTERNS



- | | | |
|------------------------|---|---------------------------------|
| 1. BASE WIDTH | : | (Inches or millimeters) |
| 2. TOP WIDTH | : | (Inches or millimeters) |
| 3. TOP OFFSET | : | (Inches or millimeters) |
| 4. LEFT HEIGHT | : | (Inches or millimeters) |
| 5. LEFT OFFSET | : | (Inches or millimeters) |
| 6. RIGHT HEIGHT | : | (Inches or millimeters) |
| 7. RIGHT OFFSET | : | (Inches or millimeters) |
| 8. KERF DIMENSION | : | (Width of cutting tool path) |
| 9. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 10. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 11. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 12. VERIFY- YES/NO | : | (YES or NO) |

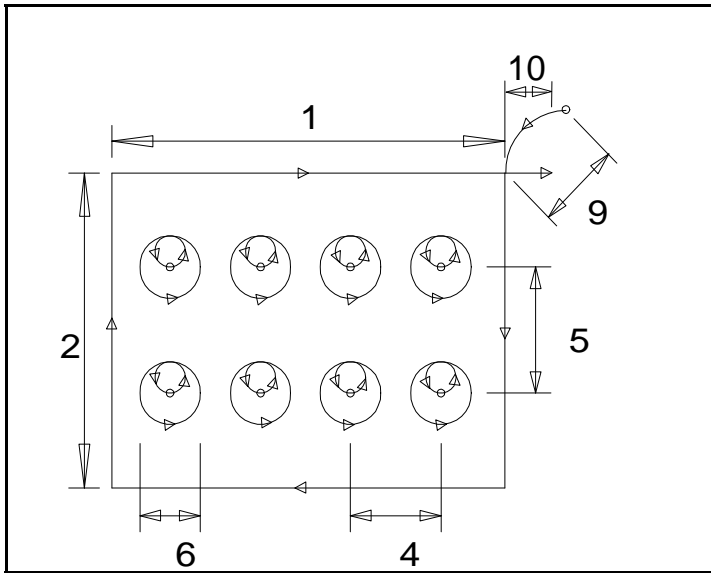
NOTES:

Like others, this part is cut with the BASE at the upper position. As a result, the prompts used to label the top and sides assume the part is rotated 180 degrees.

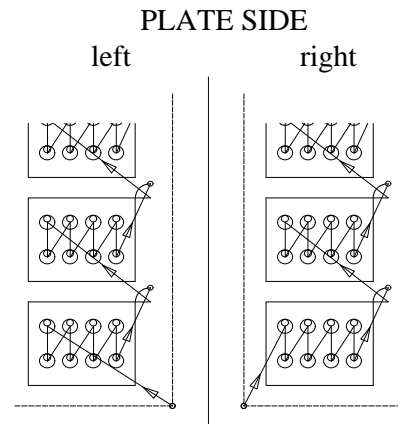
The only difference between parts created with LEFT PLATE or RIGHT PLATE enabled occurs in the traverse move to the first pierce point, as shown.

SHAPES3.43

SHAPE 43 : LAP JOINT



REPEAT PATTERNS



- | | | |
|------------------------|---|---------------------------------|
| 1. WIDTH DIMENSION | : | (Inches or millimeters) |
| 2. HEIGHT DIMENSION | : | (Inches or millimeters) |
| 3. NUMBER OF COLUMNS | : | (Count, 0 to 99) |
| 4. COLUMN DISTANCE | : | (Inches or millimeters) |
| 5. BOLT HOLE DISTANCE | : | (Inches or millimeters) |
| 6. BOLT HOLE DIAMETER | : | (Inches or millimeters) |
| 7. KERF DIMENSION | : | (Width of cutting tool path) |
| 8. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 9. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 10. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 11. VERIFY- YES/NO | : | (YES or NO) |

NOTES:

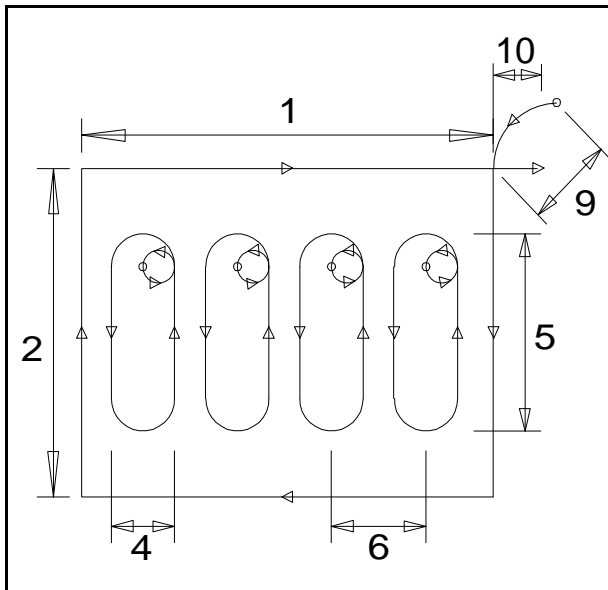
The hole pattern defined is automatically centered on the part from top to bottom and left to right.

To create a part with a single row of holes, use shape number 44, SLOTTED PLATE, with a SLOT HEIGHT equal to the SLOT WIDTH.

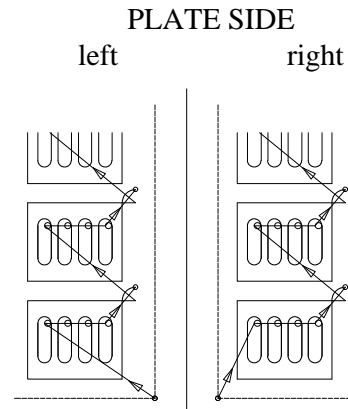
2.5RS OPERATION AND MAINTENANCE MANUAL

SHAPES3.44

SHAPE 44 : SLOTTED PLATE



REPEAT PATTERNS



- | | | |
|------------------------|---|---------------------------------|
| 1. WIDTH DIMENSION | : | (Inches or millimeters) |
| 2. HEIGHT DIMENSION | : | (Inches or millimeters) |
| 3. NUMBER OF SLOTS | : | (Count, 0 to 99) ¹ |
| 4. SLOT WIDTH | : | (Inches or millimeters) |
| 5. SLOT HEIGHT | : | (Inches or millimeters) |
| 6. SLOT DISTANCE | : | (Inches or millimeters) |
| 7. KERF DIMENSION | : | (Width of cutting tool path) |
| 8. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 9. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 10. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 11. VERIFY- YES/NO | : | (YES or NO) |

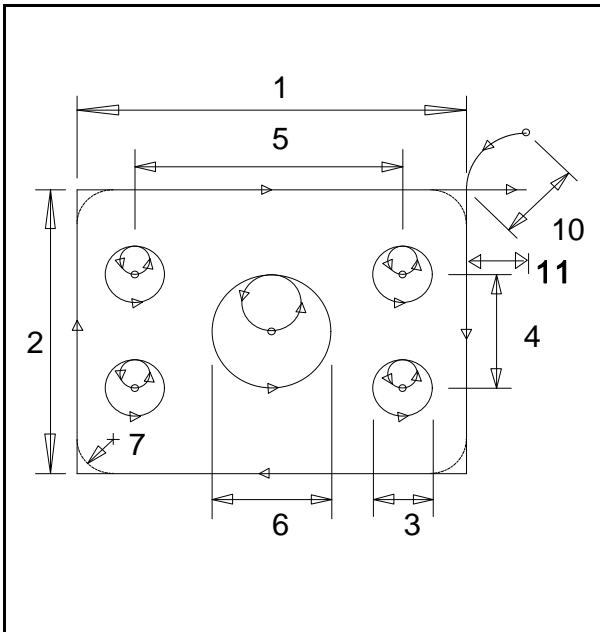
NOTES:

The slot pattern defined is automatically centered on the part from top to bottom and left to right.

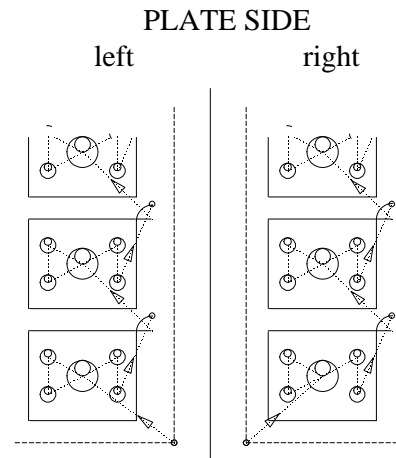
The operator must determine that the height and width specified can contain the slots.

SHAPES3.45

SHAPE 45 : LAMP BASE



REPEAT PATTERNS



1. WIDTH DIMENSION :

(Inches or millimeters)

- | | | |
|-------------------------|---|---------------------------------|
| 2. HEIGHT DIMENSION | : | (Inches or millimeters) |
| 3. BOLT HOLE DIAMETER | : | (Inches or millimeters) |
| 4. X BOLT HOLE CENTER | : | (Inches or millimeters) |
| 5. Y BOLT HOLE CENTER | : | (Inches or millimeters) |
| 6. CENTER HOLE DIAMETER | : | (Inches or millimeters) |
| 7. CORNER RADIUS | : | (Inches or millimeters) |
| 8. KERF DIMENSION | : | (Width of cutting tool path) |
| 9. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 10. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 11. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 12. REPEAT PROMPTING | : | (YES or NO) |

NOTES:

The hole pattern defined is automatically centered on the part from top to bottom and left to right.

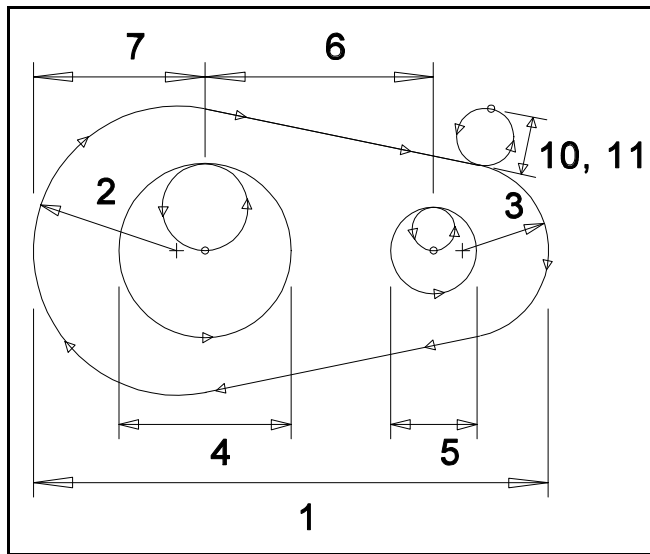
If a CENTER HOLE DIAMETER of 0 is defined, no hole is cut.

If a CORNER RADIUS of 0 is defined, sharp corners are cut.

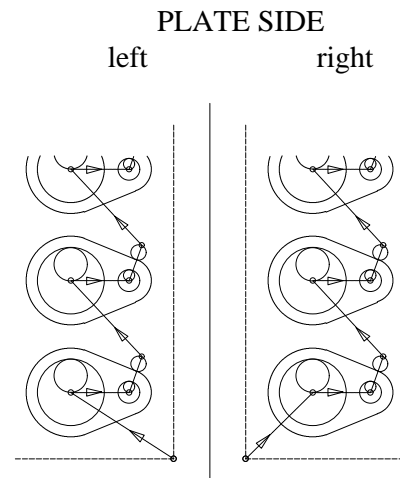
2.5RS OPERATION AND MAINTENANCE MANUAL

SHAPES3.46

SHAPE 46 : CAM



REPEAT PATTERNS



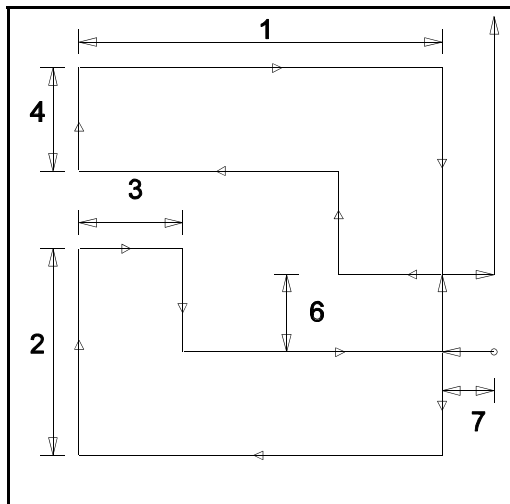
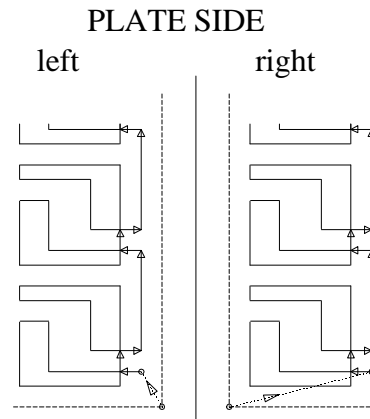
- | | | |
|------------------------|---|---------------------------------|
| 1. WIDTH DIMENSION | : | (Inches or millimeters) |
| 2. LEFT RADIUS | : | (Inches or millimeters) |
| 3. RIGHT RADIUS | : | (Inches or millimeters) |
| 4. LEFT HOLE DIAMETER | : | (Inches or millimeters) |
| 5. RIGHT HOLE DIAMETER | : | (Inches or millimeters) |
| 6. CENTER DISTANCE | : | (Inches or millimeters) |
| 7. LEFT OFFSET | : | (Inches or millimeters) |
| 8. KERF DIMENSION | : | (Width of cutting tool path) |
| 9. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 10. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 11. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 12. VERIFY- YES/NO | : | (YES or NO) |

NOTES:

If a LEFT HOLE DIAMETER of 0 is defined, no holes are cut in the part.

If a RIGHT HOLE DIAMETER of 0 is defined, only the LEFT HOLE is cut.

The LEADIN and LEADOUT DIMENSIONS always apply on the outside of the part. They also apply in the holes if they are equal to or smaller than the radius of the hole. If not, the radius is used.

SHAPES3.47**SHAPE 47 : L BRACKET 1****REPEAT PATTERNS**

1. WIDTH DIMENSION : (Inches or millimeters)
2. HEIGHT DIMENSION : (Inches or millimeters)
3. VERTICAL THICKNESS : (Inches or millimeters)
4. HORIZONTAL THICKNESS : (Inches or millimeters)
5. KERF DIMENSION : (Width of cutting tool path)
6. SCRAP DIMENSION : (Distance between parts, in/mm)
7. LEAD-IN DIMENSION : (Inches or millimeters)
8. VERIFY- YES/NO : (YES or NO)

NOTES:

All chain cut parts start from the plate corner closest to the operator. The PLATE SIDE is defined through SYSTEM SETUP DATA.

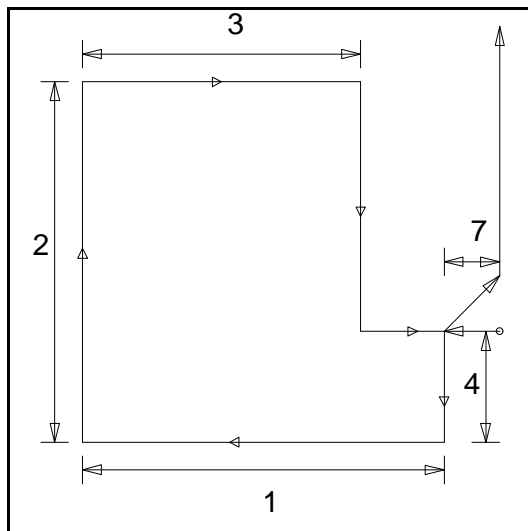
Although parts are created in pairs to minimize scrap, each part is individually counted when cut.

If part dimensions make it impossible to create part pairs without overlap, use shape 48, "L" BRACKET 2.

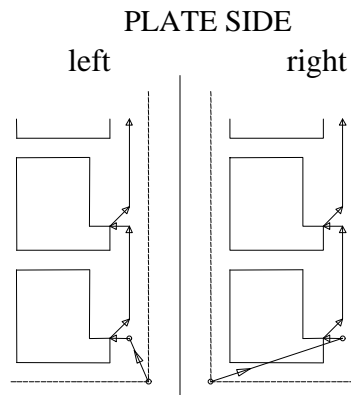
2.5RS OPERATION AND MAINTENANCE MANUAL

SHAPES3.48

SHAPE 48 : L BRACKET 2



REPEAT PATTERNS



- | | | |
|-------------------------|---|---------------------------------|
| 1. WIDTH DIMENSION | : | (Inches or millimeters) |
| 2. HEIGHT DIMENSION | : | (Inches or millimeters) |
| 3. VERTICAL THICKNESS | : | (Inches or millimeters) |
| 4. HORIZONTAL THICKNESS | : | (Inches or millimeters) |
| 5. KERF DIMENSION | : | (Width of cutting tool path) |
| 6. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 7. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 8. VERIFY- YES/NO | : | (YES or NO) |

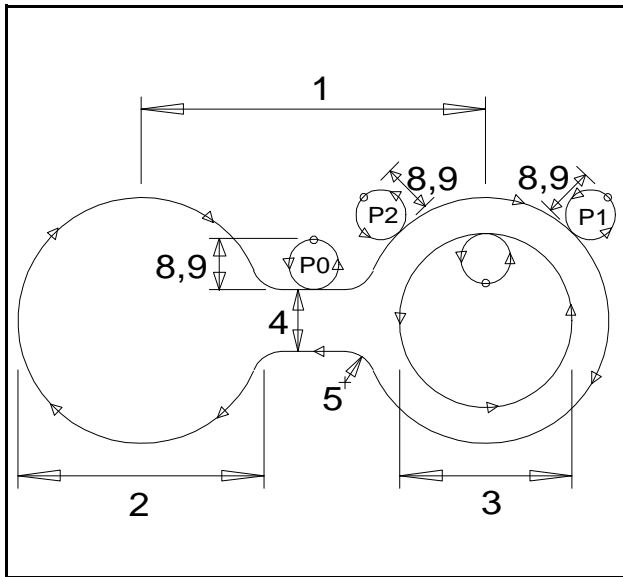
NOTES:

All chain cut parts start from the plate corner closest to the operator. The PLATE SIDE is defined through SYSTEM SETUP DATA.

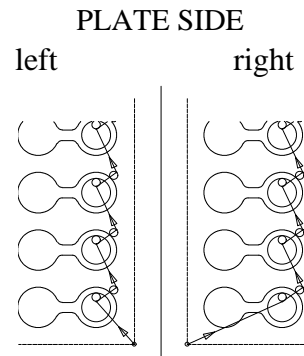
If excessive scrap can be eliminated by creating "part pairs", use shape 47, "L" BRACKET 1.

SHAPES3.49

SHAPE 49 : BI DAMPER



REPEAT PATTERNS



- | | | |
|--------------------------|---|---------------------------------|
| 1. CENTER DISTANCE | : | (Inches or millimeters) |
| 2. OUTER DIAMETER | : | (Inches or millimeters) |
| 3. INNER DIAMETER | : | (Inches or millimeters) |
| 4. THICKNESS DIMENSION | : | (Inches or millimeters) |
| 5. RADIUS DIMENSION | : | (Inches or millimeters) |
| 6. KERF DIMENSION | : | (Width of cutting tool path) |
| 7. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 8. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 9. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 10. LEAD-IN POINT 1 (P1) | : | (YES or NO) |
| 11. LEAD-IN POINT 2 (P2) | : | (YES or NO) |
| 12. VERIFY- YES/NO | : | (YES or NO) |

NOTES:

Do not set INNER DIAMETER to 0.

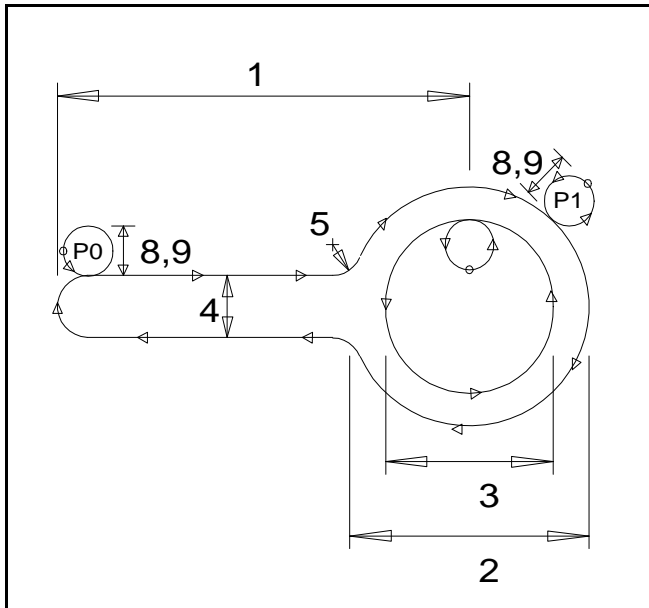
If LEAD-IN POINT 1 is selected, the prompt for LEAD-IN POINT 2 is not displayed.

If NO is selected for both optional LEAD-IN POINTS, then the default LEAD-IN POINT 0 position is used.

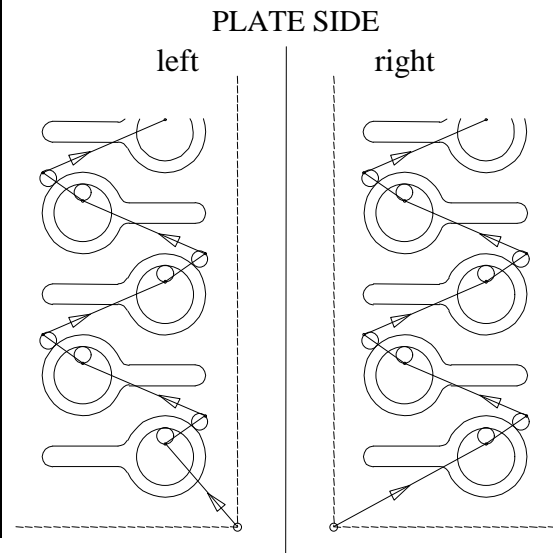
2.5RS OPERATION AND MAINTENANCE MANUAL

SHAPES3.50

SHAPE 50 : DAMPER



REPEAT PATTERNS



- | | | |
|--------------------------|---|---------------------------------|
| 1. HANDLE CENTER DIST. | : | (Inches or millimeters) |
| 2. OUTER DIAMETER | : | (Inches or millimeters) |
| 3. INNER DIAMETER | : | (Inches or millimeters) |
| 4. THICKNESS DIMENSION | : | (Inches or millimeters) |
| 5. RADIUS DIMENSION | : | (Inches or millimeters) |
| 6. KERF DIMENSION | : | (Width of cutting tool path) |
| 7. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 8. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 9. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 10. LEAD-IN POINT 1 (P1) | : | (YES or NO) |
| 11. VERIFY- YES/NO | : | (YES or NO) |

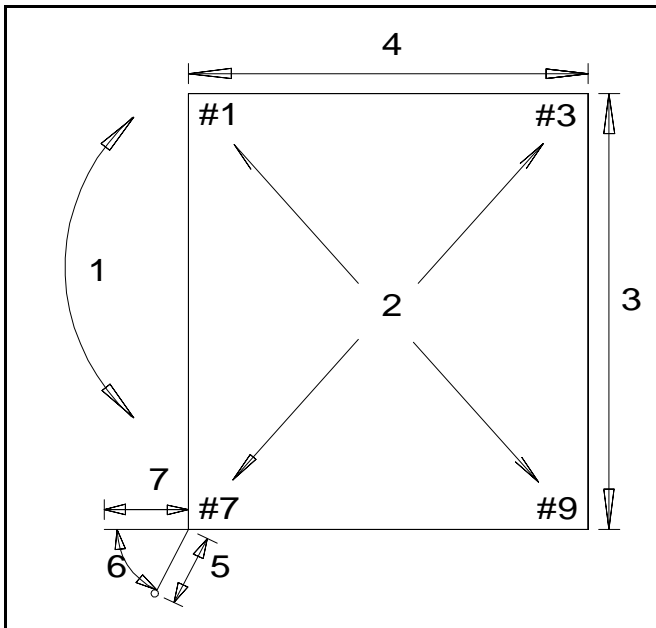
NOTES:

If INNER DIAMETER of 0 is assigned, no hole is cut.

If NO is selected for the LEAD-IN POINT 1 (P1) position prompt, the default LEAD-IN P0 position is used.

SYSTEM OPERATION : SHAPES

SHAPES3.51 SHAPE 51 : RECTANGLE (START AT PLATE CORNER)



REPEAT PATTERNS

AUTO



MANUAL

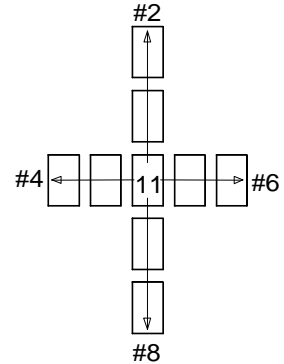
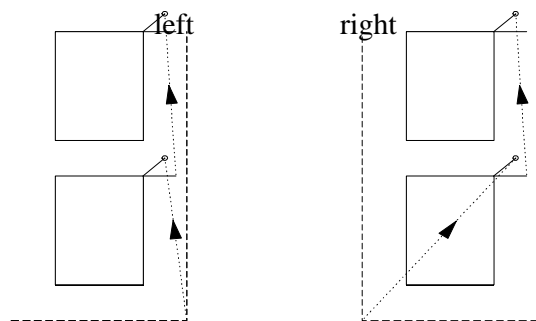


PLATE SIDE



- | | | |
|-----|-----------------------|-------------------------------------|
| 1. | CUT DIRECTION | : (Clockwise or counterclockwise) |
| 2. | STARTING POSITION | : (1 of 4 corners) |
| 3. | X DIMENSION | : (Inches or millimeters) |
| 4. | Y DIMENSION | : (Inches or millimeters) |
| 5. | LEAD-IN DIMENSION | : (Inches or millimeters) |
| 6. | LEAD-IN ANGLE (DEGS): | (0 to 90 degrees) |
| 7. | LEAD-OUT DIMENSION | : (Inches or millimeters) |
| 8. | SCRAP DIMENSION | : (Distance between parts, in/mm) |
| 9. | KERF DIMENSION | : (Width of cutting tool path) |
| 10. | REPEAT MODE | : (Automatic or manual positioning) |

IF AUTO REPEAT MODE:

11. VERIFY- YES/NO

IF MANUAL REPEAT MODE:

11. Repeat direction: (1 of 4 sides)
 12. VERIFY- YES/NO

NOTES:

The STARTING CORNER and REPEAT DIRECTION parameters can be directly entered with the numeric keypad. Direction arrows are provided for quick reference.

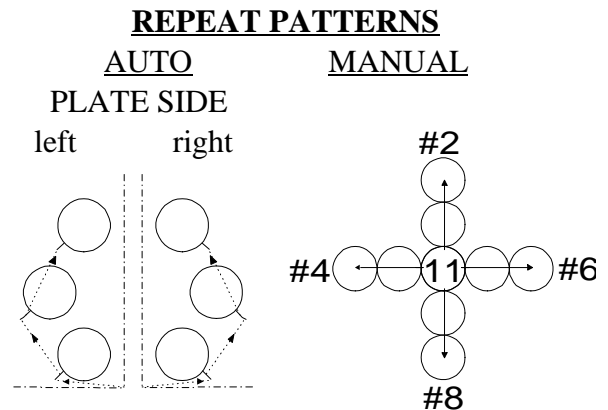
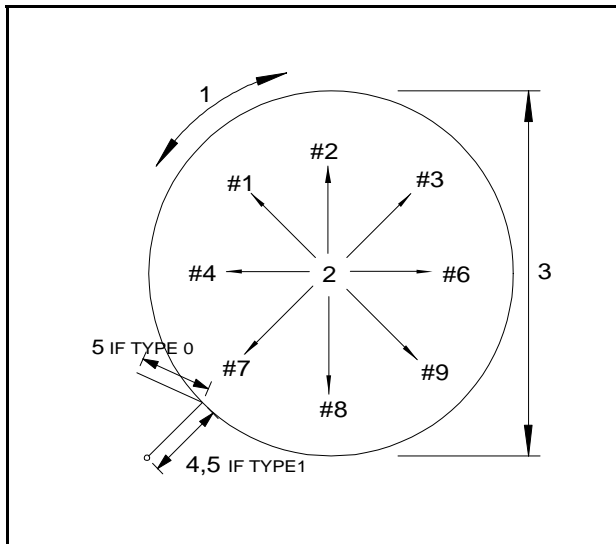
When defining the LEAD-IN ANGLE, 0 degrees is parallel to the Y axis and 90 degrees is parallel to the X axis.

The LEAD-OUT position is determined by the direction of the cut. It is either parallel to the last side cut (as shown) or 45 degrees from the last cut direction.

When running the resulting NC part program, position the torches at the corner of the plate, regardless of the REPEAT MODE selected. From this corner, the program moves out to the actual pierce point.

2.5RS OPERATION AND MAINTENANCE MANUAL

SHAPES3.52 SHAPE 52 : CIRCLE (Start at Plate Corner)



- | | | |
|-----------------------|---|-----------------------------------|
| 1. CUT DIRECTION (OD) | : | (Clockwise or counter-clockwise) |
| 2. STARTING POSITION | : | (1 of 8 corners) |
| 3. DIAMETER DIMENSION | : | (Inches or millimeters) |
| 4. LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 5. LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 6. LEAD-OUT TYPE | : | (0 or 1) |
| 7. SCRAP DIMENSION | : | (Distance between parts, in/mm) |
| 8. KERF DIMENSION | : | (Width of cutting tool path) |
| 9. REPEAT MODE | : | (Automatic or manual positioning) |

IF AUTO REPEAT MODE:

10. VERIFY- YES/NO

IF MANUAL REPEAT MODE:

10. Repeat direction: (1 of 4 points)

11. VERIFY- YES/NO

NOTES:

The STARTING CORNER and REPEAT DIRECTION parameters can be directly entered with the numeric keypad. Direction arrows are provided for quick reference.

The actual LEAD-OUT position is determined by the direction of the cut. The figure above shows the LEAD-OUT position assuming a clockwise cutting direction has been selected.

When running the resulting NC part program, position the torches at the corner of the plate, regardless of the REPEAT MODE selected. From this position, the program moves out to the actual pierce point.

When performing AUTO REPEAT mode operations, parts are shifted to the left and right at a 60 degree angle to minimize the amount of scrap between parts.

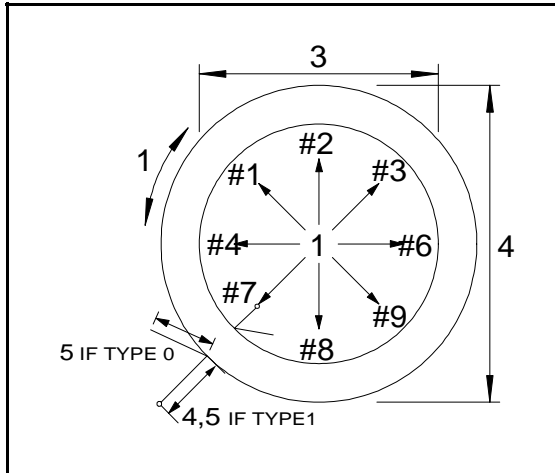
LEAD-OUT TYPE 0 is 10 degrees to tangent.

LEAD-OUT TYPE 1 follows LEAD-IN path.

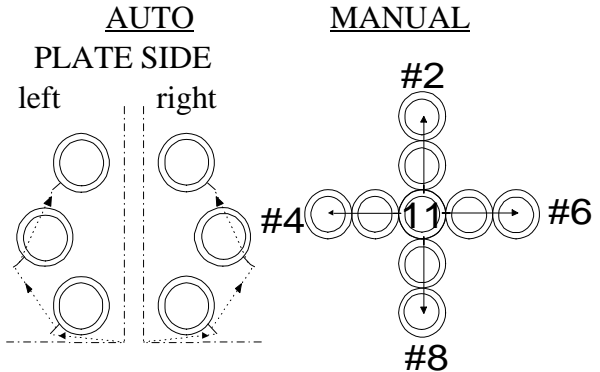
2.5RS OPERATION AND MAINTENANCE MANUAL

SHAPES3.53

SHAPE 53 : RING (Start at Plate Corner)



REPEAT PATTERNS



- | | | | |
|-----|---------------------|---|-----------------------------------|
| 1. | CUT DIRECTION | : | (Clockwise or counter-clockwise) |
| 2. | STARTING POSITION | : | (1 of 8 points) |
| 3. | INNER DIAMETER SIZE | : | (Inches or millimeters) |
| 4. | OUTER DIAMETER SIZE | : | (Inches or millimeters) |
| 5. | LEAD-IN DIMENSION | : | (Inches or millimeters) |
| 6. | LEAD-OUT DIMENSION | : | (Inches or millimeters) |
| 7. | LEAD-OUT TYPE | : | (0 or 1) |
| 8. | SCRAP DIMENSION: | | (Distance between parts, in/mm) |
| 9. | KERF DIMENSION | : | (Width of cutting tool path) |
| 10. | REPEAT MODE | : | (Automatic or manual positioning) |

IF AUTO REPEAT MODE:

11. VERIFY- YES/NO

IF MANUAL REPEAT MODE:

11. Repeat direction: (1 of 4 points)
12. VERIFY- YES/NO

NOTES:

The CUT DIRECTION prompt defines the outer diameter cut direction. The inner direction is always opposite so that the same KERF side (LEFT/RIGHT) can be used for both cuts.

The STARTING POSITION and REPEAT DIRECTION parameters can be directly entered with the numeric keypad.

The actual LEAD-OUT position is determined by the direction of the cut. The figure above shows the LEAD-OUT position assuming a clockwise cutting direction has been selected.

When running the resulting NC part program, position the torches at the CENTER of the first part, regardless of the REPEAT MODE selected.

When performing AUTO REPEAT mode operations, parts are shifted to the left and right at a 60 degree angle.

LEAD-OUT TYPE 0 is 10 degrees to tangent. LEAD-OUT TYPE 1 follows LEAD-IN path.

2.5RS OPERATION AND MAINTENANCE MANUAL

RUNNING A PROGRAM

This section of the manual describes the procedures used to actually cut the desired shape. This occurs after the shape has been selected and all necessary data entered, or after a new part has been constructed or taught.

RUN.1 PLASMA-OXY/FUEL SELECTION

Many of the machines equipped with a **2.5RS** control will only use one type of cutting process, either plasma or oxy/fuel. In these cases, the setup parameters can be set so that the correct cutting mode is selected automatically. However, if the machine has both cutting systems, a prompt will appear as:

"SELECT- PLASMA" OR "SELECT- OXY/FUEL"

Use the "+/-" key to change the display to the correct type. This does not actually switch the cutting function of the machine, only the prompting and relay sequencing used during the part execution. The operator must make sure that the correct cutting process is enabled on the machine. If this prompt does not appear, it indicates that the setup parameters have been set to only use one of the cutting modes. In these cases, no operator response is required.

At this point, the option codes are checked to see which of the optional software features are enabled in the control. If none are enabled, continue at section "CUTTING MODE SELECTION" to select the desired cutting mode otherwise, follow the directions below for each option.

RUN.2 GEOMETRY MODIFICATION OPTIONS

There are several features which allow the geometric appearance of a part to be altered:

- SCALING Allows part size to be magnified up to 65 times or reduced to .001 size.
- ROTATION Allows part to be rotated from its programmed orientation to allow alignment with the plate or nesting among other parts.
- MIRROR Allows the part to be mirror imaged in either the X, Y or both axis.

2.5RS OPERATION AND MAINTENANCE MANUAL

These operations are enabled with the "ENHANCED OPERATION" option. When this option is enabled, a prompt will appear when the part is first run, which appears as:

"GEOMETRY- NORMAL"

The word "NORMAL" will be flashing. If the ENTER key is pressed at this point, it causes the part to be cut as it is programmed which basically means that:

SCALE = 1.000

X MIRROR- NO

ROTATE = 0.00 DEGREES Y MIRROR- NO

If the "NORMAL" geometry is selected, the special geometry prompting ends.

Pressing the "+/-" key will toggle between the "NORMAL" display and "GEOMETRY-SPECIAL". If the "SPECIAL" response is entered, the prompting will then go on to the specific prompts for each operation. Once a program is run with one of the special geometric operations used it will not show the "NORMAL" prompt again until the special option is set back to the normal conditions.

RUN2.1

SCALING

If the "SCALING" option is enabled on the system, a prompt for the scale factor will appear as "SCALE= XX.XXX" . The value displayed will be the scale factor used the last time the particular program was run. The scale factor is used to enlarge or reduce the size of the entire part, either to produce a different size part, or to allow a test run to be drawn on a smaller sheet of paper. The value entered is used as a multiplier for all the part dimensions, therefore:

IF SCALE= 1.000 -THE PART WILL BE THE ORIGINAL 1:1 SIZE

IF SCALE=10.000 -THE PART WILL BE 10 TIMES ORIGINAL SIZE

IF SCALE= .125 -THE PART WILL BE 1/8 ORIGINAL SIZE.

SCALE VALUES MAY RANGE FROM 0.001 TO 65.000

(USE 1.000 FOR ACTUAL SIZE)

RUN2.2

PART ROTATION

If the part rotation option is enabled, a prompt will appear for the desired rotation angle: "ROTATE- +XXX.XX". Enter the desired rotation degrees- 0.00 is the original programmed position. A positive angle indicates a counter-clockwise rotation. A negative angle may also be entered for a clockwise rotation, however it will be converted to its equivalent positive angle position. If the part is re-run, the positive equivalent angle will appear, not the negative. Example: If -45.00 degrees is entered for the rotation, it will be stored as +315.00.

RUN2.3

X/Y AXIS MIRROR

If the MIRROR IMAGE OPTION is enabled, two prompts will appear. The first is for the X axis:
"X MIRROR- NO"

Pressing the "+/-" key will toggle the flashing response between "NO" and "YES". Press the "ENTER" key when the desired response is shown. A "NO" response causes the X axis to be cut as programmed. The "YES" response causes the X axis to be inverted so the part appears "UPSIDE DOWN" on the plate.

After the X mirror selection is entered, the prompt will change to:

"Y MIRROR- NO".

Again, toggle the selection with the "+/-" key and enter the desired choice. As before, the "NO" response causes no change in the part while the "YES" response will mirror the Y axis which reverses the left to right appearance of the part.

RUN.3

KNIFE COMPENSATION

The "KNIFE COMPENSATION" option allows a special "swivel knife" compensation routine that modifies the cut path to produce sharp corners rather than rounded corners caused by the knife's offset from center.

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RUN3.1

DIAL IN KERF

The "DIAL IN KERF" feature allows KERF to be added to the shape to be cut. A prompt to enter the desired KERF value is displayed as "KERF= +XX.XXXX". The value displayed is the KERF used the last time the part was run. The KERF dimensions entered should be the total width of the path created by the cutting process. This value can be derived by cutting a 4" square with no kerf entered, and then measuring the actual size. The difference between the actual size and the input dimension size is the kerf value. Enter this value as a positive (+) KERF DIMENSION. This alters the cut path and causes the actual piece to have the correct dimensions. The value entered for kerf is in inches for "INCH" operating systems and in millimeters for "METRIC" systems.

A negative kerf value can also be entered, however this is normally not done. If entered, it shrinks the size of the part, rather than increasing it. This can be useful if a part is programmed with too large a kerf in the dimensions. A negative kerf value counteracts the programmed kerf, shrinking the part to the correct size.

In order for the prompt for DIAL IN KERF to appear the program must contain a KERF code, such as KERF LEFT or KERF RIGHT (usually G41 or G42 in WORD ADDRESS or function 29 or 30 in ESSI).

See also the "Shapes - Dimensions Common to Most Shapes" section of this manual, especially for chain cutting kerf information.

PROGRAMMABLE KERF is a feature of part programs. This feature allows the kerf of the WADR or ESSI program to be used instead requiring that it be entered by the user. See the PART PROGRAMMING section of this manual for more information.

OVERRIDE KERF allows the operator to override the kerf that is programmed for a part, with a new value.

NOTE

The **2.5RS** can also use the Pierce Ramp time as a "HOLD TIME" for OXY/FUEL and or PLASMA CUTTING instead of a "RAMP TIME". This allows the operator to enter a pierce time which causes the machine to hold position instead of starting motion as soon as the cut starts. See "SD62 SYSTEM CONFIGURATION #2", "D8" in INSTALLATION & SETUP section. This may be use with new plasma systems that require a delay before starting motion.

RUN4.1.2 AUTO CUT

The Auto Cut Mode allows the part to be cut with all preheat and cutting processes being started and stopped by the **2.5RS**.

If OXY/FUEL or PLASMA cutting is being done, prompts for the values which control the automatic piercing cycle appears next. These include Preheat, Pierce Ramp and Part Count.

RUN4.1.2.1 HIGH PREHEAT (OXY/FUEL)

If Oxy/Fuel cutting has been selected, the operator is first prompted for the duration of the High Preheat cycle. The display shows: "PREHEAT= XXX.XX". Enter the time in seconds for the high preheat cycle. When the control moves to a new pierce point, it automatically turns on the High Preheat solenoids for the time specified. When the preheat cycle is complete, the High preheat solenoids turn off and the Cutting Oxygen is turned on.

2.5RS OPERATION AND MAINTENANCE MANUAL

the machine at the starting position on the plate (usually the lower corner) and press the green "START CYCLE" key. This starts program execution- continue at "RUNNING THE PART".

RUN.6 PLATE ALIGNMENT OPTION

The optional "PLATE ALIGNMENT" feature compensates for plates which are not aligned (not squared) with the cutting machine. Without this option, the plate must be carefully aligned to be parallel with the main rail or else the parts may run off the edge as the cutting progresses down the rail. The alignment option rotates the part program so it follows the angle of the plate. This not only insures that the parts cut correctly, but also reduces the setup time since the plate no longer has to be squared to the machine.

To perform this alignment, instead of pressing the "START CYCLE" key as the display is prompting, press the "SHF" key and then the "CYCLE STOP" key. This two key combination enters the alignment mode. The display now prompts:

"MOVE MACHINE TO" "-FIRST CORNER-" "THEN PRESS -1"
"OR 3 -SAME ANGLE"

If the number "3" key is pressed, the Plate angle calculated for the previous part is used. This feature can be used for cutting several different parts on the same plate.

The control then displays the prompt:

"ANGLE= +/- XXX.XX" then "PRESS ENTER IF OK"

When ENTER is pressed the cut process prompting continues.

To align to a new plate, the machine should be aligned with one corner of the material. Normally this should be the starting corner for the program since the machine automatically returns to this location once the procedure is complete. When positioned, press the number "1" key. The display now changes to:

"MOVE MACHINE TO" "-SECOND CORNER-" "THEN PRESS -2"

Jog the machine along the longer edge of the plate since this produces a more accurate indication of the angle of the plate. If a large plate is being cut, it is not necessary to go all the way to the next corner, simply move down either edge at least 10 feet and align the machine to the edge of the plate. Although the procedure works if the distance is less, the results is more accurate if a longer distance is used. After the machine is aligned to the second corner (or along the edge), press the number "2" key. Once these two points are identified, the angle of the plate is calculated and displayed as:

"ANGLE= +/- XXX.XX" then "PRESS ENTER IF OK"

The angle is positive for CCW angles and negative for CW. Press "ENTER" to align to this angle. This sets the displayed angle as the plate alignment value and then returns the machine to the first corner. Once the machine stops, the prompting returns to the cut mode selection (MANUAL, AUTO, ETC.) as detailed in "CUTTING MODE SELECTION". Enter the appropriate selection

SYSTEM OPERATIONS : RUNNING A PROGRAM

for the cutting mode and press "ENTER". The display now changes again to prompt for the "CYCLE START" key, however it also displays the PLATE ANGLE:

"PRESS CYCLE START" "PLATE ANG= +/- XXX.XX"

Press the "CYCLE START" key to begin the program. The parts now follow the angle of the plate and cut correctly.

RUN.7 RUNNING DISPLAYS

While cutting the part, the display shows the current status of the machine. In addition, if a condition is preventing the operation from continuing, a "WAIT" display is shown along with the condition causing the holdup. Following is a list of these displays along with a brief explanation of each:

| | |
|------------------|---|
| STOP- * E-STOP * | The STOP has been activated. This shuts down the 2.5RS drives. ****WARNING**** THIS DOES NOT SHUT OFF THE AC POWER INPUT. IT ONLY DISABLES THE DRIVES AND CUTTING FUNCTIONS. |
| STOP-HOLD POS | Program execution has been stopped-machine is holding position. |
| RUN-TEST RUN | Program is executing a TEST RUN of the program. |
| RUN-VENT XXX.X | Program is running- OXYGEN BLEEDOFF TIMER is counting down- machine is holding position. |
| RUN-TRAVERSE | Program is running- current block is non-cutting, machine is running at high TRAVERSE SPEED. |
| RUN- OXY CUT | Program is running- machine is cutting in MANUAL OXY/FUEL MODE-MACHINE speed dial controls speed. |
| RUN- PRHT XXX.X | Program is running- machine is holding position and AUTO-CUTTING HIGH PREHEAT is in progress. |
| RUN-AUTO OXY CUT | Program is running- machine is cutting in AUTOMATIC OXY/FUEL MODE. |

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| | |
|-------------------|--|
| RUN-BACKUP | Program is running- operator has "BACKUP" key pressed causing machine to re-trace cut path backward. Speed is limited by setup value. |
| RUN-DWELL XXX.X | Program is running- control is holding machine position and waiting for PROGRAMMED DWELL TIMER to reach 0 before continuing along programmed path. |
| WAIT-CUT SW OFF | Program is running, cutting is selected. Control is waiting for the cut switch to be turned on before starting to move (on some systems the cut can be started by pressing the "START CYCLE" key again). Machine is holding position. |
| WAIT-CUT SW ON | Program is running, cutting is selected. Control has finished one cut, moved to a new pierce location and is waiting for the CUT switch input to be turned off, then back on to start the new cut. Machine is holding position. |
| WAIT-START XXX | Motion is being delayed until timer reaches 0. |
| RUN-PLASMA CUT | Program is running - plasma cut is in progress, speed controlled by operators speed dial. |
| RUN-DELAY XXX.X | Program is running- plasma arc on sense has been received. Machine holds position until time reaches 0 and then begins moving along cut path. |
| RUN-ARCOFF XXX.X | Program is running- plasma cutting is being done but the arc on sense has turned off, probably indicating that the arc has gone out. The machine continues along the cutting path as if the arc was still on until the timer reaches 0.00. Then the control stops the machine and perform a "CYCLE STOP" . |
| RUN-PLASMA START | Program is running- AUTO CUT was selected and the start signal has been sent to the plasma system. The arc on input has not been received yet. |
| RUN -PIERCE XXX.X | Program is running. Oxy/Fuel cutting is selected. Torch has just pierced at a new location and is slowly accelerating up to the selected cutting speed based on the PIERCE RAMP TIME value entered by the operator. |

SYSTEM OPERATIONS : RUNNING A PROGRAM

RUN-RTN TO PATH Part program is running. This display occurs for two reasons. If the operator presses "STOP CYCLE" and jogs the machine away from the programmed path, and then presses "START CYCLE", this display shows until the machine has moved back to the correct position. This display also occurs if the machine drifts away from the correct position when it is supposed to be holding position (waiting for cutting oxygen switch to be turned on).

*** IMPORTANT ***

IF THIS DISPLAY APPEARS WHEN A PART PROGRAM IS RUNNING, AND THE MACHINE APPEARS TO BE STALLED, IT INDICATES THAT THE CONTROL IS UNABLE TO RETURN THE MACHINE TO THE CORRECT POSITION. THIS CAN OCCUR IF THERE IS A LARGE AMOUNT OF DRIFT IN THE DRIVES, OR IF THERE IS SOME KIND OF MECHANICAL BIND OR INTERFERENCE.

THE MECHANICS OF THE MACHINE SHOULD BE CHECKED FOR OPERATION IN ACCORDANCE WITH THE OPERATION MANUAL FOR THE MACHINE, AND NEEDED ACTION SHOULD BE TAKEN TO CLEAR THE BINDING OR INTERFERENCE. THE DRIVES SHOULD BE CHECKED, ESPECIALLY FOR DRIFT, ACCORDING TO THE DRIVE MANUFACTURER'S INSTRUCTIONS.

RUN.8 RUNNING DESCRIPTION

Due to the variations between cutting machines, it is not possible to give an exact description of the operating sequences to be used while running a part. The following descriptions serve to illustrate the various control functions and typical operating sequences.

If MANUAL CUT mode is selected, the program moves to the pierce point and waits for the cut to be started by the operator. At the end of the cut, the cutting process stops automatically and the machine advances to the next pierce position. When it reaches the new point, the cut switch must be turned off and back on to restart the cut.

For Oxy/Fuel cutting, the operator must manually start the cutting oxygen using the machine's cutting oxygen switch or controls. The **2.5RS** automatically turns the cut off at the end, or the operator can stop the cut by turning off the machine's cutting oxygen switch.

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For Plasma cutting, the operator must manually start the plasma cut. This can be done in one of two ways. If the machine is equipped with a separate plasma control station, the cut can be started by pressing the Start button on the plasma operators console. The plasma cut can also be started manually by pressing the "CYCLE START" key on the **2.5RS**. This allows manual cutting to be done on machines which do not have a separate manual control station.

If AUTO CUT was selected, the program advances to a new pierce point and then automatically turns on the cutting process. If Oxy/Fuel cutting is being done, the high preheat turns on for the specified time and then the cutting oxygen. To extend or shorten the high preheat time, press the "START CYCLE" key and hold for the desired preheat time. To shorten the time, just press and release the "START CYCLE" key when the cut is to start.

NOTE

The Auto Cut cycle will not start if the manual cutting switch is in the ON position.

If TEST RUN is selected, the program begins running but with all cutting functions suspended. Program steps which would be cut are run at the speed set on the machine speed dial while traverse moves are done at the high traverse speed.

If SINGLE STEP is selected, the program executes one program step each time the "START CYCLE" key is pressed.

In either the "TEST RUN" or "SINGLE STEP" modes, the part may be repositioned on the plate as follows. Allow the machine to run through the program to a point where it is apparent that the part needs to be moved to keep it on the available plate. Then press "STOP CYCLE" to stop the machine at that point. Now use the jog function to move the torch to the desired position on the plate. Once it is in the correct position, press the "START CYCLE" key again to continue the test run. This process of stopping the test, jogging the torch and then continuing may be repeated as many times as needed to position the part correctly. Once the part is positioned, press the "STOP CYCLE" key and then the "PART RET." key 3 times to return to the home position of the part. Press the "STOP CYCLE" key again to return to the main cutting prompts and select the desired cutting mode.

SYSTEM OPERATIONS : RUNNING A PROGRAM

The "PART RET." key actually allows returning to one of three different positions on the part being cut.

Pressing the "PART RET." key the **first** time returns to the most recent pierce point on the part.
The display now shows "-RETURN- PIERCE".

Pressing the "PART RET." key a **second** time returns to the start point of the current part.
The display now shows "-RETURN- START".

Pressing the "PART RET." key a **third** time will return to the home position on the selected cutting table.

The display now shows "-RETURN- HOME".

NOTE

Pressing "SHF" "PART RET." returns to table #1 (0,0) home reference position.

The "BACKUP" key can be used in CUT, TEST RUN or SINGLE STEP to retrace the cut path either for verifying the positioning or in the case of a lost cut. When pressed, (the part must be running forward first), it backs up at a preset speed as long as the key is held. When the desired point is reached, release the key and restart the cut.

NOTE

BACKUP does not work if "STOP CYCLE" is pressed.

To stop the program at any point, press the red "STOP CYCLE" key. To continue, press the "START CYCLE" key again.

After stopping, it is possible to jog away from the part (to clean a torch tip for instance). Then pressing the "BACKUP" key causes the machine to return directly to the position where it was jogged from. Pressing the "START CYCLE" key continues cutting the part.

To stop executing the program and return to the top prompting level, press the "RECYCLE" key.

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PART 3 SYSTEM UTILITIES

SYSTEM UTILITIES : PROGRAM TEXT EDITOR

EDITOR.1

PROGRAM TEXT EDITOR

The EDIT/NEW function allows the **2.5RS** to create and edit programs in PART STORAGE MEMORY. To enter this mode press the "ENTER" key when "EDIT/NEW" is displayed. The display changes to "EDIT- XXXXXXXX" with the last used program displayed. Select the desired program number from those in memory or enter a new program number that does not exist to create a new program and press "ENTER".

Once a program is selected, the first data block is displayed and editing can begin.

EDITOR1.1

MAIN DATA BLOCK DISPLAY

The editor has the ability to do two basic operations, it can display a list of data blocks in memory, and it can edit a specific block of information.

In the DISPLAY MODE, the readout shows the INTERNAL BLOCK NUMBER on the left. This number indicates the position of the block in the program. For example, the 5th block in any part program is displayed as "B0005".

To display a particular block, the scroll keys can be used to move up or down through the program. Each time a scroll key is pressed, the new block number and the type of information contained in the block is shown.

The numeric keypad can also be used to quickly access a particular block. Enter the desired block number on the keypad. When the first digit is pressed, the readout changes to:

"GO TO- B#### "

After the correct value is displayed, press "ENTER". The specified block is found and displayed.

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If the block number entered is past the end of the program, or if the SCROLL keys are used to step past the end or beginning of the program, a brief message appears indicating the condition and then the previous block is displayed.

If the program end is reached, the display shows "PROGRAM END" then backs up to the last block in the program.

If the scrolling moves past the beginning of the program, the display shows: "PROGRAM TOP" and then displays the first program block.

During the MAIN DATA BLOCK DISPLAY MODE, the left side of the display shows the block number while the right side shows a variety of information depending on the type of block: LINE, ARC, or FUNCTION. For these examples, assume that the data block displayed is the 5TH internal block in the program.

For LINE moves, the display shows "B0005- LINE +X +Y". This means that the block causes a linear movement. The remainder of the block indicates which dimensions are present in the block and the sign of the dimension. The actual dimensions are not shown at this point so that the operator can quickly scan through the data blocks without having to look for specific dimensions. To look at the actual X/Y dimensions, the block must be selected for editing as described later.

For ARC moves, the display alternates between:

"B0005 - CW/CCW ARC"

and

"B0005- +X +Y +I +J"

The first display shows the direction of the arc, either CW or CCW. The second display shows which dimensions are present in the data block and their direction. Again, to avoid extra displays, the individual dimensions are not shown at this point. As with the line, the block must be selected for editing to see the actual X/Y/I/J dimensions.

SYSTEM UTILITIES : PROGRAM TEXT EDITOR

For FUNCTION data blocks, there are several possible displays.

"B0005- **NAME**-F##" In this display, the ****NAME**** and **F##** are one of the functions listed at the end of this section. For example, if block 5 performed the CUT ON function, the display would show:
"B0005- CUT ON -F06"

"B0005- INTERNAL C0" Internal functions have been created by the **2.5RS**. Although they are displayed, they cannot be edited or deleted since they are essential to the programs execution. Normally they should be ignored.

EDITOR1.2

EDITING COMMANDS

After the desired block is displayed, the data may be displayed and changed if necessary.

To edit the block being displayed, press the DECIMAL POINT "." key and then ENTER. This two key combination is used to prevent accidental editing of a data block. If the block is a line or arc, continue at section: **LINE/ARC BLOCK EDITING**. If the block is a function, continue at section: **FUNCTION BLOCK EDITING**.

To abort the edit process without altering the block data, press the "RECYCLE" key. This returns to the 'MAIN BLOCK DISPLAY' without altering the data.

2.5RS OPERATION AND MAINTENANCE MANUAL

EDITOR1.2.1

LINE/ARC BLOCK EDITING

If the selected data block is a line or arc, the following sequence of prompts appears.

"X DIM= #####"-Displays current X dimension- enter new value if desired.

"Y DIM= #####"-Displays current Y dimension- enter new value if desired.

"I DIM= #####" -Displays current I dimension (The I dimension is distance from start point to center of an arc along the X axis). This value must be 0.00 for line blocks since including an I or J dimension in a data block causes an arc. Although the input block may have been a line, the prompts for the I and J dimensions appears. Enter the new value if desired.

"J DIM = #####" -DISPLAYS CURRENT J DIMENSION (The J dimension is the distance from the start point to the center of an arc along the Y axis). SEE COMMENTS FOR I DIMENSION ABOVE.

EDITOR1.2.2

ARC DIRECTION CW/CCW

"ARC DIRECTION CW/CCW" -This prompt only appears if either the I or J dimension is not 0.00 which indicates an arc data block. If both are 0, the block is a line and thus has no arc direction. To toggle between "CW" and "CCW", press the "+/-" key to display the desired direction. Then press "ENTER".

VERIFY- YES/NO

"VERIFY- YES/NO" -After all the previous prompts have occurred, the verify prompt is displayed. Use the "+/-" key to toggle between the YES/NO response and press "ENTER". The "YES" response causes the X/Y/I/J prompting to restart so the dimensions can be verified and changed again if necessary. The "NO" response ends the editing of the data block and stores the results in memory.

NOTE

If only the "ENTER" key is pressed for each prompt, and none of the data values changed, the original block is not replaced in memory. However, if any of the dimensions or arc direction values are changed, a new data block is created and the entire original block is replaced.

After all the prompts are entered, and the "VERIFY- NO" response entered, the readout returns to the 'MAIN DATA BLOCK DISPLAY'.

EDITOR1.2.3

FUNCTION BLOCK EDITING

If the block being edited is a function (CUTON, KRFLFT, ETC.), the following prompt is displayed:

"FNC- ## - NAME "

The ## digits contain the function number from list at the end of this section. The function name is displayed on the right side. Some examples are:

"FNC- 03 - CHNTOP" FUNCTION 03 - "CHAIN TOP"

"FNC- 05 - CUTOFF"FUNCTION 05 - "CUTTING OFF"

To change the function, the scroll keys may be used to move up or down the list of functions given in the list (end of this section). Each time an UP/DOWN SCROLL key is pressed, the next function number and name from the list is displayed. Thus there is no need to memorize the function codes since the scrolling can be used to look through the list for the desired value.

2.5RS OPERATION AND MAINTENANCE MANUAL

Instead of scrolling to the desired function, the function number can be entered directly on the keypad. As soon as the number entry starts, the display changes to:

"FUNCTION- ###" With the numbers being entered in the ## digits.

Once the desired value is displayed, press "ENTER". The display returns to the "FNC- ## - NAME" display described in FUNCTION BLOCK EDITING.

After the desired function is displayed either by scrolling through the list, or by entering the desired function number directly, press the "ENTER" key. In most cases, this finishes the editing process for the function and replaces the original data block with the new function code. Once this is done, the display returns to the 'MAIN DATA BLOCK DISPLAY' and the new function code is shown.

EDITOR1.3 DELETING A BLOCK

If it is necessary to delete a block from the program, the desired block should first be displayed as described in 'MAIN DATA BLOCK DISPLAY'. When it is displayed, press the "CE" or "CLR" key. The display changes to:

"0000 TO DELETE"

Press "ENTER". The display now prompts again to insure that the block is not deleted by accident: (again block 5 is used for example)

"DELETE B0005- NO"

Pressing "ENTER" at this point ABORTS the DELETE and does not alter the program in any way. To go through with the delete process, press the "+/-" key to toggle the selection to "YES", then press ENTER. The indicated block is erased from memory. All following blocks move up one number so block 6 becomes block 5 etc. The display now returns to the 'MAIN BLOCK DISPLAY'.

EDITOR1.4 INSERTING A DATA BLOCK

The INSERT FUNCTION allows data blocks to be added to the program either above or below any other data block in the program (no blocks may be added above the PROGRAM START or after the PROGRAM END).

To INSERT a block ABOVE the current block shown on the 'MAIN BLOCK DISPLAY', first press "SHF" then the SCROLL UP arrow.

To INSERT a block BELOW the current block shown on the 'MAIN BLOCK DISPLAY', first press "SHF" then the SCROLL DOWN arrow.

SYSTEM UTILITIES : PROGRAM TEXT EDITOR

After the SCROLL UP/DOWN key is pressed the display prompts for the type of block to be inserted, either a LINE/ARC BLOCK or a FUNCTION:

"INSERT- LINE/ARC"

OR

"INSERT- FUNCTION"

Since the only difference between line and arc blocks is the I and J dimensions, they are considered the same for the INSERT function.

Use the "+/-" key to toggle between the two selections and press "ENTER" when the desired one is displayed. This inserts a blank block into the part program and then goes immediately to the editing function for that block. If a LINE/ARC was INSERTED, the prompting goes to the X/Y/I/J/CW-CCW prompts with all the dimensions set to 0. If a function block was inserted, the prompting switches to the function editing prompts listed in "FUNCTION BLOCK EDITING" with the function code set to "PGMNOP-00". Go to the indicated section to enter the desired values.

EDITOR1.5

TERMINATING THE EDITOR

Once the necessary corrections have been made to the program, and the 'MAIN BLOCK DISPLAY' is showing, press the "RECYCLE" key to terminate the editor and return to the main "SELECT FUNCTION" prompt.

If there were no data changes in the program (no delete's, insertions or any editing of data values), the program can be run immediately with no additional processing. However, If any data had been changed, or any blocks inserted or deleted, the "DIAL-IN-KERF" and "ACCEL/DECEL" processing must be re-done on the program. Thus if a program is edited and then run, the delays associated with the kerf and decel programs will occur the first time. After that, the program can be re-run with no delay.

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EDITOR1.6

INTERNAL FUNCTION NAMES / CODES

| | | |
|----------------|-----------|--|
| PGMNOF | 00 | PROGRAM NOP - Normally NOT used during program edit. |
| UNUSED | 01 | UNUSED INDEX - Ignore |
| UNUSED | 02 | UNUSED INDEX - Ignore |
| CHNTOP | 03 | CHAIN TOP - This code sets a repeat pointer which is used when the CHAIN BOTTOM "04" code is executed. If the "03" code is not included in a program, program returns to the beginning of the program. If this code is included in a program, the repeat returns to that point rather than the top of the program. A prompt "Value #1 = 0000" allows for optional loop programming. Normally set to 0000. |
| CHNBOT | 04 | CHAIN BOTTOM - This code is placed at the end of a program to cause an automatic program repeat when the code is read. If this code is omitted, the program runs until it reaches the PROGRAM END code and then stops. The operator has to press the START key to cut another part. |
| CUTOFF | 05 | CUTTING OFF - Turns off the cutting process. |
| CUTON | 06 | CUTTING ON - Turns on the cutting process. |
| KRFOFF | 07 | KERF OFF - Kerf Off function is automatically done each time the cutting is turned off. Thus there is normally no need for a separate "Kerf Off" code in the program. It is normally only used with the "Code Conversion" option. |
| KRFLFT | 08 | KERF LEFT - Sets the Kerf direction to the left of the path for the "DIAL-IN-KERF" function. |
| KRFRHT | 09 | KERF RIGHT - Sets the Kerf direction to the right of the path for the "DIAL-IN-KERF" function. |
| MARKOFF | 10 | MARKER #1 OFF - Turns OFF the #1 marking device. |
| MRKON | 11 | MARKER #1 ON - Turns ON the #1 marking device. |

SYSTEM UTILITIES : PROGRAM TEXT EDITOR

INTERNAL FUNCTION NAMES/ CODES (CONT.)

- | | | |
|---------------|-----------|--|
| OFSOFF | 12 | OFFSET #1 OFF - Cancels the #1 marker offset and moves the machine back to the cutting position. The prompt "VAL 1=0000" is used to select 1 of 8 offsets. See SD80-SD96 in "INSTALLATION & SETUP" |
| OFSON | 13 | OFFSET #1 ON - Turns on the #1 marker offset and moves the machine to the offset position. The prompt "VAL 1=0000" is used to select 1 of 8 offsets. See SD80-SD96 in "INSTALLATION & SETUP" |
| INCH | 14 | INCH DIMENSIONS - *** EFFECTS PROGRAM DURING LOAD PROCESS ONLY. Indicates that all following dimensions are programmed in "INCH" units. While this code effects the program dimensions as they are being loaded into memory, once the program is loaded, it serves no purpose. Therefore, editing or deleting this code does not effect the operation of the machine. However, if the program is "STORED" via the RS232 port, the edited code effects the resulting Word Address or ESSI program. If the program is re-loaded, the changed codes effect the data being loaded into memory. |
| MMETER | 15 | MILLIMETER DIMENSIONS - *** AFFECTS PROGRAM DURING LOADING PROCESS ONLY. Indicates that all following dimensions are programmed in "MILLIMETER" units. (See comments for INCH code "14" above) |
| ABSDIM | 16 | ABSOLUTE DIMENSIONS - ***AFFECTS PROGRAM DURING LOADING PROCESS ONLY. Indicates that all following dimensions are in "absolute" format. When a program is being loaded, all dimensions are saved as "Incremental" movements even if the input program uses Absolute dimensions. Therefore, once the program is loaded, this code serves no purpose. Editing or deleting this code does not affect the operation of the machine, However, if the program is "stored" via the RS232 port, this code is used to re-construct the program so that it appears the same as when it was loaded. Thus changing affects the program data as it is being re-loaded into memory. |

2.5RS OPERATION AND MAINTENANCE MANUAL

INTERNAL FUNCTION NAMES/ CODES (CONT.)

- ABSRPL 17 ABSOLUTE REGISTER PRELOAD** - *** EFFECTS PROGRAM DURING LOADING PROCESS ONLY. This code occurs only in "Absolute" dimension programs and is used to reset the absolute zero point to a new location. Since dimensions are not stored in absolute format, this code has no affect on the machine after the program is loaded. It is only saved so that the program can be re-constructed when a "STORE" via the RS232 is done.
- INCDIM 18 INCREMENTAL DIMENSIONS** - *** AFFECTS PROGRAMS DURING LOADING PROCESS ONLY. Indicates that all following program dimensions were in INCREMENTAL format. (See comments for "ABSDIM" code "16")
- DWELL 19 PROGRAM DWELL** - As a part is being run, this code causes the machine to execute a programmed dwell function. The motion stops, and all relays are maintained in their current state. After the specified dwell time, the program continues execution. The dwell function can also contain a data word which sets the dwell time to be used for this and all following dwell commands until a new time is set. If the time is included in the function block, it is displayed as "VAL 1= XXX.XX" with the time being shown in seconds. When the block is edited, the same value prompt appears which allows the dwell time to be edited as desired.
- LEADIN 20 PROGRAMMED LEAD-IN** - This code operates with the "DIAL-IN-KERF" option. It indicates that the following Line or Arc block is a Lead-In to a part and should not be kerf compensated. This causes the pierce point to remain fixed rather than being offset by the kerf dimension.
- PGMSTP 21 PROGRAM STOP** - Causes the machine to Stop and all cutting functions to be turned Off. The operator must press the "START CYCLE" key resume operation.

SYSTEM UTILITIES : PROGRAM TEXT EDITOR

INTERNAL FUNCTION NAMES/ CODES (CONT.)

PRGMEND 22 PROGRAM END - This code and the "23" code both indicate the end of the part program. The only difference between these two occurs if the program is "STORED" via the RS232 port. The "22" PGMEND code is output as a "Program End-No Rewind" function while the "23" PGMRWD code is output as a "Program End-Rewind". If multiple programs are downloaded, all but the last one must end with the "PRGMEND" No-Rewind code. This allows multiple download operation. The last program in the group normally contains the "PGMRWD" rewind code which causes the rewind process to operate.

*** IMPORTANT- DO NOT DELETE THE PROGRAM END CODE***

PGMRWD 23 PROGRAM END WITH REWIND - See description for "PRGMEND-22".

SPKON 24 * DO NOT USE FOR EDITING** - This code is used to setup the optional Code Conversion tables only and has no other function. Since the same function list is used for the Editing and the Code Convert it appears in this list.

SPKOFF 25 *DO NOT USE FOR EDITING** - See comments for "Spkon" -24.

MRK2ON 26 MARKER #2 ON - Not used in **2.5RS**.

MRK2OF 27 MARKER #2 OFF - Not used in **2.5RS**.

OFS2ON 28 MARKER #2 OFFSET ON - Not used in **2.5RS**.

OFS2OFF 29 MARKER #2 OFFSET OFF - Not used in **2.5RS**.

FUNCTION 30-38 NOT USED FOR NORMAL EDITING

2.5RS OPERATION AND MAINTENANCE MANUAL

INTERNAL FUNCTION NAMES/ CODES (CONT.)

| | | |
|-----------------------------------|-----------|---|
| TB SEL VAL 1 = # | 39 | PARAMETER TABLE OVERLAY - VAL 1= # Indicates which parameter overlay table is being used. Possible Values are 0,1,2,3,4. ****CAUTION**** - When a value of 1,2,3,4 is entered, the corresponding overlay table accessed by SERV41, SERV42, SERV43, and SERV44 must be set up before the program is run. |
| GOHOME VAL 1 = # | 40 | GO HOME - Indicates which cutting table home the machine should move to. VAL1= prompts for cutting table home 1,2,3,4. |
| TOOL41 VAL 1 = # | | Special for multiple cutting tool operations. VAL 1= # selects the the tool code. |
| KRFDIM VAL 1 = # | 42 | PROGRAMMABLE KERF - A kerf value may be inserted with this function. VAL 1 equals programmed kerf dimensions in the same units as system parameter SD60- in/mm. |
| FEEDRT VAL 1 = # | 43 | PROGRAMMABLE FEEDRATE - A FEEDRATE value may be inserted with this function. VAL 1 = Programmed feedrate in the same units as SD60 ipm/mpm. |
| HTDIS | 44 | PLASMA HEIGHT SENSOR DISABLE |
| HTENA | 45 | PLASMA HEIGHT SENSOR ENABLE |
| LDAUTO VAL 1 = # | 46 | AUTO PROGRAM LOAD FOR "LOAD/RUN" operation. "VAL 1 =#" prompts for 8 digit number of next program to be loaded. |
| COUNT | 50 | PART COUNTER INCREMENT - Signals that a complete part has been cut. This is used in programs where more than one part is programmed as part of a single program. It allows each part to be counted individually. |

SYSTEM UTILITIES : PROGRAM TEXT EDITOR

EDITOR.2

CREATING A SAMPLE PROGRAM

The following example shows the steps necessary to create a new program using the editor. For simplicity, many of the available entry options as described in the manual are not used. This example shows a step by step approach to programming a part. The display as shown on the CNC is in quotation marks (" "), and the necessary operator key entries are underlined.

Select "EDIT/NEW PROGRAM" from the main menu and

PRESS ENTER

Assign a new part number and

PRESS ENTER

The control will provide the first and last blocks of the program and

"B-0001-INTERNAL Ci-PROGRAM START" is now displayed

To add a new block

PRESS SHF AND
SCROLL DOWN

The control will display, "INSERT LIN/ARC".
To change this to "INSERT FUNCTION".

PRESS +/-

To add a function,

PRESS ENTER

The control will display "FNC-00-PGMNOP"

PRESS SCROLL DOWN

UNTIL "FNC-06-CUTON" IS DISPLAYED.

PRESS ENTER

"B-0002-CUTON-F06" is now displayed.

To add a new block,

PRESS SHF AND
SCROLL DOWN

The control will now display "INSERT-LIN/ARC".
Change this to "INSERT FUNCTION" by

PRESSING +/-

To add a function,

PRESS ENTER

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The control will display "FNG-00-PGMNOP" PRESS SCROLL
DOWN UNTIL
"FNC-08-KRFLFT"
IS DISPLAYED
THEN PRESS ENTER

"B-0003-KRFLFT-F08" is now displayed.

To add a new block, PRESS SHF AND
SCROLL DOWN

The control will now display
"INSERT-LIN/ARC" PRESS ENTER

"X-DIM=0000" is displayed.

Use the numeric keypad to enter the
dimension 100 PRESS ENTER

and "Y-DIM=0000" is displayed PRESS ENTER

"I-DIM=0000" is displayed PRESS ENTER

"J-DIM=0000" is displayed PRESS ENTER

"VERIFY-YES" is displayed PRESS +/-

"VERIFY-NO" is displayed PRESS ENTER

"B-0004-LINE +X" is displayed

To add a new block, PRESS SHF AND
SCROLL DOWN

The control will now display "INSERT-LIN/ARC" PRESS ENTER

"X-DIM=0000" is displayed

Use the numeric keypad to enter the
dimension-80 and PRESS ENTER

"Y-DIM=0000" is displayed PRESS ENTER

SYSTEM UTILITIES : PROGRAM TEXT EDITOR

"I-DIM=0000" is displayed

Use the numeric keypad to enter the
dimension-40 and

PRESS ENTER

"J-DIM=0000" is displayed

PRESS ENTER

"ARC-DIRECT-CW" is displayed

PRESS ENTER

"VERIFY YES" is displayed

PRESS +/-

"VERIFY NO" is displayed

PRESS ENTER

"B-0005-ARC-CW" is displayed (and also)

"B-0005- -X -I" is displayed

To add a new block,,

PRESS SHF AND
SCROLL DOWN

The control will now display
"INSERT-LIN/ARC

PRESS ENTER

"X-DIM=0000" is displayed

PRESS ENTER

"Y-DIM=0000" is displayed

Use the numeric keypad to enter
the dimension 20 and

PRESS ENTER

"I-DIM=0000" is displayed

PRESS ENTER

"J-DIM=0000" is displayed

PRESS ENTER

"VERIFY-YES" is displayed

PRESS +/-

"VERIFY-NO" is displayed

PRESS ENTER

"B-0006-LINE +Y" is displayed

To add a new block

PRESS SHF AND
SCROLL DOWN

2.5RS OPERATION AND MAINTENANCE MANUAL

"INSERT-LIN/ARC" is displayed

Change to Insert-Function by PRESS +/-

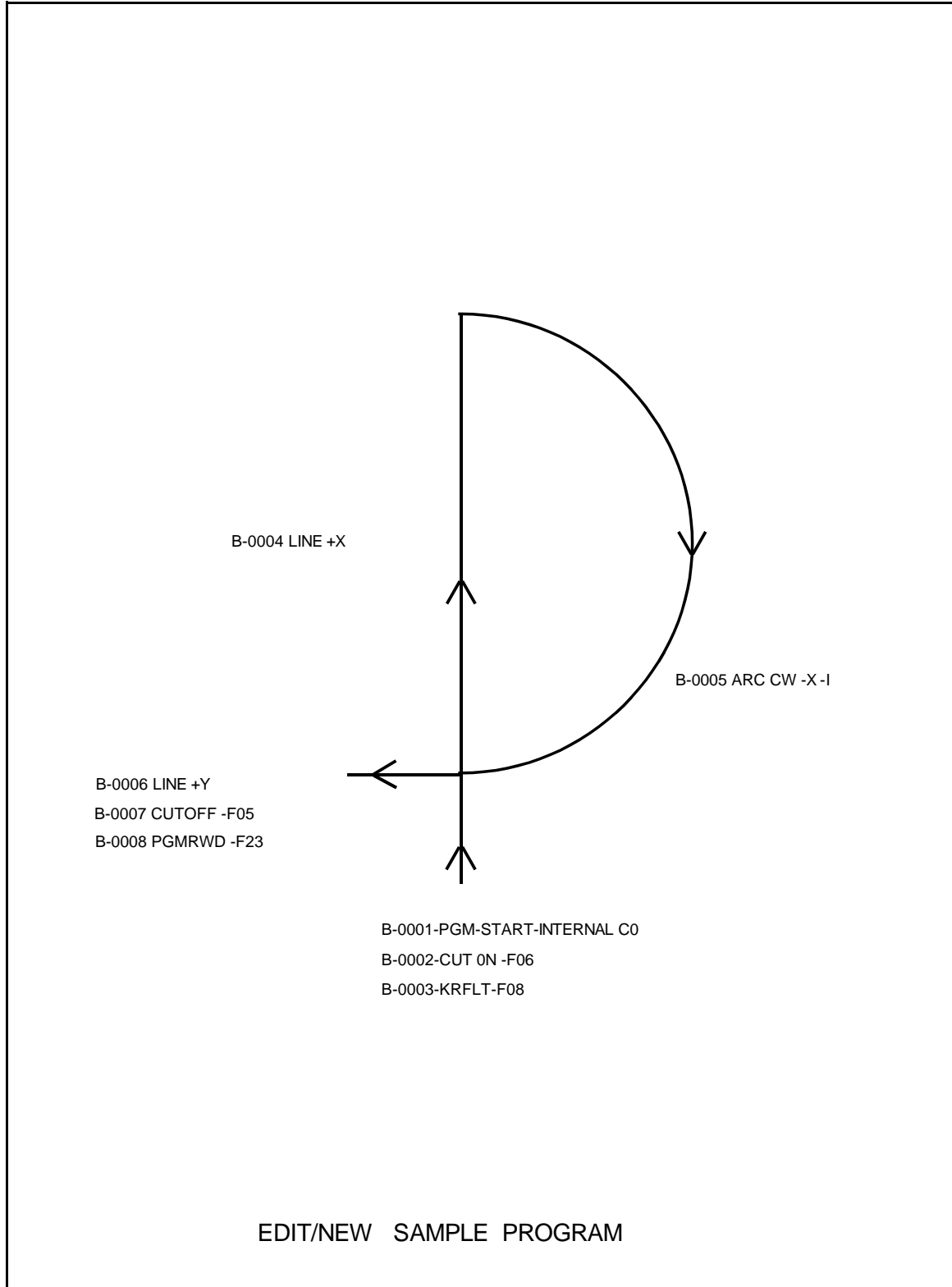
"INSERT-FUNCTION" is displayed PRESS ENTER

"FNC-00-PGMNOP" is displayed PRESS SCROLL
DOWN UNTIL
FNC-05-CUTOFF" is displayed, THEN
PRESS ENTER

"B-0007-CUTOFF-F05" is displayed

The program is finished, PRESS RECYCLE

SYSTEM UTILITIES : PROGRAM TEXT EDITOR



TEMPLATE TEACH TRACE

The "TEMPLATE TEACH" function allows the **2.5RS** used along with the machines optical tracing system to "REMEMBER" an existing template and then repeat it any number of times without the template.

Press the "ENTER" key. The display changes to: "PGM= 00000000" with the last used program displayed.

Enter program number to be used to store the taught data.

TEACH.1

TEACHING VALUES

Once the teach mode is selected, the prompt will change to "YES+ STD VAL -NO". This prompt is used to bypass many of the variables used for teaching by allowing the operator to use a "STANDARD" set of values preset in the system. The various teach setup parameters can be used to tailor the accuracy of the teaching process for different applications. The "STANDARD" values result in a good compromise of teach resolution versus memory storage.

To choose the Standard Values, press the "+/-" key one time which will cause the "YES+" on the left of the readout to begin flashing. Then press the Enter key and continue at "BEGINNING THE TEACHING PROCESS".

If some of the values are to be altered, press the "+/-" key twice so that the "-NO" on the right of the readout is flashing. Then press the "ENTER" button and go on to the individual parameter settings listed below.

If STANDARD VALUES ARE NOT SELECTED, the prompting will ask for the 6 parameters which control the teaching process.

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- DIGITIZING FACTOR** This number which can range from 2-999 sets the allowable error boundary used to determine when a new point is created. A value of 16 equals .0025". Making this number smaller will result in a more accurate representation of the part however it will create more points and therefore use more memory to store the program. Making this number larger will result in less memory being used but with less accuracy in the program.
- MAXIMUM RADIUS** Sets a limit on the size of arcs which will be created by the teaching process. This parameter is not usually altered and is mainly used for testing purposes.
- MINIMUM RADIUS** Sets a limit on the minimum size radius which will be created by the teaching process. Again, it is used mainly for testing.
- RADIUS ERROR** Used to convert a series of lines to an arc which saves memory. To determine if an arc should be created, the lines are tested to see if they fall along the same arc or are within the radius error distance of the arc. Making this number larger will result in more lines being converted to arcs however there will be some rounding and smoothing of the shape. Making it very small will limit the number of arcs created since the lines must be very close to the perfect radius.
- LINE REDUCTION** This parameter is used by the teaching process to determine when a series of short straight lines can be replaced by one longer one, thus saving memory. It's value ranges from 2-999 with a value of 16 equals .0025"). Setting this parameter smaller will cause more lines to be stored while making it larger will result in some loss of part definition.
- KERF DIRECTION** This prompt appears as "KRF 1-LF 2-RT X". It is used to set the kerf direction command in the created program either to the left or right of the cut. This value is used by the "DIAL IN KERF" feature when the part is cut. Most parts are done with the kerf to the left.

NOTE

When the Dial-In-Kerf option is used on a Taught program, the program length will be increased 25-30%. The extra space is used to store the kerf information without altering the original program dimensions. This permits the kerf to be adjusted and changed as necessary since the original dimensions are available for the re-calculation. If the Teach Kerf Direction is set either left or right, the extra space required for the kerf data will be allocated during the teach process. By allowing the space ahead of time, the actual kerf calculation will run about 20% faster. However, if the Dial-In-Kerf feature is not going to be used on a part program, a value of "0" should be entered for the "KRF 1 LF 2 RT X" prompt. This will remove the kerf codes and reduce the amount of memory required to store the part program. However, the Dial-In-Kerf will not work on the part.

TEACH.2

THE TEACHING PROCESS

Once the teach setup parameters are entered, either as the STANDARD or ALTERED values, a prompt will appear to "POSITION TRACER" and then the X and Y axis positions will be displayed. Pressing the "CE" or "CLR" key will reset the position displays to 0.00. Use the readouts to position the tracer at the starting point for the program to be taught. (In most cases, the program is taught starting from the corner of the plate.)

When the tracer is in the correct position to start the program, (usually where the corner of the plate will be when it is cut), make sure the machine cut switch is off, and that the speed dial is set to 0. then press the "ENTER" key.

If the oxy cut switch is on, the program will issue a warning message and an audible signal. Turn off the oxy cut switch then press the "ENTER" key again.

If the machine speed dial is not set to 0, a different warning will be displayed along with an audible signal. Set the machine speed dial to 0 and press the "ENTER" button again.

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The program is "TAUGHT" by running the tracing eye around the template just as if the part was actually being cut. In addition, the operator must indicate the cut should be on or off.

When the <<CUT OFF>> mode is selected, the actual path is not stored, only the final position. This gives a straight line traverse from one cutting segment to the next. When the eye is positioned at the next pierce location, the operator should change to the <<CUT ON>> mode and begin tracing the template. In the <<CUT ON>> mode, the actual path or "CONTOUR" of the part will be stored for playback later. When the cutting path is complete, the operator should leadout away from the template and then switch back to the <<CUT OFF>> mode before moving to the next pierce point.

Use the "CYCLE START" AND "CYCLE STOP" buttons to turn the teach cut on and off. Pressing the "CYCLE START" will switch to the "CUT ON-CONTOUR" mode while pressing the "CYCLE STOP" will go back to the "CUT OFF-POINT TO POINT" positioning mode. This will work for either Plasma or Oxy/Fuel cutting systems.

The remainder of this description refers only to <<CUT ON>> or <<CUT OFF>> and does not specify the method used to make the selection. The unit will "BEEP" any time the mode is changed, and the display will indicate the cutting status along with other information.

When the <<CUT OFF>> mode is selected, the display will first show "CUT OFF-PT TO PT" then the X/Y position data will return with a flashing minus sign (-) in the center of the screen to indicate the "CUT OFF" state. About every 7 seconds, a second message will appear which shows the amount of memory remaining for storing the part.

During the <<CUT OFF>> mode, the path of the machine is not stored, only the last position before the cut is turned "ON" again. Thus from the end of one cut segment to the start of the next will only store 1 point to point (PT TO PT) move. When the <<CUT ON >> mode is selected, the beeper will again indicate the change and the readout will show "CUT ON-CONTOUR" for about 1.5 seconds before returning to the X/Y position display. There will now be a flashing (+) sign in the center of the readout to indicate that the <<CUT ON>> mode is active.

*****IMPORTANT*****

Due to the software processing time, the speed during the teaching process must not exceed 25ipm (635 mmpm) or the resulting part will appear choppy due to the loss of some data.

SYSTEM UTILITIES : TEMPLATE TEACH TRACE

The template/tracing system must be set so the taught path compensates for the cutting kerf of the torch. This can either be accomplished by having the template drawn with the correct kerf modified dimensions, or by using the kerf offset feature of most tracing systems to offset the path. In either case, if the template/tracing eye combination produces a correct size part when cut optically, The resulting taught program will be the correct size also.

NOTE

Although the "Dial In Kerf" feature on the **2.5RS** allows either a positive or negative kerf to be added to the program after it is taught, the best results are still obtained by teaching the program with the kerf included in the template or tracing eye, and then using the "Dial In Kerf" to Fine Tune the resulting program.

The TEACH process allows parts to be taught in either a chain cut mode or as a pierce, step and repeat type part. To allow for the initial move from the corner of the plate to the first part, any positioning moves before the first cut are only performed the first time and are not repeated on each part.

TEACH.3 TEACHING A PROGRAM WHERE EACH PART IS PIERCED

To TEACH a pierce and cut type part, the tracer should be positioned at a point on the template that represents the location of the corner of the plate before the enter button is pressed to start the teach process. Then the tracer should be moved to the pierce location for the first cut. The X/Y COORDINATES OF THIS POINT SHOULD BE WRITTEN DOWN as they will be needed later to teach the repeat to the next part. Turn the <<CUT ON>> and lead the tracer into the pattern. Continue to trace around the pattern to the end of the CUT. Then turn the <<CUT OFF>>. Move the tracer to the next cut segment and repeat the cut on/trace/cut off sequence until all the cutouts and the outside profile of the part are taught. The final operation is to teach the repeat step move by positioning the tracer at the new pierce location for the next part. This can either be done by marking the template with the next pierce point and moving the tracer over that point. However, a more accurate method is to use the X/Y readouts to position the machine exactly at the desired location. This can be calculated by adding the total size of the part to the original pierce point location (the coordinates which were written down earlier) and moving the machine to the resulting coordinates.

Once the machine is positioned at the repeat coordinates, press the "RECYCLE" button to complete the teaching process.

2.5RS OPERATION AND MAINTENANCE MANUAL

TEACH.4

TEACHING A CHAIN CUT PART

First position the tracer at the location on the template that represents the corner of the plate, then press the "ENTER" key. Move the tracer to the location where the chain cut is to be started. Note the X/Y coordinates of the start position as they will be needed later. Now turn the <<CUT ON>>, lead into the template and trace the part. When the tracer returns to the start position, lead it out of the part and then move it up the plate to the start position for the next part. This position may either be drawn on the template or may be calculated by adding the size of the part to the start position of the first part. Remember, since the cut has not been turned off, the leadout and move to the next part are taught as a contour and not as a point to point move. After reaching the start position for the next part, press the "RECYCLE (RESET)" button to end the teach process. Since the cut was never turned off the entire part including the move to the next part will be cut and will result in a continuous chain of parts being cut. The process is complete and the part is ready to cut.

DISPLAY MODES

The DISPLAY MODE is provided as a means of accessing various information without interrupting the actual machine operation. The "DSPY" key may be pressed at any time, during any operation. It can be used while a part is being cut to check machine position, cutting speed and other operating parameters, or it can be used to access the various diagnostic displays to aid in troubleshooting a problem.

When the "DSPY" key is pressed, the operator is prompted to select the desired display from the following list:

| | |
|--------------------|------------------|
| DSPY00-EXIT MODE | DSPY20-EDIT PRGM |
| DSPY01-X/Y DISPLAY | DSPY30-SHOW WORD |
| DSPY02-PARTS CUT | DSPY31-SHOW DBL |
| DSPY03-FEEDRATE | DSPY32-SHOW CRU |
| DSPY05-SYS. STAT | DSPY33-SHOW BYTE |
| DSPY10-SYS DATA | DSPY34-SHOW CRUB |
| DSPY11-DSPY VAR | DSPY80-CONFIG |

DISPLAY.1

DPSY00-EXIT MODE

Display "00" is used to cancel the DISPLAY MENU and return to the previous operation.

DISPLAY.2

DSPY01-X/Y DISPLAY

This display shows the current position for both the X and Y axis. When a part is being run, this display shows the distance from the original start point of the part. When no part is being run, the display may be used for direct X/Y measuring. The "CLR" or "CE" key clears both readouts to 0. Thus to measure a distance, the operator should position the machine at the first location, then clear the X/Y positions by using the "CLR" or "CE" key. As the machine is moved, the readout displays the machines position referenced from the point where it was cleared.

DISPLAY2.1

DSPY02-PARTS CUT

When a part program is being run, this display shows the number of part cycles which were performed. If only one torch is being used, this is the actual number of parts produced. However if multiple torches are used, the actual number of parts is the displayed value multiplied by the number of torches.

DISPLAY2.2

DSPY03-FEEDRATE

This display shows the current setting of the machine's speed dial in either INCHES/MINUTE or MILLIMETERS/MINUTE depending on SD60 setting.

If Digital Feedrate or Programmable Feedrate is used "DSPY03" allows a new feedrate to be entered via the keypad.

DISPLAY.3

DSPY05-STATUS

DSPY05- SYSTEM STATUS displays E-STOP error messages and also displays which part program is being cut if it is selected while a part program is running.

DISPLAY.4

DSPY10-DSPY44 SERVICE DISPLAYS

There are several service and diagnostic displays also available from the "DISPLAY" menu, DSPY10 - DSPY44. These functions are displays of service functions but do not allow data entry.

See the detailed descriptions in the INSTALLATION section of this manual.

SYSTEM UTILITIES : DISPLAY MODES

DISPLAY.5

DSPY80-CONFIG

DSPY 80- CONFIGURE is a display mode which displays the system serial number, software version, and the amount of memory installed in the unit. Pressing the "ENTER" key jumps to a list of all the available options for the system with an 'ON' or 'OFF' displayed next to the option name indicating whether it has been enabled in the unit or not.

When first selected, the display continuously scrolls through the following:

| | |
|--------------------|--------------------------|
| "SERIAL xxxxxxxxx" | -Serial Number |
| VERSION mm/yy/dd" | -Software Version |
| HDW TYPE -10 " | -Hardware version number |
| ___K INSTALLED " | -Amount of MEMORY |

Pressing the "ENTER" key first shows "OPTIONS ON/OFF" and then switches to a list of all the available options for the system, along with an "ON/OFF" indication next to the name showing whether the option is enabled (turned ON) or not (OFF). Use the "ENTER" or the Scroll keys to sequence through the list.

IMPORTANT

Before calling regarding a service or operation problem, use DSPY-80 and write down the SOFTWARE SERIAL NUMBER, and SOFTWARE VERSION NUMBER displayed on the readout. This will aid the service personnel in determining the type of system, and the software installed. NOTE- The serial number must be the one displayed on the readout, not one found on a sticker somewhere on the enclosure.

SPECIAL FUNCTIONS

The "I" key on the **2.5RS** front panel is used to select the "SPECIAL FUNCTION" mode. To enter this mode, the control must be in the "RECYCLE" state ("RECYCLE" key was just pressed). Then press the "I" key to enter the SPECIAL FUNCTION menu. Use the SCROLL keys or enter the desired number directly to select from the following menu:

- | | |
|--------------------------|--|
| FNC00- EXIT MODE | Exits back to main menu. |
| FNC01- MANUAL CUT | Manual control of cutting outputs or stripping, cutting up remnants and testing cut control outputs. |
| FNC15- GO HOME | Return to one of 4 fixed home reference positions. |
| FNC16- SET HOME | Reset machine Reference (0,0) position after power-failure. |

SPECFUNC.1 MANUAL CONTROL MODE

The MANUAL CONTROL MODE in the **2.5RS** gives the operator direct control of the cutting control relay outputs. This permits several types of operation:

- Cutting processes (Plasma or Oxy/Fuel) can be turned ON/OFF and used in conjunction with the JOG controls to cut up scrap material, or for stripping plate.
- Cutting processes can be turned on before a part program is cut to check gas pressure and cut quality.
- Individual control relays can be turned ON/OFF to aid in installation and troubleshooting.

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SPECFUNC.2 PLASMA/OXY FUEL CUTTING SELECTION

As was described in the section on **RUNNING THE PROGRAM**, there are only 3 relays in the **2.5RS** for controlling the cutting process. If both **OXY/FUEL** and **PLASMA** are used on a machine, the external circuitry directs these 3 relays to the appropriate process. With the setup parameters set to allow both processes, a prompt appears for the operator to select which process is to be used for the **MANUAL CONTROL**. Use the "+/-" key to toggle between the **PLASMA** and **OXY/FUEL** selections and press "ENTER" when the correct choice is shown.

NOTE

If the machine has Plasma and Oxy-Fuel the choice should be made now. Once the Plasma or Oxy/Fuel choice is made, only the Manual Control functions for that selection are available. To switch to the other process, the operator must press the "RECYCLE" key to cancel the current operation, and re-select the manual control function again- this time choosing the other cutting process.

If only one cutting process is used on the machine, the setup parameters should have been set so that the selection of **PLASMA** or **OXY/FUEL** is made automatically. In this case, the prompt for **OXY/FUEL** or **PLASMA** does not appear.

Once the **OXY/FUEL** or **PLASMA** choice has been made, the display shows:

```
"MANUAL CONTROL "  
    then  
    *** SELECT ***
```

Then the menu of available **MANUAL CONTROL** functions for the selected cutting process is displayed. Use the **SCROLL** keys to move through the list and press "ENTER" when the correct function is displayed.

SPECFUNC2.1 OXY/FUEL MANUAL CONTROL FUNCTIONS

For OXY/FUEL cutting, the following manual control functions are available:

| | |
|--------------|--|
| OXY PRHT/CUT | High preheat, then start Cutting Oxygen |
| OXY ENABLE | Turn on Cutting Oxygen Enable relay only |
| OXY START | Turn on Cutting Oxygen Start relay only |
| PREHEAT | Turn on High Preheat relay only |

SPECFUNC2.1.1 OXY PRHT/CUT

This function is mainly used for cutting up scrap material, or for stripping plates in a single axis. It controls both the Preheat and Cutting Oxygen functions.

When selected, the control prompts the operator to press the "CYCLE START" key to turn on the High Preheat gasses. Once the High Preheat has been turned on, the operator is prompted to press the "CYCLE START" key again, to turn on the CUTTING OXYGEN (High Preheat is turned off automatically). Once the oxygen is turned on, the JOG keys on the panel can be used to move the machine to cut in the desired direction. The display now prompts the operator to press the "CYCLE STOP" key to turn off the cutting oxygen and re-start the sequence. Once the "STOP" key is pressed, the "START" would again have to be pressed once for the Preheat and a second time for the Cutting Oxygen. After all cutting is complete, or to change to a different Manual control mode, press either the SCROLL UP or SCROLL DOWN arrow key. This returns to the menu of available MANUAL CONTROL functions and allows a different one to be selected.

SPECFUNC2.1.2 OXY ENABLE

This function only activates the CUTTING OXYGEN ENABLE RELAY. It does not start the actual Cutting Oxygen, however once the Enable Relay is turned on, the Cutting Oxygen Switch on the machine panel can be used to start the oxygen if desired. Normally this function is used for testing the Enable relay output only.

Once selected, the prompts indicate that the "CYCLE START" and "CYCLE STOP" keys are used to turn the Oxygen Enable Relay ON and OFF.

Pressing one of the SCROLL ARROW keys returns to the menu of available MANUAL CONTROL functions.

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SPECFUNC2.1.3

OXY START

This function is used for testing the CUTTING OXYGEN START RELAY only. This does not actually start the flow of Cutting Oxygen gas since the Enable Relay described earlier is not turned on by this test. Therefore, this mode is used only to test the functioning of the relay output itself.

The prompting shows that the "CYCLE START" and "CYCLE STOP" keys are used to control the relay, and the SCROLL ARROW keys return back to the menu.

SPECFUNC2.1.4

PREHEAT

This function is used for testing the HIGH PREHEAT RELAY output only. Since this relay controls the High Preheat gasses directly, when it is turned on, the High Preheat gasses are turned on. Therefore, this mode could be used to check the High Preheat gas pressures before cutting a part program. More commonly, this mode is used to check the relay output for testing purposes.

The prompting shows that the "CYCLE START" and "CYCLE STOP" keys are used to control the relay, and the SCROLL ARROW keys return back to the menu.

SPECFUNC2.2 PLASMA MANUAL CONTROL FUNCTIONS

For PLASMA cutting, the following manual control functions are available:

- PLASMA CUT ...Enable plasma, then Start plasma cut
- PLASMA JOG/CUT ...JOG keys interlock with plasma cut
- PLASMA ENABLE ...Turn on Plasma enable relay only
- PLASMA START ...Turn on Plasma start relay only
- HEIGHT DISABLE ...Set for Plasma Height sensor disable

SPECFUNC2.2.1

PLASMA CUT

This selection can be used to test fire the Plasma Torch, cutting up scrap material or strip cutting a plate.

Once selected, the control prompts the operator to press the "CYCLE START" key to ENABLE the plasma torch. This does not cause the torch to fire, it only activates the Plasma Enable relay which puts the plasma control circuitry in a state where it can be started by a separate Start input. On some machines, the Enable causes the torch to be lowered to the plate. Once enabled, the display changes to prompt the operator to press the "CYCLE START" key to actually fire the plasma torch. Once the torch fires, the jog keys on the machine can be used to move the machine to cut the desired pattern. Note that the machine does not move automatically once the torch fires, it is up to the operator to use the jog controls. Since it is sometimes difficult to coordinate the jog function with the torch firing, a second cutting mode has been added which provides a better interlock between the torch and JOG controls (See PLASMA CUT/JOG). To turn the plasma torch OFF, press the "CYCLE STOP" key.

To return to the MANUAL CONTROL menu, press either the SCROLL UP or SCROLL DOWN arrow key.

SPECFUNC2.2.2

PLASMA CUT / JOG

This mode also provides a way to turn on the plasma torch for cutting up scrap material or stripping the plate. However, the first selection (PLASMA CUT) has the plasma controls and JOG controls operating independently. While this may work for some thicker plate applications, thin plate requires that the machine begin moving as soon as the arc fires, otherwise the torch goes out. The PLASMA CUT/JOG function interlocks the JOG controls with the plasma firing as follows:

Once PLASMA CUT/JOG is selected, the control prompts to press the "CYCLE START" key to ENABLE the plasma torch. This does not fire the torch, it only sets the electronics in a condition where they can be started from a separate start input. On some machines, the ENABLE causes the torch to be lowered to the plate. Once enabled, the display changes to:

"HOLD JOG KEY" -- "TO FIRE PLASMA"

2.5RS OPERATION AND MAINTENANCE MANUAL

(For old front panel styles, the operator must press the "II" key at this point to activate the jog mode.) One of the numbered keys (1-9) for is pressed and held to indicate the desired jog direction. As soon as the jog direction key is pressed, the plasma system is started. However since the plasma system goes through a purge cycle, the operator must continue to hold the jog direction number key until the arc fires. The machine does not move during this time. Once the arc fires, the machine immediately begins moving in the selected jog direction, at the speed set by the operators speed dial.

To stop the plasma cut, the operator only needs to release the jog key. Once the machine has stopped the jog motion, the plasma torch is automatically turned off, and the entire sequence must be repeated. While the torch is cutting, the operator can change the direction of cut by simply releasing the current jog direction key, and pressing a new one. However the new direction key must be pressed before the machine decelerates to a stop, otherwise the torch is turned off as described above.

There is no need to use the "CYCLE STOP" key in this mode since releasing the jog direction key automatically stops the plasma. Press the SCROLL UP or SCROLL DOWN arrow key to return to the MANUAL CONTROL menu to make a new selection.

SPECFUNC2.2.3 PLASMA ENABLE

This function is only used to test the PLASMA ENABLE RELAY output. Once selected, use the "CYCLE START" and "CYCLE STOP" keys to toggle the relay output. Pressing one of the SCROLL ARROW keys returns to the MANUAL CONTROL menu.

SPECFUNC2.2.4 PLASMA START

This function is only used to test the PLASMA START RELAY output. Once selected, use the "CYCLE START" and "CYCLE STOP" keys to toggle the relay output. Pressing one of the SCROLL ARROW keys returns to the MANUAL CONTROL menu.

SPECFUNC2.2.5 HEIGHT DISABLE

This function is only used to test the PLASMA HEIGHT SENSOR DISABLE RELAY output. Once selected, use the "CYCLE START" and "CYCLE STOP" keys to toggle the relay output. The relay is initially in the OFF condition, which allows the Plasma Height sensor to operate. Pressing the "CYCLE START" key sets the relay to the ON condition which should inhibit the Plasma Height Sensor raising or lowering the torch. This relay is used when a part program is actually being cut to prevent the torch from diving into the plate when the machine slows to go around a corner. The height sensor is disabled until the machine has re-accelerated back to cutting speed.

Pressing one of the SCROLL ARROW keys returns to the MANUAL CONTROL menu.

SPECFUNC.3

FNC15-GO HOME

The **2.5RS** control has the ability to return to one of 4 different home positions somewhere in the operating area of the machine. Table #1 (0,0) home position must be defined by the operator using the FNC-16 SET HOME function after a power failure, or after the **2.5RS** has lost power for any reason. Once it is defined, it is "remembered" regardless of what other operation is performed on the machine. Parts can be cut at any location on the table, programs can be downloaded, kerfed, etc, and the optical tracing system can be used without affecting the location of the table #1 home position. Only a power failure, or turning the control off causes this location to be lost, and require the FNC-16 SET HOME function to be re-done.

In addition to the table #1 home position, there are three additional TABLE HOME positions which are defined as offsets from the reference home position (Table #1). These TABLE HOME offsets are entered as setup parameters SD74 through SD79. The TABLE #2 HOME OFFSET, TABLE #3 HOME OFFSET and TABLE #4 HOME OFFSET parameters define a home position on each of possible cutting tables. This feature is particularly useful for operations where the material is precut to fixed sizes and is always located at the same place on the cutting tables. By defining these fixed table home positions, the torch can accurately be positioned on each table. Once a table "GO HOME" function is performed, the home position on that table is considered (0,0) position for all subsequent operations. The machine (0,0) is not affected.

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SPECFUNC3.1

GO HOME MENU

When the FNC-15 GO HOME function has been selected, the display changes to:

"GO TO HOME- 1"

There are three possible choices for the "GO HOME" function:

- GO TO TABLE HOME- 1 Causes the machine to return to the (0,0) position on the machine. This position is the point from which all other table home positions are measured.
- GO TO TABLE HOME- 2 Causes the machine to move to TABLE #2 (0,0) which is defined as an offset from TABLE #1 (0,0) position by parameter SD74 and SD75.
- GO TO TABLE HOME- 3 Causes the machine to move to TABLE #3 (0,0) which is defined as an offset from TABLE #1 (0,0) position by parameter SD76 and SD77.
- GO TO TABLE HOME- 4 Causes the machine to move to TABLE #4 (0,0) which is defined as an offset from TABLE #1 (0,0) position by parameter SD78 and SD79.

Either use the SCROLL ARROWS or enter the digit directly to select GO HOME- 1,2,3,4. Once the correct number is displayed, press "ENTER". The display changes to:

"PUSH- CYCLE START"

The machine does not actually move until the "CYCLE START" key is pressed. When it is, the machine begins moving to the selected home position, and the readout shows the X/Y distance to the final location. When it is reached, the readout shows 0,0.

SYSTEM UTILITIES : SPECIAL FUNCTIONS

SPECFUNC3.2 GO TO TABLE HOME FROM PART PROGRAMS

There are several commands and functions in the **2.5RS** that allow the table homes to be accessed automatically through the part program.

The following codes in Word address and ESSI allow the part program to command the machine to go to a particular home position:

| | <u>WADR1</u> | <u>WADR2</u> | <u>ESSI</u> |
|---------------------|----------------|--------------|-------------|
| Go to Table 1 home: | M79T1M79T179+1 | | |
| Go to Table 2 home: | M79T2M79T279+2 | | |
| Go to Table 3 home: | M79T3M79T379+3 | | |
| Go to Table 4 home: | M79T4M79T479+4 | | |

These codes can be used at any point in a non-cutting portion of a part program to re-locate the machine to a different table's home position. Also, one of the home locations can be designated as a "PARK" location to allow the operator to unload the cut parts and load new material.

The **2.5RS** operator has the ability to override the programmed home command so that if the machine is sent to Table 2, but the material is on Table 1, the operator can override the command and return the machine to Table 1. This is done by pressing the Auxiliary function button (blank area to the left of the DISPLAY button). Normally, there are several selections from this button however while a part is cutting, it's only function is to allow the override of the home functions. When the button is pressed (while a part is being cut), the display will show "GO TO HOME- X" . The operator can use the SCROLL ARROWS, or enter the number directly of the desired table home. Pressing ENTER will prompt for "PUSH-CYCLE START". When CYCLE START is pressed, the machine will proceed to the desired table home position. If the program had already been started on the wrong table, it will automatically restart after the home command so that the entire part is cut correctly at the new home position.

A variation due to this home capability occurs when the PART RETURN key is used. Normally, if this key is pressed 3 times, it will return to the starting home position for the entire program. However, since there are now multiple home positions, the 3rd press of the key will only return to the most recent Table home position. Additional presses of the button have no affect. This was done to make it easy to restart a part at a particular table home position. To recycle the entire part program, and return to the original starting position, it is necessary to first return to the local Table home position as described above, and then press "SHF" then PART RETURN. This will return to the original starting location. Note this special "SHF" operation is only needed if the part program contains table home commands. Normal existing part programs have no difference in their operation or Part returns functioning.

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SPECFUNC.4

FNC-16 SET HOME

As described in FNC-15 above, the **2.5RS** remembers Table #1 (0,0) home position as long as the power to the unit remains ON. When a power failure occurs, or the unit is turned off (or reset by SERV98- SYS RESET), the table #1 home position must be re-defined. The **2.5RS** has two methods of defining the table #1 home position. One method is used on machines that has home limit switches installed. The other method is used on machines that has no home limit switches.

SPECFUNC4.1

SETTING TABLE #1 HOME POSITION (MACHINES WITH HOME LIMIT SWITCHES)

NOTE

FOR PROPER OPERATION SD62-SYS CONFIG2 MUST BE SET FOR HOME SWITCHES. SEE THE SECTION OF THIS MANUAL COVERING SD62 - SYS CONFIG2.

The Table #1 home position is set by selecting the FNC-16 SET HOME special function. The display changes to:

"PRESS CYCLE START" -- "FOR HOME SEARCH"

Once "CYCLE START" is pressed the **2.5RS** control commands the machine to begin a search for the home position. It first moves in a direction specified by SD62-CONFIG2 to find the Y home switch at about 100 ipm. When the switch is found, it reverses direction and backs off the switch at 5 ipm. As soon as the switch input is removed, the **2.5RS** control begins to search for the Y index pulse from the encoder. Once the index pulse is found, it stops and repeats the same process for the X axis.

SPECFUNC4.2 SETTING TABLE #1 HOME POSITION **(MACHINES WITHOUT HOME LIMIT SWITCHES)**

This method is used when the machine does not have home indexing switches installed. So that this alignment can be as accurate as possible, some type of scribe mark, end stop, alignment pin or other device should be installed on the machine so the operator can accurately move the X and Y axes to a fixed location using the jog controls.

To manually set table #1 home reference position, first jog the machine to the alignment position. Locate it as accurately as possible since this affects both the reference home position and Table home positions. Once the machine is located at the proper position, select the FNC-16 SET HOME special function. The display changes to:

"YES+ SET HOME -NO"

There are two verification prompts which must both be answered "YES" to actually set the home reference position. This is done to guard against accidentally changing the home location.

When this prompt appears, use the "+/-" key to cause the + or - indicator to flash. If the "NO" response is entered for either of the verification prompts, the home position is not changed, and the procedure aborts. To set the home reference position, use the "+/-" key to make the + sign by the "YES" response flash. Then press the "ENTER" key. The display changes to:

"NO- YOU SURE +YES"

Again, this second prompt must also be answered by the +YES response. Use the "+/-" key to get the + sign flashing and press "ENTER". This causes the current location of the machine to be defined as the TABLE #1 Home position. The display shows the current encoder position as "+0.00 +0.00". Press the "RECYCLE" key to return to the main menu.

FLOPPY DRIVE OPERATION

NOTE

For proper operation of an externally mounted **2.5RS** disk drive software option #5 must be enabled. The **2.5RS** control will only load programs with a preset file extension. The file extension is set by "SD53-FILE EXTEN." See INSTALLATION & SETUP.

FLOPPY.1

FLOPPY DRIVES

The **2.5RS** DISK DRIVE is able to load and store part programs to a 3 1/2" 720K or 1.4 Meg floppy disk. The floppy drive is treated as a serial device. This gives the user flexibility to use available features, such Auxiliary Code Table, Decimal Shift and Axis swap. Programs that are loaded from and stored to the floppy disk are treated the same as they would be if loaded or stored through the serial port.

The **2.5RS** EXTERNAL DISK DRIVE is available in 2 configurations.

- 1) **2.5RS** DISK DRIVE PORTABLE. It allows loading and storing of programs from the **2.5RS**.
- 2) **2.5RS** DISK DRIVE PORTABLE with KEYPAD and LCD Display. This version allows loading and storing of programs from the **2.5RS** control. It also has a keypad and LCD display which allows for manual operation of the unit. The manual operation allows the flexibility to use the unit with other controls that support RS232 serial communications.

The **2.5RS** DISK DRIVE is 100% compatible with the MS-DOS and PC-DOS floppy disk format. Files may be copied to and from a **2.5RS** DISK DRIVE diskette by using the DOS "COPY" command.

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NOTE

The **2.5RS** DISK DRIVES are only compatible with the United States versions of MS-DOS and PC-DOS operating systems.

FLOPPY.2

FLOPPY UTILITIES DISK

The **FLOPPY UTILITIES & TEST PROGRAMS** disk that is shipped with each **2.5RS** DISK DRIVE contains a file that is used to configure the systems for the **2.5RS** control. The name of this file is EASIDSK.SYS. Normally the drive only needs to be configured once and this is done at the factory. If the drive needs to be configured again, place the FLOPPY UTILITIES & TEST PROGRAMS disk in the drive with the power off. When power is turned on to the **2.5RS** control, the disk drive reads the file EASIDSK.SYS and automatically configures the ports, baud rate, parity, data bits, stop bits and a number of other parameters to the correct settings. Once the system is configured the parameters are saved in non-volatile memory.

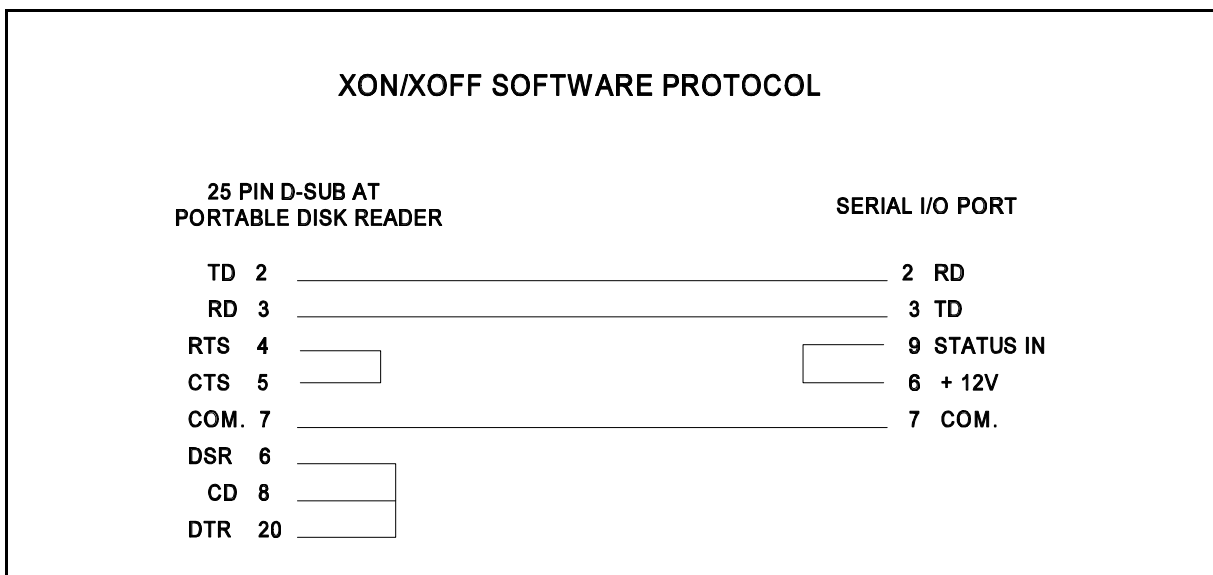
FLOPPY.3

SERIAL CONNECTION

The **2.5RS** DISK DRIVE system port, is factory configured as follows:

COM1:4800 baud, EVEN parity, 7 data bits, 1 stop bit, CTS/RTS disabled, and XON/XOFF enabled.

A 3-wire RS-232 serial cable is required for connection between the **2.5RS** and the external floppy drive. The connection is as follows.



FLOPPY.4

LOADING FILES FROM THE FLOPPY

Loading a file from a **2.5RS** PORTABLE DISK DRIVE is accomplished by pressing the "+/-" key which selects "LOAD FROM FLOPPY". Then press the "ENTER" key. The **2.5RS** prompts the operator for a numeric program number (8 digits maximum). Enter the desired program number that resides on the floppy disk. Then press the "ENTER" key. The **2.5RS** control displays the prompt:
"INSERT DISK" -- "PRESS ENTER-" "-TO CONTINUE"

Insert a formatted 3.5" floppy disk into the drive and close the door of the floppy drive. Press the "ENTER" key to continue. At this point the **2.5RS** control does one of two things. If "D2" of "SD50-SERIAL DEFINITION", which is the programming language select digit is set to "0", prompting for the program type occurs. If "D2" of "SD50-SERIAL DEFINITION" is preset to some value the control begins the process of loading from the floppy disk. A red LED indicator light on the disk drive begins to flash indicating there is some disk activity. When the transfer is complete, the **2.5RS** control display changes to display "LOADING COMPLETE".

If the selected program number exists on the disk the **2.5RS** display changes to "Loading 0" and begins to load the program. If the selected program does not exist on the floppy disk the display changes to "READ TIMEOUT", indicating that the file does not exist.

NOTE

Valid program numbers consist of up to 8 numeric digits with no leading "0's" allowed. All programs must reside in the root directory of the floppy disk. The **2.5RS** control loads and stores programs with a file extension that is preset by the "SD53-FILE EXTEN" variable. See INSTALLATION section: "SD53-FILE EXTEN" for setting this variable.

FLOPPY.5

SAVING FILES TO FLOPPY DISK

Storing a file to a **2.5RS** PORTABLE DISK DRIVE is accomplished by pressing the "." key on the keypad which selects "STORE TO FLOPPY". Press the "ENTER" key. The **2.5RS** prompts the operator for a numeric program number (8 digits maximum). Enter the desired program number to be stored on the floppy disk, then press the "ENTER" key. The **2.5RS** control displays the prompt:

"INSERT DISK" -- "PRESS ENTER-" "-TO CONTINUE"

Insert a formatted 3.5" floppy disk into the drive and close the door. Press the "ENTER" key to continue. At this point the **2.5RS** control does one of two things. If "D2" of "SD50-SERIAL DEFINITION", which is the programming language select digit is set to "0", prompting for the program type occurs. If "D2" of "SD50-SERIAL DEFINITION" is preset to some value the program begins the process of storing to the floppy disk. A LED indicator light on the disk drive begins to flash indicating there is some disk activity. When the transfer is completed the **2.5RS** control changes to display "STORING COMPLETE".

PART 4 PART PROGRAMMING

PROGRAMMING THE NC CONTROL

The **2.5RS** accepts the two major programming languages used for X/Y shape cutting machines, Word Address, as per EIA RS-274 specification, and ESSI.

In addition, several variations of each of these languages are available to be compatible with other existing equipment. The choices for program type are either selected during installation and setup, or can be selected by the operator when a particular operation is performed. The choices are:

- PGM TYPE-1 - **WADR**-Standard **2.5RS** Word Address program
- PGM TYPE-2 - **ESSI**-Standard **2.5RS** ESSI program
- PGM TYPE-3 - **INTL**-not for normal use, test only
- PGM TYPE-4 - **WADR1**-Word Address program Type #1
- PGM TYPE-5 - **WADR2**-Word Address program Type #2
- PGM TYPE-6 - **WADR3**-Special Word Address, custom aux and axis swap.
- PGM TYPE-7 - **ESSI1**-Special ESSI- custom aux and axis swap

Normally, the first two formats, "WADR" and "ESSI" are used for programming the **2.5RS**. The "WADR1" and "WADR2" formats are basically the same as the standard "WADR" format with some re-assignment of the auxiliary codes as indicated further on in this section.

The two "SPECIAL" formats, "WADR3" and "ESSI1" make use of several conversion features of the **2.5RS** so that programs that have been prepared for a different control, or that use different auxiliary code definitions can be directly loaded into the **2.5RS** without requiring re-programming. These two formats allow for the following conversions:

- Change axis sign definitions (+X becomes -X)
- Allow axis interchange (Permits X and Y axis to be swapped)
- Custom Aux Code Conversion (Allows re-defining of all M, G and ESSI auxiliary codes to match incoming program. It also allows for Special End-of-Program codes and Forced Auxiliary 'M' Code Priority).

Unless there is a specific reason for using these special formats, they should not be used since there are several parameters and data tables which must be setup for these to work correctly. If these conversions are needed, the specific setup steps are covered in the INSTALLATION section under the topic "SD51-PRGM FORMAT" and "SD70-CUSTOM AUX".

The following two sections describe the "STANDARD" WORD ADDRESS and ESSI

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PROGRAMMING. Also, for simplicity, only incremental programming is described in these sections although the **2.5RS** is capable of both INCREMENTAL and ABSOLUTE PROGRAMMING. The following sections are meant as a reference for the programming formats used by the **2.5RS** and not a training course in part programming. Therefore, it is assumed that the programmer is somewhat familiar with part programming techniques and procedures.

When the STANDARD WORD ADDRESS and ESSI FORMATS are used, the following axis definitions apply:

The "X" axis is defined as the main rail axis with +X as the direction away from the operator and -X toward the operator.

The "Y" axis is defined as the cross axis with +Y to the left and -Y to the right.

WORD ADDRESS PROGRAMMING LANGUAGE

WADR.1 WORD ADDRESS PROGRAMMING

Although there are 4 choices for WORD ADDRESS program types, they are basically the same. The major difference is in the assignment of auxiliary function codes. These differences allow the **2.5RS** to be compatible with other controls and programming systems. Some of the special formats could even be the same as the standard **2.5RS** program type. In most cases, the standard format for the system should be used. The "WADR3" special format as described above allows complete re-definition of the auxiliary code functions and axis definitions. This section deals with the "STANDARD WADR", "WADR1" and "WADR2" form.

WADR1.1 WORD ADDRESS DATA BLOCK SPECIFICATION

The WORD ADDRESS data block is made up of KEY CHARACTERS and VALUES. A KEY CHARACTER is a letter that means something special to the **2.5RS** control. The KEY CHARACTERS that are supported are as per RS274:

FOR INCH:

“ % ”, “P8 ”, “G3”, “X+54”, “Y+54”, “I+54”, “J+54”, “M3”, “T4”, “K+24”, “F54”, “Q8”

FOR METRIC:

`%”, “P8 ”, “G3 ”, “X+63 ”, “Y+63 ”, “I+63 ”, “J+63 ”, “M3 ”, “T4 ”, “K+33 ”, “F63 ”, “Q8”

All KEY CHARACTERS except for the “%” sign require a numerical value directly after them. These values further described the KEY CHARACTER to the **2.5RS** control.

Any word address character not described here is ignored.

***** IMPORTANT *****

AS PER-RS274, ALL PROGRAMS MUST START WITH A DATA BLOCK CONTAINING ONLY A “%” (PERCENT SIGN).

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WADR1.2

“N”-LINE NUMBER

The “N” key character is used for documentation purposes only. It does not affect program execution and therefore the **2.5RS** does not store these values. When the **2.5RS** loads a program through serial I/O these values are discarded to conserve memory space.

WADR1.3

“P”-PROGRAM NUMBER

This is an optional KEY CHARACTER that allows an 8 digit program number to be included in a program. If a program is loaded containing a program number, it is automatically loaded in memory as that number.

WADR1.4

X-DIMENSION FOR LINES OR ARCS

Incremental programming- distance from the start point to the end point of a move along the X (rail) axis.

Absolute programming distance from the zero point to the endpoint of the new move along the X (rail) axis.

NOTE

The following are the maximum values that can be used for the “X” value:

+/-99,999.9999 inches

+/-999,999.999 millimeters

*****IMPORTANT*****

“X” values that exceed these limits produce a "PGM SYNTAX ERR" when loaded through the serial port.

WADR1.5

Y-DIMENSION

Incremental programming- distance from the start point to the end point of a move along the Y (cross) axis.

Absolute programming distance from the zero point to the endpoint of the new move along the Y (cross) axis.

NOTE

The following are the maximum values that can be used for the "Y" values:

+/-99,999.9999 inches

+/-999,999.999 millimeters

*****IMPORTANT*****

"Y" values that exceed these limits produce a "PGM SYNTAX ERR" when loaded through the serial port.

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WADR1.6

I-DIMENSION-FOR ARCS

(Not used on lines)

Incremental programming- distance in the X (rail) axis from the start point to the center of an arc.

Absolute programming- dependent on “SD51-PRGM FORMAT”. If 3rd digit of “PRGM FORMAT” is a “0”, the dimension is the distance from ZERO (HOME) position to center of arc along the X (RAIL) axis.

If 3rd digit of “PRGM FORMAT” is “1”, dimension is incremental distance from start point to center of the arc along the X axis- thus dimension is incremental even though absolute programming is being used.

NOTE

The following are the maximum values that can be used for the “I” value:

+/-99,999.9999 inches

+/-999,999.999 millimeters

*****IMPORTANT*****

“I” values that exceed these limits produce a “PGM SYNTAX ERR” when loaded through the serial port.

PART PROGRAMMING : WORD ADDRESS

WADR1.7

J-DIMENSION-FOR ARCS

Incremental programming- distance in the Y (cross) axis from the start point to the center of an arc.

Absolute programming- dependent on "SD51-PRGM FORMAT". If 3rd digit of "PRGM FORMAT" is "0", dimension is distance from ZERO (HOME) position to center of arc along the Y (cross) axis.

If 3rd digit of "PRGM FORMAT" is "1", dimension is incremental distance from start point to center of the arc along the Y axis- thus dimension is incremental even though absolute programming is being used.

NOTE

The following are the maximum values that can be used for the "J" value:

+/-99,999.9999 inches

+/-999,999.999 millimeters

IMPORTANT

"J" values that exceed these limits produce a "PGM SYNTAX ERR" when loaded through the serial port.

WADR1.8

SPECIAL NOTE ON PROGRAMMING ARCS

The **2.5RS** attempts to cut exactly what it is programmed to cut. When programming arc blocks, the distance from the starting point of the arc to the center should equal the distance from the end point to the center. If the values are not equal, the **2.5RS** control uses the end point to center distance when cutting the part. The difference is a PATH ERROR. As this PATH ERROR increases, an undesirable cut path and machine motion occurs. The machine motion being a factor of setup parameters and machine speed.

If "BACKUP" is used to go in reverse through a cut path with improperly programmed arc blocks, machine motion is affected. The machine motion being a factor of setup parameters and backup speed.

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IMPORTANT

To prevent the possibility of a program containing an improperly programmed arc block from making unwanted cuts, use the "TEST RUN" mode of operation first before cutting the part.

WADR1.9

G-PREPARATORY FUNCTION

| CODE | FUNCTION RETAINED (NOTE-1) | SINGLE BLOCK (NOTE-2) | FUNCTION |
|---|----------------------------------|--------------------------|---|
| G02 G03 | A A | | CIRCULAR INTERPOLATION CW CIRCULAR INTERPOLATION CCW |
| G04 | | X | DWELL |
| G40 G41 G42 | B B B | | KERF COMPENSATION CANCEL KERF COMPENSATION LEFT KERF COMPENSATION RIGHT |
| G45 | | X | LEAD IN TO KERF COMPENSATED PART |
| G46 | E | | Selects which overlay parameter should be used. Example: G46 T1, where T can be 0,1,2,3 and 4. |
| G70 G71 | C C | | INCH PROGRAMMING METRIC PROGRAMMING |
| G90 G91 G92 | D D D | | ABSOLUTE PROGRAMMING INCREMENTAL PROGRAMMING ABSOLUTE REGISTER PRELOAD |
| G97 G98 | | X X | SETS PROGRAM REPEAT POINTER. G97 CAN BE FOLLOWED BY A 'T' VALUE TO GENERATE A LOOP PROGRAM INITIATES PROGRAM REPEAT AT G97 |
| G103 | | X | AUTO ERASE AND LOAD |
| NOTE-1: Function is retained until canceled or superseded by another command in the same letter group (A,B,C etc.). | | | |
| NOTE-2: Function affects only the block which it appears in. | | | |

PART PROGRAMMING : WORD ADDRESS

WADR1.10

“M”-MACHINE AUXILIARY FUNCTIONS

The supported “M” function definitions vary depending on the program format specified as illustrated in the following table. In most cases, the first column is the standard auxiliary code definitions for the 2.5RS.

| STD WADR CODE | SPECIAL WADR1 CODE | SPECIAL WADR2 CODE | WITH BLOCK | AFTER BLOCK | DESCRIPTION |
|------------------------------|------------------------------|------------------------------|---------------|----------------|---|
| M00 M02 | M00 M02 | M00 M02 | | X | Program stop End of Program |
| M03 M20 M04 M21 | M03 M20 M04 M21 | M05 M21 M03 M20 | X X | X X | CUT PROCESS OFF CUT PROCESS OFF CUT PROCESS ON CUT PROCESS ON |
| M14 M15 | M14 M15 | M50 M51 | X X | | HEIGHT SENSOR DISABLE HEIGHT SENSOR ENABLE |
| M30 | M30 | M30 | | X | END OF PROGRAM (REWIND) |
| M70 M71 M72 M73 | M70 M71 M72 M73 | M70 M71 M07 M06 | X | X | MARKER OFFSET #1 OFF MARKER OFFSET #1 ON EXAMPLE: M71 T1 WHERE 'T' CAN BE 1,2,3,4,5,6,7 OR 8 OFFSET #2 OFF OFFSET #2 ON |
| M79 | M79 | M79 | X | | GO TO TABLE HOME INDICATED BY 'T' VALUE. EXMAPLE: M79 T2, GO TO TABLE #2 (0,0) HOME POSITION. |

2.5RS OPERATION AND MAINTENANCE MANUAL

WADR1.11

“M”- DWELL TIME

The 'G04' command along with the 'F' key character and numeric value immediately following it sets the time that a dwell occurs. This dwell time is in effect for that block and all subsequent "G04" blocks until a new "F" DWELL time is included in another "G04" block. Time is in seconds.

For example:

N12 G04 F22.5 -BLOCK #12 DWELL FOR 22.5 SECONDS

The maximum value for the 'F' key character when describing a dwell time is 999.99 seconds.

WADR1.12

“F”-FEEDRATE

When no G04 precedes the "F" value, the "F" key character immediately followed by a numeric value is used for programmable feedrate. The feedrate value must be in a block by itself.

NOTE

The PROGRAMMABLE FEEDRATE option must be enabled for proper operation.

For example:

“N12 F100” causes a BLOCK #12 FEEDRATE of 100 inches/mm, depending on the operating system selected.

WADR1.13

“G” CODE DESCRIPTIONS

- G02** These two functions are used to define the
- G03** direction for arc data blocks as either CW or CCW respectively. Once either of these functions is used, all subsequent arcs are in the same direction until the opposite code is used.
- G04** This code causes a SYSTEM DWELL to be performed. During this time, the machine is held in position and all control outputs remain in their current condition. The DEFAULT DWELL time is established during the setup and installation procedure. This time is used for all G04 blocks until an "F" variable is included in the same block as the "G04". In this case, the value contained by the "F" variable is used as the dwell time for this and all subsequent "G04" blocks until changed by a new G04 block containing a different "F" time.
- G40** These 3 commands are used by the "DIAL IN KERF"
- G41** routine to compensate the cutting path for the
- G42** amount of material removed by the cutting process. The kerf directions (LEFT-G41 or RIGHT-G42) are based on which way the centerline of the torch needs to be offset as it travels along the cutting path. G40 is provided to cancel the kerf, however it is not needed in the program since the kerf is automatically turned off when not cutting.

NOTE

When a Part Program contains either Kerf Left or Kerf Right auxiliary codes, the software assumes that the "DIAL-IN-KERF" option is used to run the part. When the kerf is added to the part program, it requires approximately 25% more memory to store the kerf data along with the part dimensions. Therefore, when the incoming program is stored, this extra 25% of memory is automatically allocated for each data block. This causes the Kerf processing to run about 20% faster since the space is already available to store the results. If the "DIAL-IN-KERF" option is not to be used, or if the part program already has the kerf added to the dimensions, the KERF LEFT or KERF RIGHT codes can be removed from the part program before it is loaded. This uses less memory to store the part since no kerf space is added.

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- G45** The G45 function may be included along with the arc or line dimensions performing the leadin to the part. Including a G45 in the data block allows the data to be altered to correctly lead into the kerf compensated part.
- G46** The G46 function selects which overlay parameter table is used for the part program. This code followed by the table number (ex. G46 T1) would load overlay parameter table #1 into the running parameters and uses those parameters for running the part.
- G70** Indicates that all subsequent part dimensions are in inch units.
- G71** Indicates that all subsequent part dimensions are in metric (millimeter) units
- G90** Signals that all subsequent dimensions are in absolute programming format. Note although the X/Y dimensions are in absolute, the I/J dimensions can be either absolute or incremental depending on the setting of "SD51-PRGM FORMAT".
- G91** Signals that all subsequent dimensions are in incremental programming format.
- G92** Only used in absolute programming mode. When included in a data block containing only X/Y dimensions, it causes the internal absolute registers to be set to the X/Y dimensions from the data block. No machine motion occurs. This code is useful for re-setting the absolute zero position at various points in a part program to make the X/Y dimensioning of the subsequent data blocks easier.

G97 G97 SET PROGRAM REPEAT POINTER

G98 G98 JUMP TO G97 POINTER

These two commands are used as a pair within a part program to perform an overall program repeat function, and also to allow LOOP PROGRAMMING within a part program.

WADR1.13.1 **OVERALL PROGRAM REPEAT**

The overall program repeat function is implemented by programming the G97 to set the repeat pointer location. This is normally very close to the start of the program. Any commands before the G97 will only be performed the first time through the part but will be skipped on each repeat pass. This is sometimes used to allow the program to start at the corner of the plate and move to the first pierce point. Then the G97 is programmed so that the move from the corner isn't repeated on each repeat of the part. When the program repeats it will only execute the commands after the G97.

To set the overall repeat pointer, a G97 must be located in a data block by itself. No other information should be included in this data block. If the G97 is omitted from the program, the repeat pointer is automatically set to the first data block.

For the overall repeat function to cause the automatic repeat of the part program, a G98 is programmed at the end of the program. When this code is read, it causes the program to jump back to the point where the G97 was programmed and continues with the program from that point.

Note that the G98 should be programmed in a data block by itself, and that no commands following the G98 will be executed since the program will always jump back to the G97 location. If a G98 is programmed but there was no G97 at the beginning, the program will repeat starting at the first data block.

WADR1.14 **LOOP PROGRAMMING**

This function allows portions of a part program to be repeated a specified number of times to reduce the size of the part program. For example if 100 equally spaced holes need to be cut in a straight line, and 4 data blocks are required to cut each hole, standard programming would require 400 data blocks. By using loop programming, it would require only 6 data blocks. This is the most common use for this type of loop programming.

To program a loop, a data block containing G97 Txxxx is programmed at the start of the portion of code to be repeated. The xxxx following the T data word specifies the

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number of times the loop is to be executed. If a value of T1 is programmed, it is the same as not having the loop at all since the code would be done 1 time anyway.

The end of the loop is programmed by a data block containing only the G98 code. This is the same code as is used for the overall program repeat but since there was a G97 Txxxx block already programmed, the first G98 code following the G97 Txxxx block only acts as the end of the loop and not the overall program repeat. Any number of loops can be programmed in a single part however they cannot be NESTED, that is the G97 Txxxx must be followed by a G98, there cannot be a G97 Txxxx followed by another G97 Txxxx block.

The use of loop programming does not prevent the use of the overall program repeat function. It is still allowed to have a G97 alone in a data block at the beginning of the program to set the repeat pointer location, and a G98 at the end of the program to cause the program repeat.

G103 When LOAD/RUN operation is selected G103 causes AUTO DELETE of current program and loads new program specified by "Q" word in same data block as G103.

WADR1.15

“M”-CODE DESCRIPTIONS

M00-PROGRAM STOP Causes machine operation to halt and all cutting functions to be turned off. Pressing the "START CYCLE" key resumes program execution.

M02-PROGRAM END Either the "M02" or the "M30" must end a WORD (**NO REWIND**) ADDRESS PROGRAM. If multiple programs are to be loaded, all but the last one should end with the M02 code since it does not cause a "REWIND".

M30-PROGRAM END (W/REWIND) (This is also true if the parts are being loaded through the serial port.) The last program to be loaded can use the M30 command to stop the loading process and start the tape rewind.

M04-CUTTING ON M21 Initiates CUTTING START SEQUENCE for selected cutting system. While the cut is on, the machine moves at the speed set by operators speed dial.

M03-CUTTING OFF Turns OFF CUTTING PROCESS- after

PART PROGRAMMING : WORD ADDRESS

M20 performing any cut off sequencing, the machine moves at high TRAVERSE SPEED to next pierce location.

**M14-HEIGHT SENSOR
DISABLE** Disables height sensor contact

**M15-HEIGHT SENSOR
ENABLE** Enables height sensor contact

M70-OFFSET #1 OFF This function acts exactly opposite the M71 command and has the same ability to either be used alone (to specify OFFSET #1) or be followed by a T1 to T8 to specify one of the 8 offset pairs. When it is used, it causes the machine to offset in the negative direction from the programmed parameters.

The OFFSET OFF command is normally used to cancel an OFFSET ON command so that the machine is returned to the original position.

Use the table for M71 to determine the offset parameters referenced by this command. Where the table indicates M71T2 to cause offset #2 on, a M70T2 would cause an offset #2 off. M73 - OFFSET #2 ON

M - 73 OFFSET #2 ON This command is maintained for compatibility with older software. It causes the machine to offset based on the dimensions specified in parameters SD47,SD48 (same as SD82,SD83). It was normally used to offset for plate marker #2. Once the marker #2 portion of the program is done, the offset is canceled by using the OFFSET #2 OFF COMMAND.

Note that this function could also be programmed by using M71 T2 as described above.

M71-OFFSET #1 ON Causes the machine to offset from its current position based on the values in the setup parameters described later. One use of this function is with a plate marking device. This command is used to offset the machine position so that the marking device is now aligned where the cutting torch used to be. This allows the dimensions for the marking portion of the program to be programmed the same as the cutting moves since the marker has been shifted into the same position that was previously

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occupied by the torch. After the marking moves are done, the corresponding offset off command is used shift the cutting torch back to the proper position so that the program can continue with the torch now at the programmed coordinates.

If the M71 is used alone in a data block, it will cause the machine to offset based on the setup parameter values SD40,SD41 (also SD80,SD81). This supports existing programs where the M71 command was designated as the OFFSET #1 ON function code. (Note that the following parameters specify the same offset dimensions. The lower numbers are retained for compatibilty with older software.

SD40 -- Same as SD80 X offset #1
SD41 -- Same as SD81 Y offset #1
SD47 -- Same as SD82 X offset #2
SD48 -- Same as SD83 Y offset #2

There are a total of 8 X/Y offset pairs supported by the **2.5RS**. These are specified by parameters SD80-SD95 To select one of these offsets, the M71 is followed by a T value of 1 to 8 which selects one of the 8 offsets to be used. The following are the valid program uses:

| Data block: | Offset dimension parameters: |
|-------------|-------------------------------|
| M71 | SD80,SD81 (same as SD40,SD41) |
| M71 T1 | SD80,SD81 (same as SD40,SD41) |
| M71 T2 | SD82,SD83 (same as SD47,SD48) |
| M71 T3 | SD84,SD85 |
| M71 T4 | SD86,SD87 |
| M71 T5 | SD88,SD89 |
| M71 T6 | SD90,SD91 |
| M71 T7 | SD92,SD93 |
| M71 T8 | SD94,SD95 |

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Note that the offsets do not have to cancel each other, and it is possible to offset more than once if necessary. To end up back at the original position, each OFFSET ON must be canceled by it's corresponding OFFSET OFF function. Also, the OFFSET OFF basically causes a negative OFFSET ON. This means that an OFFSET OFF can be used to shift in the opposite direction of the setup parameter values, and then the OFFSET ON function used to cancel the "OFF" move and return to the original position.

M72 - OFFSET #2 OFF This command is maintained for compatibility with older software. It causes the machine to offset in the opposite direction of the dimensions specified in SD47,SD48 (same as SD82,SD83). It is normally used to cancel the offset caused by the M73 command after the marker #2 portion of the program is complete. Note that this function could also be programmed by using M70 T2 as described above.

M79-GO TO TABLE This command instructs the **2.5RS** control to move to the cutting table indicated by the 'T' value that follows the M79. For example: "M79 T3", Go to Table #3 (0,0) home position.

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WADR1.16 WORD ADDRESS SAMPLE PROGRAM

The following is a word address program for "SAMPLE PART #1", see the drawing below. The "REF" letters on the program listing refer to the circled reference points on the part drawing. After the program is a detailed description of each program line. The program is shown in both inch and metric units. This example assumes that overlay table #2 is used for the cutting process selected.

SAMPLE PROGRAM #1

| | INCH PROGRAM | METRIC PROGRAM | REF | COMMENTS |
|----|---------------|-------------------|-----|------------------------|
| 01 | % | % | | START OF PGM CODE |
| 02 | N2P12345678 | N2P12345678 | | PROGRAM NUMBER |
| 03 | N5G46T2 | N5G46 T2 | | OVERLAY TABLE 2 |
| 04 | N3X4Y-6.8 | N3X101.6Y-172.7 | A | MOVE FROM CORNER |
| 05 | N4G97 | N4G97 | | PRGM REPEAT POINTER |
| 06 | N5M04 | N5M04 | | CUT ON |
| 07 | N6G45X.75Y.3 | N6G45X19.1X7.6 | B | LEAD IN LINE |
| 08 | N7G41 | N7G41 | | SET KERF LEFT |
| 09 | N8G03I-.75 | N8G03I-19.1 | C | CUT CCW ARC HOLE |
| 10 | N9X-.75Y.3 | N9X-19.91X7.6 | D | LEADOUT |
| 11 | N10M03 | N10M03 | | TURN OFF CUT |
| 12 | N11X2Y-6.8 | N11X50.L8Y-172.7 | E | MOVE TO OUTSIDE |
| 13 | N12M04 | N12M04 | E | TURN CUT ON |
| 14 | N13G45X-.5Y.5 | N13G45X-12.7Y12.7 | F | LEAD IN |
| 15 | N14X-1.5 | N14X-38.1 | G | LINE |
| 16 | N15X-2I-1 | N15X-50.8I-25.4 | H | ARC (STILL CCW) |
| 17 | N16X-1.5 | N16X-38.1 | I | LINE |
| 18 | N17Y4.5 | N17Y114.3 | J | LINE |
| 19 | N18X1.5Y1.5 | N18X38.1Y38.1 | K | LINE |
| 20 | N19X-1.5Y1.5 | N19X-38.1Y38.1 | L | LINE |
| 21 | N20Y3.5 | N20Y88.9 | M | LINE |

PART PROGRAMMING : WORD ADDRESS

| | INCH PROGRAM | METRIC PROGRAM | REF | COMMENTS |
|----|-----------------------|---------------------------|-----|-------------------|
| 22 | N21G02X512.5J- 2.5 | N21G02X127I63.5J- 63.5 | N | ARC-CW |
| 23 | N22Y-11.5 | N22Y-292.1 | O | LINE AND LEADOUT |
| 24 | N23M03 | N23M03 | | CUT OFF |
| 25 | N24X6Y6.2 | N24X152.4Y157.5 | P | MOVE TO NEXT PART |
| 26 | N25G98 | N25G98 | | REPEAT PROGRAM |
| 27 | N26M30 | N26M30 | | END OF PROGRAM |

LINE 1 The first line of a WORD ADDRESS program must contain only a % (percent sign). This serves as the program start indicator. Any characters before the % are ignored. If the % is not present or has other data in the same block, the program will not load correctly.

LINE 2 This line contains the optional PROGRAM NUMBER identifier. When the program is loaded, this number is compared to the requested program number to insure that the correct program was loaded. If a PROGRAM NUMBER is used in a program, it must appear in the second line, immediately after the %.

LINE 3 The G46 T2 is used to select overlay parameter table 2. Any data blocks after the G46 code uses overlay parameter table number 2 until another G46 T# is given.

LINE 4 Initial move from corner of plate to pierce point on first part. Due to the placement of the G97 code, this block is not repeated on subsequent parts.

LINE 5 The G97 pointer is used to indicate where the program repeat should occur. Any data blocks before the G97 code are not repeated on subsequent parts.

LINE 6 Initiate the cutting process. Cutting speed set by operators speed dial or digital feedrate.

LINE 7 This line "leads in" from the pierce location to the actual part.

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LINE 8 Sets the "Kerf Compensation" to the "Left" of the cut. This command causes the "DIAL IN KERF" option to offset the cutting path to the left and thus produce the correct size part.

LINE 9 Sets the arc direction CCW and cuts a 360 degree arc.

LINE 10 This line "leads out" away from the part before the cutting process is turned off. If any melting occurs when the cutting process is stopped, it occurs in the scrap, away from the part.

LINE 11 Turn off the cutting process.

LINE 12 Move to next pierce point at high traverse speed.

LINE 13 Initiate cutting process for outside cut.

LINE 14 Line "Leads In" from pierce location to part.

LINE 15 Standard line format

LINE 16 Arc format. Direction is still CCW from previous G03 command.

LINE 17 Standard line format

LINE 18 " " "

LINE 19 " " "

LINE 20 " " "

LINE 21 " " "

LINE 22 Standard ARC format - Direction changed to CW by G02 command.

LINE 23 Standard line format- Note: Line is .5 inches longer than part. This allows the line to also function as a "Lead-Out" away from the part before turning off the cutting process.

LINE 24 Turn OFF the cutting process.

LINE 25 Move to first pierce location on next part.

LINE 26 G98 command causes program to repeat from point where G97 command was used.

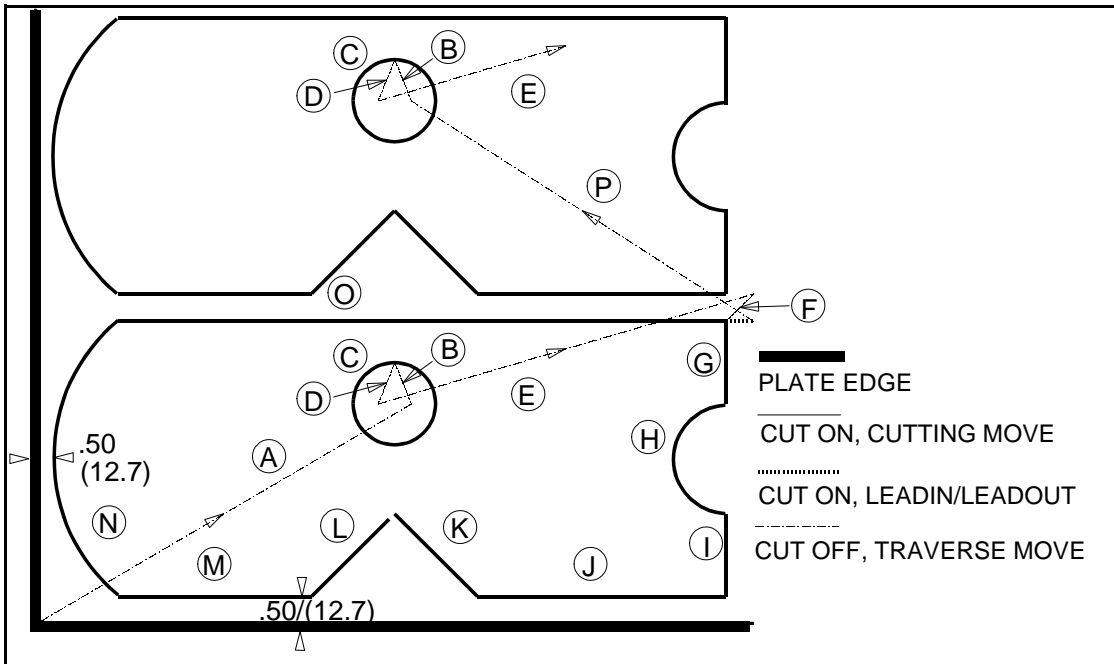
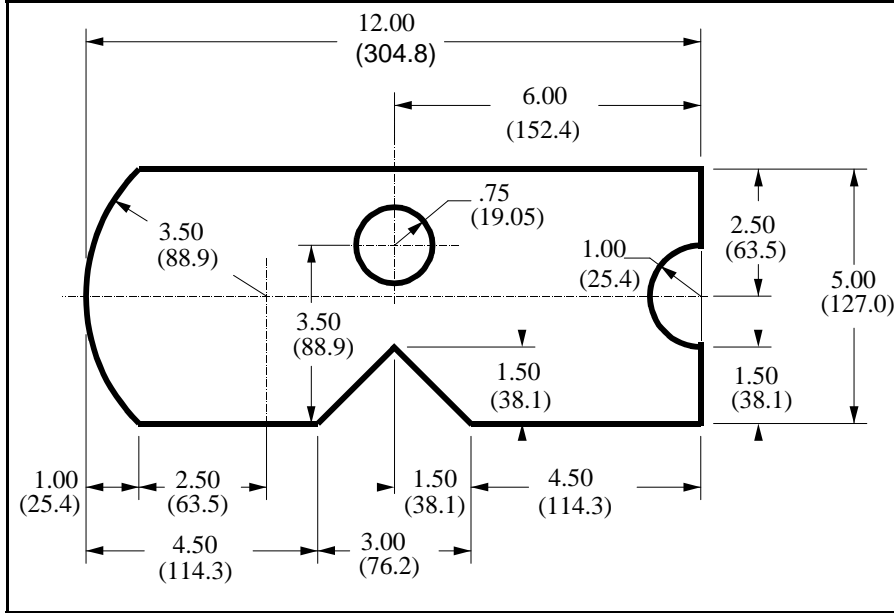
LINE 27 End of Program Command

PART PROGRAMMING : WORD ADDRESS

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PART DRAWING - SAMPLE PROGRAM 1

Dimensions: inch (millimeter)



Letters in circles denote data block letters in the program example.

ESSI.2

ESSI PROGRAMMING

ESSI part programming uses 3 types of data blocks for the program.

- LINE MOVES
- ARC MOVES
- AUXILIARY FUNCTIONS

ESSI2.1

LINE AND ARC BLOCK SPECIFICATIONS

Both the LINE and ARC BLOCKS are made up of a series of signed (+/-) dimensions. IN ESSI PROGRAMMING, the number of signs in a data block determines whether it is an arc or a line. The dimensions for the block do not contain any decimal points, rather the number of decimal places are defined as follows:

For "INCH" programming, Two decimal places are assumed.

Example:

- +200 equals a dimension of +2.00 inches
- +5 equals a dimension of +0.05 inches
- +999999 maximum dimension is +/-999999.99 inches

For "METRIC" programming, one decimal place is assumed with the unit value being 0.1 millimeters.

Example:

- +200 equals a dimension of +20.0 millimeters
- +5 equals a dimension of +0.5 millimeters
- +999999 maximum dimension is +/-999999.9 millimeters

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BLOCKS WITH 2 SIGNS, EITHER + OR - ARE "LINE" FUNCTIONS. The first signed value is the X incremental distance and the second signed value is the Y incremental distance. If one of the dimensions is 0, only a + sign need appear in the block.

Examples:

| | |
|---|---|
| Line of 1 inch in the X axis and -.5 inches in the Y axis would appear: <div style="text-align: center; margin-top: 20px;">+100-50</div> | Line of -2.5 inches in the Y axis with no movement in the X axis would appear: <div style="text-align: center; margin-top: 20px;">+0-250</div> |
|---|---|

BLOCKS WITH 5 SIGNS ARE ARC FUNCTIONS:

The FIRST signed dimension is the incremental distance from the Start Point to the End Point of the ARC along the X axis. **T T T T**

The SECOND signed dimension is the incremental distance from Start Point to the End Point of the ARC along the Y axis. **S))) - * * ***

The THIRD signed dimension is the incremental distance from the Start Point to the Center of the ARC along the X axis. **S)))))) - * ***

The FOURTH signed dimension is the incremental distance from the Start Point to the Center of the ARC along the Y axis. **S)))))) - * ***

The FIFTH sign in the data block determines the Direction of the ARC: **S)))))) - * ***

- + indicates a CCW arc
- indicates a CW arc

SEE THE ESSI SAMPLE PART FOR EXAMPLES OF ARC PROGRAMMING.

The following maximum values that can be used for 'X','Y','XC' and 'YC' values:

| | |
|--------------------|-----------------------|
| +/-99999.99 inches | ESSI value +/-9999999 |
| +/-99999.9 mm | ESSI value +/-9999999 |

***** IMPORTANT *****

Values that exceed these limits produce a "PGM SYNTAX ERR".

SPECIAL NOTE ON PROGRAMMING ARCS

The **2.5RS** attempts to cut exactly what it is programmed to cut. When programming arc blocks, the distance from the start point of the arc to the center should equal the distance from the end point to the center. If the values are not equal, the **2.5RS** control uses the end point to center distance when cutting the part. The difference is a **PATH ERROR**. As this **PATH ERROR** increases, an undesirable cut path and machine motion occurs. The machine motion being a factor of setup parameters and machine speed.

If "BACKUP" is used to go in reverse through a cut path with improperly programmed arc blocks, machine motion is affected. The machine motion being a factor of setup parameters and backup speed.

***** IMPORTANT *****

To prevent the possibility of a program containing a improperly programmed arc block from making unwanted cuts, use the "TEST RUN" mode of operation first before cutting the part.

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ESSI2.2

ESSI AUXILIARY FUNCTIONS

The third type of ESSI DATA BLOCK is used for the various AUXILIARY FUNCTIONS for the part program. The following is a list of the supported ESSI FUNCTION CODES.

| | |
|--------------------------|-------------------------------------|
| 00 -PROGRAM STOP | 64 -PROGRAM END/REWIND |
| 03 -PROGRAM IGNORING ON | 65 -MULTIPLE PARAMETER TABLE SELECT |
| 04 -PROGRAM IGNORING OFF | 66 -TOOL SELECT |
| 07 -CUT ON | 67 -PLASMA HEIGHT SENSOR ENABLE |
| 08 -CUT OFF | 68 -PLASMA HEIGHT SENSOR DISABLE |
| | 70 -INCH PROGRAMMING |
| | 71 -METRIC PROGRAMMING |
| 11 -MARKER #1 OFFSET ON | 79 -CUTTING TABLE HOME SELECT |
| 12 -MARKER #1 OFFSET OFF | 81 -INCREMENTAL PROGRAMMING |
| 29 -KERF OFFSET LEFT | 82 -ABSOLUTE PROGRAMMING |
| 30 -KERF OFFSET RIGHT | 90 -PROGRAM END- NO REWIND |
| 38 -CANCEL KERF OFFSET | 97 -SET PROGRAM REPEAT POINTER |
| 39 -PROGRAM FEEDRATE | 98 -REPEAT AT PGM POINTER |
| 40 -PROGRAMMABLE KERF | 99 -PROGRAM END/REWIND |
| 41 -PROGRAMMABLE DWELL | 103 -AUTO RELOAD FOR LOAD/RUN |

- 00 PROGRAM STOP**- causes machine operation to halt and all cutting functions to be turned off. Pressing the "CYCLE START" key resumes operation.
- 03** The **2.5RS** ignores all data between these two codes. Usually
- 04** they are used for comments and instructions which only appear on the program printout.
- 07 CUTTING ON**- initiates the start sequence for selected cutting system. While cut is on, machine moves at the speed set by the operator.
- 08 CUTTING OFF**- turns off cutting process- after performing any cut off sequencing, machine moves at high traverse speed to next pierce location.
- 11 PLATE MARKER #1 OFFSET ON**- causes the machine to move by the distances entered for the MARKER #1 X/Y OFFSET dimension during the "SETUP AND INSTALLATION" procedure. In this way the part program does not have to compensate for the physical offset between the marker and torch. Optionally followed by a +1 to +8 causing offsets 1-8 as specified by SD80-96 to be used. See INSTALLATION & SETUP: SD80-96 OFFSETS.

- 12 PLATE MARKER #1 OFFSET OFF**- cancels the offset and moves the cutting torch back to the programmed position. Optionally followed by a +1 to +8 causing offsets 1-8 as specified by SD80-96 to be used. See INSTALLATION & SETUP: SD80-96 OFFSETS
- 29** These 3 commands are used by the "DIAL IN KERF" routine to compensate
- 30** the cutting path for the amount of material removed by the cutting process.
- 38** The KERF directions (LEFT-29 or RIGHT-30) are based on which way the centerline of the torch needs to be offset as it travels along the cutting path. The 38 code is provided to cancel the kerf, however it is not needed in the program since the KERF IS AUTOMATICALLY TURNED OFF when not cutting.

***** IMPORTANT *****

See the description for Word Address codes G41 and G42 for details of the memory allocation for programs containing Kerf Left or Kerf Right commands.

- 39** Programmable Feedrate command followed by a numeric value in same resolution. Example: 39+2500 is program feedrate of 25.00 ipm. In MM 39+2500 is program feedrate of 250 mpm.
- 40** PROGRAMMABLE KERF- This code along with a value in inches or millimeters, depending on the type of system configuration, allows feedrate commands to be inserted directly into a program. Example: 40+200 in inches the programmable kerf is 2 inches. In millimeters the program kerf would be 20 millimeters.
- 41** This code causes a SYSTEM DWELL to be performed. During this time, the machine is held in position and all control outputs remain in their current condition. The DWELL TIME is set during the installation of the control and can be change by following ESSI code 40 with +XXXX where DWELL time is spdecified in milliseconds. Example 41+1000 is a 1 second dwell.

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- 65** Multiple parameter table select code. This ESSI code along with a number between 0 and 4 selects one of the five available overlay data parameter tables. Example: 65+3 selects overlay table #3.
- 67** Plasma Height Sensor Enable
- 68** Plasma height Sensor Disable
- 70** Indicates that all subsequent part dimensions are in inch units.
- 71** Indicates that all subsequent part dimensions are in metric (millimeter) units.
- 79** Cutting table home select code. This code along with a value between 0 and 4 selects the corresponding table home position. Example 79+2 causes machine to move to table 2 home (0,0) position.
- 81** Indicates that all subsequent dimensions are in INCREMENTAL PROGRAM FORMAT.
- 82** Indicates that all subsequent dimensions are in ABSOLUTE PROGRAM FORMAT. SEE "SD51-PRGM FORMAT" in the SETUP MANUAL for details regarding ABSOLUTE/INCREMENTAL for the X and Y center dimensions in ABSOLUTE MODE.
- 90** **PROGRAM END- NO REWIND-** This code does not cause the tape to rewind at the end of the load process. This allows multiple programs to be loaded by stopping the tape at the end of the first program, then after the first program is stored, it starts loading the next one on the tape. If a rewind is desired, the last program in the list should end with the "99" PROGRAM END-REWIND code described below.
- 97** These two functions are used as a pair within a part
- 98** program to perform the program repeat function. The 97 acts as a pointer in the program. When the 98 code is reached, the program jumps back to the point in the program where the 97 occurred. The program repeats to the beginning if the 97 code is not used. Example 97+XX where XX is the loop count.

- 64** **END OF PROGRAM-REWIND** (either may be used) When
- 99** loading from paper tape, this code stops the loading process and causes the tape to be rewound back to the start. If the program is being downloaded from a remote RS-232 source, this code stops the loading process and terminates the link. If multiple programs are to be loaded, the "90" code described above should be used on all but the last one.
- 103** **AUTO LOAD/RUN** with optional +XXXXXXXX specifies the next 8 digit program to be loaded.

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ESSI2.3

ESSI SAMPLE PROGRAM

The following is an "ESSI" program for "SAMPLE PART #1" -see drawing at the end of this section. The "REF" letters on the program listing refer to the circled reference points on the part drawing. After the program is a detailed description of each program line. The program is shown in both inch and metric units.

SAMPLE PROGRAM #1

| # | INCH PROGRAM | METRIC PROGRAM | REF | COMMENTS |
|----|------------------|-----------------|-----|---------------------|
| 01 | +400-680 | +1016-1727 | A | MOVE FROM CORNER |
| 02 | 97 | 97 | | PRGM REPEAT POINTER |
| 03 | 07 | 07 | | CUT ON |
| 04 | 08 | 08 | B | LEADOUT |
| 05 | 29 | 29 | | SET KERF LEFT |
| 06 | +-75++ | +-191++ | C | CUT CCW ARC HOLES |
| 07 | -75+30 | -191+76 | D | LEADOUT |
| 08 | 08 | 08 | | LEADOUT |
| 09 | +200-680 | +508-1727 | E | MOVE TO OUTSIDE |
| 10 | 07 | 07 | | CUT ON |
| 11 | -50+50 | -127+127 | F | LEADIN |
| 12 | -150+ | -381+ | G | LINE |
| 13 | -200+0-100+0+0 | -508+0-254+0+ | H | ARC COW |
| 14 | -150+ | -381+ | I | LINE |
| 15 | ++450 | ++1143 | J | LINE |
| 16 | +150+150 | 381+381 | K | LINE |
| 17 | -150+150 | 381+381 | L | LINE |
| 18 | ++350 | ++889 | M | LINE |
| 19 | +500+0+250+-250- | +1270+0+635-635 | N | ARC CW |
| 20 | +-1150 | +-2921 | O | LINE AND LEADOUT |
| 21 | 08 | 08 | | |
| 22 | +400+620 | +1016+1575 | P | MOVE TO NEXT PART |
| 23 | 98 | 98 | | REPEAT PROGRAM |
| 24 | 99 | 99 | | END OF PROGRAM |

PART PROGRAMMING : ESSI

LINE 1 Initial move from corner of plate to pierce point on first part. Due to the placement of the 97 code, this block does not repeat on subsequent parts.

LINE 2 The 97 pointer is used to indicate where the program repeat should occur. Any data blocks before the 97 code do not repeat on subsequent parts.

LINE 3 Initiate the cutting process. (Cutting process plasma/oxy-fuel selected by operator). Cutting speed set by operators speed dial.

LINE 4 This line "leads in" from the pierce location to the actual part.

LINE 5 Sets the "Kerf Compensation" to the "Left" of the cut. This command causes the "DIAL IN KERF" option to offset the cutting path to the left and thus produce the correct size part.

LINE 6 Standard ARC format- Arc direction is CCW since 5th sign is +. Note: zero dimensions (+0) are included for clarity. Only the sign of the dimension is actually needed for the part. This block cuts a 360 degree arc.

LINE 7 This line "leads out" away from the part before the cutting process is turned off. If any melting occurs when the cutting process is stopped, it occurs in the scrap, away from the part.

LINE 8 Turn off the cutting process.

LINE 9 Move to next pierce point at high traverse speed.

LINE 10 Initiate cutting process for outside cut.

LINE 11 Line "Leads In" from pierce location to part.

LINE 12 Standard line format

LINE 13 Standard Arc format- Direction is CCW since 5th sign is (+). **Note:** zero dimensions (+0) are included for clarity. Only the sign is actually needed for the part program.

LINE 14 Standard line format

LINE 15 Standard line format

LINE 16 Standard line format

LINE 17 Standard line format

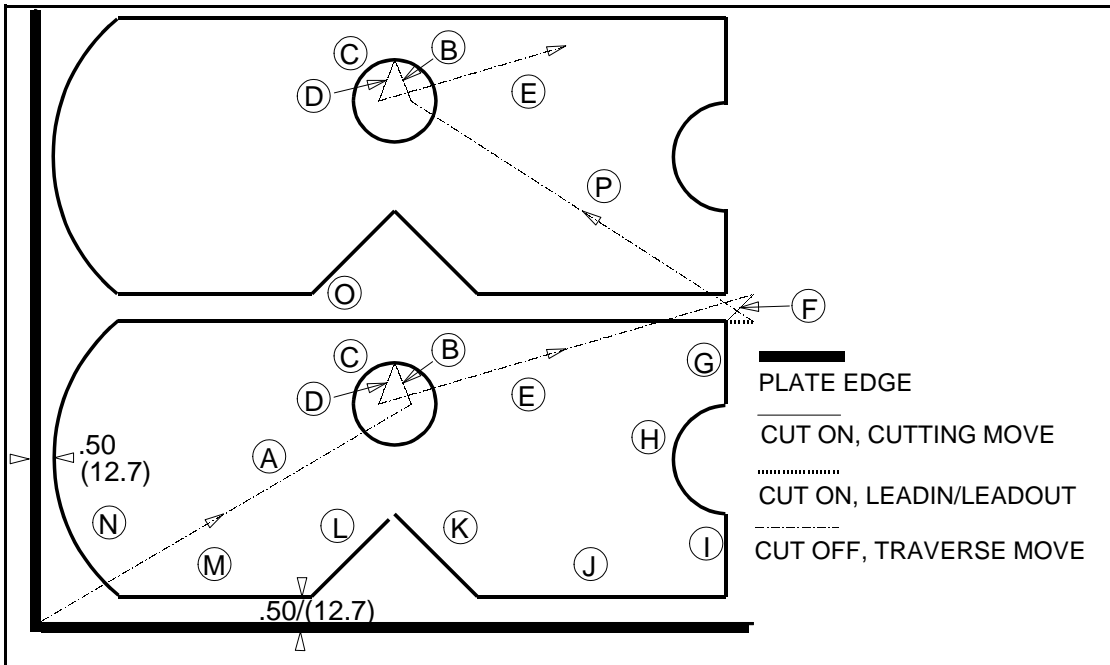
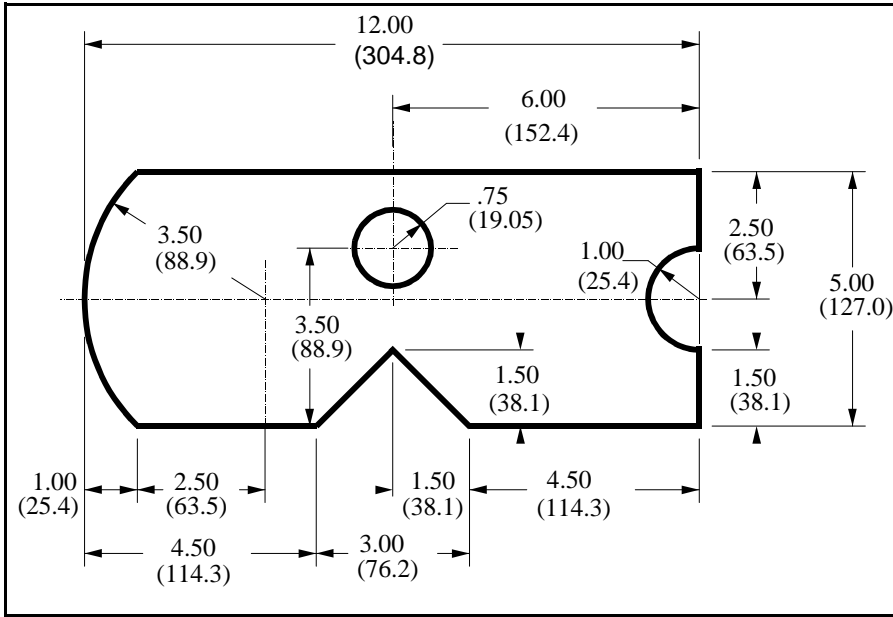
LINE 18 Standard line format

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- LINE 19 Standard ARC format - Direction is CW since 5th sign is "-".
- LINE 20 Standard line format- Note: Line is .5 inches longer than part. This allows the line to also function as a "Lead-Out" away from the part before turning off the cutting process.
- LINE 21 Turn OFF the cutting process.
- LINE 22 Move to first pierce location on next part.
- LINE 23 The 98 command causes program to repeat from point where 97 command was used.
- LINE 24 End of Program Command

PART DRAWING - SAMPLE PROGRAM 1

Dimensions: inch (millimeter)



Letters in circles denote data block letters in the program example.

2.5RS OPERATION AND MAINTENANCE MANUAL

PART 5 SERIAL COMMUNICATIONS

SERIAL COMMUNICATIONS

NOTE

SERIAL COMMUNICATIONS is an optional feature of the **2.5RS** and must be enabled for operation. CAD-LINK (CLINK) and COMMUNICATION ENHANCEMENT are special protocols used with the communication option. These must also be enabled before they will operate. The options may be easily checked to see if they are enabled by using the DSPY 80- CONFIGURE mode which displays the system Serial Number, Software Version, and the amount of memory installed in the unit. Pressing the 'Enter' button jumps to a list of all the available options for the system with an 'ON' or 'OFF' displayed next to the option name indicating whether it has been enabled in the unit or not. Press "ENTER" or use the scroll keys to step through the options to check if they are enabled. For more information on "DISPLAY 80" see the "DISPLAY MODES" section.

IF A PARTICULAR OPTION IS REQUIRED BUT IS NOT ENABLED,
CONSULT THE FACTORY.

SERIAL COMMUNICATIONS is the transferring of data between two devices over a communication link. For a communications link to operate properly, the characteristics of the transmitting and receiving devices must match. If they do not, the program will either not load at all, or will be interpreted incorrectly. The **2.5RS** can adjust the following characteristics to match the external device.

- **PROTOCOL** (RTS/CTS, XON/XOFF AND SPECIAL DEVICES)
- **PROGRAM TYPE** (WORD ADDRESS, ESSI, AND SPECIALS)
- **CHARACTER TYPE** (NUMBER OF DATA BITS, PARITY)
- **BAUD RATE-2.5RS** (110,300...9600)
- **BAUD RATE-2.5 Plus**(110,300...230K)

The same factors affect both the receiving and transmitting characteristics of the system, therefore, once set, they should function in either direction.

2.5RS OPERATION AND MAINTENANCE MANUAL

These characteristics can be set for the system one of two ways:

- Any, or all of the characteristics can be permanently set into the unit by setting the appropriate value in the "SD50-SERIAL DEFN" (see INSTALL section) variable during the machine setup procedure. If a value is set using this method, it is automatically used any time a serial operation is performed. This would be the case if the same serial device is used all the time or if a permanent connection to a remote computer is installed. This requires the least input by the operator since the values are already set.
- A zero value may be entered for any (or all) of the four selections during the setup procedure. This causes the operator to be prompted for the particular characteristic each time a serial operation is performed. Each parameter can be set independently, allowing some to be entered each time while presetting others. This would be useful if the same remote device were being used every time but with programs using both ESSI and WORD ADDRESS languages. Everything but the program type could be preset, requiring the operator to enter only the ESSI or WADR program type.

When the "LOAD- FROM RS-232" or "STORE- TO RS-232" operation is selected, the preset value is checked, and if all 4 parameters are set, the system automatically goes on to the actual loading or storing procedure. However, if any, or all of the parameters are set to 0, the system prompts the operator for the required selections.

If the "PROTOCOL" selection parameter is set to 0, the operator must select the desired protocol from the following menu:

- | | | |
|-------------------|---|---|
| PROTCL-1=RTS/CTS | - | Standard HARDWARE PROTOCOL using Request to Send and Clear to Send (RTS/CTS). |
| PROTCL-2=XON/XOFF | - | Standard SOFTWARE PROTOCOL using "XON" and "XOFF" control characters. |
| PROTCL-3=BURNY 4 | - | Special protocol used to communicate with BURNY™ 4 controls. |
| PROTCL-4=CASS 1 | | Not used. |
| PROTCL-5=PTAPE 1- | | Not used |
| PROTCL-6=CLINK 1 | - | Special protocol for communication with remote "CAD" programming center. |

A detailed description of each of these protocols is provided in this section.

SERIAL COMMUNICATIONS : SERIAL

If the program type parameter is set to 0, the operator must select the type of program to be LOADED or STORED, from the following menu:

PGM TYPE-1=WADR - Standard **2.5RS** WORD ADDRESS PROGRAM
PGM TYPE-2=ESSI - Standard **2.5RS** ESSI PROGRAM
PGM TYPE-3=INTL - TEST FORMAT-NOT FOR NORMAL USE
PGM TYPE-4=WADR1 - Special WORD ADDRESS PROGRAM TYPE 1
PGM TYPE-5=WADR2 - Special WORD ADDRESS PROGRAM TYPE 2
PGM TYPE-6=WADR3 - Special WORD ADDRESS PROGRAM TYPE 3
PGM TYPE-7=ESSI1 - Special ESSI TYPE PROGRAM 1

Specifications for the various program types are found in the PART PROGRAMMING SECTION of this manual.

If the character format parameter is set to 0, the operator must select the desired character format from the following menu:

CHAR TYPE-1 =NP7D-ASCII, NO PARITY, 7 DATA BITS
CHAR TYPE-2 =NP8D-ASCII, NO PARITY, 8 DATA BITS
CHAR TYPE-3 =EP7D-ASCII, EVEN PARITY, 7 DATA BITS (STANDARD)
CHAR TYPE-4 =EP8D-ASCII, EVEN PARITY, 8 DATA BITS
CHAR TYPE-5 =OP7D-ASCII, ODD PARITY, 7 DATA BITS
CHAR TYPE-6 =OP8D-ASCII, ODD PARITY, 8 DATA BITS
CHAR TYPE-7 =EIA-EIA, RS244 ODD PARITY FORMAT

Note: Two (2) stop bits always sent, 1 or 2 may be received.

If the BAUD RATE parameter is set to 0, the operator must select the BAUD RATE for the communication from the following menu:

BAUD RATE-1=110
BAUD RATE-2=300
BAUD RATE-3=600
BAUD RATE-4=1200
BAUD RATE-5=2400
BAUD RATE-6=4800
BAUD RATE-7=9600
BAUD RATE-8=19.2K (Note 1)
BAUD RATE-9=28.8K
BAUD RATE-A=38.4K
BAUD RATE-B=57.6K
BAUD RATE-C=115.2K
BAUD RATE-D=230K

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Note 1: BAUD rates in italics apply only to the **2.5 Plus**

See the "SETUP AND CONFIGURATION" section of this manual on SD50.

Once all the parameters are set, the **2.5RS** initiates the transmission by setting it's output status line to the active condition and then waits for the external device to enable it's port. A "*** WAITING ***" message is displayed until the external device comes "ON LINE". The **2.5RS** then delays for 1 second and begins the communication.

If the "RECYCLE" key is pressed before the operation is complete, the process is aborted and a "RECYCLE ABORT" is displayed. Press the "RECYCLE" key again to return to the top menu selection.

During a "LOAD" or "STORE" operation, the display shows the actual number of bytes being used to store the data.

A "XXXXXXXXX LOADED" message is displayed when a "LOAD" operation is successfully completed. Pressing the "RECYCLE" key returns to the main prompting menu.

If the serial device being used disables it's STATUS LINE during the communication, the display changes to "WAITING" until the port comes back "ON LINE".

Any errors that occur during a SERIAL I/O OPERATION are listed in the section "ERROR MESSAGES" of this manual.

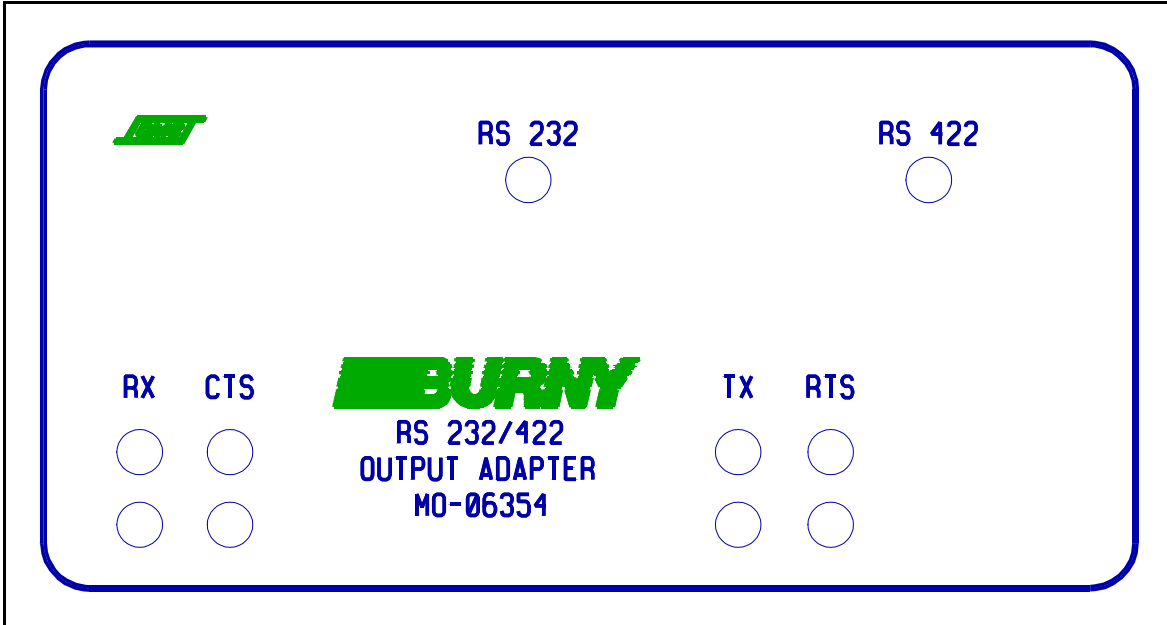
SERIAL.1 CONFIGURING THE COMMUNICATION PORT

The **2.5RS** is equipped with an isolated RS-232/RS-422 Serial Communication Port which is used to connect to host computers and other serial devices.

The communication port is housed in a separate enclosure usually attached to the back of the **2.5RS** cabinet in place of audio beeper. The enclosure (MO-06354) contains isolated RS232/422 electronics, status LEDs, audio beeper, 9 pin output connector and an internal RS232/422 selector switch.

SERIAL COMMUNICATIONS : SERIAL

There are 4 sets of LEDs which show the state of the input/output signals. The top LED shows the signal as being LOW or OFF, while the bottom LED shows the signal being HIGH or ON. When the unit is sending or receiving data, the LED's will be blinking showing the passage of the serial data stream.



The **2.5RS** serial port can be configured for either RS-232 or RS-422 level signals. The RS232/RS422 status LED's on the unit indicate the current settings. To change the selection, the MO-06354 enclosure must be unfastened from the **2.5RS** enclosure. See the information and **WARNING** on the next page before attempting this procedure.

IMPORTANT

Do not turn the screws on the MO-06354 output adaptor itself as this could loosen some of the internal hardware and require the entire unit to be disassembled.

To avoid loss of programs, read the section of this manual entitled "Backup of Programs Stored in Burny™ Controls"

See the drawing below for information about removing the output adaptor.

WARNING

When considering any type of disassembly, please note:

HIGH VOLTAGES ARE PRESENT IN BURNY™ SYSTEMS THAT CAN INJURE AND KILL.

ONLY QUALIFIED PERSONS SHOULD OPEN OR DISASSEMBLE ANY PART OF THE BURNY™ SYSTEM.

TURN OFF AND RED TAG ALL POWER SOURCES DURING SERVICE.

BE CERTAIN THAT UNAWARE PERSONS DO NOT TURN ON THE POWER DURING SERVICE.

USE A VOLTMETER TO BE CERTAIN THAT ALL POWER SOURCES HAVE BEEN TURNED OFF.

The MO-06354 is held onto the **2.5RS** enclosure by two hex nuts (actually hex standoffs) located inside the **2.5RS** enclosure. Remove these two hex standoffs inside the **2.5RS** box and pull the MO-06354 away.

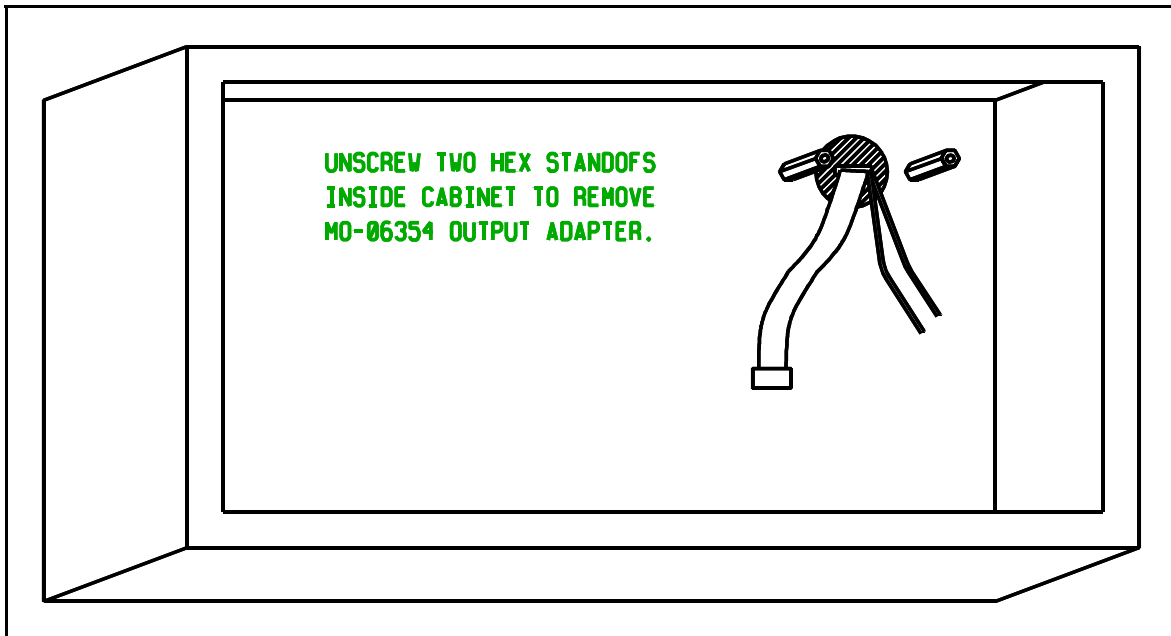
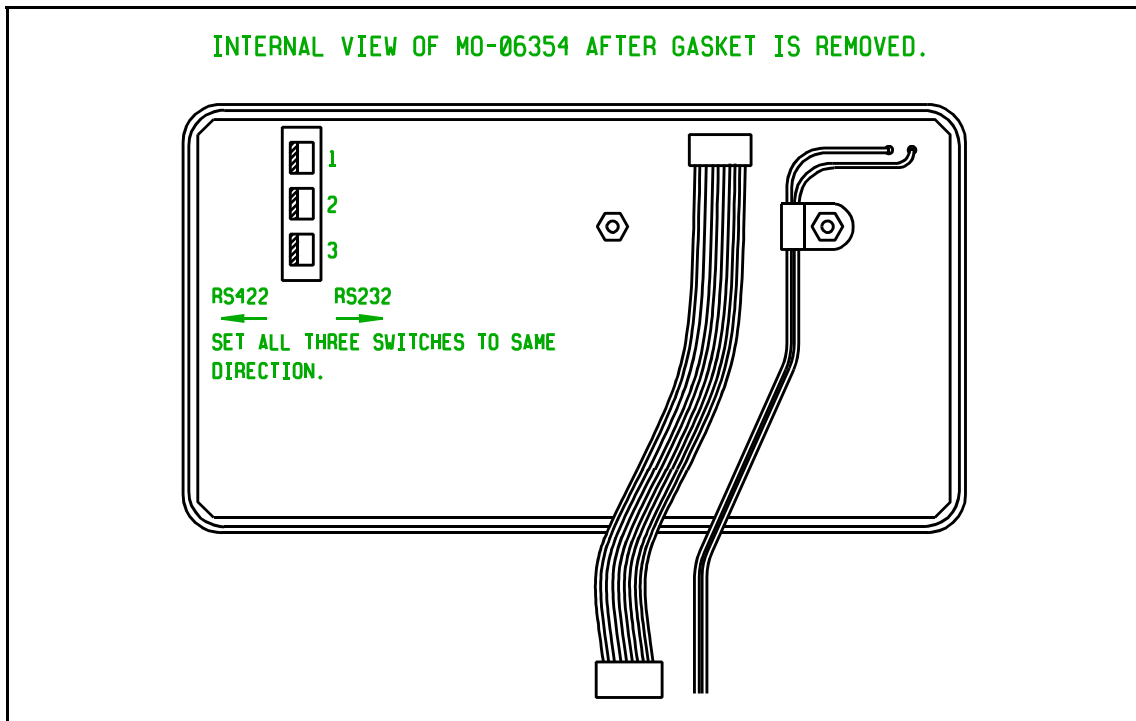


Figure 120

Then the gasket is pulled back to reveal the 232/422 selection switches. There are 3 switches. See the drawing below. All three switches must be thrown in the same direction. Set the switch to the desired setting and reassemble the unit.



2.5RS OPERATION AND MAINTENANCE MANUAL

SERIAL.2 CONNECTING TO RS-232 DEVICES

RS-232C is an abbreviation for Recommended Standard 232, Revision C. This standard comes from the engineering department of the Electronic Industries Association (EIA). RS-232C defines the wiring between two serial devices. It also defines the supposed purpose of 25 different wires, which pins they should terminate on and even what voltage levels, current drains and loads are allowed. Of the 25 pins/wires defined by the standard only 11 are used for asynchronous communications. The others are used for synchronous communication or reserved for future use. Although there are 11 used for asynchronous communication, the **2.5RS** can communicate with as few as 3 (TRANSMIT, RECEIVE AND GROUND) using SOFTWARE HANDSHAKING or as many as 5 (TRANSMIT, RECEIVE, Request-To-Send, Clear-To-Send and Signal Common) using HARDWARE HANDSHAKING. This means that either a 3 wire or 5 wire cable could connect the **2.5RS** and a host storage device. NOTE: The host storage device could be a computer, tape punch, another **2.5RS** or any other type of serial device.

SERIAL.3 RS-232 PIN CONFIGURATION

The MO-06354 SERIAL OUTPUT ADAPTER uses an industrial type round 9-pin AMP connector for it's serial output rather than the normal (and somewhat fragile) "D" connector found on most computers and RS-232 devices. The following is a description of each of the 9 pins of the port.

| <u>SIGNAL</u> | <u>PORT A</u> | <u>DESCRIPTION</u> |
|---------------|---------------|---|
| SHIELD | PIN 1 | PROTECTIVE SHIELD, DO NOT TIE TO PIN 7 |
| RIN | PIN 2 | RECEIVED DATA INPUT TO 2.5RS |
| XOUT | PIN 3 | TRANSMITTED DATA OUTPUT FROM 2.5RS |
| | PIN 4 | +5 VDC @ 25ma |
| | PIN 5 | +12 VDC @ 25mA - May be used for pullup |
| | PIN 6 | -12 VDC @ 25mA |
| GND | PIN 7 | SIGNAL GND |
| CTRL-OUT | PIN 8 | CONTROL STATUS LINE- OUTPUT FROM 2.5RS |
| STAT-IN | PIN 9 | INPUT STATUS LINE- INPUT TO 2.5RS |

NOTE

The "CTRL-OUT" and "STAT-IN" terminologies are used rather than the more conventional "REQUEST TO SEND" or "CLEAR TO SEND" since these imply specific data-set and data-terminal definitions and do not function identically on all serial devices. By choosing more general names, the correct connection to the remote equipment must be made based on signal function rather than assuming the same named pins are automatically connected.

The signal levels from the **2.5RS** are RS232 compatible and could be connected directly to a remote computer up to 50 feet away using any type of standard cable, or up to up to 500 feet away with special RS232 extended distance cable. To use RS-232 communication over 500 feet would require the addition of short haul direct wire or fiber optic modems to boost the range. The RS-422 setting of the **2.5RS** serial port allows for direct connection to RS-422 devices over 1 mile away and may be the better choice for long distance links. See the section on RS-422 communications later in this chapter for further details.

**** IMPORTANT ****

The MO-06354 RS-232/422 OUTPUT ADAPTER ASSEMBLY provides total electrical isolation between the **2.5RS** internal electronics and the transmission wire to the remote computer or serial device. As long as the distance between the two devices is within the RS-232 or 422 specifications, no additional isolation is needed to protect against ground loops or power system problems. However, there can be considerable electrical noise generated on the wires leading from the **2.5RS** to the remote computer. While this will not harm the **2.5RS** due to it's built in isolation, the noise could damage the input circuitry at the remote computer. For this reason, we recommend that all installations include some sort of transient protection and isolation at the serial port of the remote computer to protect it against line induced noise damage. There are also RS-422 to RS-232 conversion modems available which also provide this type of isolation and transient protection. By setting the **2.5RS** for RS-422 communication, and using one of these RS-422 to 232 modems, the proper isolation and transient protection is achieved, along with increasing the maximum transmission distance. See the RS-422 section of this chapter for further details.

SERIAL.4 RS-232 FOR HARDWARE HANDSHAKING

These drawings show the typical connection from a **2.5RS** control to the standard 25-Pin and 9-Pin RS-232 connectors found on most IBM compatible computers and peripherals. For **HARDWARE HANDSHAKING**, 5 wires are required: TRANSMIT DATA, RECEIVE DATA, REQUEST-TO-SEND, CLEAR-TO-SEND, and SIGNAL COMMON.

RTS/CTS HARDWARE PROTOCOL

25 PIN D-SUB AT
COMPUTER

BURNY
SERIAL I/O PORT A

| | | | | |
|------|----|-------|---|-------------|
| TD | 2 | _____ | 2 | RD |
| RD | 3 | _____ | 3 | TD |
| RTS | 4 | _____ | 9 | STATUS IN |
| CTS | 5 | _____ | 8 | CONTROL OUT |
| COM. | 7 | _____ | 7 | COM. |
| DSR | 6 | _____ | | |
| CD | 1 | _____ | | |
| DTR | 20 | _____ | | |



RTS/CTS HARDWARE PROTOCOL

9 PIN D-SUB AT
COMPUTER

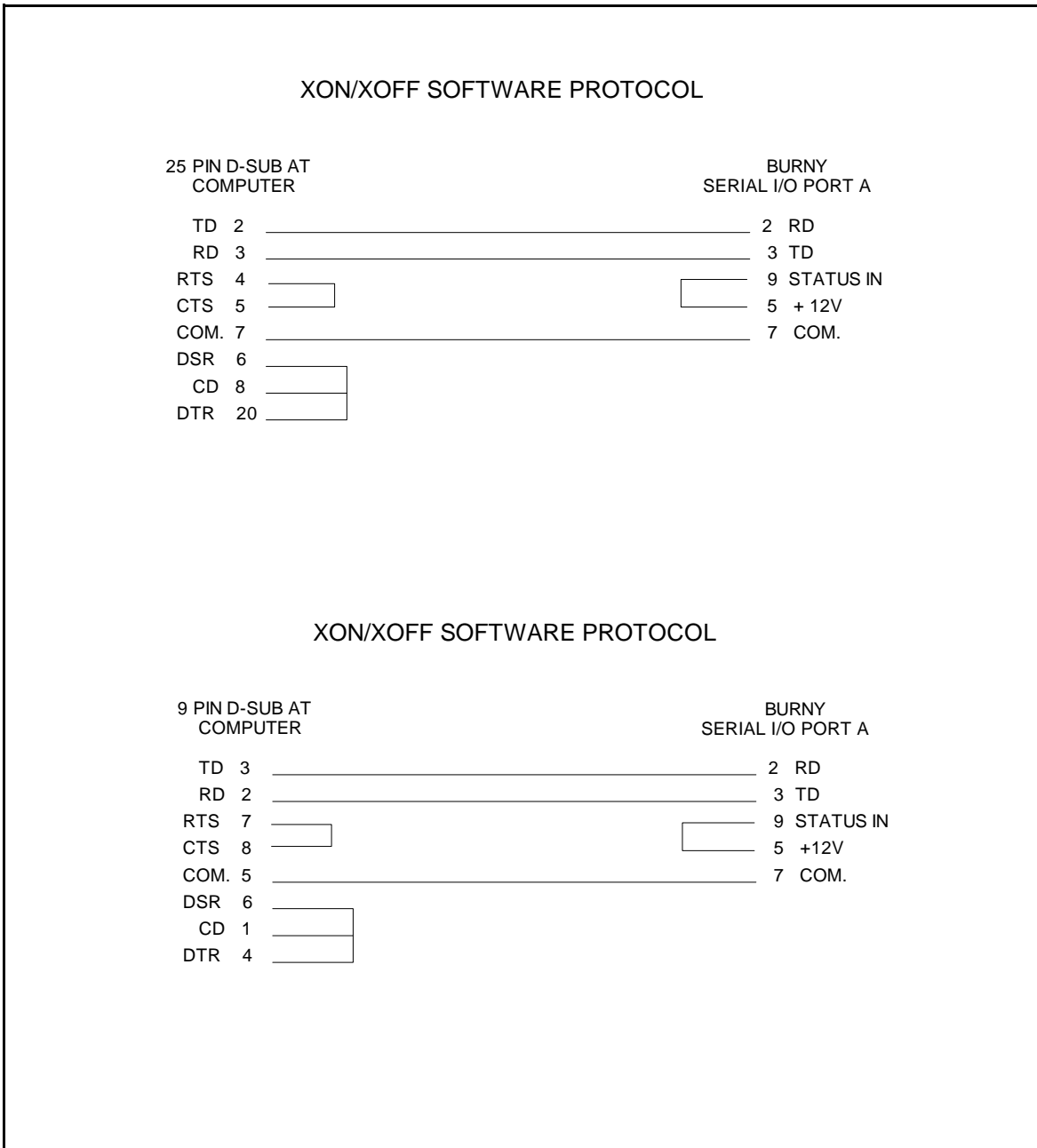
BURNY
SERIAL I/O PORT A

| | | | | |
|------|---|-------|---|-------------|
| TD | 3 | _____ | 2 | RD |
| RD | 2 | _____ | 3 | TD |
| RTS | 7 | _____ | 9 | STATUS IN |
| CTS | 8 | _____ | 8 | CONTROL OUT |
| COM. | 5 | _____ | 7 | COM. |
| DSR | 6 | _____ | | |
| CD | 1 | _____ | | |
| DTR | 4 | _____ | | |

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SERIAL.5 RS-232 FOR SOFTWARE HANDSHAKING

These drawings show the typical connection from a **2.5RS** control to the standard 25-Pin and 9-Pin RS-232 connectors found on most IBM compatible computers and peripherals. Since SOFTWARE HANDSHAKING uses transmitted characters to control the data flow instead of separate hardware lines, only 3 wires are required: TRANSMITTED DATA, RECEIVED DATA, and SIGNAL COMMON.



SERIAL.6 CONNECTION TO RS-422 DEVICES

The serial port on the **2.5RS** may be configured for either RS-232 or RS-422 operation. RS-232 is more limited in distance and in some cases may be more susceptible to noise since it is a single ended ground referenced signal. RS-422 is a differential signal type signal which permits longer transmission distances (over 1 mile) and better noise immunity. If the remote computer is equipped with an RS-422 compatible port, the **2.5RS** could be connected directly to it. However, while the RS-422 port on the **2.5RS** is electrically isolated from the internal circuitry, the RS-422 port on the remote computer may not be. Therefore even though a modem is not required to extend the distance of the transmission, it is recommended that some sort of modem or transient protection device be installed at the host computer to protect it from line induced noise. Most computers have only RS-232 level serial ports. Therefore most computers will require an RS-422 to RS-232 converting modem. This has two benefits. First, it provides the long distance transmission capability of the RS-422 signals. Second, if the proper type of modem is selected, it will provide complete electrical isolation between the long transmission wire and the computers sensitive serial port. The **2.5RS** has such a modem available as an accessory item. Part number MO-06707-0 includes a 115VAC adapter while MO-06707-1 includes a 230VAC 50/60HZ adapter. This modem provides the proper electrical isolation to protect the host computer port.

Since the **2.5RS** RS-422 port only supports the TRANSMIT and RECEIVE lines, Hardware (RTS/CTS) handshaking isn't possible. Therefore, the host computer must use SOFTWARE HANDSHAKING (XON - XOFF characters) to control the data flow between the **2.5RS** and the host computer.

-- SIGNAL LEVELS ARE RS-422 COMPATIBLE- ONLY THE FOLLOWING SIGNALS ARE USED IN THE "RS-422" MODE:

| <u>SIGNAL NAME</u> | <u>I/O PORT A</u> | <u>DESCRIPTION</u> |
|--------------------|-------------------|--|
| SHIELD | PIN 1 | PROTECTIVE SHIELD- DO NOT CONNECT TO SIG. GND. |
| | PIN 2 | B' RECEIVED DATA INPUT FROM 2.5RS |
| | PIN 3 | B TRANSMITTED DATA OUTPUT FROM 2.5RS |
| | PIN 4 | +5 VDC @ 25mA |
| | PIN 5 | +12 VDC @ 25mA |
| | PIN 6 | -12 VDC @ 25mA |
| GROUND | PIN 7 | SIGNAL GND (DO NOT CONNECT TO SHIELD GROUND |
| | PIN 8 | A TRANSMITTED DATA OUTPUT TO 2.5RS |
| | PIN 9 | A' RECEIVED DATA INPUT TO 2.5RS |

2.5RS OPERATION AND MAINTENANCE MANUAL

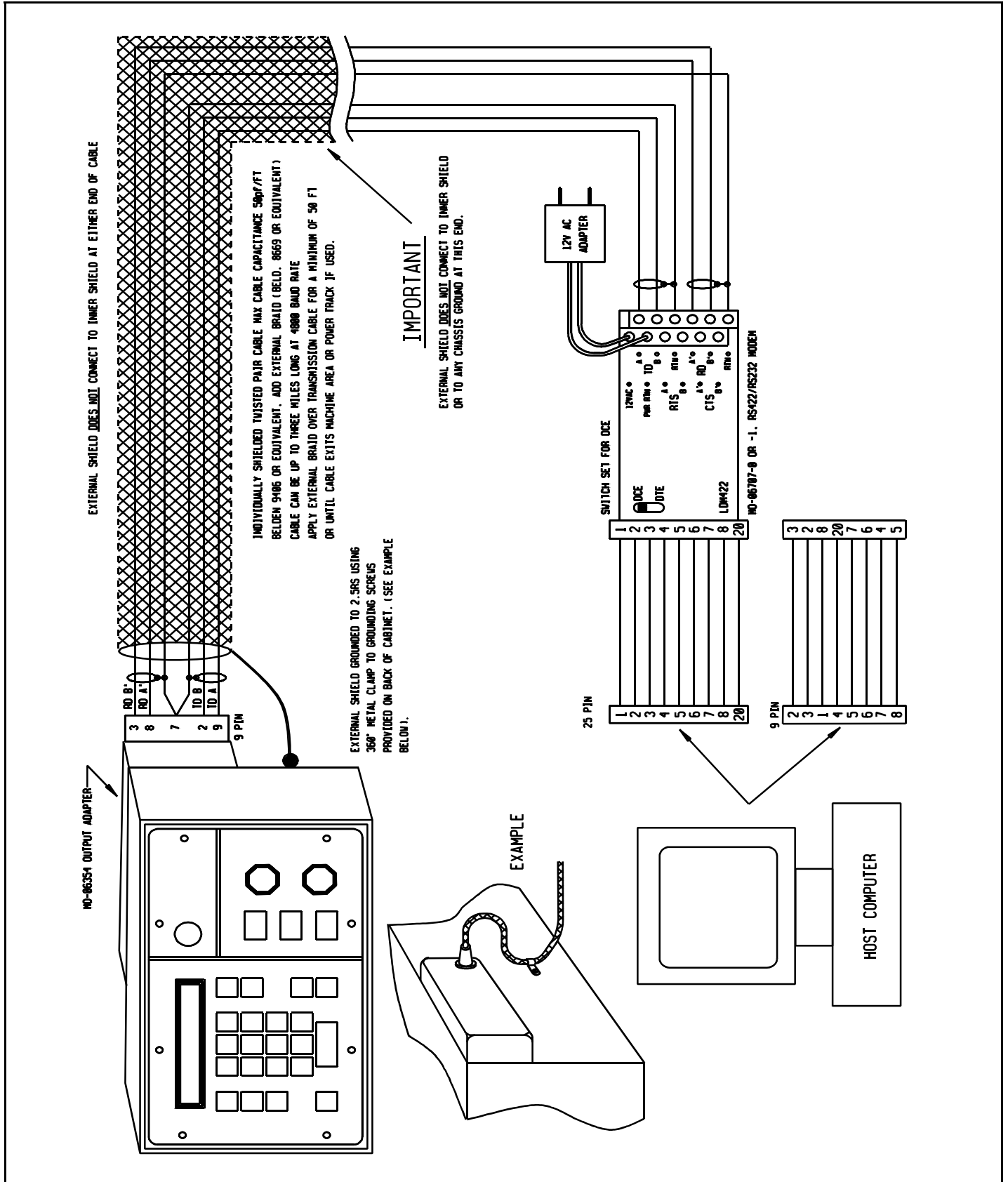


Figure 121 TYPICAL RS-422 MODEM CONNECTION

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SERIAL.7

CHARACTER FORMATS

The **2.5RS** accepts several different character formats. The most common are:

- ASCII (RS-358) -EVEN PARITY, 7 DATA BITS, 1 OR 2 STOP BITS
- "EIA" (RS-244) -ODD PARITY, 8 DATA BITS, 1 OR 2 STOP BITS
(FLEXOWRITER) (EIA-RS244 does not support some functions and codes and cannot be used if SOFTWARE PROTOCOL is used since there are no control codes defined in the RS-244 Spec.)

The character format is selected either during installation and setup, or by the operator when the serial I/O operation is selected

For the remainder of this description, the < > symbols are used to indicate specific characters as follows:

- <CR> -HEX 0D - ASCII CARRIAGE RETURN
- <EOB> -HEX 0A - ASCII END OF BLOCK (ALSO LINE FEED)
- <XON> -HEX 11 - ASCII DC1 (TRANSMITTER ON)
- <RON> -HEX 12 - ASCII DC2 (RECEIVER ON)
- <XOFF> -HEX 13 - ASCII DC3 (TRANSMITTER OFF)
- <ROFF> -HEX 14 - ASCII DC4 (RECEIVER OFF)
- <EOF> -HEX 04 - ASCII EOF (END OF FILE)
- <NULL> -HEX 00 - BLANK TAPE

HEX CODE SHOWN MUST HAVE APPROPRIATE PARITY BIT ADDED TO THE CODE.

The actual program format can be one of several types, as listed in the programming section of this manual.

SERIAL.8 HANDSHAKING PROTOCOL SPECIFICATIONS

HANDSHAKING is the way in which the data flow between the **2.5RS** and the host storage device is regulated and controlled. There are basically two types used by the **2.5RS**. The first type is **HARDWARE HANDSHAKING** which uses the **STATUS IN** and **CONTROL OUT** signal lines (**RTS** and **CTS**) to control the data that flows through the transmit and receive lines.

The second type is **SOFTWARE HANDSHAKING** which uses special characters to control the flow of data between two serial devices. They are **<XON>** for **TRANSMITTER ON** and **<XOFF>** for **TRANSMITTER OFF**.

SERIAL8.1 **RTS/CTS HARDWARE PROTOCOL**

NOTE

RTS/CTS hardware protocol is not supported when the port is configured as a RS-422 port.

The "RTS/CTS" protocol uses electrical control signals defined by the RS-232 standard to regulate the transmission. The **2.5RS** has 1 input status line and 1 output control line to perform this handshaking. The status input to the **2.5RS** should be connected to a suitable status output signal from the external device. Similarly, the **2.5RS** control output should be connected to a status input line on the remote device. Traditionally, these two signals have been called "REQUEST TO SEND" (**RTS- CONTROL OUTPUT**) and "CLEAR TO SEND" (**CTS- STATUS INPUT**). However, the exact definition may vary, thus they are referred to as only the status input and control output lines. In this way, it implies that they should be connected to give the correct function, not necessarily to the pin bearing the same name. By using this type of handshaking, either the **2.5RS** or the external device can control the data transmission. This compensates for the fact that the data may be transmitted faster than a particular device can process it. If no handshaking is used, data can be lost due to this processing time. With the handshaking, either device can stop the transmission until it is ready to accept more data.

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SERIAL8.2 XON/XOFF SOFTWARE PROTOCOL (SPECIAL HANDSHAKING PROTOCOL)

The **2.5RS** also supports some special Handshaking protocols designed for specific devices. They are as follows:

- | | |
|--------------|--|
| 3- BURNY™ IV | Special protocol to communicate with BURNY™ IV controls |
| 5- PTAPE | Special protocol to communicate with Spooling Tape Readers |

These protocols should only be used when communicating with these devices.

SERIAL8.3 COMMUNICATION ENHANCEMENT OPTION

COMMUNICATION ENHANCEMENT is one of two optional communication protocols which can be used to provide a more automated link between the host computer and the **2.5RS**. When this option is installed, the **2.5RS** transmits a request to the host computer when the operator selects a LOAD-FROM RS232 operation. The remote computer can interpret this request and send back the corresponding program without operator assistance at the computer. This allows for unattended operation of the computer and makes for a more automatic, more efficient link.

For "LOAD" operations, the **2.5RS** sends the following header when a new program is requested: (program number 12345678 used for example)

DOWNLOAD PROGRAM:12345678 <CR><EOB>

SERIAL8.4 LOAD-FROM RS232 USING RTS/CTS (HARDWARE HANDSHAKING)

The operator selects the "LOAD-FROM RS232" function, and enters the desired program number. When the "ENTER" key is pressed, any additional communication parameter prompts are displayed (as set by SD50).

Once the parameters are entered, the **2.5RS** turns on it's control line then waits for the remote device to signal it's ready to receive data by sensing the status input line.

At this point, if the "COMMUNICATION ENHANCEMENT OPTION" is enabled, the **2.5RS** sends 10 <null> characters, delays for 1 second and then send the following message:

DOWNLOAD PROGRAM:12345678 <CR><EOB>

The remote device begins transmission of the program. If the **2.5RS** needs to halt the transmission, it turns off its control output line, which should cause the remote device to stop sending data. The **2.5RS** turns the control output line back "ON" when data transmission can resume.

If the COMMUNICATION ENHANCEMENT OPTION is not enabled in the system when the END OF PROGRAM CODE is received, the **2.5RS** simply turns off its control output line while the program load is finishing. If the program ends with the PROGRAM END/REWIND CODE, the download software terminates and displays "PROGRAM LOADED". However, if the program just loaded ended with the PROGRAM END "only" (no rewind) code, the download software finishes loading the first program, and after a slight pause, turns the control output line back ON and displays "WAITING FOR NEXT" on the readout. This allows multiple programs to be loaded by ending the programs with the PROGRAM END "only" code. Each program is loaded based on the program number defined by the "P" block in the program (see individual Word address/ESSI specifications). If a program does not specifically define a program number, the **2.5RS** assigns a number with the first digit containing an "A" to indicate that it was "Assigned."

If the COMMUNICATION ENHANCEMENT OPTION is enabled when the END OF PROGRAM CODE is received, the **2.5RS** then sends a termination message of "<BEL><BEL><BEL>EOF:###<CR><LF>" where ### represents a 3 digit status code. A complete list of the status codes and their translations are located at the end of this section.

The **2.5RS** then turns off its control output line, finishes loading the program and then either terminates the download with a "PROGRAM LOADED" message, or re-enables its port for the next program as described in the section above.

The device sending the program can indicate an "END OF FILE" condition by sending an ASCII "control-D" (Hex '04'). This character indicates that the download link should be terminated. This special "END OF FILE" character can be used by the host computer to indicate that the program requested does not exist by sending only the "EOF" code. The **2.5RS** detects that only the "EOF" was sent and displays a "NO PROGRAM FOUND" message. The "EOF" character does not have to be used for normal downloading.

SERIAL8.5 TYPICAL LOAD-FROM RS232 USING XON/XOFF (SOFTWARE HANDSHAKING)

Download to the **2.5RS** using SOFTWARE PROTOCOL requires that the remote device support <XON>/<XOFF> software conventions.

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- Operator presses the "SHF" key and enters the program number to receive the data. Then the various parameter selections are made.
- **2.5RS** turns on it's CONTROL LINE and waits for the status input line to indicate that the remote device is ready (these can be tied together).
- The **2.5RS** indicates that transmission can start by sending:
<XON><RON><10 NULLS><ROFF> waits 1 second. Then sends another <XON>
- If the COMMUNICATION ENHANCEMENT option is enabled, the **2.5RS** sends the following message to request the specific program:
<RON> DOWNLOAD PROGRAM:12345678 <CR><EOB>
- The remote device can begin transmission any time after receiving the <XON> character. If the **2.5RS** needs to halt the transmission, it sends an <XOFF> character which should cause the remote device to stop sending data. The **2.5RS** sends an <XON> character when the transmission can resume.

NOTE

The STATUS INPUT LINE on the **2.5RS** must be kept at a high level when software protocol is used.

When the END OF PROGRAM CODE is received, the **2.5RS** then sends a comlink termination message of "<BEL><BEL><BEL>EOF:###<CR><LF>" where ### represents one of the 3 digit status codes listed at the end of this section. The **2.5RS** then sends an <XOFF> <ROFF> and then turns off it's OUTPUT STATUS LINE.

SERIAL8.6

CAD LINK (CLINK) PROTOCOL

CLINK is another special communications protocol which allows the **2.5RS** to send and receive part cutting programs from a remote computer via commands sent through the RS-232 port. The host computer can be programmed to use this protocol to provide a totally automatic link-- no operator is required at the host computer.

Currently there are four basic commands that are supported.

1. <ESC>!FD (FILE DATA COMMAND)
2. <ESC>!FG (FILE GET COMMAND)
3. <ESC>!FQ (FILE QUEUE COMMAND)
4. <ESC>!QQ (FILE QUIT COMMAND)

CLINK utilizes XON-XOFF software handshaking to control the flow of data between the two devices. A character-by-character check for XON or XOFF(>11 & >13) codes is done. The **2.5RS** does not currently support any block type protocols.

SERIAL8.7

FILE DATA <ESC>!FD

FILE DATA- This command is used in two different ways. For the **2.5RS** control to send a program to the remote computer, the program data must be preceded by a "FILE DATA" command string. The message is a sequence of characters incorporating the desired program number.

For example, for the **2.5RS** to send program number 8765 to the remote computer, the following message would be sent first:

```
<ESC>!FD8765<CR><LF>
```

where: ESC is the ASCII ESCAPE character
! is the ASCII EXCLAMATION point
FD is the abbreviated command for "FILE DATA"
8765 is the program number stored in the **2.5RS** control which is sent to the computer. The number is sent as standard ASCII numeric characters.
<CR> is the ASCII carriage return character
<LF> is the ASCII line feed character.

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The **2.5RS** then PAUSES FOR ONE SECOND and then begins to send program data as follows:

```
<CR><LF>
%
P8765
...PROGRAM DATA
...
...
...PROGRAM DATA
M30<CR><LF>
^Z<CR><LF>          signal for end of program data

<ESC>!QQ###<CR><LF>  status code sent by 2.5RS
```

where: ESC is the ASCII ESCAPE character
 ! is the ASCII EXCLAMATION point
 QQ is the abbreviated command for "FILE QUIT"
 ### is a three digit status code
 <CR> is the ASCII carriage return character
 <LF> is the ASCII line feed character.
 ^Z is the ASCII Control-Z character.

SERIAL8.8

FILE GET <ESC>!FG

FILE GET - The **2.5RS** control requests a program from the storage computer. The **2.5RS** control requests a program by specifying a program number of up to 8 numeric digits. Currently only numeric file names are used, no alphabetic characters are allowed. The message is a sequence of characters incorporating the desired program number.

SERIAL COMMUNICATIONS : SERIAL

For example, to request program number 12345, the **2.5RS** sends the following sequence to the computer

<ESC>!FG12345<CR><LF> where:

ESC is the ASCII ESCAPE character
! is the ASCII EXCLAMATION point
FG is the abbreviated command for "FILE GET"
12345 is the program number requested from the storage computer. The storage computer should interpret this command and send back the appropriate ascii file on the storage computer preceded by a "FILE DATA" command. Thus the "FILE GET" command is always sent by the requesting device and the "FILE DATA" command always precedes transmission of the actual program for either storing or retrieving data to/from the remote computer.
<CR> is the ASCII carriage return character
<LF> is the ASCII line feed character.

NOTE

At this time, the remote computer cannot request a program from the **2.5RS** control. All transfers are initiated at the **2.5RS** control only.

If the **2.5RS** issues a "FG" request to the remote computer for a program (12345 for example) which does not exist, the remote computer should send the following response:

<ESC>!FD12345<CR><LF><^Z>

Where the ^Z termination character is sent immediately after the FD header indicating the program does not exist.

The **2.5RS** then displays "PGM NOT FOUND" in its display.

SERIAL8.9

FILE QUEUE <ESC>!FQ

The "FILE QUEUE" command allows the **2.5RS** to make a request to the storage computer for the next program in its queue. There is no program number sent with the FILE QUEUE command. The storage computer must acknowledge the <ESC>!FQ request with <ESC>!FD#####<CR><LF>, pause one second then send the program that is next on the queue.

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***** IMPORTANT *****

Acknowledgment of <ESC>!FD<CR><LF> with no program number also works. However the actual file that is sent to the **2.5RS** MUST CONTAIN A PROGRAM NUMBER BLOCK, such as "P12345678" for Word Address. If no program number block is included in the program the **2.5RS** creates a program number of "FFFFFFFF" for that file.

SERIAL8.10 FILE QUIT <ESC>!QQ

Once a file has been transferred from the storage computer to the **2.5RS**, the **2.5RS** sends an <ESC>!QQ### followed by a three digit status code. The status codes are listed at the end of this section.

For example, the **2.5RS** operator requests program number 12345 from the storage computer.

<ESC>!FG12345<CR><LF> (Request message sent to storage computer by **2.5RS**)

<ESC>!FD12345<CR><LF> (Storage computer sends acknowledgment to **2.5RS**)

PAUSES FOR 1 SECOND

<CR><LF> (SENDS <CR><LF> BEFORE "%")

%<CR><LF> (STORAGE COMPUTER BEGINS TO SEND ASCII FILE)

PROGRAM DATA SENT BY STORAGE COMPUTER TO **2.5RS**

M30<CR><LF>

^Z<CR><LF> SIGNAL FOR END OF PROGRAM DATA

<ESC>!QQ0<CR><LF> PROGRAM COMPLETED NO ERRORS

NOTE

One digit of '0' is returned on a successful completion with no errors. All other status codes are 3 digits.

SERIAL8.11 THREE DIGIT STATUS CODES

NORMAL COMPLETION

000 -- No error

LOAD PROCESS ERRORS

102 -- SYSTEM ERROR

104 -- SYSTEM ERROR

| | | |
|-----|----|--|
| 106 | -- | SYSTEM ERROR |
| 108 | -- | SYSTEM ERROR |
| 110 | -- | DATA FORMAT ERROR (PGM SYNTAX ERROR) |
| 112 | -- | END-OF-FILE ERROR (NO END-OF-PROGRAM CODE) |

PROGRAM MEMORY ERRORS

| | | |
|-----|----|---|
| 202 | -- | MEMORY DISABLED |
| 204 | -- | SYSTEM ERROR |
| 206 | -- | PROGRAM SIZE ERROR (exceeds 128k bytes) |
| 208 | -- | MEMORY INVALID |
| 210 | -- | MEMORY FULL |
| 264 | -- | CUSTOM AUX CODE TABLE ERROR |

I/O OPERATION ERRORS

| | | |
|-----|----|----------------------|
| 302 | -- | SYSTEM ERROR |
| 304 | -- | RECYCLE KEY ABORT |
| 306 | -- | DEVICE OFF-LINE |
| 308 | -- | DEVICE NOT-READY |
| 310 | -- | READ TIMEOUT |
| 312 | -- | WRITE TIMEOUT |
| 314 | -- | PARITY ERROR |
| 316 | -- | OVERRUN ERROR |
| 318 | -- | FRAMING ERROR |
| 320 | -- | DATA HANDSHAKE ERROR |

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PART 6 SERVICE

SERVICE.1 INSTALLATION OF THE BURNY™ 2.5RS

The **2.5RS** should be installed in accordance with the National Electrical Code in the United States, and with IEC 364-4-41 in European Community countries. Additionally, the system must always be installed in accordance with local statute. The **2.5RS** should be installed, adjusted, tested and serviced by qualified personnel familiar with electrical equipment and with the contents of this manual. The **2.5RS** is intended for use only as described in this manual. These instructions have been prepared to ensure compliance with the European Community Electromagnetic Compatibility Directive, and Low Voltage Directive.

SERVICE1.1 PHYSICAL INSTALLATION OF THE BURNY™ 2.5RS

Upon receipt of the unit, unpack all pieces. Retain all packaging until you have verified there is no physical damage to the contents, and the system has been installed. The contents of each shipping container should be recorded by model number and serial number, if serialized. It is further recommended that packaging be saved in case of future upgrade or service shipping needs. All pieces should be carefully inspected for shipping damage, loose parts, and, most importantly, exposed uninsulated electrical parts. Contact Burny™ immediately if any problems occur.

The location into which the **2.5RS** will be installed should be chosen with consideration of many factors, some of which are listed here:

- C accordance with the Environmental Operating Specifications of the **2.5RS**
- C away from sources of moisture
- C avoiding undue sources of dust and other particles if possible
- C located so that unit and operator are out of areas of travel
- C unit and operator are away from zones through which objects may accidentally fall, roll, or slide
- C away from sources of heat
- C away from combustible vapors or gasses
- C located so that cables can be routed safely to the unit
- C sufficient clearance for cables to exit the cabinet
- C access to rear panel to permit dis/connection of cables and reading of labels on rear panel
- C field of view and physical environment of operator

The unit must always be mounted on top of a flat surface, using four mounting bolts, lockwashers, and nuts of 1/4-20 or M6 thread size. Use the hole pattern shown in the cabinet drawing for the **2.5RS**.

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The **2.5RS** is supplied with a plastic plug for the three inch diameter hole in the bottom. The plastic plug should be removed only for the unusual installation where cables and wires must pass through the bottom wall of the cabinet.

When bolting the cabinet to the mounting surface, the **2.5RS** front panel should be opened and the bolts inserted from the inside of the cabinet. Then the head of the bolt will be inside the cabinet and will not interfere with the internal components.

SERVICE1.2 ELECTRICAL INSTALLATION OF THE BURNY™ 2.5RS

The ground for the system should be carried throughout the entire electrical system into which the product is installed by suitable conductors and connections. The conductors and connectors used for this should be in accordance with the National Electrical Code in the United States, the IEC in CE installations, and should be in accordance with all local statutes.

The **2.5RS** cabinet must be grounded to the machine frame earth ground connection by a braided ground strap at least 12 mm in width. A wide flat ground strap provides a better RF ground path than a wire. The strap can be terminated with standard crimp terminals at both ends. The strap should connect to one of the chassis ground screws on the back of the **2.5RS** cabinet. See the instructive ground strap installation drawing.

Cables must be obtained from, designed, or approved by Burny™.

Cables and leads shall be insulated. The insulation must be rated for the maximum voltage of insulated or uninsulated conductors that the cable does or could contact. If, after installation, there are unused connectors on the rear panel of the unit, the unused connectors must be covered with a plastic protective cap.

Metal ground clamps are used at each end of every cable to connect the cable shield to equipment casings. In cases where the shield is not snug within a clamp, the clamp should be gently crimped. Over-crimping can cause internal damage to the cable. The clamp must make snug contact with the shield around the full circumference of the cable.

Cable ends connected to the 2.5RS should have shield clamps connected directly to the 2.5RS cabinet. See the cable ground to back of cabinet drawing.

Cables ends connected to rack mounted encoders (H20 or H25 type) must have the shield clamp connected to the housing of the encoder. See customer instruction drawing for the rack mounted encoder ground clamp. Motor cables are handled in a like manner, as shown on the drawing for motor cable ground clamp installation.

If motor mounted encoders are used the Burny™-supplied kit must be installed over the junction of the plastic connectors, between the encoder cable and the short lead coming from the encoder. This kit and instructions are shipped with cables for encoders and motor mounted encoders. The connector shield is also shown on the customer instruction drawing for the encoder connector shield. A connection between two cables, for example, a cable connected to an extension cable, should be treated in the same way.

Tracer unit cables are handled in a like manner as shown on the customer instruction drawing for the tracer connector shield.

Compliance with the AC line Conducted Emission portion of the EMC Directive of the EC is only possible if the **2.5RS** is equipped with the Burny™-supplied line transformer power supply. If the **2.5RS** is powered with the DC supply of the cutting machine drive or tracing system, compliance with the Line Conducted Emission portion of the EC directive is then the responsibility of the drive or tracing system manufacturer.

SERVICE1.3 CHECKING THE INSTALLATION

A check of the installation is recommended to ensure that safety, performance, and time are not lost. In CE installations, these specific tests must be performed on the completed installation:

Non-accessibility Test,

Performance Test,

Insulation Resistance Test (greater than 0.5 MOhm measured from AC input to chassis.)

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Here is a list that should be checked after any installation is complete. If possible, these types of checks should be assisted by a qualified person other than the persons that performed the installation.

- * All holes in bottom of **2.5RS** cabinet have been sealed to dust, obtrusive objects and fingers.
- * Unused wires have been protected and insulated according to local standards.
- * Electrically live parts are all protected from access by enclosures or barriers.
- * No loose parts, including screws, especially **2.5RS** front panel screws.
- * Burny™ has been informed of all problems with the hardware.
- * Environment within Burny™ operation specifications.
- * Away from sources of moisture.
- * Equipment away from combustible vapors and gasses.
- * Equipment is not too close to source of high heat.
- * Area dust and particulate level satisfactory.
- * Operator and equipment away from areas where objects fall, slide, roll etc.
- * Operator's view of work and equipment satisfactory.
- * Operator and equipment out of way of travel.
- * Cables routed so as to avoid damage after the installation.
- * Cables not unduly cramped or stretched.
- * Rear panel of unit accessible enough to see and to change cables.
- * Operator not subjected to unsafe or unnecessarily stressful conditions.
- * Wire size for AC and DC mains should be AWG 18 or larger.
- * Each cable is either supplied by, designed by, or approved by Burny™
- * The system and all other electrical devices associated with and in the proximity of the system have been properly grounded.
- * Both ends of every cable have a ground clamp attached snugly to the cable shield.
- * Every ground clamp is attached to the component in the proper manner.
- * The system programs and files are backed up properly.

**SERVICE1.4 FUNCTIONAL TESTING OF THE SYSTEM
AFTER INSTALLATION**

Functional testing of the **2.5RS** after installation is recommended. Each installed system can have a unique design, therefore a unique test may be required for the installed system. The test should be designed to ensure that:

- * The equipment has been properly integrated.
- * The **2.5RS** is suitable for and functions correctly in its environment.
- * Protective devices and control devices operate as intended.
- * The **2.5RS** is compatible with other equipment.
- * The **2.5RS** can perform to specifications when interconnected.
- * The **2.5RS** has sufficient range in its controls.
- * The system programs and files are backed up properly.

INSTALLATION.2 LIST OF DIAGNOSTICS AND TESTS OF THE 2.5RS

This is a list of diagnostics and tests contained in this manual that will assist in checking various functions of the Burny™ 2.5 RS.

| SUBJECT | TITLE | PAGE |
|--|--|-----------------------------|
| Testing machine movements without cutting | RUN.4 TEST RUN | PART 2; RUN-7 |
| Testing the Cutting Oxygen Enable Relay | SPECFUNC.2.1.2 OXY ENABLE | PART 3; SPECIAL FUNCTIONS-3 |
| Testing the Cutting Oxygen Start Relay | SPECFUNC.2.1.3 OXY START | PART 3; SPECIAL FUNCTIONS-4 |
| Testing the High Preheat Relay | SPECFUNC.2.1.4 PREHEAT | PART 3; SPECIAL FUNCTIONS-4 |
| Testing the Plasma Torch hardware | SPECFUNC.2.2.1 PLASMA CUT | PART 3; SPECIAL FUNCTIONS-5 |
| Testing the Plasma Enable Relay | SPECFUNC.2.2.3 PLASMA ENABLE | PART 3; SPECIAL FUNCTIONS-6 |
| Testing the Plasma Start Relay | SPECFUNC.2.2.4 PLASMA START | PART 3; SPECIAL FUNCTIONS-6 |
| Testing the Plasma Height Sensor Disable Relay | SPECFUNC.2.2.5 HEIGHT DISABLE | PART 3; SPECIAL FUNCTIONS-6 |
| Power-up Self Diagnostics | SETUP&CONFIG.3 POWER UP DIAGNOSTICS | PART 7; SETUP AND CONFIG-3 |
| ASCII CODES | ASCII CODES | PART 7; SETUP AND CONFIG-35 |

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| | | |
|-----------------------------------|--|-----------------------------|
| Encoder operation | SETUP&CONFIG.4.4.19 V54-XCNTR | PART 7; SETUP AND CONFIG-60 |
| Displaying of Variables Test Tool | SETUP&CONFIG.4.4 SYSTEM VARIABLE DISPLAY | PART 7; SETUP AND CONFIG-55 |
| Speed problems | SETUP&CONFIG.4.4.1 V01-X DRIVE | PART 7; SETUP AND CONFIG-55 |
| Distance problems | SETUP&CONFIG.4.4.5 V05-X ERROR | PART 7; SETUP AND CONFIG-56 |
| | SETUP&CONFIG2.0.0.0.0.1 V15-Y ERROR | PART 7; SETUP AND CONFIG-58 |
| | SETUP&CONFIG.4.4.15 V20-RADERR | PART 7; SETUP AND CONFIG-58 |
| Memory Display Utilities | SETUP&CONFIG.4.5 MEMORY DISPLAY UTILITIES | PART 7; SETUP AND CONFIG-60 |
| Debugging Aid for RS-232 line | SETUP&CONFIG.4.5.11 SERV78-LOOP BACK | PART 7; SETUP AND CONFIG-73 |

INSTALLATION.3

REPAIR OF THE BURNY™ 2.5RS

WARNING

When considering any type of disassembly, please note:

HIGH VOLTAGES ARE PRESENT IN BURNY™ SYSTEMS THAT CAN INJURE AND KILL.

ONLY QUALIFIED PERSONS SHOULD OPEN OR DISASSEMBLE ANY PART OF THE BURNY™ SYSTEM.

TURN OFF AND RED TAG ALL POWER SOURCES DURING SERVICE.

BE CERTAIN THAT UNAWARE PERSONS DO NOT TURN ON THE POWER DURING SERVICE.

USE A VOLTMETER TO BE CERTAIN THAT ALL POWER SOURCES HAVE BEEN TURNED OFF.

IMPORTANT

To avoid loss of programs, read the section of this manual entitled "Backup of Programs Stored in Burny™ Controls"

Generally, components for the **2.5RS** system are not repairable by the user. In the case of malfunction of the system, Burny™ service personnel shall be consulted to assist in isolating the component(s) causing the problem. If a component has sustained damage, the involved assembly is usually returned to the factory and a replacement assembly shipped to the user.

Service must be performed only by trained, authorized personnel. A special grounded wristband must be used when removing or installing EPROMS. All circuit cards must be shipped in special static protective packaging. Any card or part removed from a Burny™ product should be immediately placed in a static dissipative bag. Warranty replacement, repair, or credit will not be issued on circuit cards returned without the proper antistatic packaging. Contact Burny™ for specifications or help with any packaging.

SERVICE3.1 FAULT FINDING AND TROUBLESHOOTING

If a suspected malfunction is observed, refer to the proper section of this manual to verify the observed problem is a malfunction.

The user is cautioned concerning activities directed toward finding components that are malfunctioning. Without current schematics, diagnostic equipment and training, field engineers run the risk of damaging more components than were initially damaged. This could extend down-time and repair expense. Always contact Burny™ Service when damage has occurred, in order to prevent further electrical damage. Burny™ service personnel can often assist via telephone concerning the advisability of swapping parts that are already on site. Avoidance of damage to the swapped-in part is a consideration here.

The on-site person can be most valuable in diagnosing problems:

- * Being familiar with equipment and user manual.
- * Knowing conditions and events before a failure.
- * Being familiar with normal operation.
- * Observing and reporting damage accurately

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SERVICE 3.2

SPARE PARTS

Contact Burny™ Service to obtain needed parts. Always use replacement parts that are supplied, designed, or approved by Burny™.

Some users choose to keep various parts on-site in case of a sudden need. Spare parts for this purpose are not supplied with purchased equipment. However, replacement parts may be purchased from Burny™ for this purpose. Burny™ service personnel can give advice as to which replacement parts are best to have on hand.

SERVICE 4

SPECIAL TOOLS

Special tools are not required for installation and maintenance of the **2.5RS**. In the unusual event that a user is to construct or repair a Burny™ supplied cable, proper crimping and extraction tools will be specified by Burny™.

SERVICE 5

BACKUP OF PROGRAMS AND TABLES STORED IN BURNY™ CONTROLS

The **2.5RS** has a battery system which maintains power to the memory even when the AC power to the unit is removed. This keeps the programs stored in memory from being erased when the power is turned off. While this battery system is very reliable, there are still cases where something causes the stored programs to be lost. Sometimes it can be a failure of a component, or it can be an outside event, such as a lightning strike, or even dropping a plate on top of the control. There are also cases where a new version of software requires the memory to be erased and all programs re-loaded.

Regardless of the cause, there are cases where all the programs stored in memory are lost. **FOR THIS REASON, ANY IMPORTANT PROGRAMS SHOULD ALWAYS HAVE A BACKUP COPY STORED AWAY FROM THE 2.5RS CONTROL.** This way, after the damage has been repaired, or the defective component replaced, the important programs can be re-loaded from the Back-up copy.

It is important that the backup copy is stored **AWAY** from the **2.5RS** since in the case of a dropped plate, or lightning strike, the backup copy may be damaged along with the control.

Custom Auxiliary codes are saved by the battery backup system in the **2.5RS**. See the section in this manual concerning SERV70-CUSTOM AUX. These code tables cannot be backed up by floppy disk or RS232 from the **2.5RS**, as are the user programs in the paragraphs below. The original documentation for the Auxiliary Code Translation Tables should be retained to guard against the loss of battery backup or physical damage to the **2.5RS**. If the original documentation has not been retained, the files can be copied by hand from the **2.5RS** screen. (See the section SERV70-custom AUX.)

If programs are already stored on a host computer, make sure there are back-up copies of the computer data since a problem there (such as a hard disk crash) could cause the loss of program information. If the programs are only stored inside the **2.5RS**, the RS232 port on the control can be used to store the programs to one of several sources. If the unit is equipped with an internal floppy disk, all important programs should be copied to a floppy disk which is then removed from the unit (a second floppy disk containing the same information is advised also). If there is no internal floppy, the RS232 port can be used to send the programs out to a host computer. This requires software in the host computer that is capable of accepting the programs from the **2.5RS** and storing them to a disk file. After the programs are sent to the computer, Back-up copies of the computer programs should be made and stored AWAY from the computer.

Finally, there are portable floppy disk systems available which can accept programs from the **2.5RS** RS232 port and store them directly to a floppy disk. Again, more than one copy is advised.

IT IS THE CUSTOMER'S RESPONSIBILITY TO MAINTAIN BACKUP COPIES OF ALL IMPORTANT PROGRAMS AND TABLES. ALL PROGRAMS MUST BE BACKED UP BEFORE ANY SERVICE WORK (OR NEW SOFTWARE UPDATE) IS DONE TO THE CONTROL. THIS WILL PREVENT ANY LOSS OF PROGRAM INFORMATION.

SERVICE.6 REPLACING THE BURNY™ 2.5RS MEMORY BATTERY

The battery should be replaced every five years to ensure proper operation of the battery backup system. A replacement battery can be obtained from Burny™.

To replace the battery:

1. Ensure that all files and tables are backed up, as in the section of this manual "Backup of Programs and Tables Stored in Burny™ Controls."
2. Disconnect the unit from all cables and wires, keeping notes as to the proper method of reconnecting the cables and wires.
3. Open the **2.5RS** by removing the screws visible on the front panel.
4. The circuit boards mounted to the front panel should be removed from their standoffs.
5. The liquid crystal display should be carefully pried from its socket(s.) The prying operation

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should be performed bit by bit, and the display kept nearly parallel with the circuit board at all times. This will ensure that the display's machined connector pins do not shear. Additionally, the display will be more easily reinstalled if the pins are not bent.

6. The glue that is holding the battery in place should be cut with a hot scalpel.
7. The new battery can now be desoldered and the remaining solder removed from the holes in the circuit board.
8. It is important that the insulator found under the battery is reinstalled under the new battery.
9. The battery should be soldered and heat glue applied.
10. If a visual inspection indicates that the battery and insulator are in proper position, the display can be reinstalled.
11. The display should be inspected for bent pins, which should gently be straightened. Gently place the display back on its socket(s.) Ensure that each of the pins are perfectly positioned above each socket before starting to seat the display. After just starting the insertion, pause to check for pins that are bending instead of penetrating the sockets. If all of the pins can be observed as having started insertion into their sockets, then the display can be pushed into the fully seated position.
12. The circuit boards and chassis should be reassembled in reverse order of the disassembly process.
13. The front panel screws should all be installed and tightened, for good electromagnetic compatibility.
14. Reconnect the **2.5RS** to the cables and wires external to the **2.5RS**.
15. Programs and files should be reloaded into the machine.
16. The system should be tested to ascertain that performance limits important to the user are achievable. The "List Of Diagnostics and Tests Of The **2.5RS**" section of this manual contains information for diagnostics, as well as table and file checking.

SERVICE.7**BEFORE CALLING BURNY™**

Before a telephone call is made to BURNY™ for any type of assistance it is important that the **SOFTWARE SERIAL NUMBER** and **SOFTWARE VERSION DATE CODE** is known. DISPLAY MODE 80 displays this information.

DSPY 80- CONFIGURE is a display mode which displays the system Serial Number, Software Version, and the amount of memory installed in the unit. Pressing the "ENTER" key jumps to a list of all the available options for the system with an 'ON' or 'OFF' displayed next to the option name indicating whether it has been enabled in the unit or not.

When first selected, the display continuously scrolls through the following:

"SERIAL xxxxxxxxx" -Serial Number
VERSION mm/yy/dd" -Software Version
HDW TYPE -10 " -Hardware version number

___K INSTALLED " -Amount of memory

Pressing the "ENTER" key first shows "OPTIONS ON/OFF" and then switches to a list of all the available options for the system, along with an "ON/OFF" indication next to the name showing whether the option is enabled (turned ON) or not (OFF). Use the "ENTER" or the Scroll keys to sequence through the list.

***** IMPORTANT *****

Before calling regarding a service or operation problem, use DSPY-80 and write down the **SOFTWARE SERIAL NUMBER**, and **SOFTWARE VERSION NUMBER** displayed on the readout. This will aid the service personnel in determining the type of system, and the software installed. NOTE- The serial number must be the one displayed on the readout, not the one found on a label somewhere on the enclosure.

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PART 7 SYSTEM SETUP AND CONFIGURATION

SYSTEM SETUP AND CONFIGURATION

This section describes the various "SERVICE MODE" displays and adjustment procedures for the **2.5RS**. The displays show various machine conditions and can be helpful in diagnosing a problem. In addition, the "SERVICE MODE" permits adjustment of the operating characteristics of the control in order to tailor it to a specific machine. Once the operation has been adjusted for optimum performance, the parameters are stored in a non-volatile memory. This insures that the operation of the control remains consistent and is not affected by power failures.

NOTE

This section describes certain parameters that are common to only one type of cutting, such as BLEEDOFF time, which is used in oxy/fuel cutting or ARC DELAY which is for plasma cutting. These may or may not be used on all cutting machines depending on the type of cutting tools installed. Explanations are given for the majority of possible cutting tool configurations.

SETUP&CONFIG.1 SERVICE MODE KEY

Throughout this section, there are references to the "SERVICE" key. This key is not labeled on the operators panel since there is no need for it during normal operation. On the **2.5RS** the "SERVICE" key is located approximately 3 inches from the right side of the panel and 1.5 inches from the top of the panel. See the next page for illustrations showing the hidden location of this key on the new and old style front panels.

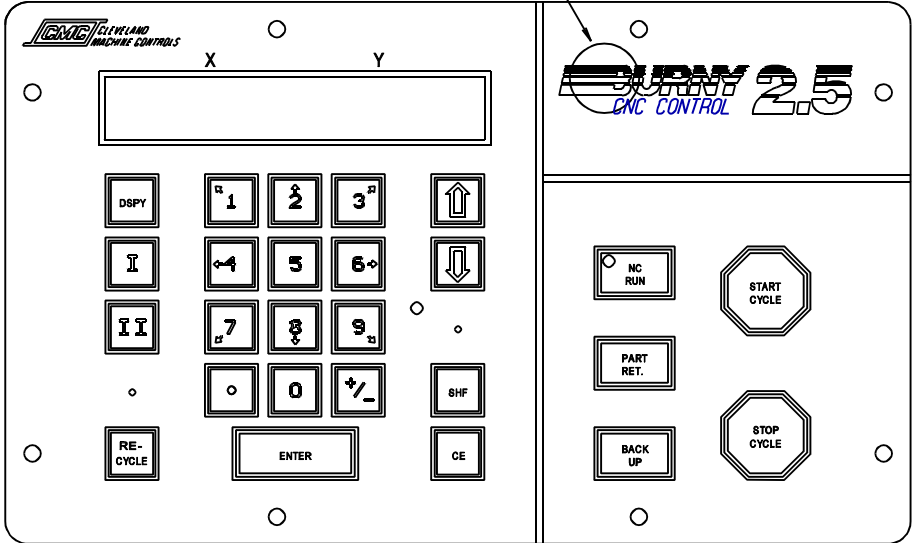
This key may be pressed at any time, during any operation to enter the "SERVICE" mode main menu. When the desired service function is complete, press the "SERVICE" key and "SERV00-EXIT" to exit the service mode and return to the previous operation.

SETUP&CONFIG.2 DISPLAY FUNCTIONS

Most of the "DISPLAY MODE" functions are described in the main operators manual. However, several of the displays are not used during normal operation and so are not covered in the "DISPLAY MODE" section. Most of the display functions are also available by pressing the "SERVICE" key. The difference is that, if a "DISPLAY" function is selected, by pressing the "DSPY" key the values can be displayed but not changed. If the same function is selected as a "SERVICE" function by pressing the SERVICE key the values are also displayed, but may be altered by entering the desired values. Some of the service functions are not available through the DISPLAY key.

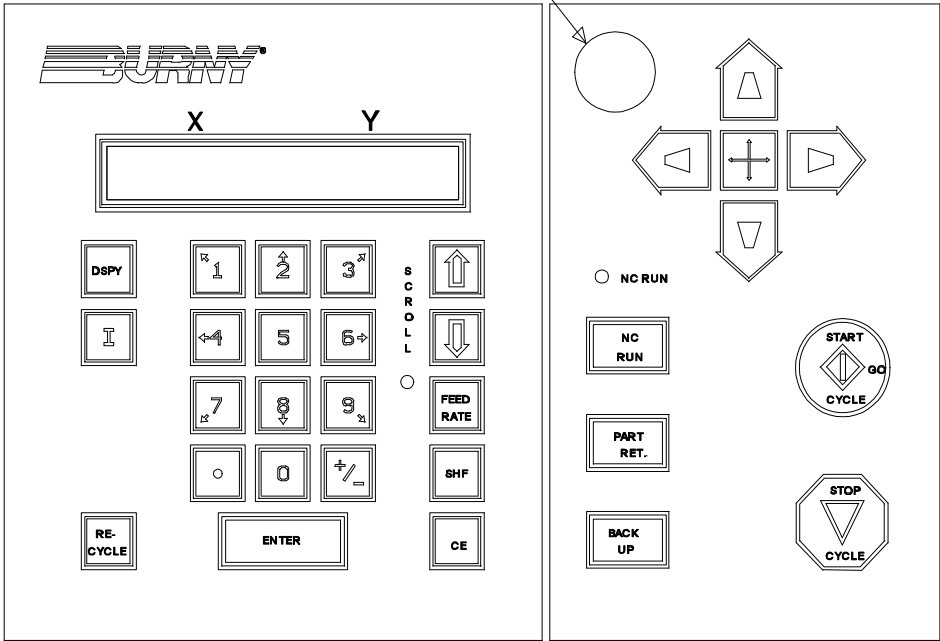
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SERVICE MODE KEY LOCATED HERE



OLD STYLE FRONT PANEL

Service Mode Key located here



NEW STYLE FRONT PANEL

SETUP&CONFIG.3

POWER UP DIAGNOSTICS

When the 2.5RS is first turned on, it automatically performs several diagnostic checks. These are indicated on the readout as they are being performed. Normally it should continue to sequence through the various tests and then automatically start normal operation. If a problem is detected, the testing stops and an error message is displayed. In most cases, this indicates a problem with the actual circuitry and should be reported to the Burny™ service department for information on repair or replacement.

The final test before normal operation begins is a check of the keyboard to detect any shorted keys. Since no keys are supposed to be pressed during the power up sequence, the test routine checks that all keys are open and then allows normal operation to begin. If a shorted key is found, an error message is displayed showing which key is shorted from the following table.

| "XX" KEY NAME | "XX" KEY NAME | "XX" KEY NAME |
|------------------|------------------|---------------------|
| 00 -- Number 0 | 40 -- "DSPY" | 85 -- "NC RUN" |
| 01 -- Number 1 | 41 -- Service | 86 -- "START CYCLE" |
| 02 -- Number 2 | 46 -- "I" | 87 -- "STOP CYCLE" |
| 03 -- Number 3 | | 88 -- "BACKUP" |
| 04 -- Number 4 | | 89 -- "PART RET" |
| 05 -- Number 5 | 60 -- "II" (Jog) | 8A -- Scroll UP |
| 06 -- Number 6 | | 8B -- Scroll DOWN |
| 07 -- Number 7 | 66 -- "SHIFT" | |
| 08 -- Number 8 | | 8D -- Mesg. Index |
| 09 -- Number 9 | | 8E -- RECYCLE |
| 10 -- "+/-" | | |
| 11 -- "." | | |
| 12 -- "ENTER" | | |
| 13 -- "CE" "CLR" | | |

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SETUP&CONFIG.4 SERVICE AND DISPLAY MODES

The "SERVICE" key may be pressed at any time, during any operation to access the service FUNCTION MENU. When it is pressed, the readout displays "SERV00- EXIT MODE". The operator should select the desired service function from the following list by either scrolling to the number or by entering the service function number directly. Once the correct value is displayed, press the "ENTER" key to access the function.

NOTE

Since the "DISPLAY" mode accesses many of the same functions as the Service mode, the following menu also displays the various "DISPLAY" functions. These are accessed by pressing the "DSPY" key at any time, and then selecting the desired display function.

SETUP&CONFIG4.1 SERVICE AND DISPLAY MODE MENUS

SERVICE MODES IN THE 2.5RS

| | |
|---------------------------|---------------------------|
| SERV00- EXIT MODE | SERV50- AXIS SPEEDS |
| SERV01- X/Y DISPLAY | SERV51- SPEED CALIBRATION |
| SERV02- PARTS CUT | SERV52- MEMORY RESET |
| SERV03- FEEDRATE | SERV54- REFERENCE ADJUST |
| SERV05- SYSTEM STATUS | |
| SERV10- SYSTEM DATA SETUP | |
| SERV11- DISPLAY VARIABLES | SERV70- CUSTOM AUX CODES |
| | |
| SERV30- SHOW WORD | SERV78- LOOP BACK TEST |
| SERV31- SHOW DOUBLE WORD | |
| SERV32- SHOW CRU WORD | SERV80- CONFIGURE |
| SERV33- SHOW BYTE | |
| SERV34- SHOW CRU BYTE | |
| | |
| SERV40- CURRENT TABLE | |
| SERV41- TABLE 1 DATA | SERV97- VARIABLE STORE |
| SERV42- TABLE 2 DATA | SERV98- SYSTEM RESET |
| SERV43- TABLE 3 DATA | |
| SERV44- TABLE 4 DATA | |

SETUP&CONFIG4.1.1 SERV00, DSPY00 - EXIT MODE

This selection is used to exit the SERVICE and DISPLAY modes and return to normal operation.

NOTE

If Service or Display mode is used while a part is actually running, the "EXIT MODE" must be used to return to the normal operation before the cutting mode (AUTO/TEST/MANUAL) can be changed.

SETUP&CONFIG4.1.2 SERV01, DSPY01 - X/Y DISPLAY

Displays THE CURRENT X/Y axis positions. If used while a part is running, the dimensions reflect the distances from the initial start position. At other times, the readouts can be cleared and used for X/Y measuring. See section "DISPLAY MODES" for further details.

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SETUP&CONFIG4.1.3 SERV02, DSPY02 - PARTS CUT

When running a program this display shows the number of part cycles performed. Multiply by the number of torches for the actual number of parts cut.

SETUP&CONFIG4.1.4 SERV03, DSPY03 - FEEDRATE

Shows the current setting of the operators speed dial. For correct operation, this number must be within 5% of the actual machine speed. If it is significantly different, the operation becomes erratic. (See SERV54 for calibrating feedrate input.)

If the digital feedrate feature is enabled, (see SD62-SYSCFG2) selecting DSPY03 first displays the current FEEDRATE setting and then allows the digitally controlled feedrate to be varied. The SCROLL arrows can be used to increase or decrease the FEEDRATE at a smooth rate, or the desired FEEDRATE can be entered directly on the keyboard. When the "ENTER" key is pressed, the new feedrate takes effect. NOTE- If the feedrate is lowered, the displayed value ramps down to the new value. Wait until the display has reached the entered feedrate value before exiting the DSPY03 mode-- the feedrate does not continue to ramp down if the display is canceled.

NOTE

If the unit is equipped with a HI/LO/OFF speed selector switch, it should be set to the closest range for the desired cutting speed. The digital displayed feedrate cannot be set above the value set by the HI/LO/OFF selector switch. Therefore, if the switch is set to OFF, the displayed feedrate shows 0.00 and cannot be raised. If the selector is set on LO, the displayed feedrate can only be raised as high as the maximum of the LO range. Setting the switch to HI allows control over the entire speed range--however, better performance is achieved at slower cutting speeds if the selector is first set to LO and then the digital feedrate set to the desired value.

SETUP&CONFIG4.1.5 SERV05 - SYS. STATUS

This function gives the status of the system. If a program is running the display will show the program number of the part being cut.

SETUP&CONFIG4.1.6 SERV10, DSPY10 - SYS DATA

This function is the most important service mode. It allows the various operating parameters to be changed and thus allows the control operation to optimized for a particular machine.

This "SERVICE/DISPLAY" function accesses a second menu of all the adjustable parameters in the system. These parameters are used to control the dynamic characteristics of the system and

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also to configure the **2.5RS** to match the particular cutting machine and interface wiring.

If this function is selected through the "DISPLAY" mode, the system parameters may be displayed but not altered. Only by using the "SERVICE" key can these values be displayed and entered.

Once this mode is selected, the display changes to "SD00- EXIT MODE" which is the first parameter in the list. Select the desired parameter by scrolling or by directly entering the 2 digit number of the particular parameter. Once the correct entry is displayed, press the "ENTER" key. This causes the current value for that parameter to be displayed.

If the value is correct, press the "ENTER" key to step to the next parameter in the menu. If the value needs to be changed, enter the desired value using the numeric keypad, decimal point, and "CLR" OR "CE" keys. Press the "ENTER" key when the value is correct. Press the "ENTER" key a second time to step to the next parameter in the menu.

NOTE

Some of the parameters do not show their effect on the machines performance until the "ENTER" key is pressed the second time and the menu has been stepped to the next parameter.

If the parameter requires a choice between two alternatives, pressing the "+/-" key switches between the two choices.

Examples: Left/Right Norm/Rev Yes/No

SETUP&CONFIG4.2 SYSTEM DATA PARAMETERS MENU:

SD00- NOT USED
SD01- ARC ON PURGE DELAY
SD02- BLEEDOFF TIME
*SD03- ACCEL TIME
SD04- MAX DRIVE SPEED
SD06- BACKUP SPEED
*SD07- CORNER SPEED
SD08- MIN HOLD SPEED
SD09- ERROR SPEED MAXIMUM
*SD10- RUN SPEED LIMIT
SD11- TRAVERSE SPEED LIMIT
*SD12- MIN ACCEL
*SD14- GAIN BREAK
SD15- ERROR WARNING DISTANCE
*SD16- LOOP GAIN

SD17- ARC OFF DELAY

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- *SD18- SLOWDOWN DISTANCE
- *SD19- HEIGHT SENSOR DISABLE LOOKAHEAD
- SD20- X ENCODER DISTANCE/REV
- SD21- Y ENCODER DISTANCE/REV
- SD22- ENCODER LINES/REV
- SD23- X ENCODER DIRECTION
- SD24- Y ENCODER DIRECTION
- SD25- X DRIVE DIRECTION
- SD26- Y DRIVE DIRECTION
- SD27- PLATE SIDE
- SD28- HEIGHT SENSOR RELAY
- *SD29- SLOWDOWN RADIUS
- *SD30- MINIMUM RADIUS SPEED
- SD31- PLASMA TABLE #1
- *SD32- MIN SLW ANG
- *SD33- MAX SLW ANG

- SD40- X MARKER OFFSET
- SD41- Y MARKER OFFSET
- SD42- MARKER SPEED (Not used in this control)
- SD43- MARKER DELAY (Not used in this control)

- *SD45- DEFAULT DWELL
- *SD46- MINIMUM OFF DELAY
- SD47- X MARKER OFFSET #2
- SD48- Y MARKER OFFSET #2
- *SD49- START DELAY
- SD50- SERIAL DEFINITION
- SD51- PROGRAM FORMAT
- SD52- SPECIAL END-OF-PGM
- SD53- FILE EXTENSION
- SD60- OPERATING SYSTEM
- SD61- SYSTEM CONFIGURATION
- SD62- SYSTEM CONFIGURATION #2
- SD63- SYSTEM CONFIGURATION #3
- SD68- SPEED RANGE
- SD69- ALTERNATE LANGUAGE SELECTION
- SD70- KNIFE DIAMETER
- SD71- KNIFE BP ANGLE

- SD74- X OFFSET TABLE 1 TO TABLE 2 HOME POSITION
- SD75- Y OFFSET TABLE 1 TO TABLE 2 HOME POSITION

- SD76- X OFFSET TABLE 1 TO TABLE 3 HOME POSITION

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SD77- Y OFFSET TABLE 1 TO TABLE 3 HOME POSITION

SD78- X OFFSET TABLE 1 TO TABLE 4 HOME POSITION

SD79- Y OFFSET TABLE 1 TO TABLE 4 HOME POSITION

SD80- X OFFSET #1

SD81- Y OFFSET #1

SD82- X OFFSET #2

SD83- Y OFFSET #2

SD84- X OFFSET #3

SD85- Y OFFSET #3

SD86- X OFFSET #4

SD87- Y OFFSET #4

SD88- X OFFSET #5

SD98- Y OFFSET #5

SD90- X OFFSET #6

SD91- Y OFFSET #6

SD92- X OFFSET #7

SD93- Y OFFSET #7

SD94- X OFFSET #8

SD95- Y OFFSET #8

SD96- X OFFSET FROM TABLE 1 TO X HOME LIMIT SWITCH POSITION.

SD97- Y OFFSET FROM TABLE 1 TO Y HOME LIMIT SWITCH POSITION.

SDA0- X BACKLASH

SDA1- Y BACKLASH

SDA2- LASH RATE

ALL variables marked with "*" are also in the overlay tables. See Detailed Menu for further information.

*** IMPORTANT ***

All values in parenthesis (), appear in the display but have no function in this control.

In the display of each menu item, below each parameter label is the unit of measure for that value. All times are entered in "SECONDS". Any distance or speed values are entered in the units selected by the "OPERATING SYSTEM" parameter "SD60". If an "INCH" system is selected, the units are "INCHES" and "INCHES PER MINUTE" (ipm). If a "METRIC" system is selected, the units are "MILLIMETERS" and "MILLIMETERS PER MINUTE" (MPM). For this reason, if a new system is being setup, "SD60" and "SD68- SPEED RANGE" should be set first so that the other values which are affected by the INCH/METRIC switch and speed are correct.

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SETUP&CONFIG4.2.1 SD01-ARC ON DELAY **(seconds)**

This time value is only used when the PLASMA CUTTING operation is selected. It delays the start of motion on a plasma cut after the "ARC ON" input has been received. For Plasma Systems with Current Sensing Relay outputs, this value is normally set to 0.00, causing the machine to begin moving as soon as the arc transfers to the plate.

For Plasma Systems without the CSR output, this timer can be used to delay machine motion for approximately the same time as the purge cycle at the beginning of a plasma cut. Thus the machine holds position until the timer reaches 0 and then begins along the cut path.

If a machine uses OXY FUEL cutting only, this parameter should be set to 0.

SETUP&CONFIG4.2.2 SD02-BLEEDOFF TIME **(seconds)**

This time value is used with OXY/FUEL CUTTING. When the cutting oxygen is turned off at the end of a cut, the machine holds position for the specified time to allow the oxygen to "BLEED OFF" before moving to the next cut.

If a machine uses PLASMA cutting only, this parameter should be set to 0.

SETUP&CONFIG4.2.3 SD03-ACCEL TIME **(seconds, multiple parameter)**

This value sets the acceleration time, for the machine to go from 0 to full speed. The value should be set as low as possible to minimize the delay which occurs when the machine negotiates a corner. However it should not be set so low that an abrupt "JUMP" occurs after each corner. (Normally .2 to 1.0 SEC)

SETUP&CONFIG4.2.4 SD04-MAXIMUM DRIVE SPEED **(ipm/MPM)**

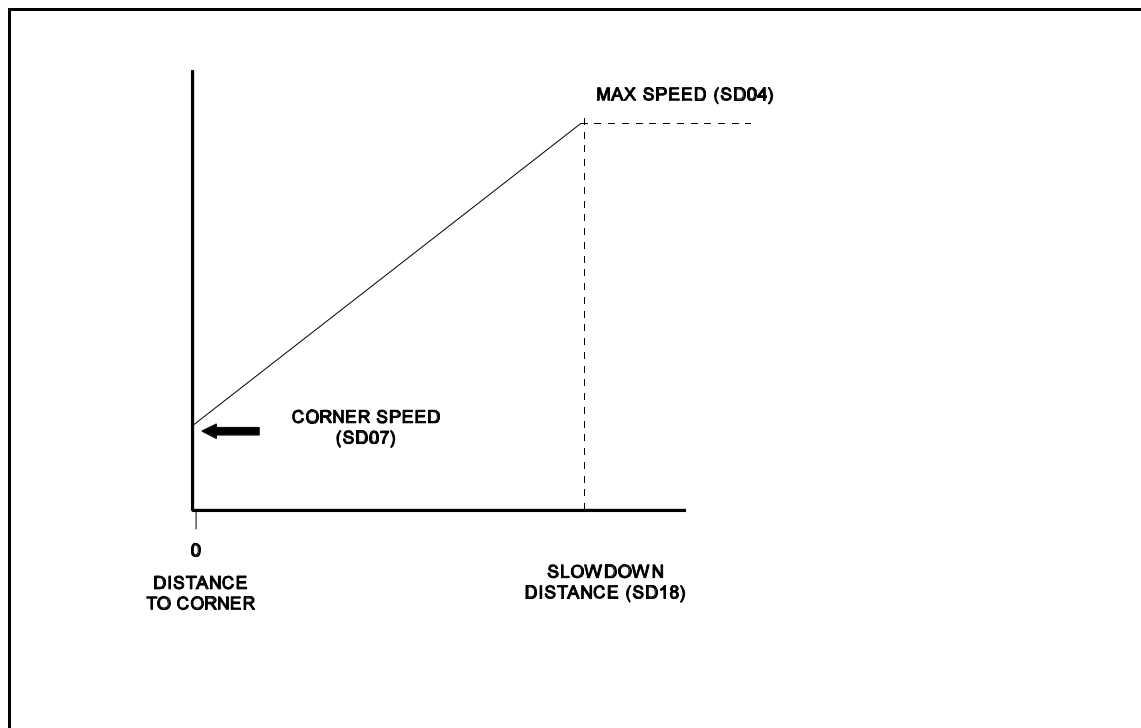
This value must be set to the MAXIMUM DRIVE SPEED of the machine at full reference. This value is used in many of the position loop gain and slowdown calculations and if not set correctly, can seriously affect machine performance. This value must be set to the capability of the drive system, not the desired maximum speed. The maximum speed value cannot exceed the speed range selected by parameter "SD68-SPEED RANGE". Consult the machine operation manual for the maximum machine speed. To LIMIT THE SPEED, see "SD10 AND SD11"

SETUP&CONFIG4.2.5**SD06-BACKUP SPEED****(ipm/MPM)**

This value sets the speed of the machine, when the "BACKUP" key is pressed. This is the maximum speed when backing up, however, the speed can be set slower by lowering the operators speed dial. There is no accel-decel when backing-up, therefore this speed should be set to a low enough speed that the machine can backup around a corner without excessive stress (bumping) in the gearbox or drive system. Consult the drive and machine operation manuals for the maximum drive and machine speeds.

SETUP&CONFIG4.2.6**SD07-CORNER SPEED****(ipm/MPM, multiple parameter)**

This value, along with parameter "SD18" control the deceleration ramp used to "SLOWDOWN" before a corner. The slope of this ramp is constant regardless of the travel speed as illustrated:



As can be seen from the graph, both the SLOWDOWN DISTANCE (PARAMETER -SD18) and the CORNER SPEED affect the DECELERATION RAMP. Both these values should be set to the minimum required to achieve acceptable corners on parts. This minimizes the time required to do the corner and therefore reduces the variation in the cut quality due to the change in cutting speed.

NOTE

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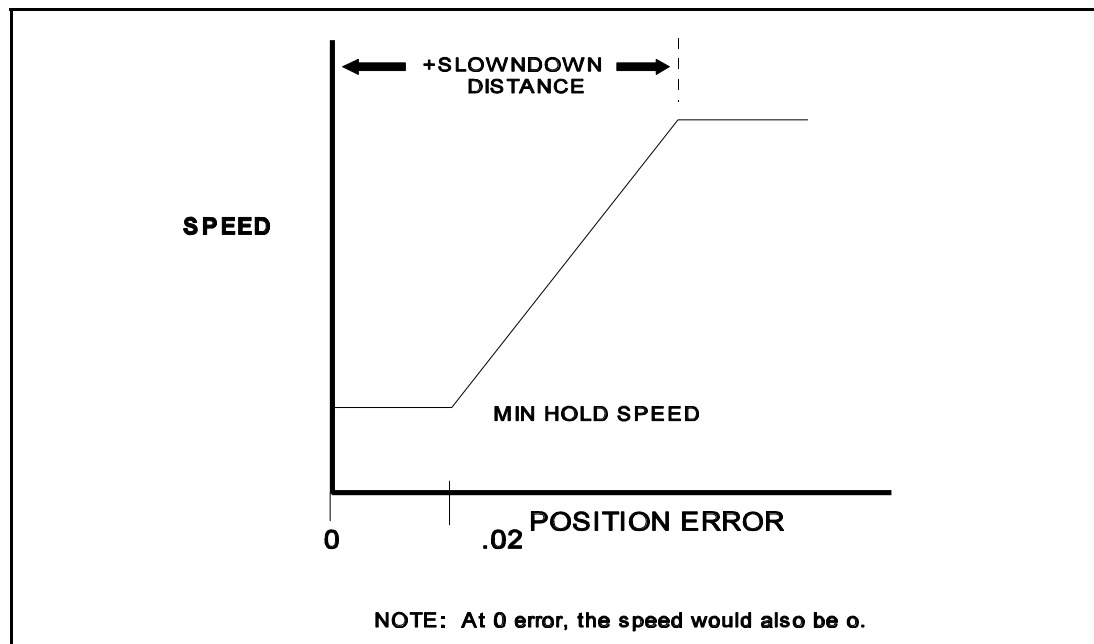
TO PREVENT STALLING IN CORNERS, DO NOT SET THE CORNER SPEED TO 0.00.

Typical Values: CORNER SPEED- 10 ipm/250mpm
 SLOWDOWN DIST- .75in/19mm

SETUP&CONFIG4.2.7 SD08-MINIMUM HOLD SPEED (ipm/MPM)

This speed value is used when the control is holding the machine in position. The speed entered for this parameter is used as a fixed "GAIN" value during the time the machine is within .02in/.5mm of the correct position. Within this distance the machine is moved at the "MIN HOLD SPD" toward the correct position. If the distance is greater than .02in, a normal linear proportional gain is used to move the machine back until it is again within this "HOLD" boundary. This fixed gain method actually provides a higher gain and therefore better position hold than could be achieved with a normal proportional gain loop.

The following graph illustrates position hold loop:



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SETUP&CONFIG4.2.8 SD09-ERROR SPEED MAXIMUM

(ipm/MPM)

This parameter is used to limit the MAXIMUM ERROR SPEED, which can be developed due to large position errors. This helps to prevent oscillation by limiting the "VIOLENCE" of the shaking that occurs in unstable systems (minimum speed 20 ipm/500 MPM). A good starting point for this value is to set it to one half of the maximum speed set in SD04-MAXIMUM DRIVE SPEED. Consult the drive and machine operation manual for the drive and machine maximum run speeds.

SETUP&CONFIG4.2.9 SD10-RUN SPD LIMIT

(ipm/MPM, multiple parameter)

This parameter and the next are used to limit the speed of the machine to something less than the maximum drive capability. Normally, it is not necessary to limit the speeds since the machine was designed to work with the drive system. However, some older machines cannot travel as fast as the drive capacity without literally shaking themselves apart. In these cases, the RUN SPEED and TRAVERSE SPEED LIMITS are used. The "RUN SPEED LIMIT" limits the maximum speed during cutting portions of the part program. The "TRAVERSE SPEED LIMIT" (SD11) limits the speed during non-cutting traverse moves.

If no limiting is required, set both the "RUN SPD LIMIT" and "TRAVERSE SPEED LIMIT" to the same speed as "MAX SPD" (SD04).

SETUP&CONFIG4.2.10 SD11-TRAVERSE SPEED LIMIT

(ipm/MPM)

This value acts the same as "RUN SPD LIMIT" (SD10). However, it limits the speed during non-cutting, fast traverse moves. See description for SD10- RUN SPEED LIMIT

SETUP&CONFIG4.2.11 SD12- MIN ACCEL

(Seconds)

This parameter specifies the minimum time which will be used for an acceleration from one speed to another. If the bit in SD62 is set to use Speed Dependent Accel time, the value entered for SD03-ACCEL TIME is used as the time for accelerating from 0 to Max Speed. If the control is operated at a lower feedrate, the acceleration time will be lowered proportionately. When the machine is operated at a very low speed, the acceleration time can get very short which doesn't work well on some machine frames. This parameter specifies a minimum acceleration time so that regardless of the feedrate affect on the accel time, the control will always use at least this minimum time amount.

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SETUP&CONFIG4.2.12 SD14-GAIN BREAK (encoder counts, multiple parameter)

This parameter may help to improve the cutting accuracy of a system by increasing the gain of the system for small position errors without increasing the overall gain of the systems and causing oscillation. The value entered specifies a fixed gain region on either side of the correct (zero error) path where the loop gain of the system is forced. It is entered as encoder counts, not inches or millimeters. Any path error within this region causes a correction to be generated as if it is already at the specified number of encoder counts. Errors outside this region are unaffected.

Example: If the system loop gain is set to 2.00 ipm/count.

| Error in encoder counts | Correction Speed with GAIN BRK-0 | Correction Speed with GAIN BRK-4 |
|----------------------------|-------------------------------------|-------------------------------------|
| 0 | 0.00 ipm | 0.00 ipm |
| 1 | 2.00 ipm | 8.00 ipm |
| 2 | 4.00 ipm | 8.00 ipm |
| 3 | 6.00 ipm | 8.00 ipm |
| 4* | 8.00 ipm | 8.00 ipm |
| 5* | 10.00 ipm | 10.00 ipm |

* After 4 counts, both results are the same with GAIN BRK set to 4.00.

SETUP&CONFIG4.2.13 SD15-ERROR WARNING DISTANCE (in/mm)

The **2.5RS** constantly monitors the PATH ERROR DISTANCE while running a part. The value entered in this parameter may be a positive or negative value. If a positive value is entered and the error exceeds the value set for this parameter, a WARNING MESSAGE is displayed and BEEPING OCCURS. This indicates that the machine is not responding to positioning commands and that the part being produced is out of tolerance.

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If a negative value is entered and the error exceeds the value set for this parameter, a CYCLE STOP in addition to the WARNING MESSAGE is displayed and BEEPING OCCURS. The display then flashes "WARNING PATH ERROR". This indicates that the machine is not responding to positioning commands and has stopped. The value should be large enough that the normal "BUMPS" and "SHAKES" associated with a cutting machine in a production shop do not cause "NUISANCE" tripping of the warning. It's main purpose is to issue a WARNING when something breaks or is jammed on the machine and causes a large offset from the correct path.

Typically set around .05in/1.25mm

SETUP&CONFIG4.2.14 SD16-LOOP GAIN **(multiple parameter)**

This value is the most critical of all the setup parameters in affecting the machines performance while cutting a part. The position loop constantly compares the position of the machine to the correct programmed path. Any difference (or PATH ERROR) is multiplied by the "LOOP GAIN" value. This result is then output to the drives which causes the machine to move back toward the correct path. This value should be set to as large a value as possible to give the most accurate part. However, if it is set too high, the machine becomes unstable and oscillates while moving around the part. Thus adjusting this value is a trial and error procedure. Too low a value causes some loss of accuracy in the part while too high a value causes unstable operation.

The units for "LOOP GAIN" are the same as those used for any of the other speed inputs, either Inches per Minute, or Millimeters per Minute. However, the value entered is the correction speed for a Path Error of approximately .0025in/.0625mm. If the Path Error is more than .0025in/.0625mm, the correction speed is the number of encoder counts of error multiplied by the Loop Gain.

Example: (Inch System) If LOOP GAIN- 2.00 and the Path error is 5
encoder counts (.0125in) the correction speed output to the drive
is (2.00 x 5) 10.0 ipm.

2.5RS OPERATION AND MAINTENANCE MANUAL

SETUP&CONFIG4.2.15 SD17-ARC OFF DELAY (seconds)

This time value, is only used during PLASMA CUTTING. During a PLASMA CUT, if the "ARC ON" input signal is removed, the **2.5RS** automatically issues a "CYCLE STOP" command which halts motion and waits for the operator to press the "CYCLE START" key before continuing. The "ARC OFF DELAY" time provides a delay before the ARC OFF condition is recognized. This permits the machine to keep moving if a part falls out before the cut is completed or if a previous cut path is crossed. If this timer were not provided, the control would stop as soon as the "ARC ON" signal is removed and could not complete the cut path. (Typically set 1-2 seconds.)

If only OXY-FUEL is used, set this value to 0.00.

SETUP&CONFIG4.2.16 SD18-SLOWDOWN DISTANCE (in/mm, multiple parameter)

This value sets the deceleration distance used when slowing for a corner in the part program. See the description in SD07 for an explanation of the SLOWDOWN PARAMETERS and their interaction.

SETUP AND CONFIGURATION

SETUP&CONFIG4.2.17 SD19-HEIGHT SENSOR DISABLE LOOKAHEAD (in/mm, multiple parameter)

This distance value is only used during PLASMA cutting operations. It affects the operation of the Plasma Height Sensor Disable Relay output from the control.

Normally, the relay energizes when the corner slowdown software reduces the speed of the machine before going around a corner. This parameter adds an additional condition for causing the Height Sensor Disable Relay to energize by setting a lookahead distance for disabling the height sensor before the end of cut, or before a Plasma Height Sensor Disable auxiliary function in the part program is executed. This is especially useful when the part program contains either a leadout, or a cross or intersection in the cutting path. Both of these conditions can cause the plasma torch to "dive" into the plate.

In the case of the leadout, many times the part being cut will fall out of the plate before the end of the leadout move. The plasma height sensor would detect the plate moving down and attempt to follow it, possibly causing the torch to crash into the plate.

In the other case, when the cut path either crosses, or even just touches a previous cut path, the torch can again dive into the plate. By setting this distance value to some nominal value (keep the value as small as possible), it can prevent these problems.

In the case of the leadout, by establishing a standard leadout length (for example, .25 inches), and setting SD19 to .40 inches, it would guarantee that the plasma height sensor would be disabled at least .15 inches before the leadout started, and so it can't follow the part falling out.

In the case of the cross or intersect of a previous cut, the part program must contain the appropriate Height Sensor Disable code (see programming section) at the point of intersection. SD19 would then disable the height sensor at the specified distance BEFORE the intersect point and prevent the torch from diving into the plate.

SETUP&CONFIG4.2.18 SD20-X ENC DIST/REV
SETUP&CONFIG4.2.19 SD21-Y ENC DIST/REV
SETUP&CONFIG4.2.20 SD22-ENC COUNTS/REV

The 'X' & 'Y' encoder distance per one revolution and the number of encoder counts per one revolution allow for various encoder/rack/pinion combinations to be used with the **2.5RS** control. The **2.5RS** has the ability to use a wide range of encoders.

The value entered in "SD20-X ENC DIST/REV" is the length of travel (in/mm) along the X axis per one revolution of the X axis encoder.

The value entered in "SD21-X ENC DIST/REV" is the length of travel (in/mm) along the Y axis per one revolution of the Y axis encoder.

2.5RS OPERATION AND MAINTENANCE MANUAL

Parameter "SD22-ENC COUNTS/REV" affects both the X and Y axis. The value entered is the number of quadrature encoder counts (lines) per one revolution of the encoder.

The **2.5RS** uses the distance per revolution and the counts per revolution parameters while the machine is moving to convert the encoder counts to total inches or millimeters of travel. See **SETUP&CONFIGURATION & SETUP:ENCODERS** for further information.

SETUP&CONFIG4.2.21 SD23-X ENCODER DIR

The quadrature encoders used for position feedback provide both direction and position information. Depending on the mounting of the X axis encoder, the direction information may or may not be correct. (This can be checked by using the SERV01- X/Y DISPLAY function.) If the direction needs to be reversed, press the +/- key which toggles the "NORM"/"REV" data to the opposite condition. This causes the X axis encoder to count in the correct direction.

SETUP&CONFIG4.2.22 SD24-Y ENCODER DIR

Y AXIS ENCODER REVERSING- See X axis descriptions (SD23).

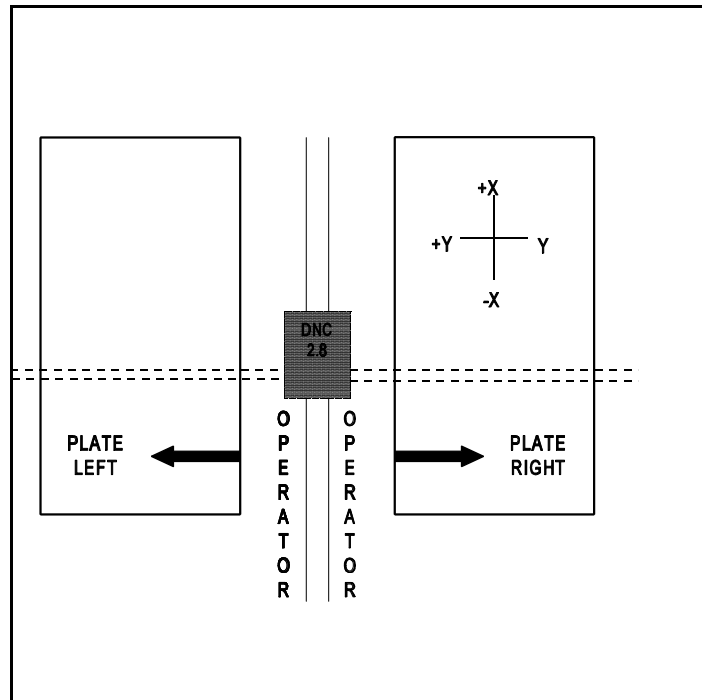
SETUP&CONFIG4.2.23 SD25-X DRIVE DIR

This parameter is used to reverse the polarity of the X axis drive output signal. Depending on the machine's drive electronics and the interface card in the **2.5RS**, the drive output signal for the X axis sometimes needs to be inverted so that the motion of the machine is correct. Use the jog keys to move the machine in the X axis and check that it moves in the correct direction. If not, use the +/- key to toggle the "NORM"/"REV" values. This reverses the polarity of the X drive output signal.

SETUP&CONFIG4.2.24 SD26-Y DRIVE DIRECTION

This parameter is used to reverse the polarity of Y axis drive output signal. See (SD25) for detailed description.

This parameter should be set to the position of the plate being cut with respect to the operators console (LEFT/RIGHT). This value is used by the STANDARD SHAPE routines and others to determine repeat movements and initial moves from the corner of the plate. All programs should start at THE CORNER OF THE PLATE NEAREST TO THE OPERATORS CONSOLE SINCE THIS GIVE THE BEST VIEW OF THE PLATE FOR ALIGNING THE TORCHES. To change the value, press the "+/-" key to toggle the "LEFT/RIGHT" indication.



Some systems have one of their output relays used as a PLASMA HEIGHT SENSOR disable relay. This relay's contacts are normally connected to the plasma system's HEIGHT CONTROL. When the **2.5RS** slows for a corner, this relay energizes, and causes the PLASMA HEIGHT SENSOR to "FREEZE" at the current height. Once the machine has re-accelerated, this relay turns off and allows the HEIGHT SENSOR to function normally. Depending on the PLASMA SYSTEM used, the contact must either CLOSE or OPEN in order to perform the disable function. If this parameter is set to "NORM", the output contact is normally "OPEN" and closes to disable the HEIGHT SENSOR. If set to "REV" the output contact is normally "CLOSED" and opens to disable the sensor. Use the +/- key to toggle the indicator to select the desired operation.

2.5RS OPERATION AND MAINTENANCE MANUAL

SETUP&CONFIG4.2.27 SD29-SLOWDOWN RADIUS (in/mm, multiple parameter)

The SLOWDOWN RADIUS parameter is used by the Accel/Decel routine to determine if a certain radius arc can be cut at the current machine speed or if the speed needs to be reduced due to a small radius. When an arc is cut, it's radius is compared to this parameter and causes a slowdown proportional to the ratio of the two radii. (Typically set to 2-3 inches/50-80 mm.)

SETUP&CONFIG4.2.28 SD30-MIN RAD SPD (in/mm, multiple parameter)

This speed value is used as the minimum cutting speed for small Radii, even if the corner speed is lower. In this way, the corner speed can be adjusted to give the best decel to a full corner without the small radii (such as the fill-in blocks created by kerf) running at an unacceptably slow rate. Normal values are probably between 10-30 ipm.

SETUP&CONFIG4.2.29 SD31-PLASMA TB1

SD31 prompts "PLASMA TB1" and is answered by a YES or NO response. If the NO response is entered, the control uses the standard SD10 setup parameters for both OXY-FUEL and PLASMA cuts. However, if SD31 is set to YES, and the control is set for PLASMA CUTTING, the parameters in Overlay Table #1 are used to control the machine. This allows the SD10 Table #0 parameters to be set for the best OXY-FUEL cutting, and the overlay SERV41 Table #1 parameters to be set for the best PLASMA cutting. This allows the overlay table to be used even though the part program does not contain any specific codes.

SETUP&CONFIG4.2.30**SD32-MIN SLW ANG
(degrees, multiple parameter)**

This parameter along with SD33-MAX SLW ANG define the angle range for the slowdown routine. When a part is run, the change in direction which occurs between data blocks is checked. If the direction of the programmed path changes by more than the SD33- MAX SLW ANG (Maximum slowdown angle) parameter, the machine performs a full corner slowdown at the intersection of the two blocks. Similarly, if the change in direction between two data blocks is less than the number of degrees specified by SD32- MIN SLW ANG (Minimum Slowdown Angle), the machine runs through the intersection with no slowdown at all. Changes in direction which are between the MIN and MAX values are scaled accordingly. Changes in direction which are close to the MIN value run almost at full speed and as the angle increases toward the MAX value, the machine slows down to a lower speed at the corner.

Typical Values:

SD32- MIN SLW ANG - 10 DEGREES

SD33- MAX SLW ANG - 22 DEGREES

SETUP&CONFIG4.2.31**SD33-MAX SLW ANG
(degrees, multiple parameter)**

This parameter sets the maximum boundary angle used by the corner slowdown routines. See SD32 for description.

2.5RS OPERATION AND MAINTENANCE MANUAL

SETUP&CONFIG4.2.32 SD40-X MARKER OFFSET #1 (in/mm)

Parameters (SD40,41,42,43 AND SD80-95) are used when the configuration of the **2.5RS** supports a Plate Marking device. Certain versions do not include a Plate Marking function-- in these cases, these parameters can be ignored. Parameters (SD40) and (SD41) should be set to the X/Y offset distance between the cutting torch and the Marking device. When a part requires marking, a "Marker Offset On" command is first used to shift the marking device to the X/Y position where the cutting torch was previously located. This allows the marking portion of the program to be dimensioned the same as the cutting moves without having to compensate for the distance between the marker and cutting torch. When the "Marker ON" command is issued, the control turns ON the Marking device. The control holds position for the time specified by the (SD43) parameter and then begins moving along the marking path. If the (SD42) Marking Speed parameter is set to 0.00, the operator can control the speed of the marker using the normal feedrate controls on the machine. If the (SD43) parameter is set to a speed other than 0.00, the marker moves at that speed automatically provided that the machine's feedrate control is set higher than the SD43 marking speed. If the feedrate control is set to a lower speed, it overrides the SD43 speed and runs at the lower value.

Parameters (SD80) - (SD95) are offsets that may be used on machines that have multiple PLASMA and OXY-FUEL torches on the same station. These additional offsets allow the marker on one torch to be used with another torch simply by programming the appropriate "T" field value.

NOTE

For a more detailed description see SD80 PROGRAMMABLE OFFSETS.

SETUP&CONFIG4.2.33 SD41-Y MARKER OFFSET #1 (in/mm)

Marker offset dimension in the Y axis. See (SD40) for description.

SETUP AND CONFIGURATION

SETUP&CONFIG4.2.34 SD42-MARKING SPEED (Not used in this control) (ipm/MPM)

Sets the speed to be used for both the plate marking device when the marker is turned ON. If this parameter is set to 0.00, the operator is able to set the marking speed manually using the normal feedrate controls on the machine.

SETUP&CONFIG4.2.35 SD43-MARKER DELAY (Not used in this control) (seconds)

This timer is used to delay the start of motion when the plate marking device is turned ON. This delay can be used to allow the marking head to be lowered into position. Also, it can be used to hold the machine in position for a center punching operation.

SETUP&CONFIG4.2.36 SD45-DEFAULT DWELL (seconds, multiple parameter)

This value sets the system default for the dwell time used when a "dwell" auxiliary code is included in a part program. This value is used unless the part program establishes a new dwell time.

SETUP&CONFIG4.2.37 SD46-MIN OFF DELAY (seconds, multiple parameter)

This delay time, causes a dwell after any control output is turned off. It operates on all outputs (Cutting oxygen, etc.) and is in addition to any specific "OFF" delays for a particular operation, such as the oxy/fuel BLEEDOFF TIME. (Typically 0 to 1 SEC)

SETUP&CONFIG4.2.38 SD47-X MARKER OFFSET #2 (in/mm)

Marker offset #2 dimension in the X axis. See (SD40) for description

SETUP&CONFIG4.2.39 SD48-Y MARKER OFFSET #2 (in/mm)

Marker offset #2 dimension in the Y axis. See (SD40) for description.

2.5RS OPERATION AND MAINTENANCE MANUAL

SETUP&CONFIG4.2.40 SD49-START DELAY (seconds, multiple parameter)

This timer is used to delay motion along the cut path when any of the tools on the machine are started or one of the stations lowered. For example, when the PLASMA TORCH IS ENABLED, this delay prevents the plasma arc from firing for the specified time which allows the station to reach its cutting position.

SETUP&CONFIG4.2.41 SD50-SERIAL DEFINITION

This parameter selects the various program and COMMUNICATION CHARACTERISTICS of the serial RS-232 port. The value is a 4 digit number, where each digit controls a specific function. If any digit is set to zero (0), the operator is prompted to make the selection when a serial operation is performed.

D1 sets up the communication protocol.

| | | | |
|----|----|----|----|
| D1 | D2 | D3 | D4 |
|----|----|----|----|

| D1 of SD50 Ö | 0 | 1 | 2 | 5 | 6 |
|---|---|---|---|---|---|
| The Operator is prompted for Protocol | X | | | | |
| RTS/CTS - HARDWARE PROTOCOL | | X | | | |
| XON/XOFF - SOFTWARE PROTOCOL | | | X | | |
| PTAPE 1 - Special SPOOLING TAPE READER PROTOCOL | | | | X | |
| CLINK 1 - Special Cad Comm Link | | | | | X |

NOTE: Any number not listed should not be used.

See Section "SERIAL COMMUNICATIONS" for more information.

PROGRAMMING LANGUAGE, SD50

| | | | |
|----|----|----|----|
| D1 | D2 | D3 | D4 |
|----|----|----|----|

| D2 of SD50 Ö | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|----------|----------|----------|----------|----------|----------|----------|----------|
| The Operator is prompted for program type | X | | | | | | | |
| WADR -Standard 2.5RS WORD ADDRESS | | X | | | | | | |
| ESSI -Standard 2.5RS ESSI | | | X | | | | | |
| INTL -Test Only- not for normal use | | | | X | | | | |
| WADR1 -Special WORD ADDRESS #1 | | | | | X | | | |
| WADR2 -Special WORD ADDRESS #2 | | | | | | X | | |
| WADR3 -Special WORD ADDRESS #3 | | | | | | | X | |
| ESSI1 -Special ESSI | | | | | | | | X |

NOTE: Any number not listed should not be used.

See Section "PROGRAMMING" for more information.

2.5RS OPERATION AND MAINTENANCE MANUAL

CHARACTER FORMAT SPECIFICATION, SD50

| | | | |
|----|----|----|----|
| D1 | D2 | D3 | D4 |
|----|----|----|----|

D3 selects the FORMAT SPECIFICATION.

| D2 of SD50 Ö | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|--|---|---|---|---|---|---|---|---|
| Operator Prompted for Character Format | X | | | | | | | |
| NP7D -ASCII- NO PARITY- 7 DATA BITS | | X | | | | | | |
| NP8D -ASCII- NO PARITY- 8 DATA BITS | | | X | | | | | |
| EP7D -ASCII- EVEN PARITY- 7 DATA BITS | | | | X | | | | |
| EP8D -ASCII- EVEN PARITY- 8 DATA BITS | | | | | X | | | |
| OP7D -ASCII ODD PARITY- 7 DATA BITS | | | | | | X | | |
| OP8D -ASCII- ODD PARITY- 8 DATA BITS | | | | | | | X | |
| EIA -EIA RS244 ODD PARITY FORMAT | | | | | | | | X |

SETUP AND CONFIGURATION

CHARACTER FORMAT SPECIFICATION, SD50

| | | | |
|----|----|----|----|
| D1 | D2 | D3 | D4 |
|----|----|----|----|

D4 selects the BAUD RATE.

| D4 of SD50 Ö | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D |
|---------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Operator Prompted | X | | | | | | | | | | | | | |
| 110 BAUD | | X | | | | | | | | | | | | |
| 300 BAUD | | | X | | | | | | | | | | | |
| 600 BAUD | | | | X | | | | | | | | | | |
| 1200 BAUD | | | | | X | | | | | | | | | |
| 2400 BAUD | | | | | | X | | | | | | | | |
| 4800 BAUD | | | | | | | X | | | | | | | |
| 9600 BAUD (See note 1.) | | | | | | | | X | | | | | | |
| 19.2 K BAUD (See note.2.) | | | | | | | | | X | | | | | |
| 28.8 K BAUD | | | | | | | | | | X | | | | |
| 38.4 K BAUD | | | | | | | | | | | X | | | |
| 57.6 K BAUD | | | | | | | | | | | | X | | |
| 115.2 K BAUD | | | | | | | | | | | | | X | |
| 230K BAUD | | | | | | | | | | | | | | X |

Note 1 (2.5RS): Baud rate of 9600 should only be used under perfect transmission conditions. If any trouble is experienced with transmission at 9600 Baud, a slower rate should be used until the trouble is diagnosed.

Note 2 (2.5Plus): Settings in the shaded area apply only to the 2.5 Plus. For now, 19.2 BAUD may be the setting for maximum transfer rate because faster settings could cause the control to spend more time starting and stopping the communication.

In the following sections, this manual explains numbers used to specify various characteristics of the **2.5RS**.

2.5RS OPERATION AND MAINTENANCE MANUAL

SETUP&CONFIG4.2.42

SD51-PRGM FORMAT

Each digit in this 8 digit number is used to select a particular option for the programming formats of RS-232 or paper tape loaded programs. The programming description described in section "PROGRAMMING" only describes the "STANDARD" format used by the **2.5RS**, not the various option possibilities. Most customers can use the standard "ESSI" or "WORD ADDRESS" formats as is and do not require the special features set by this variable. In these cases, set this variable to "00000000".

Press "SHF" then "0" to enter a value of "A"

Press "SHF" then "1" to enter a value of "B"

Press "SHF" then "2" to enter a value of "C"

Press "SHF" then "3" to enter a value of "D"

Press "SHF" then "4" to enter a value of "E"

Press "SHF" then "5" to enter a value of "F"

PROGRAM FORMAT, SD51

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 |
|----|----|----|----|----|----|----|----|

NOTE: For SD51, **D1-D2** are not used and should be set to 0.

PROGRAM FORMAT, SD51

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 |
|----|----|----|----|----|----|----|----|

| D3 of SD51 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BYPASS % SIGN REQUIREMENT ON WADR PROGRAMS | | X | | X | | X | | X | | X | | X | | X | | X |
| SUPRESS NUL OUTPUTS ON ESSI UPLOAD | | | X | X | | | X | X | | | X | X | | | X | X |
| DURING CLINK PROGRAM REQUEST, SEND FILE SPECIFIED BY SD53 | | | | | X | X | X | X | | | | | X | X | X | X |
| DISABLE COMMUNICATION ENHANCEMENT OPTION | | | | | | | | | X | X | X | X | X | X | X | X |

Here, 0 is the normal setting for most machines.

SETUP AND CONFIGURATION

PROGRAM FORMAT, SD51

The fourth digit, **D4**, affects all programs loaded by any "WADR3" or "ESSI1" format. It sets the default for a decimal shift of the value for programmable kerf and/or programmable feedrate.

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 |
|----|----|----|----|----|----|----|----|

| D4 of SD51 Ö | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|--------------------------|-----------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PROGRAMMABLE KERF | Not shifted | X | | | | X | | | | X | | | | X | | | |
| | Shifted left 1 place | | X | | | | X | | | | X | | | | | X | |
| | Shifted left 2 places | | | X | | | | X | | | | X | | | | | X |
| | Shifted left 3 places | | | | X | | | | X | | | | X | | | | |
| PROGRAMMABLE FEEDRATE | Not shifted | X | X | X | X | | | | | | | | | | | | |
| | Shifted left 1 place | | | | | X | X | X | X | | | | | | | | |
| | Shifted left 2 places | | | | | | | | | X | X | X | X | | | | |
| | Shifted left 3 places | | | | | | | | | | | | | | X | X | X |

2.5RS OPERATION AND MAINTENANCE MANUAL

PROGRAM FORMAT, SD51

The fifth digit **D5** only affects programs loaded using either the "WADR3" or "ESS11" special program formats. These special formats allow various conversions to be performed on the program being loaded to comply with the standard programming. Setting this digit to a "1" causes the "**CUSTOM AUX**" code tables described in the "SERV70" section of this manual to be used when the program is loaded. If the digit is set to "0" the normal aux codes as described in the programming section are used.

Implied Decimal Shift (IDS in the table below)-Allows the **2.5RS** to read tapes which are programmed with an implied decimal point in the 'X','Y','I','J' dimensions. Example: Some controls program a 2" dimension as X200. This would normally be interpreted as a 200 inch move. The Decimal Shift Function allows a 2 digit shift to the left to be added to the number so it is correctly loaded as 2.00 inches. Similarly some programs are loaded in 1/10 scale. A decimal shift right of 1 causes these programs to be cut correctly.

SETUP AND CONFIGURATION

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 |
|----|----|----|----|----|----|----|----|

| D5 of SD51 | | Ö | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|--|--------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Auxiliary Code Translation Table NOT enabled | IDS=not shifted | | X | | | | | | | | | | | | | | | |
| | IDS=left 1 place | | | X | | | | | | | | | | | | | | |
| | IDS=left 2 places | | | | | X | | | | | | | | | | | | |
| | IDS=left 3 places | | | | | | | X | | | | | | | | | | |
| | IDS=left 4 places | | | | | | | | X | | | | | | | | | |
| | IDS=right 1 place | | | | | | | | | | X | | | | | | | |
| | IDS=right 2 places | | | | | | | | | | | X | | | | | | |
| | IDS=right 3 places | | | | | | | | | | | | X | | | | | |
| Auxiliary Code Translation Table enabled | IDS=not shifted | | X | | | | | | | | | | | | | | | |
| | IDS=left 1 place | | | X | | | | | | | | | | | | | | |
| | IDS=left 2 places | | | | | X | | | | | | | | | | | | |
| | IDS=left 3 places | | | | | | | X | | | | | | | | | | |
| | IDS=left 4 places | | | | | | | | X | | | | | | | | | |
| | IDS=right 1 place | | | | | | | | | | X | | | | | | | |
| | IDS=right 2 places | | | | | | | | | | | X | | | | | | |
| | IDS=right 3 places | | | | | | | | | | | | X | | | | | |

PROGRAM FORMAT SD51

The sixth digit (**D6**) only affects programs loaded using "WADR3" or "ESSI1". This digit allows the axis definitions of the incoming program to be changed to match the standard X/Y axis definitions used by the **2.5RS**.

Forced Auxiliary Code Priority- In Word address programming, it is possible to include auxiliary functions (M and G codes) in the same block as an X/Y move, or an Arc. The **2.5RS** follows the RS-274 specifications which specifies certain functions should be executed before the movement while others are done after the movement programmed in the same block is complete. However, some other NC controls assume that all auxiliary functions are done before any movement when they are contained in the same block. So that these programs can be read without re-programming, the software has the ability to force all auxiliary codes to operate before the movement in the same block.

2.5RS OPERATION AND MAINTENANCE MANUAL

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 |
|----|----|----|----|----|----|----|----|

| D6 of SD51 Ö | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | E | D | F |
|---------------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Y INVERTED | | X | | X | | X | | X | | X | | X | | X | | X |
| X INVERTED | | | X | X | | | X | X | | | X | X | | | X | X |
| X AND Y AXES EXCHANGED | | | | | X | X | X | X | | | | | X | X | X | X |
| ALL AUX CODES FORCED TO HIGH PRIORITY | | | | | | | | | | X | X | X | X | X | X | X |

IF D6 IS EQUAL TO:

- 0-** +X--> +X +Y--> +Y (Standard)
- 1-** +X--> +X +Y--> -Y
- 2-** +X--> -X +Y--> +Y
- 3-** +X--> -X +Y--> -Y
- 4-** +X--> +Y +Y--> +X
- 5-** +X--> -Y +Y--> +X
- 6-** +X--> +Y +Y--> -X
- 7-** +X--> -Y +Y--> -X
- 8-** +X--> +X +Y--> +Y and all Aux Codes Forced to High Priority.
- 9-** +X--> +X +Y--> -Y and all Aux Codes Forced to High Priority.
- A-** +X--> -X +Y--> +Y and all Aux Codes Forced to High Priority.
- B-** +X--> -X +Y--> -Y and all Aux Codes Forced to High Priority.
- C-** +X--> +Y +Y--> +X and all Aux Codes Forced to High Priority.
- D-** +X--> -Y +Y--> +X and all Aux Codes Forced to High Priority.
- E-** +X--> +Y +Y--> -X and all Aux Codes Forced to High Priority.
- F-** +X--> -Y +Y--> -X and all Aux Codes Forced to High Priority.

SETUP AND CONFIGURATION

PROGRAM FORMAT SD51

Digit **D7** affects programs loaded under any of the "WADR" or "ESSI" program formats when they are programmed in "ABSOLUTE". Incremental programs are not affected. For absolute programs, this digit establishes how the I and J arc coordinates are defined. Setting this digit to an even number causes the I/J to be the same type as the X/Y dimensions. Therefore on absolute programs, the I/J also must be in absolute. Setting this digit to a odd number forces the I/J dimensions to be in incremental even if the program is in absolute. For incremental programs, the I/J is always incremental.

The third digit also selects whether or not the **2.5RS** should used the **SPECIAL END OF PROGRAM ASCII SEQUENCE** set in SD52. This affects programs loaded under WADR3 and ESSI1.

SD51 now has a bit defined which allows the end of program string function to be included on WADR3, ESSI1 or both types of special programs. Setting the bit off ignores the special string and only looks for the normal end of program codes.

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 |
|----|----|----|----|----|----|----|----|

| D7 of SD51 | 0 | 1 | 4 | 5 | 8 | 9 | C | D |
|-------------------------------|---|---|---|---|---|---|---|---|
| FORCE I/J INCREMENTAL | | X | | X | | X | | X |
| SPECIAL EOP ON WADR3 PROGRAMS | | | X | X | | | X | X |
| SPECIAL EOP ON ESSI1 PROGRAMS | | | | | X | X | X | X |

IF D7 IS EQUAL TO:

- 0** - Default conditions
- 4** - Special End-of-Program on WADR3 loads only
- 8** - Special End-of-Program on ESSI1 loads only
- C** - Special End-of-Program on WADR3 & ESSI1 loads
- 1** - Sets I/J dimensions for incremental even if program is in absolute.
- 5** - Special EOP on WADR3 loads only enabled and I/J dim. for incremental.
- 9** - Special EOP on ESSI1 loads only enabled and I/J dim. for incremental.
- D** - Special EOP on WADR3 & ESSI1 loads enabled and I/J dim. for incremental.

NOTE: Any number not listed should not be used.

2.5RS OPERATION AND MAINTENANCE MANUAL

PROGRAM FORMAT SD51

Digit (D8) also affects all programs loaded by any "WADR" or "ESSI" format. It sets the default for program dimensions as either absolute or incremental. This causes any program which does not have a code declaring it as either absolute or incremental to be assumed as the type set by this digit.

Programs which contain the correct auxiliary code for ABSOLUTE/INCREMENTAL are loaded according to that code regardless of this digit.

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 |
|----|----|----|----|----|----|----|----|

IF D8 IS EQUAL TO:

0 - INCREMENTAL DIMENSIONS USED AS DEFAULT

1 - ABSOLUTE DIMENSIONS USED AS DEFAULT

SETUP&CONFIG4.2.43

SD52-SPECIAL EOP

This parameter allows up to 4 characters to be entered (in ASCII as 8 digits) which specify a 4 character string which can act as the end of a Word Address, or ESSI Program. This feature aids in reading tapes from other controls which do not provide a normal auxiliary function (M,G,or ESSI code) at the end of a program. For example, some controls use a '%' sign as the end of program. If the '%' is the end of program code, the ASCII value of the '%' is '25'. The EOP value would be equal to "EOP-25000000".

If the end of program code was `END', then EOP - 454E4400 because in ASCII:

E - '45'

N - '4E'

D - '44'

SETUP AND CONFIGURATION

ASCII CODES

| CHAR | HEX | CHAR | HEX | CHAR | HEX |
|------|-------------|------|------|------|------|
| NULL | - 00 | + | - 2B | V | - 56 |
| SOH | - 01 | , | - 2C | W | - 57 |
| STX | - 02 | - | - 2D | X | - 58 |
| ETX | - 03 | . | - 2E | Y | - 59 |
| EOT | - 04 | / | - 2F | Z | - 5A |
| ENQ | - 05 | 0 | - 30 | [| - 5B |
| ACK | - 06 | 1 | - 31 | \ | - 5C |
| BEL | - 07 | 2 | - 32 |] | - 5D |
| BS | - 08 | 3 | - 33 | ^ | - 5E |
| HT | - 09 | 4 | - 34 | _ | - 5F |
| LF | - 0A | 5 | - 35 | ` | - 60 |
| VT | - 0B | 6 | - 36 | a | - 61 |
| FF | - 0C | 7 | - 37 | b | - 62 |
| CR | - 0D | 8 | - 38 | c | - 63 |
| SO | - 0E | 9 | - 39 | d | - 64 |
| SI | - 0F | : | - 3A | e | - 65 |
| DLE | - 10 | ; | - 3B | f | - 66 |
| DC1 | - 11 (XON) | < | - 3C | g | - 67 |
| DC2 | - 12 (RON) | - | - 3D | h | - 68 |
| DC3 | - 13 (XOFF) | > | - 3E | i | - 69 |
| DC4 | - 14 (ROFF) | ? | - 3F | j | - 6A |
| NAK | - 15 | @ | - 40 | k | - 6B |
| SYN | - 16 | A | - 41 | l | - 6C |
| ETB | - 17 | B | - 42 | m | - 6D |
| CAN | - 18 | C | - 43 | n | - 6E |
| EM | - 19 | D | - 44 | o | - 6F |
| SUB | - 1A | E | - 45 | p | - 70 |
| ESC | - 1B | F | - 46 | q | - 71 |
| FS | - 1C | G | - 47 | r | - 72 |
| GS | - 1D | H | - 48 | s | - 73 |
| RS | - 1E | I | - 49 | t | - 74 |
| US | - 1F | J | - 4A | u | - 75 |
| SP | - 20 | K | - 4B | v | - 76 |
| ! | - 21 | L | - 4C | w | - 77 |
| ' | - 22 | M | - 4D | x | - 78 |
| # | - 23 | N | - 4E | y | - 79 |
| \$ | - 24 | O | - 4F | z | - 7A |
| % | - 25 | P | - 50 | { | - 7B |
| & | - 26 | Q | - 51 | | - 7C |
| ' | - 27 | R | - 52 | } | - 7D |
| (| - 28 | S | - 53 | ~ | - 7E |
|) | - 29 | T | - 54 | DEL | - 7F |
| * | - 2A | U | - 55 | | |

2.5RS OPERATION AND MAINTENANCE MANUAL

SETUP&CONFIG4.2.44

SD53-FILE EXTEN

This variable gives the **2.5RS** control the ability to add a fixed file extension of any type to part programs. Files that are tagged with a "CNC", "TXT" or any other valid file extension can be loaded from the **2.5RS** DISK DRIVE or serial port. Programs that are stored to the **2.5RS** DISK DRIVE or out the serial port have this file extension added to the program number.

"SD53-FILE EXTEN" allows up to 4 characters to be entered (in ASCII as 8 digits) which can act as the file extension. NOTE: Although 4 characters may be entered the MS-DOS operating system only allows a 3 character extension. Other operating systems allow more than 3 characters.

For example: If the desired file extension of all files that are to be loaded from the floppy and stored to the floppy is ".CNC",

Then SD53-FILE EXTEN- 434E4300

```
C - '43'  
N - '4E'  
C - '43'
```

The **2.5RS** control adds the "." automatically.

If the desired file extension of all files that are to be loaded from the floppy and stored to the floppy is ".TXT",

Then SD53-FILE EXTEN- 54585400

```
T - '54'  
X - '58'  
T - '54'
```

The **2.5RS** control adds the "." automatically.

SEE ASCII CODE TABLE ABOVE, IN THIS SECTION ON SD52, FOR A LIST OF CHARACTERS AND THEIR ASCII VALUES.

SETUP&CONFIG4.2.45

SD60-OPERATING SYS

This parameter selects between an INCH BASED OPERATING SYSTEM or a METRIC (MILLIMETER) BASED SYSTEM. Use the "+/-" key to toggle the selection.

The type of system selected determines the following:

IF "INCH" OPERATING SYSTEM IS SELECTED:

- S** All Dimension and Distances for both Displays and Entered values are in "INCHES".
- All Speed displays and entries are in "INCHES PER MINUTE" (IPM).
 - All Standard Shape Programs prompt for "INCH" part dimensions.

IF "METRIC" OPERATING SYSTEM IS SELECTED:

- All Dimensions and Distances for both Displays and entered data are in "MILLIMETERS".
- All Speed displays and entered values are in "MILLIMETERS PER MINUTE" (MPM).
- All Standard Shape Programs prompt for "MILLIMETER" part dimensions.

IMPORTANT

Although the **2.5RS** switches from inches to millimeters, changing from one to another does not convert the dimensions in the program. The **2.5RS** setup parameters along with the programs stored in the control are not re-adjusted to inches or millimeters.

SETUP&CONFIG4.2.46

SD61-SYSTEM CONFIGURATION #1

The "SD61- SYS CONFG1" - Primary system configuration flag is used to select the desired system operation for the machine it is being installed on.

Since the **2.5RS** can be used on several different types of special purpose cutting machines, there are individual specialized cutting and operating characteristics which are used for each machine. Set SD61 to the desired system configuration as explained below:

Most machines with OXY-FUEL and PLASMA: Set SD61 to 0.

Machines using the Burny™ 2,5RS E-STOP function: Set SD61 to 12.

Machines used with Replicator™: Set SD61 to 16.

2.5RS OPERATION AND MAINTENANCE MANUAL

SETUP&CONFIG4.2.47 SD62-SYSTEM CONFIGURATION #2

The “SD62 - SYS CONFIG” Secondary system configuration flag is used to select the desired operation for the machine it is being installed on.

“D1” should be set to “0”.

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 |
|----|----|----|----|----|----|----|----|

“D2” Selects programmable feedrate, programmable kerf, digital feedrate, home limit switch reading, the Inhibit enable input, and the NCRUN mode. (Inhibit also causes NCRUN mode to switch off.)

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 |
|----|----|----|----|----|----|----|----|

| D2 of SD62 Ö | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ENABLE INHIBIT INPUT AND ALSO SWITCHES OFF NCRUN | | X | | X | | X | | X | | X | | X | | X | | X |
| HOME LIMIT SWITCHES | | | X | X | | | X | X | | | X | X | | | X | X |
| DIGITAL FEEDRATE | | | | | X | X | X | X | | | | | X | X | X | X |

SETUP AND CONFIGURATION

| | | | | | | | | | | | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|--|--|---|---|---|---|---|---|---|---|
| PROGRAMMABLE FEEDRATE AND PROGRAMMABLE KERF | | | | | | | | | | | | X | X | X | X | X | X | X | X |
|--|--|--|--|--|--|--|--|--|--|--|--|---|---|---|---|---|---|---|---|

SD62-SYSTEM CONFIGURATION #2

“D3” manipulates the default condition for the X & Y home index switches and the X & Y home index inputs from the encoders. These bits can also be used to bypass a particular input by setting the invert bit so that the input is detected as being "ON" when there is no device actually plugged in. This is useful where a machine has only home switches but no home index inputs from the encoders.

“SD96”-X offset from table 1 to X HOME limit switch and "SD97"-Y offset from table 1 to Y HOME limit switch are used to establish the (0,0) position of the machine at a fixed offset from the home switch/index locations. This allows the switches to be located anywhere in the machines's travel but allow the (0,0) position to be established at a logical point for the actual cutting process.

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 |
|----|----|----|----|----|----|----|----|

| D3 of SD62 | Ö | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|-----------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Y INDEX INVERT | | | X | | X | | X | | X | | X | | X | | X | | X |
| X INDEX INVERT | | | | X | X | | | X | X | | | X | X | | | X | X |
| Y LIMIT SWITCH INPUT INVERT | | | | | | X | X | X | X | | | | | X | X | X | X |
| X LIMIT SWITCH INPUT INVERT | | | | | | | | | | X | X | X | X | X | X | X | X |

2.5RS OPERATION AND MAINTENANCE MANUAL

SD62-SYSTEM CONFIGURATION #2

“D4” sets the search direction for the machine once "FNC16-SET HOME" function has been selected, and home limit switches have been enabled.

D4 also specifies how the high preheat relay will behave during Oxy/Fuel cutting. There are 3 choices for the high preheat relays behavior-- it can be selected to turn off at the end of the PREHEAT time, it can be set to remain on during the PREHEAT and the PIERCE RAMP time, or it can be set to turn on at the start of the PREHEAT time, and remain on during the entire cutting cycle, and turn off when the cutting oxygen turns off at the end of the path.

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 |
|----|----|----|----|----|----|----|----|

| D4 of SD62 Ö | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|--|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LEAVE HIGH PREHEAT RELAY ON DURING CUTTING -- GASES ON | | X | | X | | X | | X | | X | | X | | X | | X |
| LEAVE HIGH PREHEAT RELAY ON DURING PIERCE RAMP | | | X | X | | | X | X | | | X | X | | | X | X |
| -Y LIMIT SWITCH SEARCH | | | | | X | X | X | X | | | | | X | X | X | X |
| -X LIMIT SWITCH SEARCH | | | | | | | | | X | X | X | X | X | X | X | X |

SETUP AND CONFIGURATION

SD62-SYSTEM CONFIGURATION #2

"D5" enables or disables deceleration for the pressing of or the release of the backup button, and also swaps offsets 1 and 2 with offsets 3 and 4 if plasma is selected.

The selection of the accel/decel for the Backup button was added based on customer requests. The normal operation of the backup button is to decel to a stop and then reverse direction. Similarly when the button is released, the machine would again decel to a stop and then change directions and resume motion along the cut path. Some customers preferred that there is no accel/decel when this button is pressed or released to give them finer control over the machine by changing directions as soon as the button is pressed or released.

WARNING

With no accel/decel, the machine will change directions abruptly, which could cause damage to the drive system. It is recommended that if this bit is set, that the SD06-BACKUP SPEED parameter is set to a very slow setting, and that the operator use caution when pressing this button when the machine is traveling at higher speeds.

The selection to swap the marker offsets allows the programmer to use the same offset number to select the same marking device whether the machine is cutting with Oxy/Fuel or Plasma. Without this function, the programmer would have to use Offset #1 (for example) to move from the Oxy/Fuel Torch to Marker #1, but would have to use a different offset (Offset #3) to move from the Plasma torch to Marker #1. When this function is turned on, Offset #1 would be set to the Oxy/Fuel to Marker #1 offset dimension, and Offset #3 would be set to the Plasma to Marker #1 offset dimension. Then, the part program would only specify to use Offset #1. If the machine was cutting with Oxy/Fuel, the actual Offset #1 dimensions would be used to move the machine from the Oxy/Fuel torch to the Marker #1 location. But if the machine is cutting with Plasma, the offset dimension would be swapped, so that the part program which still specifies to use Offset #1 would actually use Offset #3 and would correctly move from the Plasma torch to the Marker #1 location. Offsets #2 and #4 work the same and would be used for a second marking device.

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 |
|----|----|----|----|----|----|----|----|

| D5 of SD62 | Ö | 0 | 4 | 8 | C |
|--|---|---|---|---|---|
| SWAP OFFSETS 1,2 WITH 3,4 IF PLASMA SELECTED | | | X | | X |
| NO DECEL ON BACK UP BUTTON PRESS OR RELEASE | | | | X | X |

PROGRAM FORMAT SD62

2.5RS OPERATION AND MAINTENANCE MANUAL

"D6" is used to re-configure the jog directions to match the machine axis and disable the latched jog function, and also to disable latched jogs.

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 |
|----|----|----|----|----|----|----|----|

| D6 of SD62 | Ö | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|-------------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Y JOG DIRECTION INVERTED | | | X | | X | | X | | X | | X | | X | | X | | X |
| X JOG DIRECTION INVERTED | | | | X | X | | | X | X | | | X | X | | | X | X |
| X and Y JOG DIRECTIONS EXCHANGED | | | | | | X | X | X | X | | | | | X | X | X | X |
| DISABLE LATCHED JOGS | | | | | | | | | | X | X | X | X | X | X | X | X |

If "D6" IS EQUAL TO:

0- +X--> +X +Y--> +Y (STANDARD)

1- +X--> +X +Y--> -Y

2- +X--> -X +Y--> +Y

3- +X--> -X +Y--> -Y

4- +X--> +Y +Y--> +X

5- +X--> -Y +Y--> +X

6- +X--> +Y +Y--> -X

7- +X--> -Y +Y--> -X

8- Disable of the latched jog function

9- +X--> +X +Y--> -Y & Disable latched jog function

A- +X--> -X +Y--> +Y & Disable latched jog function

B- +X--> -X +Y--> -Y & Disable latched jog function

C- +X--> +Y +Y--> +X & Disable latched jog function

D- +X--> -Y +Y--> +X & Disable latched jog function

E- +X--> +Y +Y--> -X & Disable latched jog function

F- +X--> -Y +Y--> -X & Disable latched jog function

SETUP AND CONFIGURATION

SD62-SYSTEM CONFIGURATION #2

"D7" selects DRIFT COMPENSATION, LATCHED BACKUP ENABLE, BACKLASH COMPENSATION ENABLE, and enables the Series 1000 tracer/NC jog controls.

The LATCHED BACKUP ENABLE causes the Back button to change to a toggle action instead of the normal momentary operation. Pressing the button while the program is running forward will cause the machine to stop and reverse direction with the cutting process turned off. The button can be released at this point and the backup motion will continue. When the desired position is reached, press and release the Backup button again to cause the machine to reverse directions again and begin traveling in the forward programmed directions.

Servo drives sometimes develop an offset, or drift, over a period of time or temperature change. If drift becomes excessive, especially when greater than the SD08-MIN HOLD SPD, the drift will cause the software to stall the machine at pierce points.

DRIFT COMPENSATION is a special software routine that monitors X and Y axes servo drive drift and produces a voltage that exactly cancels the drift. The monitoring function occurs when the system is not in the RUN mode, after the RECYCLE button is pressed, and continues to measure the drift even during RS-232 downloading operations. To insure that the drift is canceled correctly, when this feature is enabled, press the RECYCLE button, and then let the machine sit motionless for about 30 seconds while watching for drift. This process should be repeated in 2-3 hours if the system has been cutting continuously since drift sometimes develops as servo drives warm up with use.

Use DSPY11 and display V08-X DRIFT and V18-YDRIFT to observe the drift compensation at any given time. This display expresses drift compensation as a percentage of drive output.

BACKLASH COMPENSATION is another special software feature that helps compensate for unaccounted for motion between the feedback encoder, and the actual machine. For example, if the system is using encoders mounted to the back of the drive motors, and there is a gearbox between the motor and the drive pinion, there could be backlash, or lost motion in the gearbox, and to some degree, between the pinion gear and the gear rack. There are 3 system parameters which control the operation of this feature-- SDA0- X LASH, SDA1-Y LASH, and SDA2-LASH RATE. The X and Y lash values are the amount of lost motion measured in each of the X and Y axes, and the Lash Rate parameter controls how quickly the lost motion is made up when the axis changes direction. See SDA0, SDA1, and SDA2, later in this section.

Use DSPY11 to display V72-XBKLSH and V73-YBKLSH to show the backlash compensation value being applied and removed as the machine is changing directions while jogging along the part profile. Note that backlash compensation is only used for cutting, and not for jogging.

| | | | | | | | |
|----|----|----|----|----|----|-----------|----|
| D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 |
|----|----|----|----|----|----|-----------|----|

2.5RS OPERATION AND MAINTENANCE MANUAL

| D7 of SD62 | Ö | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|------------------------------|----------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| REP1200 JOG ENABLE | | | X | | X | | X | | X | | X | | X | | X | | X |
| BACKLASH COMPENSATION ENABLE | | | | X | X | | | X | X | | | X | X | | | X | X |
| DRIFT COMPENSATION ENABLE | | | | | | X | X | X | X | | | | | X | X | X | X |
| LATCHED BACK-UP ENABLE | | | | | | | | | | X | X | X | X | X | X | X | X |

SETUP AND CONFIGURATION

SD62-SYSTEM CONFIGURATION #2

"D8" affects the acceleration time of the **2.5RS**.

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 |
|----|----|----|----|----|----|----|----|

| D8 of SD62 | Ö | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | A | B | C | D | E | F |
|-----------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SPEED DEPENDANT ACCEL | | | X | | X | | X | | X | | X | | X | | X | | X |
| TEACHABLE PREHEAT | | | | X | X | | | X | X | | | X | X | | | X | X |
| PLASMA PIERCE HOLD | | | | | | X | X | X | X | | | | | X | X | X | X |
| OXY PIERCE HOLD | | | | | | | | | | X | X | X | X | X | X | X | X |

SPEED DEPENDENT ACCELERATION- Setting this parameter to a value of "00000001" provides a speed dependent accel time.

For example:

SD03-ACCEL TIME - 1.5 SECONDS
SD04-MAXIMUM DRIVE SPEED - 150 ipm

When the cut speed is set to 150 and "D8" in SYSCFG2 is set to a '1' the machine accelerates to 150 ipm in 1.5 seconds. When the cut speed is reduced to 75 ipm the machine accelerates to cutting speed in .75 seconds.

Setting "SYSCFG2" bit "D8" to "0" provides acceleration to cut speed based on the value of "SD03-ACCEL TIME". This is the same type of acceleration as in previous software versions.

TEACHABLE PREHEAT- The **2.5RS** has the ability to learn a preheat time. When the correct bit is enabled a teachable preheat time is enabled. The "CYCLE START" key is use to extend or shorten preheat time. The new time is remembered and used on all subsequent pierces.

2.5RS OPERATION AND MAINTENANCE MANUAL

SETUP&CONFIG4.2.48 SD63-SYSTEM CONFIGURATION #3

The “SD63 - SYS CONFIG3” parameter settings are defined below. This parameter allows using the optional Marker Relay output as a general purpose on/off auxiliary output. An auxiliary output can be used as an auxiliary control for a cutting process.

If a marker output is reassigned as an auxiliary output, it functions as a simple ON/OFF output. The same Word address M codes, or ESSI function codes are used to turn the auxiliary output ON and Off, however there are no marker delays, and the marker speed parameters have no effect.

SD63 can set the auxiliary output to be turned off by “CYCLE STOP”, or it can keep the “Cycle Stop” from affecting the auxiliary output. This second option would be used if the marker was to control a machine setup mode. In this way the machine mode would not change just because recycle was pressed.

The auxiliary output will always turn off when the “RECYCLE” button is pressed. The auxiliary output will also turn off if the Marker OFF code is pressed.

| | | | | | | | |
|----|----|----|----|----|----|----|----|
| D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 |
|----|----|----|----|----|----|----|----|

| D1 of SD63 | Ö | 0 | 1 | 8 | 9 | A | B |
|--|---|---|---|---|---|---|---|
| ENABLE KNIFE KERF OPTION | | | X | | X | | X |
| AUX OUTPUT DOES NOT GET TURNED OFF BY CYCLE STOP | | | | | | X | X |
| MARKER RELAY BECOMES AN AUXILIARY OUTPUT | | | | X | X | X | X |

* * *

* Shaded columns apply only to 2.5 Plus.

Note: Numbers not listed in the table should not be used. Unused bits in SD63 and in all parameters should be set to zero.

SETUP&CONFIG4.2.49

SD65

This parameter is not used for normal operations-- ALL 4 DIGITS OF THIS PARAMETER MUST BE SET TO 0000. Note this parameter is also contained in the 4 overlay tables-- the value for SD65 in all 4 overlay tables must also be set to 0000. See instructions later in this manual for entering data in the overlay tables using SERV41, 42, 43, 44.

| | | | |
|----|----|----|----|
| D1 | D2 | D3 | D4 |
|----|----|----|----|

ALL 4 DIGITS OF THIS PARAMETER, SD65 MUST BE SET TO 0000.

SETUP&CONFIG4.2.50

SD68-SPEED RANGE

(in/mm)

The SPEED RANGE parameter allows the 15 bit speed range of the control to be scaled up or down to provide more resolution in the range that the machine is operating in. This parameter allows the range of speed displays to be shifted to match the requirements for different types of machines. For example, water jet machines usually run very slow so the range can be shifted down to allow for better resolution. High speed plasma, glass cutters and other applications may require speeds above the 1310 ipm value (with a reduced resolution).

**** IMPORTANT ****

This parameter like SD60 (INCH/MM) must be set before any other parameters are entered.

Setting SD68 to 4 selects the normal Burny™ range. The following selections are available:

| SD68 | MAX SPEED (ipm / mm/min) | RESOLUTION (ipm/ mm/min) |
|----------|--------------------------|--------------------------|
| 0 | 81.9175 / 2047 | .0025 / .0625 |
| 1 | 163.835 / 4095 | .005 / .125 |
| 2 | 327.67 / 8191 | .01 / .25 |
| 3 | 655.34 / 16383 | .02 / .5 |
| 4 NORMAL | 1310.68 / 32767 | .04 / 1 |
| 5 | 2621.36 / 65535 | .08 / 2 |
| 6 | 5242.76 / 131068 | .16 / 4 |
| 7 | 10485.44 / 262136 | .32 / 8 |

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SETUP&CONFIG4.2.51 SD69-LANGUAGE SEL.

SD69-LANGUAGE SELECT allows the one alternate language to be selected. The language option, option #11, must first be enabled and EPROM #3 replaced with an having the appropriate language.

Set "SD69-LANGUAGE SELECT" to the following value to select the alternate language:

- 0 - ENGLISH
- 1 - GERMAN
- 2 - FRENCH
- 3 - FINNISH
- 4 - ITALIAN
- 5 - SPANISH
- 6 - SWEDISH
- 7 - DUTCH
- 8 - PORTUGUESE
- 9 - NORWEGIAN
- A - ROMANIAN

NOTE: An "A" is selected by first pressing the "SHF" key and then pressing the zero key.

SETUP AND CONFIGURATION

SETUP&CONFIG4.2.52 SD70-KNIFE DIA. (in/mm)

This parameter is for the special swivel knife compensation routine which modifies the cut path to produce sharp corners rather than the radius corners caused by the knife offset. If this option is installed in the control, this parameter should be set to twice the offset distance from the center of rotation to the knife point. This is the same as the diameter of the circle which would result if the knife was rotated 360 degrees.

SETUP&CONFIG4.2.53 SD71-KNIFE BP ANGLE (degrees)

This parameter is also used with the special knife compensation option. It sets the minimum change in direction which causes the special knife processing to take effect. Thus for small changes in direction, the path is unaffected. However, if a sharp corner (greater than this parameter value) is found, the path is modified so that a sharp corner is actually cut.

SETUP&CONFIG4.2.54 SD80-SD95 PROGRAMMABLE OFFSETS (in/mm)

Programmable Offsets can be used with multiple PLASMA and or OXY-FUEL torches that may or may not have multiple markers mounted on the same station. These additional offsets allow the marker on one torch to be used with another torch simply by programming the appropriate "T" field value.

In **2.5RS** WORD ADDRESS programming language, programmable offset values are defined using a "T" field in a program block with an "M71" MARKER OFFSET ON function code.

For example:

Word Address programming format, "M71 T4",
ESSI programming format, "11+4" defines

MARKER #1 OFFSET ON, and uses the values in "SD86 XOFST4" and "SD87 YOFST4" for the offset move.

2.5RS OPERATION AND MAINTENANCE MANUAL

NOTE

The **2.5RS** sets the following parameters always equal to each other:

"SD40 X MARKER OFFSET" -- "SD80 X OFFSET #1"

"SD41 Y MARKER OFFSET" -- "SD81 Y OFFSET #1"

"SD47 X MARKER OFFSET" -- "SD82 X OFFSET #2"

"SD48 Y MARKER OFFSET" -- "SD83 Y OFFSET #2"

See (SD40) for additional information on markers and marker offsets.

Programmable offsets:

| "T" VALUE | OFFSETS USED |
|--------------|----------------------------|
| 1 | SD80 XOFST1 SD81 YOFST1 |
| 2 | SD82 XOFST2 SD83 YOFST2 |
| 3 | SD84 XOFST3 SD85 YOFST3 |
| 4 | SD86 XOFST4 SD87 YOFST4 |

| "T" VALUE | OFFSETS USED |
|--------------|----------------------------|
| 5 | SD88 XOFST5 SD98 YOFST5 |
| 6 | SD90 XOFST6 SD91 YOFST6 |
| 7 | SD92 XOFST7 SD93 YOFST7 |
| 8 | SD94 XOFST8 SD95 YOFST8 |

SETUP&CONFIG4.2.55 SD96-X HOME INDEX SWITCH (in/mm)

The value entered here is the X axis distance from the home index switch to the cutting table home position.

SETUP&CONFIG4.2.56 SD97-Y HOME INDEX SWITCH (in/mm)

The value entered here is the Y axis distance from the home index switch to the cutting table home position.

SETUP&CONFIG4.2.57

SDA0-X LASH

(inches)

Amount of backlash in the Y axis

SETUP&CONFIG4.2.58

SDA1-Y LASH

(inches)

Amount of backlash in the Y axis

SETUP&CONFIG4.2.59

SDA2-LASH RATE

(inches)

The desired maximum physical increment of backlash compensation to be applied each 8 ms scan position cycle. This parameter can be used to control how fast backlash is compensated. For example, if .050 inches is entered, and the lash is .100, the lash would be corrected with two steps of .050 inches, and would take two position scan cycles, or 16 ms. If .025 inches was entered for the lash rate, the same lash compensation would take four steps of .025 inches, and 32 ms.

SETUP&CONFIG4.3

MULTIPLE SETUP PARAMETER TABLES

Due to the different types of cutting tools which may be included on the same machine (router, water jet, plasma etc), the setup parameters need to be set differently for each type of tool. The **2.5RS** has the ability to do this and get optimum performance out of the tool being run. This ability is accessed through Service Mode 10, "SYSTEMS DATA", which has 4 additional overlay tables selectable by a 'G' code followed by a 'T' select number in the part program. Each table can be setup to provide optimum performance for a particular tool and then called by the program before the cutting begins. The overlay tables do not contain the entire list of setup variables since many of them are common for all cutting tools (encoder directions, maximum drive speed, etc.)

IMPORTANT

Data entered into the Multiple Setup Parameter Tables, will return to previously saved data if the RECYCLE key is pressed, the system is turned off, or power is lost, unless the SERV97-VARSTOR function is used.

Read the section of this manual entitled "SERV97-VAR STOR."

The parameters which are contained in the overlay tables are:

- SD03- ACCEL TIME
- SD07- CORNER SPEED
- SD10- RUN SPEED LIMIT
- SD14- GAIN BREAK
- SD16- LOOP GAIN
- SD18- SLOWDOWN DISTANCE
- SD19- HEIGHT SENSOR DISABLE
- SD29- SLOWDOWN RADIUS
- SD30- MIN RAD SPD
- SD32- MIN SLW ANG
- SD33- MAX SLW ANG
- SD45- DEFAULT DWELL TIME
- SD46- MINIMUM OFF TIME
- SD49- START DELAY TIME
- SD65-OVERLAY CFG

When a part program is running, the parameters from the selected table are copied into a running parameter area which is actually used to run the part program. When a part program is started, the system always defaults to the '0' table which is setup by the normal SERV10 procedure. If no table select codes are contained in the part program, the system runs using the SERV10 parameters. To switch to a different table, the program must contain one of the following data blocks as a separate line in the program:

- G46 T1 (Selects overlay table #1)
- G46 T2 (Selects overlay table #2)
- G46 T3 (Selects overlay table #3)
- G46 T4 (Selects overlay table #4)
- G46 T0 (Selects standard SERV10 table)

NOTE

The G46 can be swapped to any other M or G code desired by use of the custom code conversion feature available through WADDR3. The number following the 'T' word must be an integer 0-4 or it defaults to the standard '0' table.

The part program can contain any number of table select functions. This would allow customizing one table for high speed cutting on large data blocks and another for intricate portions of the program. Also, the inclusion of the RUN SPEED LIMIT parameter allows the maximum cutting speed of the part to be limited so that it does not exceed the capacity of the tool (this would help prevent router bit breaks by limiting the feedrate to a safe range). The TRAVERSE SPEED LIMIT is not table selectable since there is no cutting process running during traverse moves.

The setup procedure for the tables is similar to the standard SERV10 procedure.

IMPORTANT

These tables will return to the previously saved values if the RECYCLE key is pressed, the system is turned off, or power is lost, unless the SERV97-VARSTOR function is used. Read the section of this manual entitled "SERV97-VAR STOR."

- SERV10- Sets up the non-overlaid parameters and also the '0' table entries of the overlaid ones. This function operates the same as in previous software versions. When these parameters are being entered, the display shows "SDxx-nnnnnnn" (Example: "SD03- ACCEL TIME").
- SERV41- Sets up overlay table #1 parameters. The entry procedures are the same however the readout appears as "1-xx- nnnnnnn" to show that table #1 is being accessed (Example: "1-03- ACCEL TIME").
- SERV42 Sets up overlay table #2 parameters. The entry procedures are the same however the readout appears as "2-xx-nnnnnnn" to show that table #2 is being accessed (Example: "2-03- ACCEL TIME").
- SERV43- Sets up overlay table #3 parameters. The entry procedures are the same however the readout appears as "3-xx-nnnnnnn" to show that table #3 is being accessed (Example: "3-03-ACCEL TIME").
- SERV44- Sets up overlay table #4 parameters. The entry procedures are the same however the readout appears as "4-xx-nnnnnnn" to show that table #4 is being accessed (Example: "4-03-ACCEL TIME").

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- SERV40- First displays which table is currently selected and then allows that table to be changed. It also permits a different table to be selected for testing purposes.

When SERV40 is first selected, it displays "CURRENT TABLE- X" where the X is a digit 0-4. This is the index of the table which is currently running the machine. To adjust the parameters in this table, press the "ENTER" key when the CURRENT TABLE display is showing. The proper table is accessed and is changed just as if the SERV41-44 procedures listed above was used.

To force the selection of a particular table for testing, when the CURRENT TABLE display is showing, enter a new index number 0-4. The appropriate table is copied into the running table area and immediately affects the operation of the machine. Then pressing ENTER accesses the new table for adjusting.

Parameters which are not in the overlay tables can only be accessed and adjusted by using the SERV10 procedure. Note that if SERV40 is used to access the '0' table, only the overlaid parameters are displayed so that the 0 table appears the same as 1-4. Accessing the 0 table through SERV10 allows all the parameters to be accessed.

Due to the additional memory required to store the multiple setup tables, there is not sufficient RAM available to keep all the parameters available for access at any time. Therefore, when the machine is not running, the RAM used to store the multiple tables is re-used for other system purposes. The parameters are recalled from the Non-Volatile memory back to the operating RAM when a part is selected for running. The parameters are also recalled to operating RAM when the "RECYCLE" key is pressed. Therefore, the parameters can only be entered or displayed either in the "RECYCLE" state, or after a part has been selected for running and the Kerf, Accel/Decel and Part Rotation software has finished. The parameters can be adjusted all the time a part is running regardless of whether the machine is moving or stopped.

IMPORTANT

If PARAMETERS are adjusted but the new values are not stored using the SERV97 procedure before the "RECYCLE" key is pressed, the new values are replaced by the previously stored data which is recalled from the Non-Volatile memory. Similarly, if the parameters are adjusted in the Recycle state, and then a part is selected for running without storing the values first, they are also returned to their previous values.

SETUP&CONFIG4.4 SYSTEM VARIABLE DISPLAY

This function is an important tool in checking the controls and various operating and diagnostic displays. It displays many of the values used in the position loop calculations. It also shows various hardware locations which reduces the need for external test equipment when looking for a problem.

The SYSTEM VARIABLE DISPLAY FUNCTION allows many internal data values to be displayed for troubleshooting and diagnostic purposes. When "SERV11" or "DSPY11" is selected, a second menu is presented. Select the desired display from the following menu, either by scrolling or entering the specific display number.

Once the mode is selected, the display changes to "V01-X DRIVE " which is the first variable in the list. Select the desired variable by scrolling or by directly entering the 2 digit number of the particular variable. Once the correct one is displayed, press the "ENTER" key. This causes the current value for that variable to be displayed.

SETUP&CONFIG4.4.1 V01-X DRIVE

Displays the X drive output from the position loop as a percentage from 0 to +/- 100%. When the operator is controlling the machine speed with the speed dial, a 100% READING indicates that the position loop is COMMANDING 100% of the speed dial setting. If a traverse move is being performed, the 100% value indicates 100% of the maximum speed of the machine as entered for (SD04).

This display is useful when the machine is not running at the correct speed. If the Feedrate shown for "SERV03-FEEDRATE" is correct, and this display shows that the position loop is commanding 100% of the current feedrate, it indicates the machine should be running at the feedrate speed. If it is running slower, it indicates a mechanical or electrical problem usually outside of the **2.5RS**.

2.5RS OPERATION AND MAINTENANCE MANUAL

SETUP&CONFIG4.4.2

V02- XDAOUT

This display shows the actual "bit" value being sent to the X axis D/A converter. Since a 10 bit converter is used in the **2.5RS**, a displayed value of "03FF" indicates the full 100% bit value is being sent to the converter. A negative output has an 8 in the first digit (83FF). The D/A bit value is determined by multiplying the X drive value (V01) by the SPEED CALIBRATION FACTOR for the X axis.

SETUP&CONFIG4.4.3

V03-X ABS (in/mm)

Shows the same data as "SERV01" -the current X position value, however it is displayed with 4 decimal places (.0000) for inch systems and 3 decimal places (.000) for metric systems.

SETUP&CONFIG4.4.4

V04-X ENC

Shows the current X position value as actual input encoder counts.

The equation used to calculate the X position based on incoming encoder counts and the X encoder scaling value (SD20) is:

$$\begin{array}{l} \text{INPUT} \\ \text{ENCODER X COUNTS} \\ \text{(V04)} \end{array} \times \begin{array}{l} \text{ENCODER} \\ \text{DIST/REV (SD20)} \\ 4 \times \text{ENCODER} \\ \text{LINE/REV (SD22)} \end{array} = \begin{array}{l} \text{ABSOLUTE} \\ \text{POSITION} \\ \text{(V03)} \end{array}$$

SETUP&CONFIG4.4.5

V05-X ERROR (in/mm)

When the **2.5RS** is doing a line program block, this display shows the X distance from the CORRECT PATH. If inaccurate parts are being cut, displays V05, V15 and V20 can be used to prove whether the problem is mechanical or is due to the **2.5RS** position loop. While a part is being cut (or test run), check the X ERROR and Y ERROR (V15) at various points along the part while a line is being cut and V20 during ARCS. If the error is very small, or 0, it indicates that the **2.5RS** is OK and that the problem is mechanical. This could be caused by a loose encoder bracket or torch holder, or backlash in the drive system. If the display shows a large error, it indicates that the **2.5RS** "knows" that the path is incorrect, but that it is unable to correct for it. This can still be caused by a mechanical problem but is usually due to an electrical problem with

SETUP AND CONFIGURATION

either the drive system electronics or the **2.5RS** interface card. Another possible reason for large errors while cutting a part is that the "LOOP GAIN" (SD16) is set too low which prevents the error from being corrected.

SETUP&CONFIG4.4.6 **V06-XERSCL**

Displays the speed percentage being commanded after the path error has been "SCALED" by the "LOOP GAIN". This display works for either lines or arcs.

Example: Assume a part is being cut, and the operators speed dial is set to 20.00 IPM. The maximum speed at that point would be 20 ipm which would be 100% speed. If this display showed 25% it indicates that a speed of 5 ipm (25% of 20 ipm) is being commanded due to the error in the X axis.

SETUP&CONFIG4.4.7 **V07-X HOME**

Displays the distance from the HOME ALIGNMENT REFERENCE POSITION in the X axis.

SETUP&CONFIG4.4.8 **V11-Y DRIVE**

Y AXIS DRIVE COMMAND- SEE V01 (X DRIVE) for description.

SETUP&CONFIG4.4.9 **V12-YDAOUT**

Y AXIS D/A OUTPUT BITS - SEE V02 (XDAOUT) for description.

SETUP&CONFIG4.4.10 **V13-Y ABS**

Y AXIS ABSOLUTE POSITION DISPLAY- SEE V03 (X ABS) for description.

SETUP&CONFIG4.4.11 **V14-Y ENC**

Y AXIS INPUT ENCODER COUNTS- SEE V04 (X ENC) for description.

SETUP&CONFIG4.4.12 **V15-Y ERROR**

Y AXIS LINE ERROR DISPLAY - SEE V05 (XERROR) for description.

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SETUP&CONFIG4.4.13 V16-YERSCL

Y AXIS SCALED ERROR DISPLAY - SEE V06 (XERSCL)

SETUP&CONFIG4.4.14 V17-Y HOME

Displays the distance from the HOME ALIGNMENT REFERENCE POSITION in the Y axis.

SETUP&CONFIG4.4.15 V20-RADERR (in/mm)

While an "ARC" program block is being run, this shows the path error, from the CORRECT ARC RADIUS. A positive value indicates that the machine is outside the correct radius. Negative values indicate that the error is inside the correct radius.

This value can be used in the same way as the X ERROR and Y ERROR displays described in (V05) to determine the cause if a part is inaccurate. This display shows the Path Error while running an ARC data block. See V05 for details on possible causes.

SETUP&CONFIG4.4.16 V21-RADSCL

This value also pertains to running arc blocks and shows the commanded speed percentage after the "LOOP GAIN" has "SCALED" any radius error (AS DISPLAYED IN V20). See V06 for a description of this type of display. Once this value is calculated, it is divided between the XERSCL (V06) and YERSCL (V16) values depending on the position of the machine along the arc.

SETUP&CONFIG4.4.17 VARIABLES 22-49

TEST ONLY- Not needed during normal installation and servicing.

| | |
|-------------|--------------------------------|
| V22- ENDDST | ENDPOINT DISTANCE |
| V23- ARCBND | ARC ENDPT BOUNDARY DISTANCE |
| V30- ACCSCL | ACCEL/DECEL SCALE VALUE |
| V40- PRETME | DISPLAYS PREHEAT TIMER |
| V41- ARCTME | DISPLAYS ARC ON DELAY TIMER |
| V42- BLETME | DISPLAYS BLEEDOFF TIMER |
| V43- MRKTME | DISPLAYS MARKER ON DELAY TIMER |

SETUP&CONFIG4.4.18**V50-BP INPUT**

This display shows the current state of the 8 signal inputs from the interface card and main card. The data is displayed as an 8 bit binary value. A "1" shows that the input is "ON" while a 0 indicates "OFF"

```
BP INPT- 00000000
TTTTTTTT
*****.) QJ4
*****.) QJ5
*****.) QNON-VOL DATA BIT
****.) Q1 FOR OPERATE, 0 FOR ESTOP
***.) QNOT USED
**.) QY EXTERNAL JOG REQUEST
*. ) QX EXTERNAL JOG REQUEST
.) Q1 FOR CUT/TOOL ON SENSE
```

SETUP&CONFIG4.4.19**V54-XCNTR**

Shows 8 bit hexadecimal value of X axis encoder counter. Can be used to check encoder input circuitry by making sure counter counts smoothly when encoder is being turned.

SETUP&CONFIG4.4.20**V55-YCNTR**

Shows 8 bit hexadecimal value of Y axis encoder. (See V54)

SETUP&CONFIG4.4.21**V60-BP OUT**

Shows an 8 digit binary display of drive control output and relay control bits being sent to the interface card circuitry. Each digit controls a different function:

```
BP OUT- XXXX0000
TTTTTTTT
*****.) Q1 FOR CUT START          1-OFF, 0-ON
*****.) Q1 FOR PREHEAT            1-OFF, 0-ON
****.) QSPARE                       1-OFF, 0-ON
***.) Q1 FOR CUT OFF                1-OFF, 0-ON
**.) QX D/A SIGN BIT
*. ) QY D/A SIGN BIT
*. ) Q1 FOR INTERNAL REF, 0 FOR SPEED DIAL
.) Q1 FOR LOW SPEED RANGE, 0 FOR NORMAL
```

SETUP&CONFIG4.4.22

V72-X BACKLASH

SETUP&CONFIG4.4.23

V73-Y BACKLASH

Use DSPY11 to display V72-XBKLSH and V73-YBKLSH to show the backlash compensation value being applied and removed as the machine is changing directions while moving along the part profile. Note that backlash compensation is only used for cutting, and not for jogging.

SETUP&CONFIG4.5 MEMORY DISPLAY UTILITIES

The **2.5RS** has 5 display utilities which can be used to display any memory or CRU location in the system in a variety of display formats. The "CRU" address space is a single bit processing utility which provides 32k bit locations in addition to the normal 64k address space of the microprocessor.

The five display utilities are:

SERV30/DSPY30- SINGLE WORD MEMORY DISPLAY
SERV31/DSPY31- DOUBLE WORD MEMORY DISPLAY
SERV32/DSPY32- 16 BIT CRU DISPLAY
SERV33/DSPY33- SINGLE BYTE MEMORY DISPLAY
SERV34/DSPY34- 8 BIT CRU DISPLAY

For any of these displays, once the selection is made, the display changes to the DISPLAY FORMAT selected. See the individual descriptions of the display formats.

SETUP AND CONFIGURATION

Regardless of which is selected, the address of the data is displayed on the left of the readout as a 4 digit -hexadecimal number, while the data is displayed on the right of the display. The memory address is flashing, which indicates that the address value can be changed by entering the desired value. Once the correct address is entered, the data at that address is Automatically displayed. To alter the data at that address, press the "ENTER" key again. This stops the address flashing and starts flashing the data value. Now, any value entered on the keypad changes the data field. Once the new data value is entered, press the "ENTER" key. This places the data value back at the address location. The data field continues to flash and the value can be changed again. Once the flashing value is correct, press the "ENTER" key again to return to the address entry mode (address flashing).

To enter either the Address or Data value, use the NUMERIC keypad and the "CLR" OR "CE" keys.

If a HEXADECIMAL value is being entered, 0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F can be used. To enter a number, just press the value on the keypad. To enter an-"F " use a 2 key combination of the " SHIFT" key and then one of the numbers on the keypad:

Press "SHF" then "0" to enter a value of "A"

Press "SHF" then "1" to enter a value of "B"

Press "SHF" then "2" to enter a value of "C"

Press "SHF" then "3" to enter a value of "D"

Press "SHF" then "4" to enter a value of "E"

Press "SHF" then "5" to enter a value of "F"

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SETUP&CONFIG4.5.1 SERV30-SINGLE WORD MEMORY DISPLAY

SINGLE WORD, 16 bit hexadecimal display/entry of any memory location in the system.

The display for the "SERV30/DSPY30" utility appears as follows:

```
+))))))))) ,
* MW@XXXX- "AA" HHHH *
.)))))0))0))0))-
      *      *      *
      *      *      *
```

The Address of the data is displayed on S)))))-

the left of the readout (indicated by XXXX).

The address may be changed when it is flashing

by entering the desired value on the keyboard.

The Data at the displayed address is shown here S)))))-

interpreted as ASCII data.

The Data at the displayed address is shown here S)))))-

as a 4 Digit Hexadecimal value. To Enter a new data value (only possible if entered through SERV30), first press the "ENTER" key. This causes the address value to stop flashing and the Data value to start flashing. Now, any value entered on the keypad alters the Data value.

Press the "ENTER" key when the value is correct. This places the new data at the indicated address. The Data field continues to flash, so the Data value can be changed again and again. To return to the Address selection mode, press the "ENTER" key again. The Data value stops flashing and the Address value starts flashing indicating that a new address may be entered.

SETUP&CONFIG4.5.2 SERV31-DOUBLE WORD MEMORY DISPLAY

DOUBLE WORD, 32 bit hexadecimal display/entry of any memory location in the system.

The display for the "SERV31/DSPY31- SHOW DBL" utility appears as:

```
+))))))))) ,
* MD@XXXX- HHHHHHHH *
.)))))0))0))0))-
      *      *
      *      *
```

The Address of the 2 word data is shown on S))-)

the Left side of the readout as a 4 Digit Hex value.

The Data is shown on the Right of the readout S)))))-

as an 8 Digit Hexadecimal value.

SETUP&CONFIG4.5.3 SERV32-16 BIT CRU DISPLAY

16 BIT FIELD, 16 bit hexadecimal display/entry of any "CRU" location in the processors CRU address space. The display for the "SERV32/DSPY32- SHOW CRUW" utility appears as:

```
+))))))))) ,
* CW@XXXX- HHHH *
.))))0)))0)))-
      *      *
      *      *
```

The Address of the least significant bitS)))- *
of the 16 Bit CRU value is shown on the left. *
*
*

The 16 Bit CRU value is shown as a 4 Digit Hex S)))- *
value on the right of the readout. *

SETUP&CONFIG4.5.4 SERV33-SINGLE BYTE MEMORY DISPLAY

SINGLE BYTE, 8 bit hexadecimal DISPLAY/ENTRY of any memory location in the system. The display for the "SERV33/DSPY33- SHOW BYTE" utility appears as:

```
+))))))))) ,
* MB@XXXX-BBBBBBBB *
.))))0)))0)))-
      *      *
      *      *
```

The Address of the memory byte is shown onS- *
the Left of the readout. *
*
*

The Data byte at the address is shown on the rightS- *
of the readout in an 8 bit binary format. *

2.5RS OPERATION AND MAINTENANCE MANUAL

SETUP&CONFIG4.5.5 SERV34-8 BIT CRU DISPLAY

The display for the "SERV34/DSPY34- SHOW CRUB" utility appears as:

```
+))))))))) ,
* CB@XXXX-BBBBBBBB *
.))))0)))0)))-
```

The Address of the least significant bit(S)))))-
of the 8 Bit CRU value is shown on the left
of the readout as a 4 Digit Hexadecimal number

The 8 CRU data bits are shown in Binary format S)))))-
on the right of the readout. (Msb to Lsb)

SETUP&CONFIG4.5.6 SERV50-AXIS SPEED

This function can only be accessed through the SERVICE MENU. When selected, the display continuously shows the X/Y axis speeds. This display is particularly useful in adjusting the machine servo drives.

When this service mode is selected, the display shows the X and Y axis speeds (ipm/MPM) on the readout. These displays are much easier to use for checking the X and Y speeds than using a stopwatch or tachometer. Not available through Display key.

Use this display to balance the +/- X and +/- Y speeds so they all run the same.

SETUP&CONFIG4.5.7 SERV51-SPEED CALIBRATION

This "SERVICE MODE ONLY" function performs an automatic speed calibration routine which matches the outputs from the **2.5RS** to the servo drives. This helps counteract any nonlinear characteristics of the drives and leads to a more consistent cutting speed regardless of the direction of travel.

Once the machine servos have been adjusted so that they run at the same speed in all directions (SEE SERV50 ABOVE), this function is used to balance the servo outputs of the **2.5RS**.

SETUP AND CONFIGURATION

This function actually performs 4 speed calibrations, each at a different speed. In this way, any differences between the Hi and low speed operation of the machine can be accommodated. For each of the four calibrations, the readout displays:

"SET SPD DIAL- THEN CYCLE START- SET XXX NNNNNN"

The operator should set the machine speed dial to the speed indicated by the "XXX" digits in the readout. The current setting of the speed dial is displayed in the "NNNNNN" digits. Once the speed dial is set, pressing the "CYCLE START" key starts the calibration procedure.

The Automatic Calibration routine (Patented) runs a square shape and monitors the speed on each of the sides of the square. Each time the square is complete, the calibration factor for each side is adjusted to try to balance the speeds. Another square is run to check the results of the new calibration values. This process continues until the 4 directions are balanced, or for a maximum of 10 times around the square.

While the Calibration is being done, the display shows the X and Y speeds.

Once all 4 directions are balanced, the machine stops and the operator is again prompted to:

"SET SPEED DIAL -THEN CYCLE START -SET SPD XXX NNNNNN"

The operator should set the speed dial to the new speed indicated by the "XXX" digits in the readout and press "CYCLE START".

This process is repeated 4 times, each time with a new setting of the speed dial. When the procedure is complete the display shows:

"CALIBRATION DONE"

IMPORTANT

The calibration value will return to the previously saved value if the RECYCLE key is pressed, the system is turned off, or power is lost, unless the SERV97-VARSTOR function is used. Read the section of this manual entitled "SERV97-VAR STOR."

At this point, the calibration values are stored in the operating memory of the system. However, they have not been transferred to the non-volatile parameter storage memory yet. Thus, if power is lost before they are transferred, the previous calibration values would be returned. See "SERV97-VAR. STORE" for details on permanently storing the values.

SETUP&CONFIG4.5.8 SERV52-MEMORY RESET

This "SERVICE MODE ONLY" function causes the program memory to be erased and re-initialized. It is used when new software is updated and requires re-structuring of the program storage memory. It erases the existing program as well as the "CUSTOM AUXILIARY CODE" table described in section "CUSTOM AUX" of this manual.

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When "SERV52- MEM RESET" is selected, it displays:
"YES+ RESET -NO"

To reset the memory for the new card, press "+/-" key to cause the "YES" in the readout to flash. Then press "ENTER". To abort the procedure without altering the memory, press "+/-" key to cause the "NO" to flash then press "ENTER".

If "YES" was selected, a second prompt makes sure that the operator is aware that the procedure erases any existing programs:

"NO YOU SURE YES"

To RESET THE MEMORY, press "+/-" key to cause the "YES" in the readout to flash. Then press "ENTER".

To abort the procedure without altering the memory, press "+/-" key to cause the "NO" to flash, and then press "ENTER".

SETUP&CONFIG4.5.9 SERV 54-AUTOMATIC REFERENCE ADJUSTMENT

This "SERVICE MODE ONLY" function calibrates the A/D input circuitry and avoids a manual pot adjustment. The calibration value is stored in the non-volatile memory along with the other system parameters.

IMPORTANT

The calibration value will return to the previously saved value if the RECYCLE key is pressed, the system is turned off, or power is lost, unless the SERV97-VARSTOR function is used. Read the section of this manual entitled "SERV97-VAR STOR."

This procedure is used to adjust the input circuitry which converts the voltage from the operators speed dial into the numerical value used by the **2.5RS**. This procedure only needs to be done when the system is installed, or when service work to the system which might alter the speed dial voltage has occurred. The voltage from the speed dial is converted into a digital value which appears as the "FEEDRATE- XXXX" when "DSPY03" is selected. When the speed dial is set for maximum speed, the value displayed on the readout should equal the number entered for the "SD04-MAX SPEED" parameter in the setup list. If the displayed value is too low, or if the speed dial must be turned quite a ways down before the numbers start dropping, this procedure should be done.

TO PERFORM THE "AUTOMATIC REFERENCE ADJUSTMENT":

- 1) Turn the operators speed dial to the "FULL SPEED" maximum position. Also, if there are any speed range switches, set them to the high speed setting so that the speed dial is now set for the maximum drive speed.

SETUP AND CONFIGURATION

- 2) Press the "ENTER" key. The readout temporarily shows the DATA AND CALIBRATION VALUES, and then changes to the normal:

"FEEDRATE- XXX.XX"

At this point, the value displayed on the readout should be the same as the value entered for the MAXIMUM DRIVE SPEED AS "SD04- MAX SPD".

For the procedure for the **2.5 Plus**, see Part 7, Page 82.

SETUP&CONFIG4.5.10 SERV70-CUSTOM AUX TABLES

This "SERVICE" function is used to setup the data tables for the AUXILIARY CODE TRANSLATION. These tables are used when programs are loaded using either "WADDR3" or "ESSI 1" program formats to translate the AUXILIARY CODES from the input values to the standards used by the **2.5RS**.

IMPORTANT

Values will return to the previously saved values if the RECYCLE key is pressed, the system is turned off, or power is lost, unless the SERV97-VARSTOR function is used.
Read the section of this manual entitled "SERV97-VAR STOR."

The **2.5RS** includes several features which allow the format of the programs loaded into the system to be altered so that they match the programming standards of the system. These programs must be loaded through the RS-232 PORT. They may be programmed in either "ESSI" or "WORD ADDRESS". Examples of the conversion utilities of the **2.5RS** are:

ABSOLUTE/INCREMENTAL PROGRAMMING (SEE SD51-PRGM FORMAT)

Allows programming in either Incremental or Absolute dimensions with selectable definition of arc I and J dimensions.

AXIS REVERSAL AND EXCHANGE (SEE SD51-PRGM FORMAT)

Allows definition of X and Y axis to be reversed and permits +/- sign definitions for each axis to be configured to match the incoming program.

Along with these features, the "CUSTOM AUXILIARY CODE" function described in this section of the manual allows the auxiliary codes within a part program to be converted to the standard function codes used by the **2.5RS**. For example, most systems use "G02" for a clockwise arc and a "G03" for counter clockwise. However, if the programming standard used for other machines at

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the users site would happen to use a "G27" and G33" or even a pair of "M" codes, they could be reassigned by the "CUSTOM AUX CODE" feature so that they would cause the correct "CW" and "CCW" arcs to be cut. This feature also allows "ESSI" auxiliary codes to be re-assigned in the same way.

The "CUSTOM AUX CODE CONVERSION" feature only works if programs are loaded using the "WADR3" or "ESSI1" special program formats. The standard programming instructions in the operation manual do not mention these formats since they are not required by the majority of the users. The special conversions and axis definitions as described in "SD51- PRGM FORMAT" and the AUXILIARY CODE conversions do not affect programs if they are loaded using any of the other programming formats (WADR,WADR1,WADR2,ESSI). This allows standard programming to be less confusing and simpler.

To use the "CUSTOM AUX CODE CONVERSION" feature, first the left most digit of "SD51- PRGM FORMAT" must be set to a "1" as described in that section of the manual. If it is a "0", the standard "WADR" or "ESSI" program formats for the **2.5RS** are used regardless of the setting of this table.

Assuming that the "SD51-PRGM FORMAT" digits are properly set, the conversion table must be loaded for the necessary code changes.

The table works by checking each incoming word address "M" or "G" code, and all "ESSI" auxiliary functions. It scans through the table to see if the specific code is listed in the conversion table. If it is not, the code remains unchanged and is loaded normally. However if the table contains a conversion definition for the particular auxiliary code, the input code is replaced with the new value from the table. It is then processed and stored in memory.

The table may contain up to 50 conversions, made up of any combination of WORD ADDRESS "M" and "G" codes or "ESSI" function codes. Each entry in the table contains information which defines which type of input it is "LOOKING" for and what the conversion should be.

To access the table for display and possible modification of the conversion values, Select "SERV70- CUSTOM AUX". When the "ENTER" key is pressed, the memory is checked to see if the aux table has been initialized. If so, the prompting continues by displaying the first table location "AUX01-".

SETUP AND CONFIGURATION

Since the AUXILIARY CODE TRANSLATION TABLE is stored in the battery backed program memory, the room for the table data must be allocated in the memory space. This is performed automatically when the "SERV52-MEMORY RESET" function is done. However if the **2.5RS** had been updated from an earlier software version, it is possible that the room for this table is not available in memory. If this occurs, an error message: "AUX TABLE ERROR" is displayed which indicates that the table is not present in memory. To correct the error and allow the table to be loaded, perform the "SERV52-MEMORY RESET" function described in MEMORY RESET section of this manual. Once the memory is cleared, select the "SERV70- CUSTOM AUX" function and continue.

There are 3 basic displays which are used in loading the data into the conversion table. The first occurs when the table is first entered, or after a value has been changed. It shows which of the 50 TABLE ENTRIES is being displayed, along with the current definition for that table value. For example:

"AUX01-M20-CUTOFF"

Shows that the first table location is being referenced, and that a word address function code "M20" is to be converted to perform the "CUT OFF" function of the control. Another example:

"AUX14- 33-KRFOFF"

This indicates that TABLE POSITION 14 is defined to convert an "ESSI" 33 FUNCTION CODE to the KERF OFF OPERATION in the system.

At this point, the desired table position can be reached by either pressing the numbered keys on the keypad or by using the "SCROLL FUNCTION" keys of the system. If a numbered key is pressed, the readout immediately changes to show the new table location. Do not press the "ENTER" key when trying to select a particular table location but simply press the 2 digit number.

Once the desired TABLE LOCATION is displayed, the actual conversion data definition can be displayed and later modified. Press the "ENTER" key to change from the "DISPLAY" MODE to the "MODIFY ENTRY" MODE. In the first example where "AUX01-M20-CUTOFF" was displayed, pressing the "ENTER" key causes the display to change to:

"32005-M20-CUTOFF"

The 5 digit number on the left is called the "TVVFF" code, where the left most digit "T" indicates the auxiliary code type as:

- 1- ESSI function code
- 2- WORD ADDRESS G function code
- 3- WORD ADDRESS M function code

The next two digits "VV" contain the actual number of the ESSI, or WORD ADDRESS M or G code. In this example, since an M20 was to be converted, the digits were set to "20".

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The final two digits "FF" contain the INTERNAL FUNCTION CODE which is assigned to the input auxiliary code. These numbers are selected from the following table:

SETUP AND CONFIGURATION

| FF | CODE | NAME | FUNCTION |
|----|------|---------|---|
| | S))) | S))))Q | S))))))Q |
| | 00 | PGMNOP | NO OPERATION- USE TO IGNORE AUX FUNCTIONS |
| | 01 | CWARC | CLOCKWISE ARC DIRECTION |
| | 02 | CCWARC | COUNTER-CLOCKWISE ARC |
| | 03 | CHNTOP | CHAIN TOP |
| | 04 | CHNBOT | CHAIN BOTTOM |
| | 05 | CUTOFF | CUT OFF |
| | 06 | CUTON | CUT ON |
| | 07 | KRFOFF | KERF OFF |
| | 08 | KRFLFT | KERF LEFT |
| | 09 | KRFRHT | KERF RIGHT |
| | 10 | MRKOFF | MARKER #1 OFF |
| | 11 | MRKON | MARKER #1 ON |
| | 12 | OFSOFF | MARKER OFFSET OFF |
| | 13 | OFSON | MARKER OFFSET ON |
| | 14 | INCH | PROGRAMMING IN INCH UNITS |
| | 15 | MMETER | PROGRAMMING IN MILLIMETER UNITS |
| | 16 | ABSDIM | ABSOLUTE PROGRAM DIMENSIONS |
| | 17 | ABSRPL | ABSOLUTE REGISTER PRELOAD |
| | 18 | INCDIM | INCREMENTAL PROGRAM DIMENSIONS |
| | 19 | DWELL | PROGRAMMABLE DWELL |
| | 20 | LEADIN | SPECIAL LEAD-IN BLOCK |
| | 21 | PGMSTP | PROGRAM STOP |
| | 22 | PGMEND | PROGRAM END |
| | 23 | PGMRWD | PROGRAM END WITH REWIND |
| | 24 | SKPON | TAPE IGNORING ON |
| | 25 | SKPOFF | TAPE IGNORING OFF |
| | 26 | MRK2ON | AUXILIARY OUTPUT ON |
| | 27 | MRK2OF | AUXILIARY OUTPUT OFF |
| | 28 | OFS2ON | MARKER OFFSET #2 ON |
| | 29 | OFS2OF | MARKER OFFSET #2 OFF |
| | 30 | CUTSPD | SELECT TO RUN AT CUTTING SPEED |
| | 31 | HI SPD | SELECT TO RUN AT HI TRAVERSE SPEED |
| | 32 | XFR RUN | NOT USED |
| | 33 | XFR A | NOT USED |
| | 34 | V LOAD | EXTERNAL VARIABLE LOAD |
| | 35 | X HOME | NOT USED |
| | 36 | Y HOME | NOT USED |
| | 37 | XHOMRT | NOT USED |
| | 38 | YHOMRT | NOT USED |
| | 39 | TB SEL | OVERLAY PARAMETER TABLE SELECT |
| | 40 | GOHOME | GO TO TABLE HOME |
| | 41 | TOOL | TOOL SELECT |
| | 42 | KRFDIM | PROGRAMMABLE KERF DIMENSION |
| | 43 | FEEDRT | PROGRAM FEEDRATE |
| | 44 | HT DIS | PLASMA HEIGHT DISABLE |
| | 45 | HT ENA | PLASMA HEIGHT ENABLE |
| | 46 | LDAUTO | AUTO LOAD/RUN |
| | 47 | PMARK1 | SINGLE PUNCH MARK ON MARKER1 |
| | 48 | PMARK2 | SINGLE PUNCH MARK ON MARKER2 |
| | 49 | PGMNOP | NO OPERATION |
| | 50 | COUNT | INCREMENT PART COUNT |

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IMPORTANT

If any table location is loaded with a "TVVFF" value of "00000", THE SOFTWARE DOES NOT SCAN PAST THAT LOCATION. For example, if table location "AUX22" contains "00000", no conversion codes contained in "AUX23" through "AUX50" are processed. Therefore, do not enter "00000" as the "TVVFF" code for any table location unless none of the following locations are used. If the conversion information at a particular table location needs to be erased, either use it for a new conversion, or enter an unused auxiliary code as a "PGMNOP" command.

The following are several examples of typical conversion table "TVVFF" codes with an explanation of their function:

- TVVFF- 23302 - CAUSES INCOMING "G33" TO BE LOADED AS COUNTER-CLOCKWISE ARC FLAG.
- TVVFF- 12206 - CAUSES INCOMING ESSI "22" FUNCTION CODE TO BE LOADED AS CUT ON COMMAND.
- TVVFF- 36422 - CAUSES INCOMING "M64" TO BE LOADED AS PROGRAM END CODE.
- TVVFF- 31200 - CAUSES INCOMING "M12" TO HAVE NO FUNCTION CAUSES IT TO BE IGNORED.
- TVVFF- 26605 - CAUSES INCOMING "G66" TO BE LOADED AS CUT OFF COMMAND. Normally "G" functions do not control cutting functions however the conversion table even allows for this type of re-assignment.

Using the Numeric Keypad, enter the desired "TVVFF" code. As soon as the numeric entry starts, the display changes to "TVVFF- XXXXX" with the newly entered digits appearing in the "XXXXX" position on the readout. When the "ENTER" key is pressed, the display reverts back to the MODIFY ENTRY format and shows the result of the new "TVVFF" code just entered. For Example, if the display shows:

"32005-M20-CUTOFF"

To change this table position to convert a "G31" to the Cut On function, use the numeric keypad to enter: "23106" . Each digit appears as it is entered. After all 5 digits are in, the display appears as:

"TVVFF- 23106"

Press the "ENTER" key to actually load the new table value, and the display returns to the MODIFY ENTRY format and show:

"23106-G31-CUTON"

SETUP AND CONFIGURATION

If the value is incorrect, re-enter the correct 5 digit code and press "ENTER" again. Once the data is correct, press the "ENTER" key a second time to return to the TABLE POSITION DISPLAY which now shows the next table position. If the previous entry had loaded the "AUX01" table location, the display would now show "AUX02-_____".

Although these descriptions may be confusing, it should become clear after the procedure is actually performed. To determine if this feature is needed at all, consult the PROGRAMMING section of this manual to see if the AUXILIARY CODES defined as "STANDARD" for the **2.5RS** are acceptable. If they are, there is no need for the "CUSTOM AUX CODE CONVERSION" feature. However, if special conversions are required, setup this table to perform the needed reassignments.

Once the table is loaded, press the "RECYCLE" key to exit.

SETUP&CONFIG4.5.11 SERV78-LOOP BACK

This procedure aids in debugging the RS-232 link from the **2.5RS** to a host computer.

When selected, this procedure begins sending the characters '0-9' and 'A-Z' followed by a CR,LF. This pattern is sent continuously as long as the Clear-to-Send (CTS) input line is in the active state. The display contains two data fields. The left side of the screen shows the characters which are being received on the RS-232 port, while the right side shows the status of the CTS line. If the CTS line is high (which allows the **2.5RS** to transmit data), the right side shows 'CTS'. If the CTS line goes low, the right side shows 'NOCTS'. The unit can be connected to a simple monitor, or a computer running "CROSS TALK" or a similar terminal emulation software package and the data link in both directions can be verified. Also, by looping the **2.5RS** back to itself, it provides a sort of self check. If the screen shows that it is receiving the data being transmitted, it probably indicates that the RS-232 port of the **2.5RS** is ok. When the fiber optic modems are used, the loopback can be done at two locations. Either a single fiber can be looped between the transmit and receive port of the modem inside the **2.5RS**, or the modem at the other end of the link can have it's RS-232 signals looped back so that the data being sent by the **2.5RS** goes out and back through both modems. The selection of BAUD RATE and CHARACTER FORMAT is similar to the operation of the program downloading software. The values stored in SD50 appears as the defaults when the LOOPBACK routine is called. The selections for program type (WADR,ESSI,etc.) and handshaking protocol (RTS, XON etc) do not have any effect on the loopback test.

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NOTE

There is a short delay after every 10 character's sent from the **2.5RS**. The data displayed in the readout when the **2.5RS** is looped back to itself pauses and allows it to be read and checked for proper operation. This delay may be disabled by pressing the "." decimal point key.

SETUP&CONFIG4.5.12 SERV97-VARIABLE STORE

This "SERVICE" FUNCTION allows the setup parameters adjusted with "SERV10" and the speed calibration and reference adjustment results from "SERV41", "SERV42", "SERV43", "SERV44" and, "SERV54", to be stored in a non volatile memory inside the **2.5RS**. If this function is not used, all adjustments return to their previous values when the power to the system is turned off and on or the "RECYCLE" key is pressed to switch modes of operations.

The **2.5RS** is equipped with a special "NON-VOLATILE" memory which is used to store the "SYSTEM DATA" parameters setup with the "SERV10" procedure and also the calibration values resulting from the "SERV51" speed calibration and "SERV54" reference adjust. This memory requires no battery or external power in order to "REMEMBER" the data. The only way the data in the memory can be changed is by using the "SERV97" procedure.

Since all data values are stored together, all adjustment of the "SYSTEM DATA" parameters and the speed calibration should be done before using the "SERV97" procedure.

If any of the "SYSTEM DATA" parameters are re-adjusted at a later date or if a second speed calibration is done, this procedure should be used again to store the changes.

NOTE

It is possible to try making adjustments to the "System Data" values without losing the original settings. To do this, use "SERV10" and "SERV40-44" to make any desired changes once a part program is already running, however, do not use the "SERV97" procedure to store them. The **2.5RS** uses the changed data until the "RECYCLE" key is pressed, or the power is turned off. When the power is re-applied or the "RECYCLE" key is pressed, the original values still stored in the Non-Volatile memory are returned. This can be a useful testing tool since the values can be changed while a part is running without worrying about permanently altering the machines performance.

When the "SERV97- VAR. STORE" function is selected, the display changes to a message which only says:

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- First, select "SERV51- SPD CAL", and press the "ENTER" key. The readout then prompts the operator to "SET SPD DIAL-THEN CYCLE START" and then displays "SET XXX - XXXXX" and the current setting of the speed dial is displayed. Do not press the "CYCLE START" key as the readout has instructed. Instead, press the "RECYCLE" key. This aborts the Speed Calibration, however the speeds have been preset to full speed. After all the parameters are set, the Speed Calibration can be done correctly.
- Now select -"SERV10- SYSTEM DATA".
- Set the following parameters as indicated. Note: Some of the values are preset to an estimated value now and then fine-tuned later. These estimated values are typical entries for the parameter but are not to be taken as the only valid ones.

(TYPICAL SETUP EXAMPLE)

| <u>PARAMETER</u> | <u>SET TO</u> | <u>EXPLANATION</u> |
|--------------------------|-----------------|---|
| SD60- OPERSYS | INCH | Given information- although this is not the first parameter, it should be set first so that any other speed or distance values appear in the correct units. |
| SD61- SYS CONF1G. | 0 | Standard 2.5RS |
| SD68- SPEED RANGE | 1 | Maximum machine speed is 163 ipm |
| SD01- ARC DELAY | 0.00 | Must be set to 0.00 to disable PLASMA PROMPTING |
| SD02- BLEEDOFF | 2.00 EST | This estimated value represents a typical time for the oxygen manifold to BLEEDOFF after the cut is turned off. When a part is actually cut, if the time appears too long or short, it can be re-adjusted. *****ALTHOUGH the time is arbitrary, it must be set to some non-zero value (at least .01) to automatically select the oxy/fuel cutting prompts. If both the PLASMA and BLEEDOFF TIMERS are set to 0.00, or if both are set to non-zero values, the operator is prompted to select the desired cutting sequence before the part can be run. This does not switch the machine electronics, only the prompting and relay sequencing performed by the control. |
| SD03-ACCEL TIME | .60 EST | ESTIMATED ACCEL TIME .60 SEC may be adjusted later. |

SETUP AND CONFIGURATION

| | | |
|------------------------------------|-----------------|--|
| SD04- MAX DRV SPD | 150.00 | Set to maximum speed of drive system on cutting machine- given as 150 ipm. |
| SD06- BACKUP SPD | 40.0 EST | NOMINAL BACKUP SPEED- may be adjusted. |
| SD07- CORNER SPD | 10.0 EST | NOMINAL CORNER SPEED- adjusted later. |
| SD08-MIN HOLD SPD | 2.00 EST | NOMINAL VALUE - adjusted later. |
| SD09-MAX ERR SPD | 20.0 EST | This value is usually acceptable as is. |
| SD10-RUN SPD LMT | 150.00 | Allows machine to cut up to maximum speed capacity of drive system. |
| SD11-TRV SPD LMT | 150.00 | Allows machine to traverse at maximum speed of drive system. |
| SD14- GAIN BREAK | 0 | Normally set to 0. |
| SD15- ERR WRN DST | .25 EST | ERROR WARNING DISTANCE set so warning sounds if machine jams and deviates from cut path by more than .25 in. |
| SD16- LOOP GAIN | 1.50 EST | Loop gain to be adjusted once actual test part is run. |
| SD17- ARC OFF TIME | 0.00 | Must be set to 0.00 to disable plasma prompts since machine only has OXY/FUEL. |
| SD18- SLWDWN DIST | .75 EST | Nominal SLOWDOWN distance-to be adjusted later when test part is run. |
| SD19- HEIGHT SENSOR DISABLE | 0.00 | No Plasma in use, oxygen only. |
| SD20 X DIST/REV | 5.105 | Given value for distance covered in one revolution of X axis encoder. |
| SD21- Y DIST/REV | 4.990 | Given value for distance covered in one revolution of Y axis encoder. |
| SD22- ENC LIN/REV | 500 | Encoders specified as 500 lines/rev. |

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| | | |
|------------------------------------|----------------|--|
| SD23- X ENC DIR | X | CANNOT BE PRESET-SET BY TEST. |
| SD24- Y ENC DIR | X | CANNOT BE PRESET. |
| SD25- X DRIVE DIR | X | CANNOT BE PRESET. |
| SD26- Y DRIVE DIR | X | CANNOT BE PRESET. |
| SD27- PLATE SIDE | RIGHT | Information given states that plate to be cut is to the "RIGHT" of the operator. |
| SD28- HEIGHT RELAY | NORM | Relay is used for Plasma auto height disable. Not used in OXY/FUEL cutting. |
| SD29- SLWDWN RAD | 2.00 | Nominal SLOWDOWN RADIUS although this value seems correct for many machines. |
| SD30- MIN RAD SPD | 20.00 | Typical Minimum Radius Speeds are 10-30 ipm. Adjusted later if necessary. |
| SD32- MIN SLW ANG | 10 | Typical value for most machines. |
| SD33- MAX SLW ANG | 22 | Typical value for most machines. |
| SD46- MIN OFF DLY | .50 EST | NOMINAL VALUE- gives .5 SEC delay after any function is turned off. |
| SD60- OPER SYS. | INCH | Given information. |
| SD62- SYS CONFIG2 | 0 | Set to 0. |
| SD63-SYSTEM CONFIGURATION 3 | 0 | Set to zero. |
| SD65-OVERLAY CFG | 0 | Set to zero. |
| SD31-PLASMA TB1 | No | Oxy/Fuel only was specified. |
| SD40-X MARKER OFFSET #1 | 0 | No marker. |

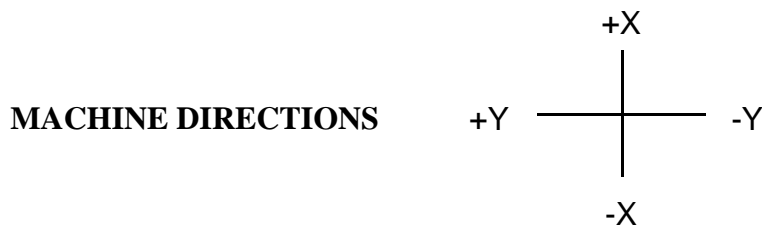
SETUP AND CONFIGURATION

| | | |
|--|----------------------------|---|
| SD41-Y MARKER OFFSET #1 | 0 | No marker. |
| SD42-MARKING SPEED (Not used in this control) | 0 | No marker. |
| SD43-MARKER DELAY (Not used in this control) | 0 | No marker |
| SD45-DEFAULT DWELL | 0 | Set to zero. |
| SD47-X MARKER OFFSET #2 | 0 | No marker. |
| SD48-Y MARKER OFFSET #2 | 0 | No marker. |
| SD49-START DELAY | 0 | Usually for plasma cutting. Set to 0 for oxy/fuel. |
| SD50-SERIAL DEFINITION | See Pg. 27 this section | Different BAUD range for 2.5RS and 2.5Plus |
| SD51-PRGM FORMAT | See Pg. 28 this section | |
| SD52-SPECIAL EOP | 0 | Set to zero. |
| SD53-FILE EXTEN | 434E4300 | “CNC” is standard. This is not really needed since downloading is not being used. |
| SD69- LANGUAGE SEL. | 0 | Set for English. |
| SD70-KNIFE DIA. | 0 | Not used for oxy/fuel cutting. |
| SD71-KNIFE BP ANGLE | 0 | Not used for oxy/fuel cutting. |

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| | | |
|--|---|---|
| SD80-SD95 PROGRAM-MABLE OFFSETS | 0 | Set to 0 unless customer has specific use. |
| SD96-X HOME INDEX SWITCH | 0 | No home function specified on this machine. |
| SD97-Y HOME INDEX SWITCH | 0 | |
| SDA0-X LASH | 0 | Initially set to 0. |
| SDA1-Y LASH | 0 | Initially set to 0. |
| SDA2-LASH RATE | 0 | Initially set to 0. |

After the values are preset, the following procedures will help in adjusting the values.



1. Turn up the operators speed dial and jog the machine in the +X direction. (See jog instructions). The machine should move in the rail axis, away from the operator.

If the machine moves toward the operator in the X (Rail) Axis, reverse the setting of "SD25-X DRIVE DIR" to the opposite "NORM"/"REV" setting.

If the machine moves in the cross axis, the wires to the drives are crossed. Correct the wiring, re-enter the preset values and go on.

2. Jog the machine in the +Y direction. The machine should move in the cross axis, to the left.

If the machine moves to the Right when the +Y Jog is pressed, reverse the setting of "SD26-Y DRIVE DIR" to the opposite "NORM"/"REV" setting.

SETUP AND CONFIGURATION

3. Now that the drives are moving in the right direction, the direction of the encoders must be set. Use the "SERV01- X/Y DSPLY" to show the X and Y positions and press the "CE" key to clear the X and Y values. Now plug in the X axis encoder cable only- do not plug in the Y encoder yet. Jog the machine in the +X direction to move down the rail. If the X readout counts positive (+), the X axis encoder direction is correct.

If the X position counts NEGATIVE (-), reverse the setting of "SD23- X ENC DIR" to the opposite "NORM"/"REV" value.

If the Y position counts when the X axis is moved, the encoder cables are interchanged.

4. Plug in the Y axis encoder and jog in the +Y direction. If the Y position counts positive (+), the Y encoder direction is correct.

If the Y position counts NEGATIVE (-), reverse the setting of "SD24- Y ENC DIR" to the opposite "NORM"/"REV" value.

5. Select "SERV54-AUTOMATIC REFERENCE ADJUSTMENT". Turn the operators speed dial to the "FULL SPEED" maximum position. Also, if there are any speed range switches, set them to the high speed setting so that the speed dial is now set for the maximum drive speed.

Press the "ENTER" key. The readout temporarily shows the DATA AND CALIBRATION VALUES, and then changes to the normal:

"FEEDRATE= 150.00"

At this point, the value displayed on the readout should be the same as the value entered for the MAXIMUM DRIVE SPEED AS "SD04- MAX SPD" or 150 for this example.

6. Set the control to test run a 5.00 inch diameter "CHAIN CIRCLE" part. Start the test run and turn the speed dial to full speed.

While the machine is going around the circle, if the path oscillates or is wavy, reduce the setting of "SD16- LOOP GAIN" until the oscillation stops. If no oscillation is noted, try raising the "SD16- LOOP GAIN" value until the shaking starts and then reduce it till it just stops.

Now check the performance of the machine as it slows for each corner of the part. If it appears to be banging into the corners rather than smoothly decelerating, either increase the "SD18- SLOWDOWN DIST" or decrease the "SD07- CORNER SPD" values. Since this is a trial and error type of adjustment, it is impossible to predict which adjustment gives the best results. Similarly, if the corners appear "Mushy", reduce the "SD18- SLOWDOWN DIST" or increase the "SD07- CORNER SPD".

After the machine slows for a corner, notice the acceleration out of the corner back to full speed. If it appears too long, reduce the "SD03- ACCEL TIME" value. Similarly if the acceleration appears too fast, increase the accel time.

2.5RS OPERATION AND MAINTENANCE MANUAL

Now Select SHAPE-23 "SQUARE- RADIN" and enter the appropriate dimensions to give a 5" rectangular part. Enter a corner radius of 0.10" in order to check the "SD30-MIN RAD SPD" parameter. Run the part at full speed and notice the speed during the small radii in the corners. If it appears that the radius runs to slow, increase the "SD30-MIN RAD SPD" parameter. If the machine overshoots the radius or seems to be running the small corner radii too fast, lower the "SD30-MIN RAD SPD" value.

The objective of all these adjustments is to provide the smoothest most accurate operation with a minimum of time spent in the corners. Try various combinations of adjustments to get the optimum performance.

7. Setup the control and run a series of "RINGS". After the cut is turned off, watch that the cutting oxygen has completely stopped before the machine begins to move to the pierce point on the outside.

If the machine begins to move before the cutting oxygen has stopped, increase the "SD02-BLEEDOFF" time value.

If the Bleedoff time value seems excessive, reduce the setting of "SD02-BLEEDOFF". Make sure the new value still provides enough delay to allow the cutting oxygen to stop before moving to the next part.

8. If the machine drives are well balanced, there is no need to do the automatic speed calibration. However, if the speeds are not balanced, the automatic speed calibration routine should be performed. See "SERV51- SPD CAL".
9. After all parameters are adjusted, and the speed calibration done, go to the "SERV97- VAR STORE" section of the manual and store the new values in the non-volatile memory.
10. Backlash is any lost motion when the machine is moved in the + and then in the - direction. Determine the backlash in each axis of the machine. This is done by joggng the machine and then subtracting the displayed dimensions from the measured movement in those axes.

Enter these dimension in SDA0 and SDA1. Set SDA2 to about 1/10 of the maximum value entered for SDA0 or SDA1

SERV54- REF ADJUST for the Burny 2.5 PLUS

The 2.5 PLUS software contains an enhanced version of the SERV54 –REF ADJUST that can compensate for both the voltage at the speed dials maximum setting, and also for any offset voltage at the speed dial's 0 speed setting. This is useful for systems where a small amount of offset voltage in the reference circuit prevents the readout from actually reaching 0.00 when the speed dial is turned fully CW. Alternately, this 0 speed voltage setting can be bypassed so only the maximum pot setting is adjusted as would have occurred with the old SERV54 in previous software versions.

SETUP AND CONFIGURATION

Press the hidden SERVICE button and select SERV54-REF ADJUST (either enter 54 or scroll down to SERV54.

Press the ENTER button—The screen will change to prompt the operator to:

“SET SPD DIAL= 0

“THEN PRESS ENTER”

“OR CE TO CANCEL”

The operator should turn the machine speed dial fully CCW to it's 0 speed setting, and turn any speed range switch on the machine to LOW or OFF. This allows the control to measure any offset voltage at the zero setting of the pot so it does not affect the speed settings on the machine.

Press ENTER after the speed dial is set to 0

At this point, if there is significant offset voltage present (over 50 mv), the control will not accept the 0 speed setting on the pot and will issue a series of 5 “warning beeps”. The display will remain on the “SET SPD DIAL= 0 “ prompt. This can occur if the speed dial is not set fully CCW. To correct the problem, turn the pot to it's full CCW setting and press the ENTER button again.

To bypass this 0 speed voltage adjustment, press the CE button. This will cancel any previous 0 volt adjustment and go on to the MAX pot setting.

NOTE: Some machines will not use a speed pot – the cutting speed is controlled using Digital Feedrate input only. In this case, pressing the CE button will bypass the 0 pot adjustment and continue on to adjust for the MAX pot setting.

Once the 0 pot setting is accepted, the prompt will change to:

“SET SPD DIAL=MAX”

“THEN PRESS ENTER”

The operator should turn the machine's speed dial fully CW to it's maximum setting. Also, if there are any speed range switches, set them to the HIGH SPEED setting so that the speed dial is at it's maximum setting.

Press the ENTER button to calculate the adjustment factor for the MAX position of the speed pot. The readout temporarily changes to show the data and calibration values, and then changes to the normal feedrate display:

2.5RS OPERATION AND MAINTENANCE MANUAL

FEEDRATE = XXXX.XX

Test the speed dial by slowly backing away from the full CW position and verify that the displayed FEEDRATE value begins to drop as the pot is turned.

Continue turning the speed dial all the way to its 0 speed setting and verify that the display shows: FEEDRATE=0. If it does not quite reach 0, it could indicate that noise on the signal was measured during the 0 calibration of the pot. If this occurs, repeat the SERV54 procedure.

If the pot operation is correct, the calibration values must be stored permanently. To do this, press the hidden SERVICE button and perform the SERV97 procedure. This will permanently store the results of the SERV54 procedure.

MACH2

MACHINE INTERFACE

This section describes the relays and sensing inputs of interface cards based on the **2.5RS COMBO INTERFACE CARD**. These relays and sensing inputs are used for the interface to the cutting machine. All the connections are made to 6PL on the interface card. See the Electrical Specifications section of this manual for the exact connection points available to the user for the inputs and outputs described below.

The **2.5RS** may also be ordered with interface cards that are not based on the COMBO CARD. Always refer to the Electrical Specifications section of this manual for connection points and electrical specifications for those cards.

MACH2.1

SENSING INPUTS

CAUTION

To ensure proper operation of the E-STOP or OXY SENSE and also the CUT SENSE inputs, and to avoid damage to the **2.5RS**, use the following information..

The sensing inputs are each isolated and are each set up for a two wire hook up. These inputs will respond to either AC or DC voltages.

On the interface circuit card, a 5 Watt resistor is connected in series with the input line. Check the value of this resistor to be sure that it matches the voltage of the circuitry on the machine. The values for the resistor are:

24 VAC or DC machine circuits use a 2 kOhm 5 Watt resistor on the card. Some cards require a jumper to bypass another resistor so that only the 2 kOhm resistor is actually used.

120 VAC or DC machine circuits use a 10 kOhm 5 Watt resistor on the card. There should not be a jumper across this resistor.

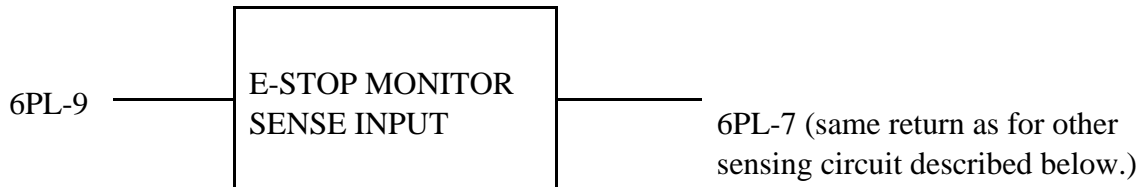
240 VAC or DC machine circuits use a 18 kOhm 5 Watt resistor on the card. There should not be a jumper across this resistor.

This resistor limits the maximum current drawn by the sensing input circuitry, however the input will respond to much lower voltages. **Therefore, care must be taken that when the input is supposed to be "Off" there are no low level leakage paths, such as suppression capacitors across switches or relay contacts, which could provide enough current to be sensed as an "On" input.** See also the Electrical Specifications section in this manual.

MACH2.2

E-STOP SENSING INPUT

Some of the interface cards for the 2.5RS include an additional sensing input circuit for monitoring the E-STOP status of the cutting machine. For those interfaces that provide this function, the connections are:



This input can be configured for various voltages as described in the Electrical Specifications Sections of this manual, and also above. The E-STOP monitoring function can be **enabled or disabled** depending on the settings of parameter SD61:

Setting SD61=0 Disables the E-STOP monitor input. This setting should be used for interface cards that do not provide the E-STOP input, or for machines where this input is not wired.

Setting SD61=12 Enables the E-STOP monitor input and requires the external machine wiring to provide an input voltage to this point as described below.

It is highly recommended that this input be connected to the machine's E-STOP circuit to allow the 2.5RS to properly respond to an E-STOP condition on the cutting machine.

For the E-STOP monitor to initiate an E-STOP, the voltage at 6PL-9 and 6PL-7 must be removed. Voltage must be applied to this input by the machine when the machine is ready to run. This allows the 2.5RS to stop any jog or part programs that may be running. If a jog is attempted while there is no voltage across 6PL-9 and 6PL-7, a message will appear warning that the machine is currently in an E-STOP condition.

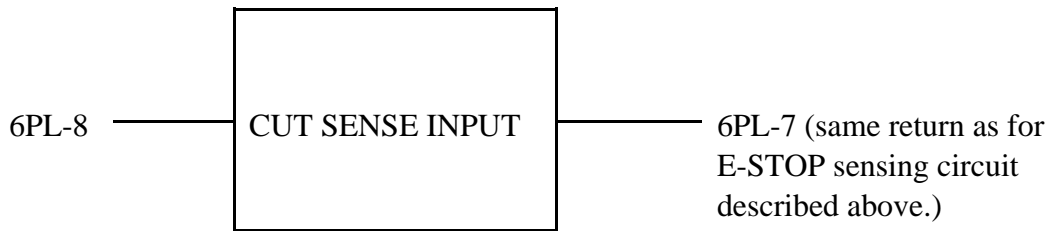
See the Electrical Specifications Section of this manual.

Note that the 2.5RS uses a common return for 6PL-9 (E-STOP sense) and 6PL-8(CUT or ARC ON sense). This common return is 6PL-7. The external circuitry must be able to accommodate a common return for both sense voltages.

SETUP AND CONFIGURATION

MACH2.3

OXY/FUEL CUT SENSE INPUT



This input is used to sense that the cutting oxygen switch has been turned on and that motion along the cut path can begin. Typically, this signal is connected directly to the cutting oxygen switch or to a signal line which operates at the same time. The cut switch must be sensed in an 'OFF' position before the logic will allow the cutting circuit to be enabled. Once a cut has finished and the machine has moved to a new pierce location, this signal must go off for at least 1 second before a new cut will be allowed to start.

NOTE

In the following descriptions, the term "OVERRIDE" will be used to indicate that the operator has pressed the "NC RUN" button and has caused the LED in the button to go out. This disconnects the **2.5RS** outputs and returns to manual machine operation. See GENERAL OPERATIONS SECTION.

MACH.3

OXY/FUEL CUT INTERFACE DESCRIPTION

Although the **2.5RS** operates either OXY/FUEL or PLASMA cutting systems, the small size of the cabinet prevents the use of independent relays for each function. Therefore, the 3 relays are used for both plasma and oxy/fuel cutting. If a machine is to have only one of the cutting processes, the connections can be made directly to the **2.5RS**. However, if the machine is to have both plasma and oxy/fuel, it usually requires the addition of an external relay to switch the signals from the **2.5RS** to the appropriate cutting circuitry. This description shows the operation for both the plasma and oxy/fuel cutting modes.

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As described in the "2.5RS INSTALLATION SECTION", the selection of either the oxy/fuel or plasma operation of the relays is determined in one of two ways:

- A. If the "ARC ON DELAY" and "ARC OFF DELAY" setup parameter are set to 0.00, the **2.5RS** will automatically assume that only OXY/FUEL CUTTING is to be done, and the relays will act accordingly. Or if the cutting oxygen "BLEEDOFF" time is set to 0.00, the plasma cutting sequence will be assumed.
- B. If both the PLASMA and OXY/FUEL setup parameters have values other than 0.00 entered, it indicates that both systems are present on the machine. In this case, the operator will be prompted to enter the type of process being used, either plasma or oxy/fuel. This will then select the appropriate relay sequencing. However, it does not switch the external circuitry to the desired system. Thus the operator is responsible for making sure that the machine is set to use the same cutting process as is entered into the **2.5RS**.

If the **2.5RS** is set for oxy/fuel cutting (See Above), the following are the definitions of the relays.

MACH.4 RELAY CONTACTS

The RELAY CONTACT outputs used for the cutting interface are capable of switching loads rated as in the Electrical Specifications section of this manual. Since these are Power contacts, it is not recommended that they be used for "Dry" circuit logic levels. All contacts are "Maintained" type. If a momentary action is required, external circuitry must be used to perform it.

MACH4.1 OXY ENABLE CONTACT

If the **2.5RS** is set for oxy/fuel cutting (See Above), the following are the definitions of the relays.

PINS 5 AND 6 OF 6PL

6PL-6 S)))) 1 /))) Q 6PL-5

This contact must be connected to the oxygen cutting circuit in such a way that opening it will stop the cutting oxygen and reset any automatic relay sequencing. When running a part, this

SETUP AND CONFIGURATION

contact will not close until the "OXY sense input" is first sensed to be off.

2.5RS OPERATION AND MAINTENANCE MANUAL

This prevents the enable contact from re-starting the cut. This contact is only supposed to enable the cutting circuit so the oxygen can be started either by the manual cut switch or by the **2.5RS** "OXYGEN START CONTACT".

If the **2.5RS** is set to "OVERRIDE", this contact will be maintained in a closed position to enable the existing machine cutting circuitry.

MACH4.2 OXY START CONTACT

PINS 3 AND 4 OF 6PL

6PL-3 S))) 1 /))) Q 6PL-4

This contact is connected to the cutting circuit so that it can initiate the cutting oxygen, but only if the "OXY ENABLE CONTACT" is closed. It may either directly connect the cutting oxygen circuit, or may provide a signal to the machines existing AUTO CUT circuitry. This contact will only operate when "AUTO" oxy/fuel cutting is selected. The contact will close after the "PREHEAT" time reaches zero (0) and will remain closed until the part is complete. If "MANUAL" cutting is selected, this contact will remain open, and the cutting oxygen must be started with the machines existing manual cutting controls.

If the **2.5RS** is in "OVERRIDE", this contact stays open.

MACH4.3 HI PREHEAT CONTACT

PINS 1 AND 2 OF 6PL

6PL-1 S))) 1 /))) Q 6PL-2

This contact is connected to the cutting circuit in such a way that it can initiate the HIGH PREHEAT FUNCTION of the gas controls. This contact will only operate when "AUTO" oxy fuel cutting is selected, in "MANUAL" cutting, the contact will remain open. This contact will close for the "PREHEAT" time specified by the operator and then open for the remainder of the cut.

If the **2.5RS** is in "OVERRIDE", this contact will remain open.

SETUP AND CONFIGURATION

MACH4.4

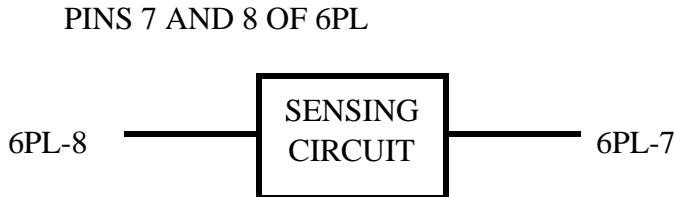
PLASMA INTERFACE

If the **2.5RS** is set for PLASMA CUTTING, the following relay sequencing will be used. The following table shows the changes in assignment for the relay contacts and the sensing input:

| <u>CONTACTS</u> | <u>OXY/FUEL</u> | <u>PLASMA</u> |
|-----------------|-----------------|-----------------------|
| CONTACT 6PL-1,2 | HI PREHEAT | HEIGHT SENSOR DISABLE |
| CONTACT 6PL-3,4 | OXY START | PLASMA START |
| CONTACT 6PL-5,6 | OXY ENABLE | PLASMA ENABLE |
| INPUT 6PL-7,8 | OXY CUT SWITCH | PLASMA ARC ON SENSE |

MACH4.5

PLASMA ARC ON "GO" INPUT



This input is used for sensing when the arc has transferred to the plate and motion along the cut path can begin. It operates much the same as the "OXY SENSE INPUT" described earlier in that it must be in an "OFF" state before the plasma circuit will be enabled. Also, motion along the cut begins when the input goes "ON".

Since some plasma units do not have a "ARC ON" contact output, a timer function is provided which delays motion by a specific time after this input receives the "ON" signal. This plasma-on delay time is set with the "SD01-ARC DELAY" parameter described in the Installation section of this manual. A second timer set by "SD17- ARC OFF DLY" causes a delay after the arc goes out. This allows the machine to continue moving after a part falls out and causes the arc to extinguish.

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MACH4.6

PLASMA ENABLE CONTACT

PINS 5 AND 6 OF 6PL

6PL-5 S))) 1\ /))) Q 6PL-6

This contact is typically connected in series with the plasma stop circuit so that opening it will stop the cut but closure does not initiate the cut. The enable contact will not close until the "arc on" input is sensed as being "OFF". Once it has closed to enable a plasma cut, it will remain closed for the entire part and then open when it is finished. It will also open if either the "CYCLE STOP" or "BACKUP" button is pressed.

If the **2.5RS** is set to "OVERRIDE", this contact will be maintained in a closed position to allow for normal manual control of the plasma circuit.

MACH4.7**PLASMA START CONTACT**

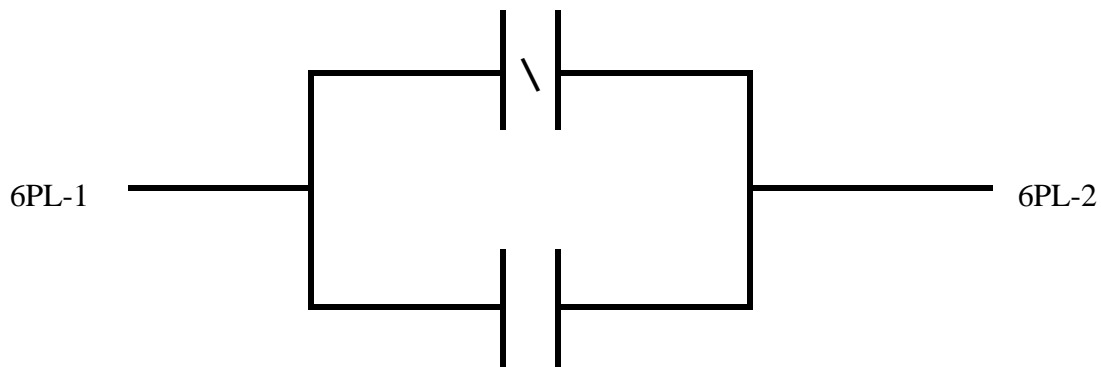
6PL-3 S))) 1 /))) Q 6PL-4

This contact should be connected to the plasma control circuitry so that it can close to initiate the plasma cut, but the cut can still be stopped. either by the "PLASMA ENABLE CONTACT" opening, or by the operator pressing the plasma stop button. This contact only operates when "AUTO" plasma cutting is selected and will remain closed during the entire plasma cut. If "MANUAL" cutting is selected, this contact will remain open.

If the **2.5RS** is in "OVERRIDE, this contact stays open.

MACH4.8**PLASMA HEIGHT DISABLE CONTACT**

PINS 1 AND 2 OF 6PL



This contact is connected to the plasma height sensing system such that when activated, the height sensor is disabled and the torch is "FROZEN" at the existing height. When the contact is released, the height sensor regains control of the torch height. The normal (non-activate) state of this contact is selectable by "SD28-HEIGHT RELAY" parameter for either NORMALLY OPEN or CLOSED operation. Thus it can be set to accommodate the various height sensing systems.

The contact will maintain the "NORMAL" condition as long as the machine is running at the speed set by the operators speed dial. However, when the machine is slowed for a corner, this contact will switch and maintain the activated condition until the machine has accelerated back to the normal cutting speed. This prevents the height sensor from lowering the torch due to the reduced cutting speed in the corner.

If the **2.5RS** is in "OVERRIDE", this contact will be maintained in the "NORMAL" condition as set by the "SD28" PARAMETER.

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MACH4.9 CUT CONTROL RELAY OUTPUT SEQUENCING DIAGRAMS

| | 1A POWER OFF | 1B AFTER POWER UP | 1C PRESS RECYCLE |
|--------------------------|-----------------|-------------------------|---------------------|
| OXYGEN ENABLE CONTACT | OPEN | OPEN | OPEN |
| OXYGEN START CONTACT | OPEN | OPEN ----- | OPEN ----- |
| HIGH PREHEAT CONTACT | OPEN | OPEN | OPEN |

MANUAL OXY/FUEL CUTTING SEQUENCE

This sequence will be followed when oxy fuel cutting is selected either by the combination of setup parameters, or by the operator selecting oxy/fuel cutting when the part is run.

| | 2A | 2B | 2C | 2D | 2E | 2G | 2F | 3H |
|---------------|---|---|--|--|---|--|---|--|
| | RECYCLE/RESET PROGRAM SELECT AND SETUP | PRESS CYCLE START MOVING TO NEW PIERCE POINT | ARRIVE AT PIERCE POINT WAIT UNTIL OXY SW INPUT IS OFF | OXY SW. SENSE INPUT OFF--- ENABLE OXY CUT CIRCUIT | WAIT FOR OXY SENSE INPUT TO SENSE CUT OXYGEN IS ON, THEN START CUT MOTION | CUTTING IF BACKUP IS PRESSED DURING THIS TIME, GO TO 2C | WHEN CUTTING PATH IS COMPLETE GO TO 2B | AT ANY TIME, IF CYCLE STOP PUSHED GO TO 3B |
| OXYGEN ENABLE | OPEN | OPEN | OPEN | CLOSE | CLOSE | OPEN | OPEN | OPEN |
| OXYGEN START | OPEN | OPEN | OPEN | CLOSE | CLOSE | OPEN | OPEN | OPEN |
| HIGH PREHEAT | OPEN | OPEN | OPEN | OPEN | OPEN | OPEN | OPEN | OPEN |

SETUP AND CONFIGURATION

OXY/FUEL - "AUTOCUT" RELAY SEQUENCING

| | 3A | 3B | 3C | 3D | 3E | 3F | 3I | 3G | 3H |
|-----------------|-------------------------------------|---|--|--------------------------------------|---|--|--|---|--|
| | RECYCLE AND SELECT PROGRAM | AFTER CYCLE PUSHED MOVING TO NEW PIERCE POINT | ARRIVE AT NEW PIERCE POINT WAIT FOR INPUT OFF | PREHEAT FOR SPECI FIED TIME | PREHEAT OFF ENABLE OXY AND START CUT | DON'T MOVE UNTIL OXY SENSE INPUT IS ON | CUTTING IF BACKUP PUSHED DURING THIS TIME GO TO 3B | TURN OFF OXY AT END OF CUT PATH GO TO 3B | AT ANY TIME, IF CYCLE STOP PUSHED GO TO 3B |
| OXY ENABLE | OPEN | OPEN | OPEN | OPEN | CLOSE | CLOSE | OPEN FOR BACKUP | OPEN | OPEN |
| OXY START | OPEN | OPEN | OPEN | OPEN | CLOSE | CLOSE | OPEN FOR BACKUP | OPEN | OPEN |
| HIGH PREHEAT | OPEN | OPEN | OPEN | CLOSE | OPEN | OPEN | OPEN | OPEN | OPEN |

2.5RS OPERATION AND MAINTENANCE MANUAL

PLASMA CUTTING- "MANUAL CUT" RELAY SEQUENCING

| | 4A | 4B | 4C | 4D | 4E | 4F | 4H | 4G |
|-----------------------------|------------------------------|--|---|---|--|--------------------------------------|---|---|
| | RECYCLE SELECT PROGRAM | PRESS CYCLE START MOVING TO NEW PIERCE POINT | ARRIVE AT PIERCE POINT WAIT FOR ARC-ON SENSE TO BE OFF | ENABLE PLASMA CUTTING OPERATOR STARTS PLASMA WAIT TILL ARC-ON IS SENSED | DELAY MOTION FOR PURGE DELAY TIME (SD01) | BEGIN MOTION ALONG CUT PATH | CUTTING IF BACKUP PRESSED GOTO 4C | WHEN CUTTING PATH IS COMPLETE OR IF CYCLE STOP IS PRESSED GOTO 4B |
| PLASMA ENABLE | OPEN | OPEN | OPEN | CLOSE | CLOSE | CLOSE | OPEN FOR BACKUP | OPEN |
| PLASMA START | OPEN | OPEN | OPEN | OPEN | OPEN | OPEN | OPEN FOR BACKUP | OPEN |
| PLASMA HEIGHT DISABLE | OPEN | OPEN | OPEN | OPEN | OPEN CLOSE *NOTE1 | OPEN CLOSE *NOTE1 | OPEN FOR BACKUP | OPEN |

Assumes plasma cutting has been selected either by the combination of setup parameters, or by the operator selecting plasma cut mode before the part is run.

NOTE1 HEIGHT DISABLE CONTACT remains closed until machine accelerates to cutting speed. It then opens to allow height sensor operation. The contact will close again if machine slows for a corner in the part program, or if the HEIGHT SENSOR DISABLE function code is read from the part program.

SETUP AND CONFIGURATION

PLASMA CUTTING- "AUTOCUT" RELAY SEQUENCING

| | 5A RECYCLE SELECT PROGRAM | 5B PRESS CYCLE START MOVING TO NEW PIERCE POINT | 5C ARRIVE AT PIERCE POINT WAIT FOR ARC-ON SENSE TO BE OFF | 5D ENABLE PLASMA BEGIN START DELAY TIMER (SD49) | 5E START DELAY TIME =0.00 START PLASMA WAIT TILL ARC-ON SENSED | 5F DELAY MOTION FOR PURGE DELAY TIMER | 5G BEGIN MOTION ALONG CUT PATH WHEN PURGE DELAY TIMER =0.00 | 5H WHEN CUTTING PATH IS COMPLETE OR IF CYCLE STOP IS PRESSED GOTO 4B | 5I IF BACKUP PRESSED |
|-----------------------------|------------------------------------|--|---|--|--|---|---|---|-------------------------------|
| PLASMA ENABLE | OPEN | OPEN | OPEN | CLOSE | CLOSE | CLOSE | CLOSE | OPEN | OPEN |
| PLASMA START | OPEN | OPEN | OPEN | OPEN | CLOSE | CLOSE | CLOSE | OPEN | OPEN |
| PLASMA HEIGHT DISABLE | OPEN | OPEN | OPEN | OPEN | CLOSE | CLOSE | OPEN CLOSE *NOTE1 | OPEN | OPEN |

* NOTE1 HEIGHT DISABLE CONTACT remains closed until machine accelerates to cutting speed. It then opens to allow height sensor operation. The contact will close again if machine slows for a corner in the part program, or if the HEIGHT SENSOR DISABLE function code is read from the part program.

PART 8 ERROR MESSAGES

ERROR MESSAGES

This section contains the various ERROR MESSAGES which may occur during operation. In some cases, the error is merely an incorrect number entry while others indicate a hardware or software error which should not occur under any circumstances.

ERROR.1 ERRORS FROM PROGRAM OPERATIONS

These errors can occur during any of the selection operations for the major program functions (RUN, LOAD, ETC).

ERROR1.1 DUPLICATE PROGRAM

When "LOAD" or "TEACH" is selected and a program number is entered as the number to be used in storing the data, it is checked to make sure that no other program already stored in memory has the same number. If a duplicate number is found, this error is displayed. At this point, either use the "DELETE" function to erase the duplicate or enter a different program number for the new program.

ERROR1.2 PROGRAM LIST EMPTY

This error indicates that no programs are stored in memory. It occurs, for instance, when the "DELETE" function is used and there are no programs to delete.

ERROR1.3 ENTER PROGRAM NUMBER

This message occurs when a program number of 00000000 is entered for any function. Zero may not be used for a program number.

2.5RS OPERATION AND MAINTENANCE MANUAL

ERROR1.4 NO PROGRAM FOUND

If either "RUN", "DELETE" or "STORE" is selected and the entered program number is not in memory, a "NO PGM XXXXXXXX" message is displayed. Correct the program number and re-enter it.

ERROR1.5 MEMORY DISABLED

This error can occur when selecting any of the functions. It indicates that a potential power loss was detected and that program memory has been set to a protected state. This is done so that if a power loss does occur, the programs in memory remain intact. To correct, press the "RECYCLE" key to re-enable and test the memory.

ERROR1.6 PROGRAM MEMORY FULL

This error occurs when either "LOAD" or "TEACH" is selected and indicates program memory is full and cannot accept another program. Use the "DELETE" function to erase any unneeded programs and re-enter the desired function.

ERROR1.7 END OF LIST

This is not an error condition but merely a data display. It occurs in any function mode when instead of entering a program number, the scroll functions are used to index through the list of available programs. When the last program in memory is reached, an "END OF LIST" message is displayed followed by the number of bytes of memory currently used for program storage and the number remaining available for new programs.

ERROR1.8 "0" BYTES IN PROGRAM

This indicates that a program which was selected to run has no program data in it and therefore cannot run. This can occur if a program load is started but not completed. The program space was created in memory but no data was ever stored. The normal operation at this point would be to delete the program and either re-load it or run a different one.

ERROR1.9 RECYCLE ERRORS

Each time the "RECYCLE" key is pressed, the main system memory used for storing part programs is checked for any data or format errors. If all tests are OK, the main "SELECT FUNCTION" prompt returns. However, if an error is detected, a "PGM MEMORY ERR" appears instead. Press "RECYCLE" again to try to clear the error. If the memory can be reset, the error message is removed and the usual "SELECT FUNCTION" prompt is redisplayed.

ERROR1.10 DATA ERROR - RESET MEMORY

If a "DATA ERROR", message followed by "YES RESET MEM. NO" appears, it indicates that the program data is invalid and is unusable. To abort the reset operation, press the "+/-" key to make the word "NO" in the readout flash and then press "ENTER". This does not correct the problem however, and program memory is not reset. To reset memory and return to normal operation, press the "+/-" key to make the word "YES" in the readout flash, then press "ENTER". When the reset operation is selected, a further prompt is issued to make sure that the operator realizes that this operation erases all programs in memory. To continue with the reset, press the "+/-" key to make the word "YES" in the readout flash, then press "ENTER".

ERROR1.11 RESET MODE ONLY

Some operations cannot be used while others are running. If they are attempted at the wrong time, a "RESET MODE ONLY" message is displayed and the operation does not execute. To perform the desired operation, the current operation must be stopped by pressing the "RECYCLE" key and then re-selecting the function.

ERROR.2 RUN TIME ERRORS

These error messages only appear while a part program is actually running.

ERROR2.1 MEMORY TRIP WHILE RUNNING

The protection circuitry for program memory constantly monitors various circuit conditions for any problems. If an error develops, it trips a protection latch which prevents any data from being written into the program memory. This message occurs while running a part and indicates that an error condition has been detected. To reset the error, first return the machine to the original start position so the part can be re-run. Then press the "RECYCLE" key to re-enable the memory. The test run mode can be used to re-trace the machine path back to where the operation was halted. The desired cutting mode can then be selected and operation resumed.

ERROR2.2 PATH ERROR

The **2.5RS** constantly monitors the machine position while a part is being run. If it detects that the path has deviated by more than a preset value (selected during installation), it issues a warning message accompanied by a beeping sequence. This warning does not stop the machine, only warns the operator that the part being cut is not within the preset error distance.

ERROR.3 TEACH MEMORY ERRORS

During the **TEMPLATE TEACHING** process, the data storing operation is constantly being checked for errors. If an error is detected, the teaching process stops and an error message is displayed. The various explanations for these errors are found in section "**TEMPLATE TEACH TRACE**".

ERROR.4 ERRORS DURING SERIAL I/O OPERATIONS

Several conditions can occur during the **SERIAL I/O** operations which cause error messages to be displayed.

ERROR4.1 READ TIMEOUT

This error indicates that the data being received by the **2.5RS** has stopped for longer than the nominal timeout value (60 SEC). The operation has been aborted.

ERROR4.2 WRITE TIMEOUT

This error indicates that data transmission has been delayed due to an in-operative device being connected to the RS-232 port for longer than a the nominal timeout value (60 SEC).

ERROR4.3 PARITY ERROR

This error indicates that during a serial operation, a PARITY ERROR was detected and caused the operation to abort.

ERROR4.4 OVERRUN ERROR

During data reception, if the data is transmitted too fast, or is sent at the wrong baud rate, an overrun error occurs and terminates the operation.

ERROR4.5 FRAMING ERROR

During data reception, a received character with the wrong number of bits causes this error to be displayed and terminates the operation. This can occur if noise is present on the transmission line or if the wrong baud rate is used.

ERROR4.6 DATA COMM ERROR

This error indicates that the handshaking controlling the communication did not work and that data was lost.

ERROR4.7 FORMAT ERROR

During a "LOAD" operation, if the program being received does not match the specified program format type (ESSI, WORD ADDR, ETC,) this error message is displayed.

ERROR4.8 PROGRAM NUMBER WARNING

When a program "LOAD" operation is complete, the program number contained in the transmitted data is compared to the number requested by the operator. If these two do not match, this warning occurs, however the program is loaded as the number requested.

PART 9 RETROFITS

RETROFIT AND RETROFIT INSTALLATION

RETRO.1 GENERAL EXPLANATION OF A CNC RETROFIT

The main reason to add a **2.5RS** control to a cutting machine is to increase productivity. The **2.5RS** eliminates the need to use a template. The **2.5RS** also adds accuracy to the shape being cut and makes the operator's job of cutting easier.

The objective of the installation section is to graphically explain the mounting of necessary hardware utilized by the **2.5RS** to run the cutting machine. A **2.5RS** can be installed on almost any cutting machine with an X-Y coordinate drive system. The **2.5RS** provides NC control with the capability of switching back to photocell control if it is desired.

At the end of this section are drawings of hardware that the **2.5RS** uses and how it is mounted on a cutting machine. It would be difficult to supply a drawing for every cutting machine.

The purpose of the hardware mounting drawings is to give a basic idea of how the hardware is actually mounted. By using the drawings and following the specified rules for correct mounting procedure, it should be possible to mount the necessary hardware on almost any cutting machine.

Keep in mind that this section gives the basic idea of the hardware mounting procedure. The actual method implemented by the customer is determined by the personal preference and added input from personnel involved in the project.

2.5RS OPERATION AND MAINTENANCE MANUAL

RETRO.2

GEAR RACK MOUNTING

1. Always try to mount the gear rack teeth facing sideways or facing down. Mounting the rack with the teeth facing up will cause the rack to accumulate cutting dirt and the teeth to become clogged creating dimensional errors.
2. The gear rack should be mounted directly to the machine if possible. If this method does not allow for proper clearance or encoder mesh into the gear rack, another method must be used. One such method is to mount the gear rack on a separate angle bracket. By doing this, the gear rack is away from the cutting machine surface to give extra clearance for proper mesh. Washers or spacers can also be used to move the gear rack away from the cutting machine surface for added clearance.
3. Be sure that the gear rack covers the entire travel distance of both rail and cross axis. Allow enough rack at all travel limit ends that encoder does not go off of the end of the gear rack.
4. When joining two sections of rack, always use a short piece (about 2 or 3 inches) to obtain proper mesh between six foot rack sections. Invert the short piece of rack into the two sections that are being joined together, over the joint to obtain proper mesh. **DO NOT BUTT TWO SECTIONS AGAINST EACH OTHER.** This will cause an improper mesh and result in dimensional errors on parts being cut.
5. Take the time to do a good job. Improper mounting of rack will result in problems and the control will not work to expectations.
6. Use whatever means is possible to insure that the gear rack is straight both horizontally and vertically. A bowed rack will cause dimensional errors on parts being cut.

RETRO.3 ENCODER MOUNTING EXPLANATION

The purpose for using digital encoders with the **2.5RS** system is to provide a feedback pulse. This tells the **2.5RS** exactly where it is at all times. Incorrect mounting of the encoders will cause the **2.5RS** to get false distance readings causing the cut part to be the wrong size. The following rules are provided so that encoders are mounted correctly insuring that accurate feedback is supplied to the **2.5RS**. This in turn will insure the parts being cut are correct dimensionally.

1. Always have the encoder parallel to the gear rack (see drawing # B0-19621). The distance from the center of the encoder shaft and distance from the center of the shoulder screw pivot should be the same distance to the gear rack.
2. Choose a suitable location for encoder mounting. Try to stay away from mounting the encoder in a vulnerable location such as the end of a rail truck or next to the torches.
3. On a bridge type machine with a dual rail axis, always mount the rail encoder on the tracing table side away from the cutting torch side.
4. On a cantilever machine, always mount the rail encoder on the center support beam. If possible, mount the rail axis encoder on the tracing table side away from the cutting torch side.
5. If possible, mount the cross axis encoder to the cross axis drive gearbox. Mounting the encoder to the tracing eye is acceptable, but use this method as a second choice.
6. Encoders come with a universal mounting bracket. (See Drawing # BO-19618). The mounting bracket configuration can be re-arranged to meet mounting requirements.
7. Always leave enough clearance from the top of the encoder housing to any part of the cutting machine. An encoder cable is plugged into the connector on top of the encoder housing. This calls for a 3" clearance from the top of the housing to any part of the cutting machine.

2.5RS OPERATION AND MAINTENANCE MANUAL

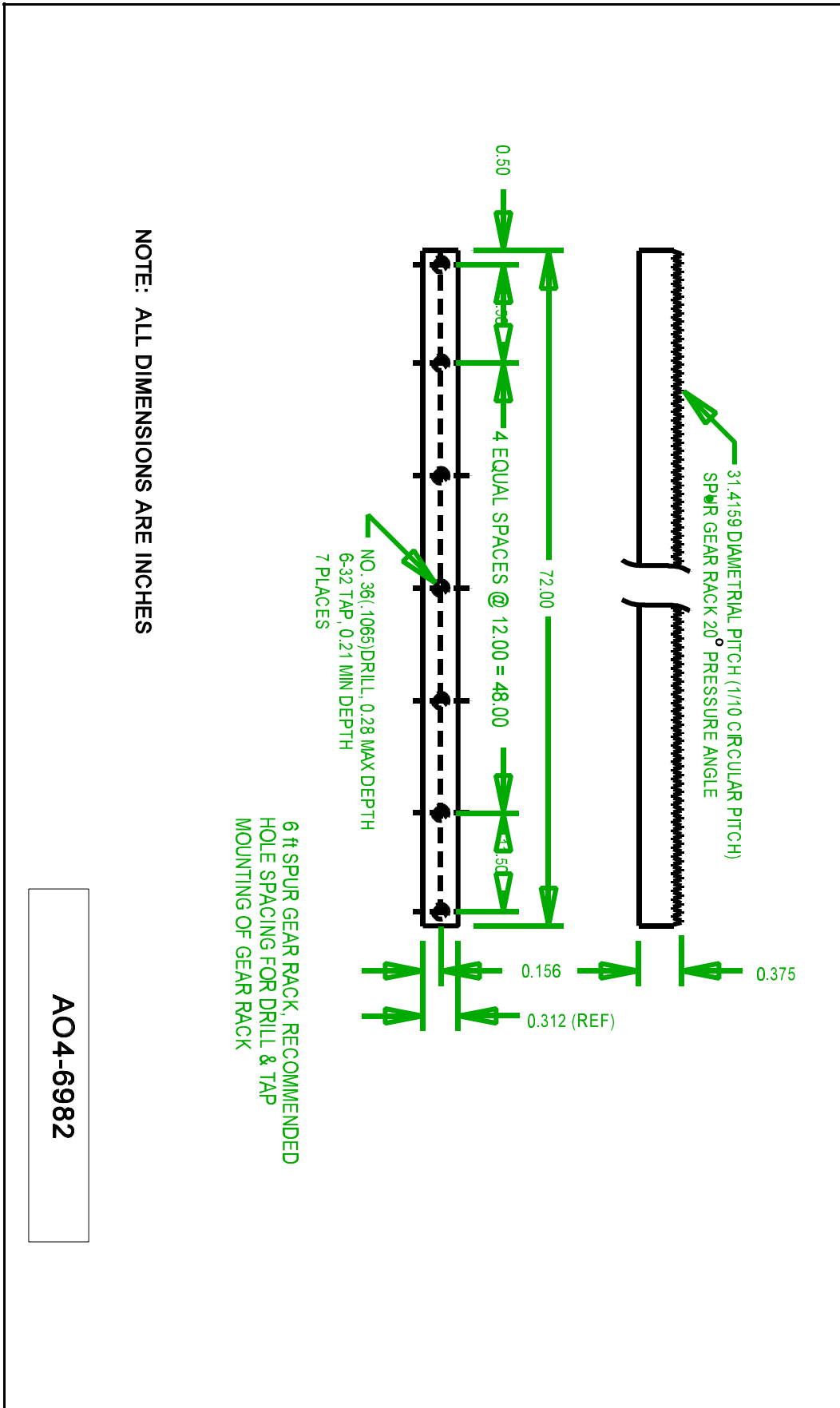
8. Encoders are spring loaded with minimum tension into the gear rack. Encoders do not require a great amount of tension to hold them for proper mesh with the gear rack. Just enough tension to keep the encoder firmly meshed and to keep it from popping out of the rack will do. Too much tension will damage the encoder. A conventional tension or compression spring can be used to spring load the encoder into the gear rack.
9. After the encoders are mounted, be sure to run the cutting machine to all maximum travel limits. Verify that nothing interferes with either encoder.
10. Avoid any sharp impacts to the encoder. Sharp impacts will damage the encoder.

RETRO.4 CABLE LENGTH DETERMINATION

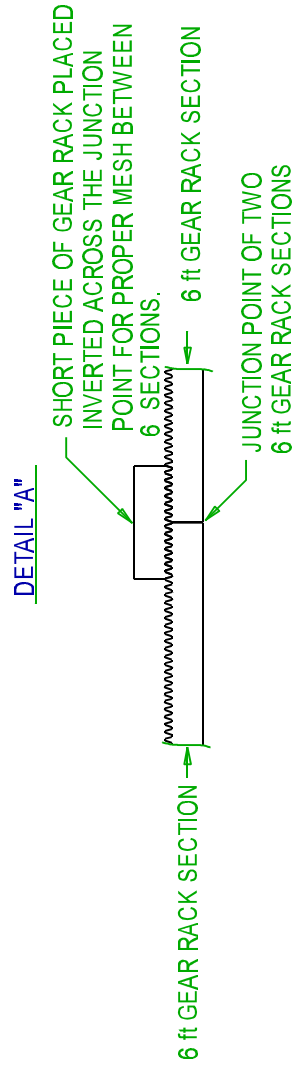
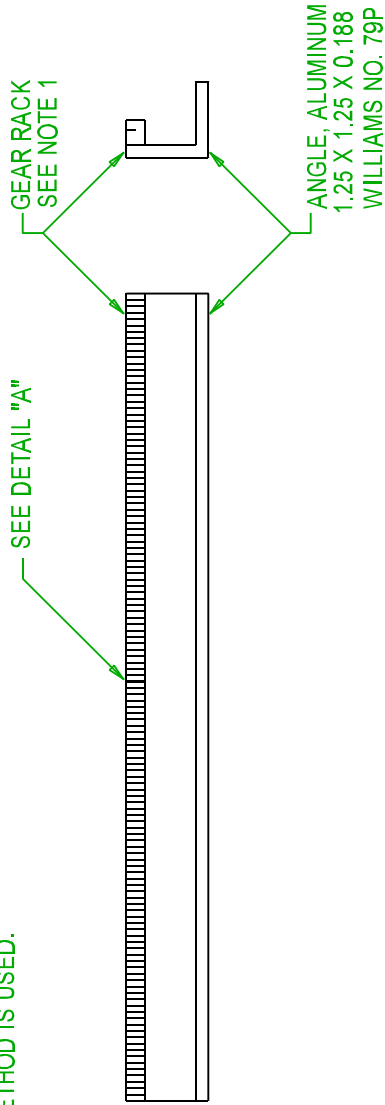
1. In general, the cable lengths that are needed depend on the application and what additional options are ordered with the **2.5RS**.
2. The determination of cable lengths is very important. In general, always allow more. (At least an extra 18 to 24 inches)
3. It is important to make sure all cables are long enough, but extremely long cables can act as an antenna for electrical noise.
4. For plasma cutting applications it is a **MUST** that all **2.5RS** cables be routed to keep them separated from any plasma cables by a minimum of two feet. This is done to minimize the possible damage caused by high frequency spikes produced by a plasma system.
5. Always determine the location of the **2.5RS** and encoders before measuring for cable lengths.
6. Encoder cables are always needed for the **2.5RS** application. To determine the length of the encoders cables, first decide where the encoders will be mounted. Then measure the length from each encoder (X and Y) to the lower back panel of the **2.5RS**. The two lengths normally will be different.

7. Generally, the cross axis encoder cable will be longer than the rail axis encoder cable. Because the **2.5RS** and the rail axis encoder are both stationary, the distance from the **2.5RS** to the rail axis encoder is fixed. The cross axis encoder cable length is determined by measuring from the **2.5RS** to the tracing eye or the cross axis drive, where the encoder is mounted. This cable should be long enough to reach both limits of the axis.
8. Generally the **2.5RS** is mounted to the operators station which contains all the signals needed to control the cut solenoids. However if this is not the case a power/oxy cable length may be needed for some **2.5RS** application. This length is determined by measuring between the cutting machines existing operators panel,(where the gas function controls are located) and the back panel of the **2.5RS**.
9. Generally the **2.5RS** is mounted to the operators station which contains all the signals needed to control the drives. However if a drive cable length may be needed on some **2.5RS** applications. This length is determined by measuring between the cutting machines operating station, (where tracing and stripping controls are located) to the back panel of the **2.5RS**.
10. When measuring for cables, DO NOT measure in a straight line from point to point. Allow enough cable for proper routing with existing machine cables.

2.5RS OPERATION AND MAINTENANCE MANUAL



NOTE:
1.) GEAR RACK CAN BE DRILLED & TAPPED OR WELDED TO ANGLE BRACKET. EXERCISE EXTREME CARE IF TACK WELD METHOD IS USED.

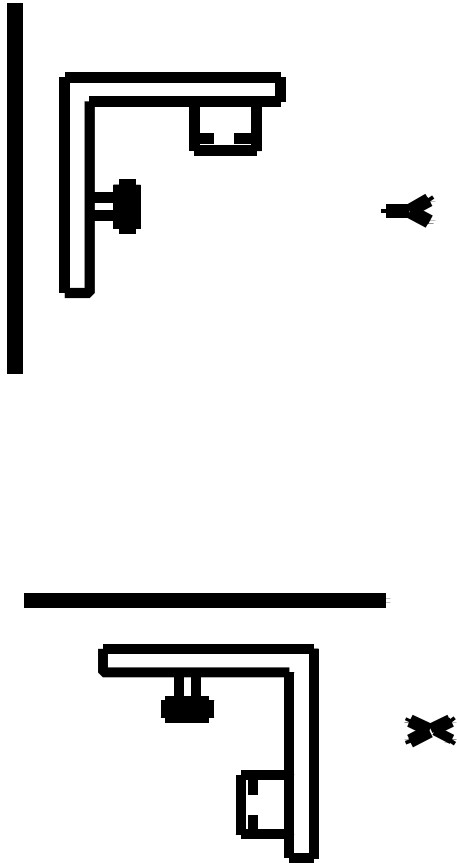


GEAR RACK BRACKET ASSEMBLY

B01-1684

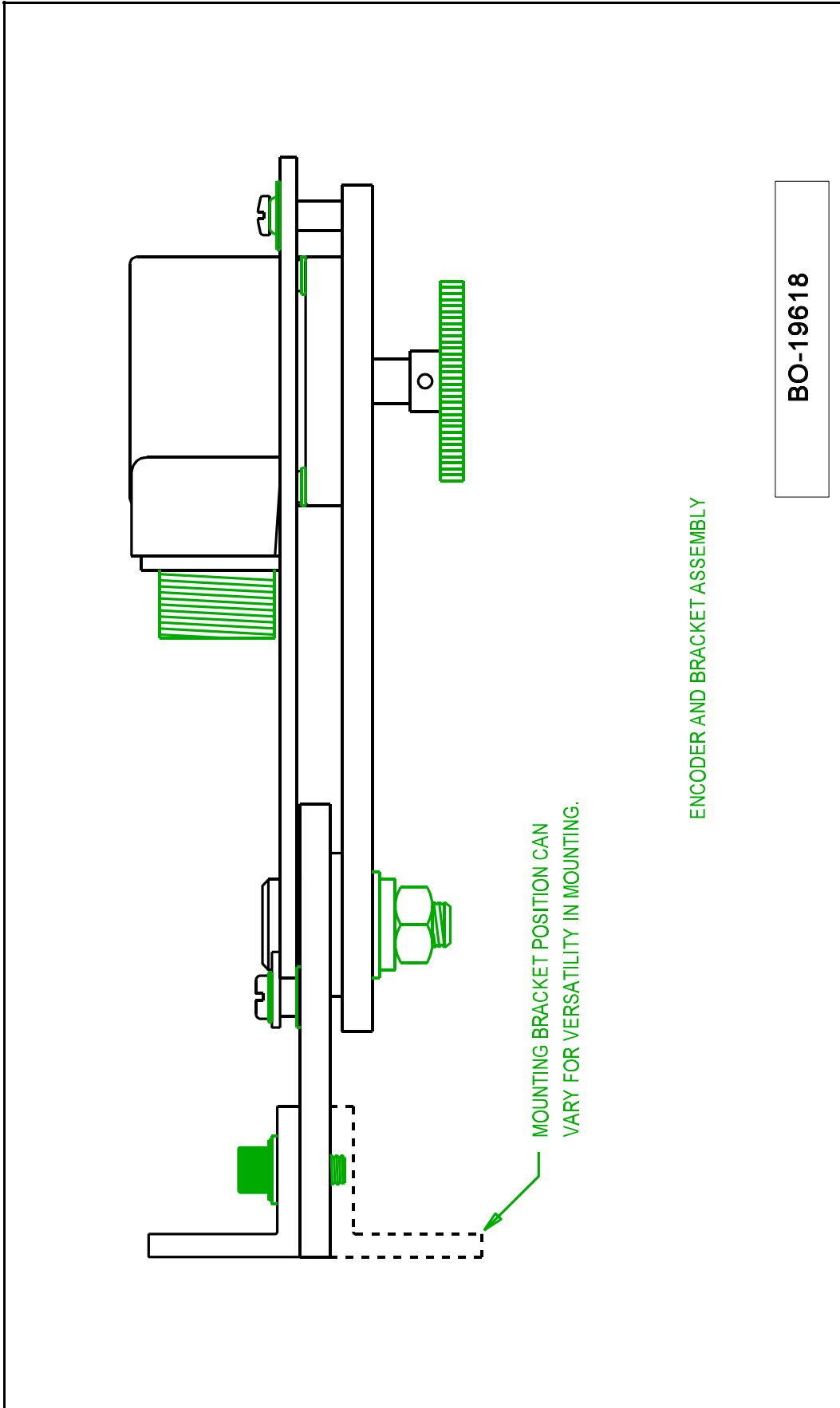
NOTE:

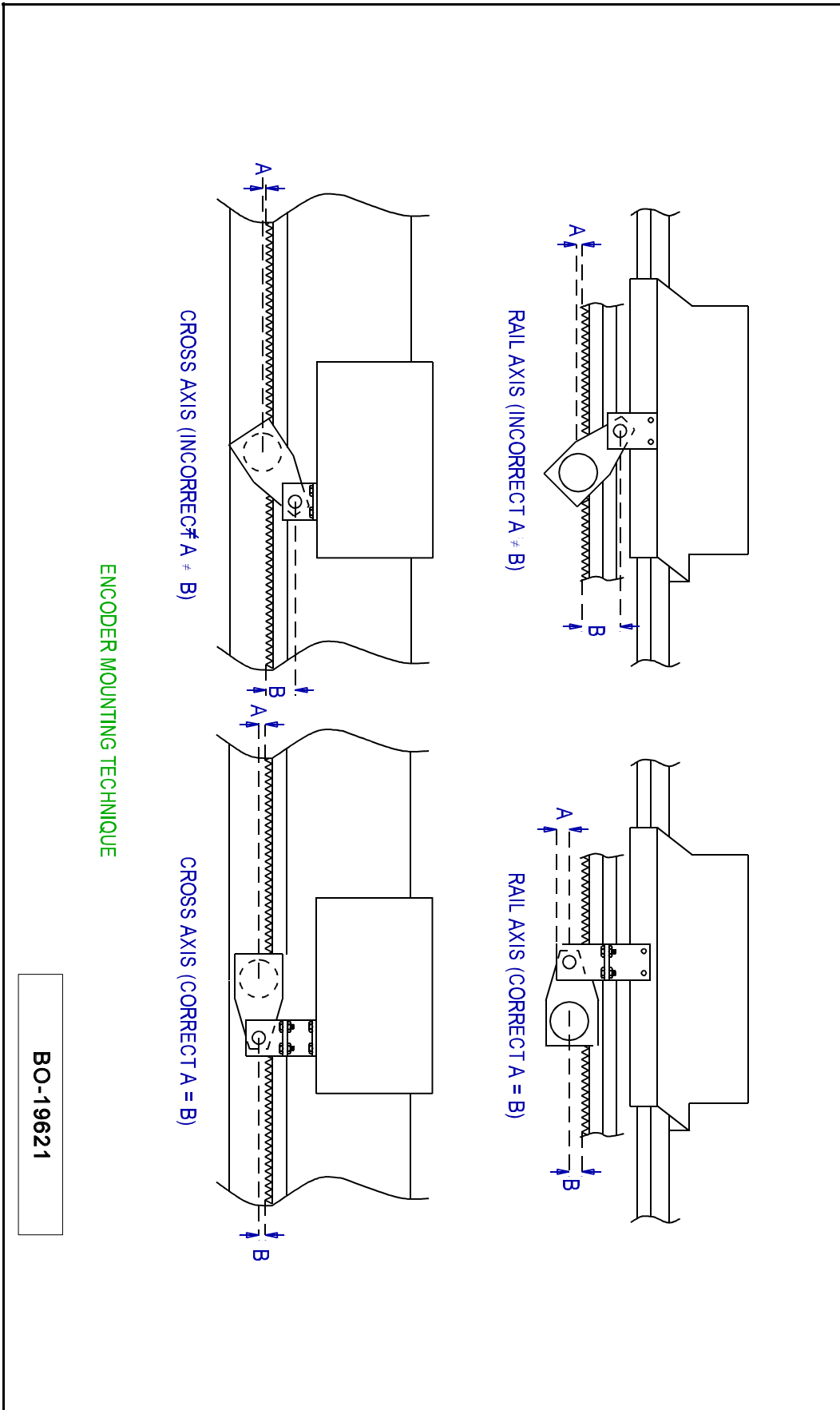
- 1.) TYPICAL MOUNTING OF GEAR RACK ON ANGLE BRACKET.
GEAR RACK TEETH SHOULD FACE DOWN OR TO THE LEFT
OR RIGHT, NEVER FACING UP. THIS IS DONE TO PRE-
VENT THE GEAR RACK FROM ACCUMULATING DUST & DIRT.

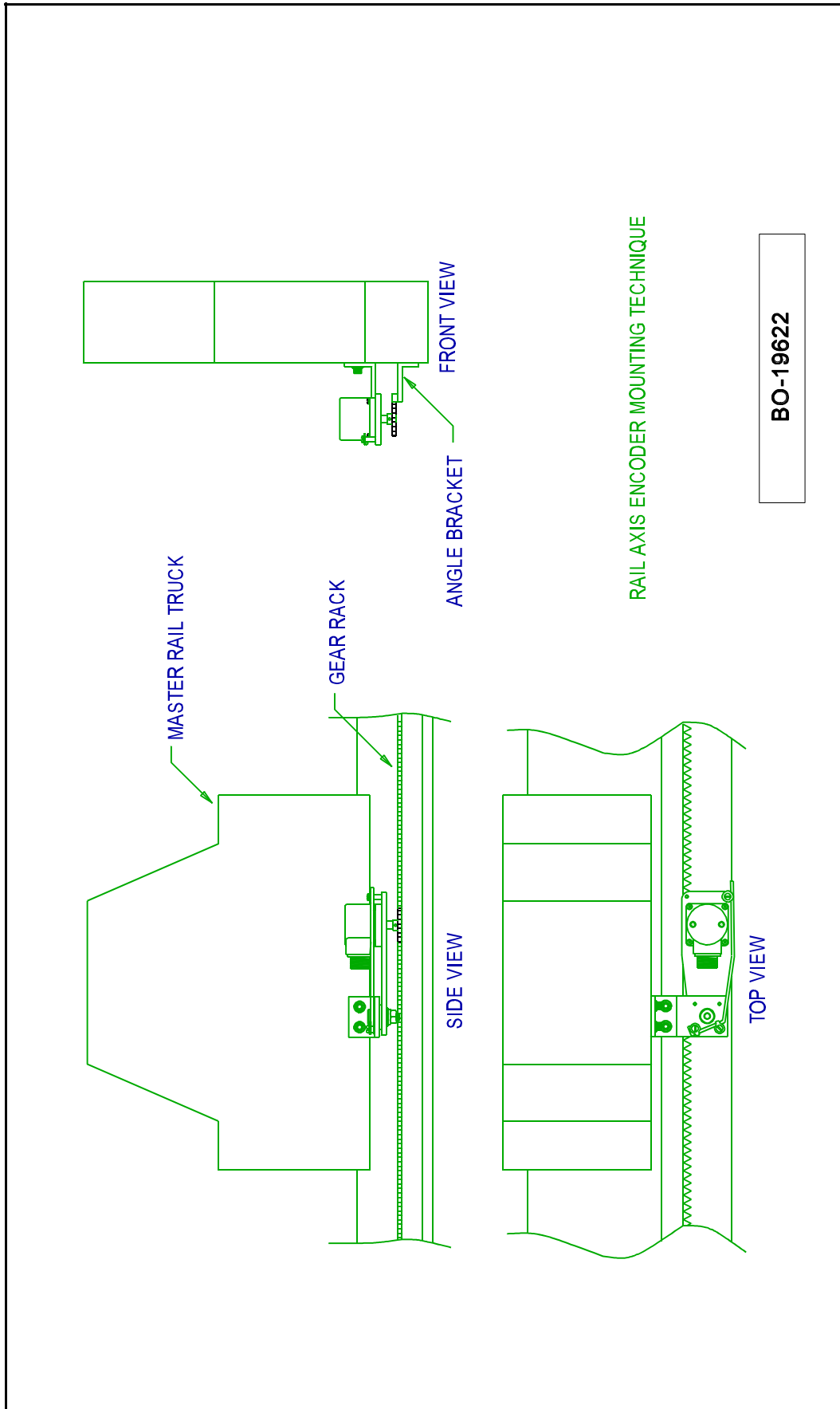


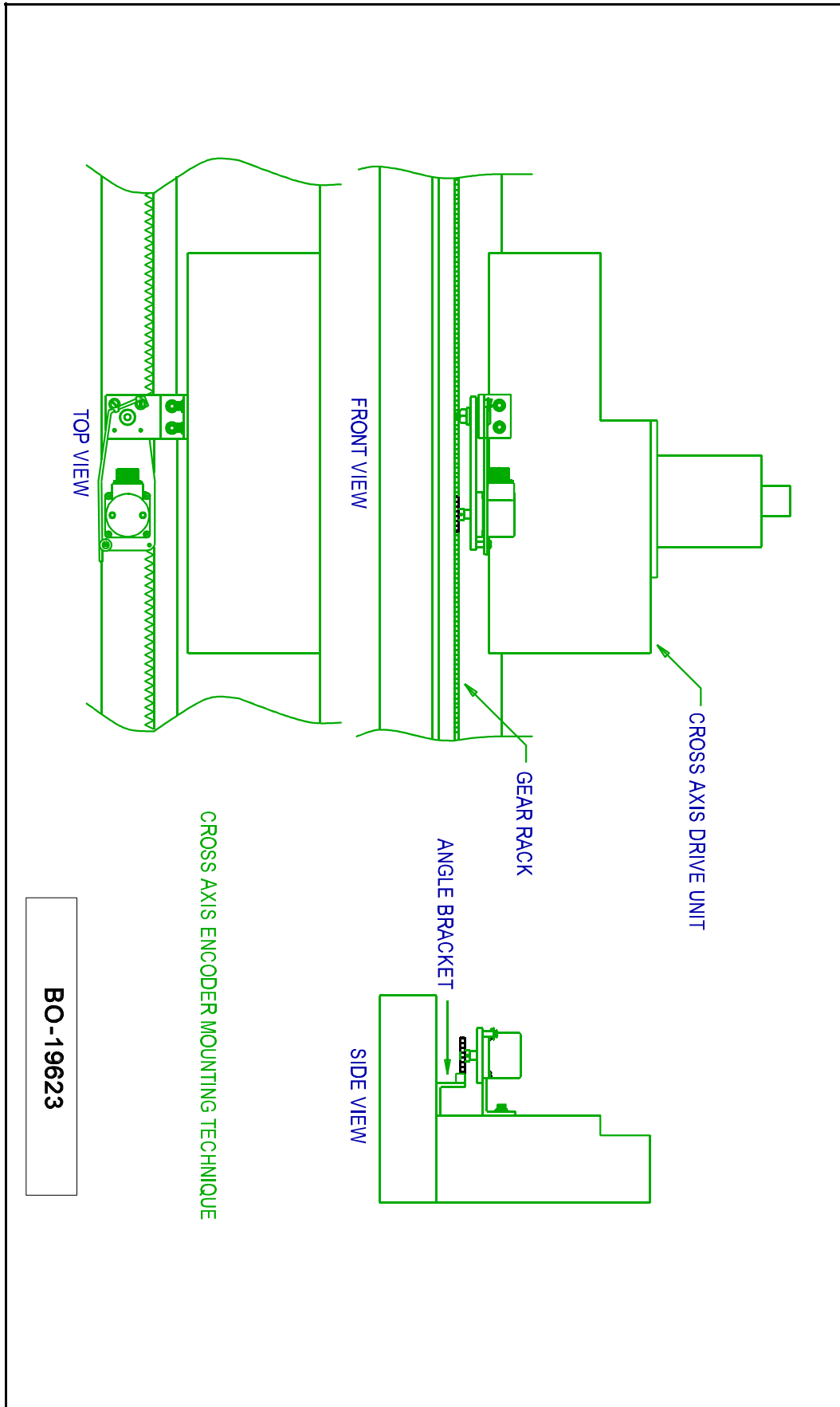
GEAR RACK BRACKET MOUNTING
UTILIZING ANGLE BRACKETS

AO-19617



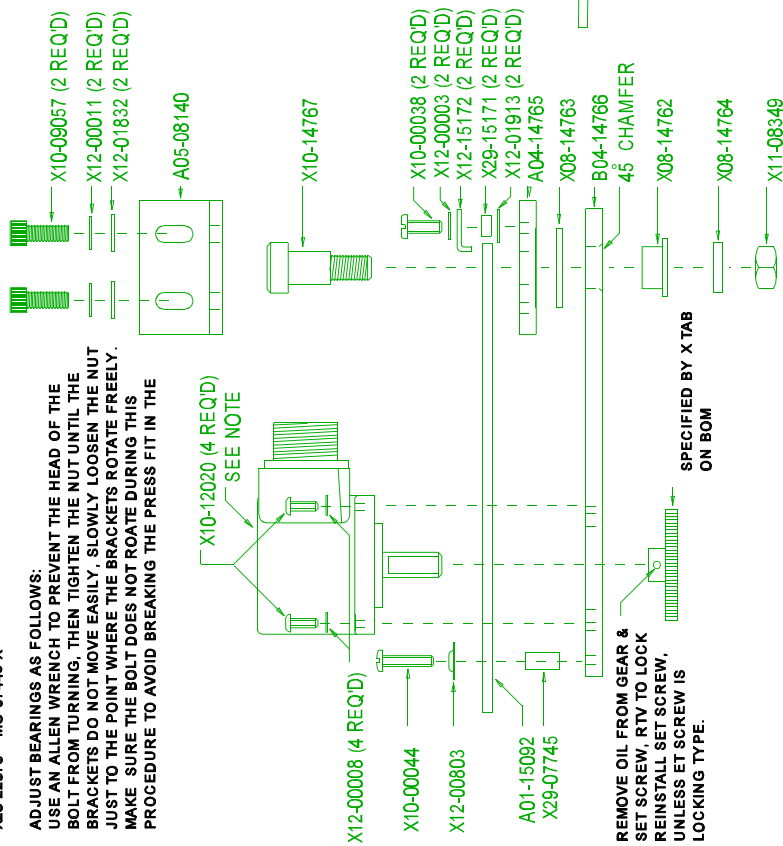






NOTE:
 X28-14763 = MO-03952-X
 X28-22070 = MO-07445-X

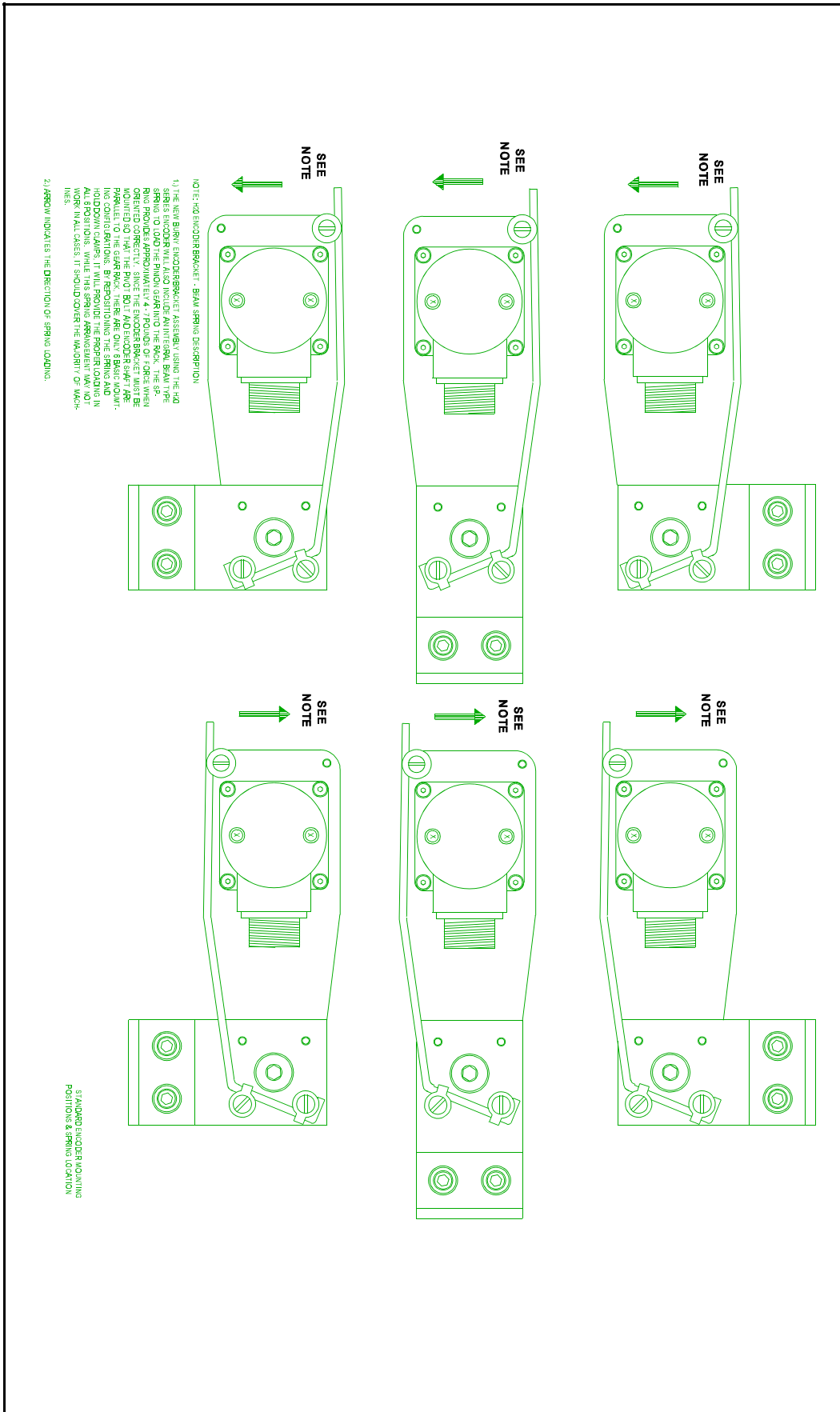
ADJUST BEARINGS AS FOLLOWS:
 USE AN ALLEN WRENCH TO PREVENT THE HEAD OF THE
 BOLT FROM TURNING, THEN TIGHTEN THE NUT UNTIL THE
 BRACKETS DO NOT MOVE EASILY. SLOWLY LOOSEN THE NUT
 JUST TO THE POINT WHERE THE BRACKETS ROTATE FREELY.
 MAKE SURE THE BOLT DOES NOT ROTATE DURING THIS
 PROCEDURE TO AVOID BREAKING THE PRESS FIT IN THE



ENCODER BRACKET ASSEMBLY

CO-12137 / 1 OF 2

2.5RS OPERATION AND MAINTENANCE MANUAL



PART 10 PRODUCT SPECIFICATIONS

**PRODUCT SPECIFICATIONS
for the BURNY™ 2.5RS**

SPECS.1 PHYSICAL ENVIRONMENT OPERATING LIMITS:

Temperature 5E to 40E C
 Relative Humidity 5% to 85% (1 g/m3 to 25 g/m3)
 Atmospheric pressure 86 kPa to 106 kPa
 Climatic Class 3K3

SPECS.2 ELECTRICAL SPECIFICATIONS

The electrical specifications for the various configurations of the **2.5RS** can be found in the tables below. At the end is the table of electrical specifications for the encoder electronics.

**2.5RS for REPLICATOR™ 900 using:
 MO-09489-0, -1, or -2 INTERFACE CARD
 (See pins 31 and 32 below)
 MO-02643 POWER / OXY PIGTAIL
 And either
 MO-09498-010 DRIVE CABLE for 230 V
 Or
 MO-09499-010 DRIVE CABLE for 115 V**

| PIGTAIL WIRE LABEL | 2.5RS BACK PANEL "EXT DRIVE" CONNECTOR PIN NUMBER | DESCRIPTION | RATINGS |
|--------------------|---|---|--|
| WIRE LABEL 21 | PIN NUMBER 25 | Preheat contacts. These are normally open dry contacts. | 2 A @ 230VAC maximum 3 A @ 30 VDC maximum |
| WIRE LABEL 22 | PIN NUMBER 26 | This is the other half of the Preheat contacts. | |
| WIRE LABEL 32 | PIN NUMBER 27 | Start Cut contact. These contacts can be configured as normally open or normally closed by jumper settings (17J and 18J) on the interface card. These are dry contacts. | 2 A @ 230VAC maximum 3 A @ 30 VDC maximum |
| WIRE LABEL 37 | PIN NUMBER 28 | This is the other half of the Start Cut contact. | |

2.5RS OPERATION AND MAINTENANCE MANUAL

| | | | |
|------------------|------------------|--|--|
| WIRE LABEL 4 | PIN NUMBER 29 | Stop Cut contact. These contacts can be configured as normally open or normally closed by jumper settings (22J and 23J) on the interface card. These are dry contacts. | 2 A @ 230VAC maximum 3 A @ 30 VDC maximum |
| WIRE LABEL 8 | PIN NUMBER 30 | The other half of the Stop Cut contact. | |
| WIRE LABEL 23 | PIN NUMBER 31 | Cut Sense input. | Use the specification with the number of the interface board, with suffix. MO-09489-2 use: 24 VAC @ 15 mA MO-09489-0 use: 115 VAC @ 15 mA MO-09489-1 use: 230 VAC @ 15 mA |
| WIRE LABEL 18 | PIN NUMBER 32 | Cut Sense input return. | |
| | PIN NUMBER 34 | Chassis Ground | 0 V |
| WIRE LABEL 34 | PIN NUMBER 35 | Neutral conductor of machine's power source. Input | 0 VAC @ 0.11 A |
| WIRE LABEL 1 | PIN NUMBER 36 | Input for powering the 2.5RS from a 115 VAC power source (with the MO-09499-010 drive cable in use.) | 115 VAC @ 0.22 A |
| | PIN NUMBER 37 | Input for powering the 2.5RS from a 230 VAC power source (with the MO-09498-010 drive cable in use.) | 230 VAC @ 0.11 A |

**2.5RS for SERVOPAK™ I/O RATINGS:
MO-05798-0, -1, or -2 INTERFACE CARD (See pins 31 and 32)
MO-09434 SPLITTER CABLE
MO-09435 POWER /OXY PIGTAIL**

| MO-09435 PIGTAIL WIRE COLOR | 2.5RS BACK PANEL "EXT DRIVE" CONNECTOR PIN NUMBER | DESCRIPTION | RATINGS |
|-----------------------------|---|---|--|
| RED | 25 | Preheat contacts. These are normally open dry contacts. | 2 A @ 230VAC maximum 3 A @ 30 VDC maximum |
| RED | 26 | This is the other half of the Preheat contacts. | |
| YELLOW | 27 | Start Cut contact. These contacts can be configured as normally open or normally closed by jumper settings (17J and 18J) on the interface card. These are dry contacts. | 2 A @ 230VAC maximum 3 A @ 30 VDC maximum |
| YELLOW | 28 | This is the other half of the Start Cut contact. | |

PRODUCT SPECIFICATIONS

| | | | |
|--------|----|---|--|
| BLUE | 29 | Stop Cut contacts. These contacts can be configured as normally open or normally closed by jumper settings (22J and 23J) on the interface card. These are dry contacts. | 2 A @ 230VAC maximum 3 A @ 30 VDC maximum |
| BLUE | 30 | This is the other half of the Stop Cut contacts. | |
| ORANGE | 31 | Cut Sense input. | Use the specification with the number of the interface board, with suffix. MO-05798-2 use: 24 VAC @ 15 mA MO-05798-0 use: 115 VAC @ 15 mA MO-05798-1 use: 230 VAC @ 15 mA |
| GREY | 32 | Cut Sense return. | 0 V |
| GREEN | 34 | Chassis Ground | 0 V |
| WHITE | 35 | Return for Pin 36 | 0 V |
| BLACK | 36 | Input pin for powering the BURNY™ 2.5RS from a 115 VAC machine power source. | 115 VAC @ 0.25 A |

KS07 2.5RS MNJ-10379 PACKAGE using MO-03473 Interface Card, MO-03562 Enclosure, MO-06354 Serial Adaptor

2.5RS BACK PANEL 37 PIN "EXT DRIVE" CONNECTOR:

| PIN # | DESCRIPTION | RATINGS |
|--------------|--|--|
| 1 | Cross ground, (Return for cross output) | 0 V |
| 2 | Input to cross "A" relay | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| 3 | Input to cross "B" relay | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| 4 | Output to cross "A" | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 2, then maximums are the same as for pin 2. |
| 5 | Output to cross "B" | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 3, then maximums are the same as for pin 3. |
| 6 | Rail ground, (Return for rail outputs, pins 9 and 10 below.) | 0 V |
| 7 | Input to rail "A" relay | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| 8 | Input to rail "B" relay | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |

2.5RS OPERATION AND MAINTENANCE MANUAL

| | | |
|--------|---|---|
| 9 | Output to rail "A" | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 7, then maximums are the same as for pin 7. |
| 10 | Output to rail "B" | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 9, then maximums are the same as for pin 9. |
| 11, 12 | Speed reference input pins | Nominal: 0 to 26 VAC, 400 Hz Maximum: 30 V, 150 mW |
| 13, | Commoned contacts of contact sets for wire numbers 14 and 15 below. | See 14 and 15 below. |
| 14 | Relay determines which NC is in control Dry contacts, normally closed, other half of contact set is pin 13 | Maximums: 30 VDC @ 2 A, or 60 VDC @ 1 A; 120 VAC @ 2 A |
| 15 | Relay determines which NC is in control Dry contacts, normally open other half of contact set is pin 13 | Maximums: 30 VDC @ 2 A, or 60 VDC @ 1 A; 120 VAC @ 2 A |
| 16 | Low speed relay input +. When +24 V with respect to pin 17 is applied, the speed range is set to low speed. | Maximums: +24 VDC , 0.6 A for relay coil Return for 24 VDC source of pin 20 |
| 17 | Return for low speed relay input (See pin 16.) | |
| 18 | Signal common | |
| 19 | NCRun output (low true) Signals that Burny™ 2.5RS is in control. | Sinks 500 mA @ 50 V. High impedance to negative voltages. -50 V maximum. These pins are isolated from each other with common cathode diodes. |
| 20 | Positive supply power output. | +24 VDC @ 40 ma |
| 25, 26 | Preheat relay contacts (Dry contact) | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 27, 28 | Start cut relay contacts (Dry contact) | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 29, 30 | Enable cut output (Dry contact) | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 31 | Cut sense AC return, (See pin 32.) | 115 VAC @ 15 mA Input. See operator manual |
| 32 | Cut sense input, to signal the 2.5RS that cutting oxygen is operating. | "MACHINE INTERFACE-SENSING INPUT". |
| 34 | Chassis ground | 0 V |
| 35 | AC return | 0 V |
| 36 | Input pin for powering the 2.5RS from a 115 VAC machine power source. | 115 VAC @ 0.25 A |
| 37 | Input pin for powering the 2.5RS from a 230 VAC machine power source. | 230 VAC @ 0.110 A |

**PCT 2.5RS MNJ-09045 PACKAGE using
MO-03432 Interface Card
MO-03435 Power Pigtail
MO-03533 Internal Drive Pigtail
MO-02460 Standard Drive Pigtail
MO-02382-010 Standard Drive Pigtail**

2.5RS BACK PANEL 37 PIN "EXT DRIVE" CONNECTOR:

| PIN # | DESCRIPTION | RATING |
|-------|---|--|
| 1 | Signal common | 0 V |
| 2 | Ground for +5 VDC regulator in Burny™ 2.5RS | 0 V |
| 3 | +20 VDC input | +24 V @ 400 mA maximum |
| 5 | -20VDC input | -33 V @ 100 mA maximum |
| 6 | Analog ground | 0 V |
| 7 | - Analog Supply input | -15 +/- 5% VDC @ 20 mA |
| 8 | + Analog Supply input | +15 +/- 5% VDC @ 20 mA |
| 9 | Speed Reference Input | Nominal: 0 to +12 V peak. Limits: 8 to 16 V peak .006 mA |
| 10 | Enable Y Drive Input | Logic high is 4.90 V minimum, 24 V maximum, Logic low is 1.35 V maximum, 0 V minimum. |
| 11 | Enable X Drive Input | Logic high is 4.90 V minimum, 24 V maximum, Logic low is 1.35 V maximum, 0 V minimum. |
| 14 | X Drive reference output | If Burny™ reference is selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 15, then maximums are the same as for pin 15. |
| 15 | Input for X Drive reference from Tracer | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| 17 | Y Drive reference output | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 18, then maximums are the same as for pin 18. |
| 18 | Input for Y Drive reference from Tracer | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |

MO-03435 POWER PIGTAIL:

| MO-03435 PIGTAIL WIRE NUMBER | DESCRIPTION | RATING |
|------------------------------|---|---|
| 1, 2 | Preheat relay contacts | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 3, 4 | Start cut relay contacts (Dry contact) | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 5, 6 | Enable cut output (Dry contact) | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |

2.5RS OPERATION AND MAINTENANCE MANUAL

| | | |
|---|--|---|
| 7 | Cut sense AC return. (See pin 8.) | Return for Cut sense signal. (See pin 8.) |
| 8 | Cut sense input, to signal the 2.5RS that cutting oxygen is operating. | 115 VAC @ 15 mA maximum |

**HEATH TRACER 2.5RS with MNJ-09045 PACKAGE using
MO-07154 Interface Card
MO-03538 Modified Enclosure
MO-03435 Power Pigtail
MO-17155 Interface Pigtail**

MO-17155 INTERFACE PIGTAIL:

| MO-17155 PIGTAIL WIRE COLOR | DESCRIPTION | RATING |
|-----------------------------|---|--|
| Yellow | Ground | 0 V |
| Red | + end of differential Speed Reference Input | ±15VDC maximum 0.1 mA |
| White | - end of differential Speed Reference Input | ±15VDC maximum 0.1 mA |
| Black | Y Drive enable | Logic HI is 4.90 V minimum, 24 V maximum, Logic LO is 1.35 V maximum, 0 V minimum. |
| Tan | Y Drive reference output | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pink wire, then maximums are the same as for pink wire. |
| Pink | Input for Y Drive reference from Tracer | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| Yellow/Red | X Drive Enable | Logic HI is 4.90 V minimum, 24 V maximum, Logic LO is 1.35 V maximum, 0 V minimum. |
| Green/Red | X Drive reference output | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from Black/Red wire, then maximums are the same as for Black/Red wire. |
| Black/Red | Input for X Drive reference from Tracer | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |

TERMINAL BLOCK 1 (1TB)

| TERMINAL NUMBER | DESCRIPTION | RATING |
|-----------------|---|-------------------------------------|
| 1 | AC Supply input return | AC Supply Return, See pins 2 and 3. |
| 2 | Input pin for powering the 2.5RS from a 115 VAC machine power source. | 115 VAC @ 0.25 A |
| 3 | Input pin for powering the 2.5RS from a 230 VAC machine power source. | 230 VAC @ 0.110 A |
| 4 | System Ground | 0 V |

MO-03435 POWER PIGTAIL:

PRODUCT SPECIFICATIONS

| MO-03435 PIGTAIL WIRE NUMBER | DESCRIPTION | RATING |
|---------------------------------------|---|---|
| 1, 2 | Preheat relay contacts (Dry contacts) | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 3, 4 | Start cut relay contacts (Dry contacts) | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 5, 6 | Enable cut output (Dry contacts) | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 7 | Cut sense input AC return. (See pin 8.) | Return for Cut sense signal. (See pin 8.) |
| 8 | Cut sense input, to signal the 2.5RS that cutting oxygen is operating. | 115 VAC @ 15 mA maximum. See operator manual "MACHINE INTERFACE-SENSING INPUT". |

2.5RS OPERATION AND MAINTENANCE MANUAL

HL90 2.5RS with MNJ-09045 PACKAGE using MO-03374 Interface Card MO-03434 Drive Pigtail

| MO-03434 PIGTAIL PIGTAIL WIRE NUMBER | DESCRIPTION | RATING |
|--|---|--|
| 12 | Cut Off output | Output low = 40 mA maximum pull down to 0.7 V maximum; Output high: will be pulled up to level of Cut Sense signal through 10 kOhm resistor. |
| 1 | Signal ground | 0 V |
| 2 | Power Ground | 0 V |
| 3 | + 20 VDC Unregulated input | +33 VDC, 2 A maximum. 2A fuse |
| 4 | Input to supply power to 12 VDC powered encoders. | See installation section of 2.5RS manual for encoder setup. |
| 5 | -20 VDC Unregulated input | -33 VDC, 2 A maximum. |
| 6 | Analog Ground (for Speed signal processing) | 0 V |
| 7 | -12 Analog input (for Speed signal processing) | -12 VDC, 500 mA maximum |
| 8 | +12 Analog input (for Speed signal processing) | +12 ± VDC, 500 mA maximum |
| 9 | Speed Reference Input | Nominal: 0 to -6.6 V peak, 0 to +6.6 V peak, 0.2 mA Limits: -5.79 to -7.4 V peak, 5.79 to 7.4 V peak, .035 mA |
| 10 | Cut Start output | Output low = high impedance to 0.8 V; Output high = 15 kOhm resistor pull up to 11.35 V max. |
| 11 | Cut Sense input | Logic low = 0 to 1.35 VDC Logic High = 4.2 to 5 VDC |
| 13 | Lamp Off (hi true) output | 12V max, 15 mA max |
| 14 | Output to Y axis | If Burny™ signal selected, output is 1 mA, +/- 15V. If signal selected is customer signal from pin 15, then maximums are the same as for pin 15. |
| 15 | Input to Y axis from alternate device | 125 VAC maximum, 30 VDC maximum, 0.5 A maximum. |
| 16 | Strip Sense (hi true) input | Input low = 0 to 5 VDC 2 mA maximum Input high = 12 VDC |
| 17 | Output to X axis | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 15, then maximums are the same as for pin 15. |
| 18 | Input to X axis from alternate device | 125 VAC maximum, 30 VDC maximum, 0.5 A maximum. |

| S.W. ECT-150 2.5RS with MNJ-09045 PACKAGE using | | |
|--|--------------------------------------|--|
| MO-03467 Interface Card NC2.5 | | |
| MO-03538 Modified Enclosure | | |
| MO-03435 Power Pigtail | | |
| MO-03497 Interface Cable NC2.5 | | |
| MO-03497 CABLE CONNECTOR WITH FEMALE CONTACTS: | | |
| CONN- ECTOR FEMALE PIN LETTER | DESCRIPTION | RATING |
| A | Speed Reference Input | 3.9 to 4.4 VDC maximum, 0.032 mA |
| K | Ground | 0 V |
| C | Enable X Drive Output | If Burny™ signal selected, output is 1 ma, +/- 15V. If selected signal is customer signal from pin E of male connector of MO-03497, then maximums are the same as for pin E male of connector of MO-034967. See below. |
| E | Enable Y Drive Output | If Burny™ signal selected, output is 1 ma, +/- 15V. If selected signal is customer signal from pin E of male connector of MO-03497, then maximums are the same as for pin E male of connector of MO-034967. See below. |
| D | -24 V | These signals do not connect to the 2.5RS, but are passed through to the same pins on the male connector. 230 V @ 2 A maximum |
| H | +24 V | |
| B | -Speed | |
| F | CCW Steer | |
| J | Catch | |
| MO-03497 CABLE CONNECTOR WITH MALE CONTACTS: | | |
| CONN- ECTOR MALE PIN LETTER | DESCRIPTION | RATING |
| A | Speed Reference Input | 3.95 to 4.44 VDC maximum, 20 mA max |
| K | Ground | 0 V |
| C | X Drive reference Input | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| E | Y Drive reference Input | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| D,H,B, F,J | Same as for female connector, above. | Same as for female connector, above. |
| TERMINAL BLOCK 1 (1TB) | | |
| TERMINAL NUMBER | DESCRIPTION | RATING |
| 1 | AC Supply input Return | AC Supply Return. See pins 2 and 3. |

2.5RS OPERATION AND MAINTENANCE MANUAL

| 2 | Input pin for powering the 2.5RS from a 115 VAC machine power source. | 115 VAC @ 0.25 A Input |
|--------------------------------|--|---|
| 3 | Input pin for 230 VAC machine power source. | 230 VAC @ 0.110 A Input |
| 4 | System Ground | 0 V |
| MO-03435 POWER PIGTAIL: | | |
| PIGTAIL WIRE NUMBER | DESCRIPTION | RATING |
| 1, 2 | Preheat relay contacts | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 3, 4 | Start cut relay contacts (Dry contact) | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 5, 6 | Enable cut output (Dry contact) | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 7 | Cut sense AC return. (See pin 8.) | 115 VAC @ 15 mA Input. With jumper 15J installed, this input is designed for 24V AC or DC @ 12 ma. Resistors 1R and 51R on interface card should be scaled accordingly. |
| 8 | Cut sense input, to signal the 2.5RS that cutting oxygen is operating. | |

C & G RETROFIT 2.5RS for RETROFIT with MNJ-10380 **MO-07542 INTERFACE CARD** **MO-05376 CABLE KSOX SERIES** **MO-07422 PIGTAIL**

| PIGTAIL MO-07422 | | |
|-------------------------|--|--|
| PIGTAIL WIRE NUMBER | DESCRIPTION | RATING |
| 1 | Signal Ground | 0 V |
| 2 | Power Ground | 0 V |
| 3 | Positive supply power output | +24 VDC @ 40 mA Output |
| 4 | Input to supply power to 12 VDC powered encoders. | See installation section of 2.5RS manual for encoder setup. |
| 5 | Output: Negative supply power. | -24 VDC @ 40 mA Output |
| 6 | Analog Ground | 0 V |
| 9 | Speed reference input from customer's speed potentiometer. | Nominal: 0 to 9.16 V peak, Limits: +3.9 to +14.4 V peak. |
| 14 | This is the Y drive reference output. | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 15, then maximums are the same as for pin 15. |
| 15 | This is the Y drive reference input. | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| 16 | X and Y Drive Enable input | Input Low = 0 to 1.35 VDC, High = 4.4 to 5 VDC |
| 17 | This is the X drive reference output. | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 15, then maximums are the same as for pin 15. |

PRODUCT SPECIFICATIONS

| | | |
|--------|---|--|
| 18 | This is the X drive reference input. | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A~ |
| 25, 26 | Preheat Gas solenoid power contact. These are normally open dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 27, 28 | Start Cut contact. These are dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 29, 30 | Enable Cut contacts. These are dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 31 | Sense return for pin 32. | See pin 32. |
| 32 | Cut On Sense from the customer's machine. Signals the 2.5RS that the cutting oxygen is operating. | 115 VAC, 15 mA maximum. See operator manual "MACHINE INTERFACE-SENSING INPUT". |
| 33 | Stop input from the customer's machine. Signal is supplied by the machine. Lack of voltage on this pin causes the BURNY™ to stop moving and shut off the cutting process. | 115 VAC, 15 mA maximum. See operator manual sections "SD61-SYSTEM CONFIGURATION" and "MACHINE INTERFACE – SENSING INPUT". |
| 34 | Protective ground from machine power source. | Chassis Ground |
| 35 | Neutral conductor of machine's power source. | 0 V |
| 36 | Input pin for powering the 2.5RS from a 115 VAC machine power source. | 115 VAC @ 0.25 A Input |
| 37 | Input pin for powering the 2.5RS from a 230 VAC machine power source. | 230 VAC @ 0.110 A Input |

ESAB PICOREX PXA, PXB, SUPRAREX 2.5RS with MNJ-10380
using:
MO-04339 INTERFACE CARD
MO-03561 CABLE KSO TYPE

| 2.5RS 37 PIN BACK PANEL "EXT DRIVE" CONN- ECTOR PIN NO. | DESCRIPTION | RATINGS |
|---|--|--|
| 1 | Signal Ground | 0 V |
| 2 | Power Ground | 0 V |
| 3 | Positive supply power output. | +24 VDC @ 40 mA Output |
| 4 | Input supply power to 12 VDC powered encoders. | See installation section of Burny™ 2.5RS manual for encoder setup. |
| 5 | Negative supply power output. | -24 VDC @ 40 mA Output |
| 6 | Analog Ground | 0 V |
| 7 | + Analog Supply input | +20 VDC to +30 VDC, 2 V ripple maximum |
| 8 | - Analog Supply input | -20 VDC to -30 VDC, 2 V ripple maximum |

2.5RS OPERATION AND MAINTENANCE MANUAL

| | | |
|--------|---|---|
| 9 | Speed reference input from customer's speed potentiometer. | Nominal: 0 to +2.5 V peak or 0 to +2.5 V. Limits: +1.2 to +3.8 V peak or -1.2 to -3.8 V peak @ .08 mA |
| 10 | Enable Drive input #1 | These inputs are isolated from each other with common anode diodes . Logic low = 0 to 1.35 V Logic High = 4.2 to 5 V |
| 11 | Enable Drive input #2 | |
| 12 | Enable Drive input #3 | |
| 13 | NC Run Low output (low true) | Sinks 500 mA @ 50 V. High impedance to negative voltages. -50 V maximum. |
| 14 | This is the Y drive reference output. | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 15, then maximums are the same as for pin 15. |
| 15 | This is the Y drive reference input. | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| 16 | Enable X and Y Drives Input | Logic HI is 4.90 V minimum, 24 V maximum, Logic LO is 1.35 V maximum, 0 V minimum. 1 mA maximum. |
| 17 | This is the X drive reference output. | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 15, then maximums are the same as for pin 15. |
| 18 | This is the X drive reference input. | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| 25, 26 | Preheat Gas solenoid power contacts. These are normally open dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 27, 28 | Start Cut contacts. These are dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 29, 30 | Enable Cut contacts. These are dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 31 | Return for pin 32. | See pin 32. |
| 32 | Cut On Sense from the customer's machine. Signals 2.5RS that the cutting oxygen is operating. | 230 V, 15Ma See operator manual "MACHINE INTERFACE-SENSING INPUT" |
| 33 | Stop input from the customer's machine. Signal is supplied by the machine. Lack of voltage on this pin causes the BURNY™ to stop moving and shut off the cutting process. | 230 VAC @ 15 mA maximum. See operator manual section "MACHINE INTERFACE – SENSING INPUT". See operator manual section "SD61-SYSTEM CONFIGURATION" and "MACHINE INTERFACE – SENSING INPUT". |
| 34 | Protective ground from machine power source. | Chassis Ground |

PRODUCT SPECIFICATIONS

| | | |
|----|---|----------------------------|
| 35 | Neutral conductor of machine's power source. | 0 VAC @ 0.25 A Input |
| 36 | Input pin for powering the 2.5RS from a 115 VAC machine power source. | 115 VAC @ 0.25 A Input |
| 37 | Input pin for powering the 2.5RS from a 230 VAC machine power source. | 230 VAC @ 0.110 A Input |

**ESAB SUPRAREX SMB 2.5RS with MNJ-10380 using:
MO-04373 INTERFACE CARD
MO-03561 CABLE KSO TYPE**

2.5RS BACK PANEL 37 PIN "EXT DRIVE" CONNECTOR:

| "EXT DRIVE" CONNECTOR PIN NO. | DESCRIPTION | RATINGS |
|-------------------------------|--|--|
| 1 | Signal Ground | 0 V |
| 2 | Power Ground | 0 V |
| 3 | Positive supply power output. | +24 VDC @ 40 mA Output |
| 4 | Input to supply power to 12 VDC powered encoders. | See installation section of 2.5RS manual for encoder setup. |
| 5 | Negative supply power output. | -24 VDC @ 40 mA Output |
| 6 | Analog Ground | 0 V |
| 9 | Speed reference input from customer's speed potentiometer. | Nominal: 0 to +5 V peak or 0 to -5 V peak. Limits: -1.3 V peak to -3.8 V peak or +1.3 V peak to +3.8 V peak @ 0.16 mA |
| 10 | Enable Drive input #1 | These inputs are isolated from each other with common anode diodes . Logic low = 0 to 1.35 V Logic High = 4.2 to 5 V |
| 11 | Enable Drive input #2 | |
| 12 | Enable Drive input #3 | |
| 13 | NC Run Low output (low true) | Sinks 500 mA @ 50 V. High impedance to negative voltages. -50 V maximum. |
| 14 | This is the Y drive reference output. | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 15, then maximums are the same as for pin 15. |
| 15 | This is the Y drive reference input. | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| 16 | Enable X and Y Drives Input | Logic HI is 4.90 V minimum, 24 V maximum, Logic LO is 1.35 V maximum, 0 V minimum. 1 mA maximum. |

2.5RS OPERATION AND MAINTENANCE MANUAL

| | | |
|--------|---|---|
| 17 | This is the X drive reference output. | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 15, then maximums are the same as for pin 15. |
| 18 | This is the X drive reference input. | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| 25, 26 | Preheat Gas solenoid power contacts. These are normally open dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 27, 28 | Start Cut contacts. These are dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 29, 30 | Enable Cut contacts. These are dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 31 | Sense return for pin 32. | 230 VAC 15 mA |
| 32 | Cut On Sense from the customer's machine. Signals 2.5RS that the cutting oxygen is operating. | 230 VAC, 15 mA See operator manual "MACHINE INTERFACE-SENSING INPUT". |
| 33 | Stop input from the customer's machine. Signal is supplied by the machine. Lack of voltage on this pin causes the BURNY™ to stop moving and shut off the cutting process. | 230 VAC @ 15 mA maximum. See manual for other voltages. See operator manual section "SD61-SYSTEM CONFIGURATION" and "MACHINE INTERFACE – SENSING INPUT". |
| 34 | Protective ground from machine power source. | Chassis Ground |
| 35 | Neutral conductor of machine's power source. | 0 VAC @ 0.25 A |
| 36 | Input pin for powering the 2.5RS from a 115 VAC machine power source. | 115 VAC @ 0.25 A |
| 37 | Input pin for powering the 2.5RS from a 230 VAC machine power source. | 230 VAC @ 0.110 A |

ESAB SUPRAREX SM, SXC, HANCOCK KESTREL, STEWART WARNER M33 2.5RS with MNJ-10380 using:
MO-03541-0 INTERFACE CARD FOR 115 VAC Cut Sense
MO-03541-2 INTERFACE CARD FOR 230 VAC Cut Sense
MO-03561 CABLE KSO TYPE

2.5RS BACK PANEL 37 PIN "EXT DRIVE" CONNECTOR:

| "EXT DRIVE" CONNECT OR PIN No. | DESCRIPTION | RATINGS |
|--------------------------------|---|---|
| 1 | Signal Ground | 0 V |
| 2 | Power Ground | 0 V |
| 3 | Positive supply power output. | +24 VDC @ 40 mA maximum draw |
| 4 | Input to supply power to 12 VDC powered encoders. | See installation section of 2.5RS manual for encoder setup. |
| 5 | Negative supply power output. | -24 VDC @ 40 mA maximum draw |
| 6 | Analog Ground | 0 V |

PRODUCT SPECIFICATIONS

| | | |
|--------|--|--|
| 9 | Speed reference input from customer's speed potentiometer. | Nominal: 0 to +33 V peak or 0 to -33 V peak. Limits:-23 to -45 V peak or+23 to +45 V peak @ 0.75 mA |
| 10 | Speed potentiometer drive reference input used when the 2.5RS is not in control (not in NC RUN). | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| 11 | BURNY™ speed reference output looped-back signal from pin 10 when the BURNY™ is not in control. | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| 12 | Enable X and Y drives input (low true) | Logic HI is 4.90 V minimum, 24 V maximum, Logic LO is 1.35 V maximum, 0 V minimum. |
| 14 | This is the Y drive reference output. | +/- 3 VDC @ .5 mA maximum |
| 16 | Sync Reference input . Input for scaling the X and Y outputs. | +/- 10 VDC @ 1 mA maximum |
| 17 | This is the X drive reference output. | +/- 3 VDC @ .5 mA maximum |
| 25, 26 | Preheat Gas solenoid power contacts. These are normally open dry contacts. | 2 A @ 230 VAC maximum or 2 A @ 30 VDC maximum |
| 27, 28 | Start Cut contacts. These are dry contacts. | 2 A @ 230 VAC maximum or 2 A @ 30 VDC maximum |
| 29, 30 | Enable Cut contacts. These are dry contacts. | 2 A @ 230 VAC maximum or 2 A @ 30 VDC maximum |
| 31 | Sense return for pin 32. | See pin 32. |
| 32 | Cut On Sense input from the machine. Signals 2.5RS that the cutting oxygen is operating. | Interface card MO-03541-0: 115 VAC @ 15 Ma maximum. See operator manual "MACHINE INTERFACE – SENSING INPUT." Interface card MO-03541-1: 230 VAC @ 15 Ma maximum. See operator manual "MACHINE INTERFACE – SENSING INPUT." |
| 34 | Protective ground from machine power source. | Chassis Ground |
| 35 | Neutral conductor of machine's power source. | 0 VAC |
| 36 | Input pin for powering the 2.5RS from a 115 VAC machine power source. | 115 VAC @ 0.25 A |
| 37 | Input pin for powering the 2.5RS from a 230 VAC machine power source. | 230 VAC @ 0.110 A |

**ETEK NS3003 / 2001, KSO9, ZINSER,
LTEC (LINDE) CM56 2.5RS with MNJ-10380 for ETEK NS3003 /
2001 USING:
MO-03650 INTERFACE CARD
MO-03561 CABLE KSO TYPE**

2.5RS BACK PANEL 37 PIN "EXT DRIVE" CONNECTOR:

2.5RS OPERATION AND MAINTENANCE MANUAL

| "EXT DRIVE" CONNECT OR PIN No. | DESCRIPTION | RATINGS |
|--------------------------------|--|--|
| 1 | Signal Ground | 0 V |
| 2 | Power Ground | 0 V |
| 3 | Positive supply power output. | +24 VDC @ 40 mA Output |
| 4 | Input to supply power to 12 VDC powered encoders. | See installation section of 2.5RS manual for encoder setup. |
| 5 | Negative supply power output. | -24 VDC @ 40 mA |
| 6 | Analog Ground | 0 V |
| 9 | Speed reference input. | Nominal: 0 to +5 V peak or 0 to -5 V peak. Limits:-2.4 to -7.7 V peak or +2.4 to +7.7 V peak @ 0.1 mA |
| 10 | Reference input. | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| 11 | BURNY™ speed reference output. | 7.2 VDC @ 15 mA if Burny™ reference is used. If customer signal is selected, see pin 10 for specifications. |
| 12, 13 | NC Run output (low true) | Sinks 500 mA @ 50 V. High impedance to negative voltages. -50 V maximum. These pins are isolated from each other with common cathode diodes. |
| 14 | This is the Y drive reference output. | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 15, then maximums are the same as for pin 15. |
| 15 | This is the Y drive reference input. | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| 16 | Enable X and Y Drives input | Logic HI is 4.90 V minimum, 24 V maximum, Logic LO is 1.35 V maximum, 0 V minimum. 1 mA maximum. |
| 17 | This is the X drive reference output. | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 15, then maximums are the same as for pin 15. |
| 18 | This is the X drive reference input. | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| 25, 26 | Preheat Gas solenoid power contacts. These are normally open dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 27, 28 | Start Cut contacts. These are dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 29, 30 | Enable Cut contacts. These are dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |

PRODUCT SPECIFICATIONS

| | | |
|----|---|--|
| 31 | Sense return for pin 32. | 115 VAC @ 30 mA |
| 32 | Cut On Sense from the customer's machine. Signals 2.5RS that the cutting oxygen is operating. Input | 115 VAC @ 15 mA maximum See operator manual "MACHINE INTERFACE – SENSING INPUT". |
| 34 | Protective ground from machine power source. | Chassis Ground |
| 35 | Neutral conductor of machine's power source. Input | 0 VAC @ 0.25 A |
| 36 | Input pin for powering the 2.5RS from a 115 VAC machine power source. | 115 VAC @ 0.25 A |
| 37 | Input pin for powering the 2.5RS from a 230 VAC machine power source. | 230 VAC @ 0.110 A |

**2.5RS with MNJ-10380 for ETEK NS3003 with SP150 using:
MO-03650 INTERFACE CARD
MO-07146-010 POWER / OXY CABLE**

| MO-07146-010 POWER / OXY CABLE | 2.5RS 37 PIN BACK PANEL "EXT DRIVE" CONNECTOR PIN NO. | DESCRIPTION | RATINGS |
|--|--|-------------------------------|--|
| Both inner and both outer shields of cable | 2 | Power Ground | 0 V |
| CABLE CONNECTOR PINS 8, 9, 14, 15 | 6 | Analog Ground | 0 V |
| CABLE CONNECTOR PIN 12 | 9 | Speed reference input. | Nominal: 0 to +5 V peak or 0 to -5 V peak. Limits:-2.4 to -7.6 V peak or+2.4 to +7.6 V peak @ 0.1 mA |
| CABLE CONNECTOR PIN 3 | 10 | Reference input | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| CABLE CONNECTOR PIN 4 | 11 | Burny™ speed reference output | 7.2 VDC @ 15 mA if Burny™ reference is used. If customer signal is selected, see pin 10 for specifications. |
| CABLE CONNECTOR PIN 6 | 14 | Y drive reference output. | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 15, then maximums are the same as for pin 15. |
| CABLE CONNECTOR PIN 16 | 15 | Y drive reference input. | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| CABLE CONNECTOR PINS 1, 2 | 16 | Jog enable input. | Logic HI is 4.90 V minimum, 24 V maximum, Logic LO is 1.35 V maximum, 0 V minimum. 1 mA maximum. |

2.5RS OPERATION AND MAINTENANCE MANUAL

| | | | |
|--------------------------|--------|---|--|
| CABLE CONNECTOR PIN 7 | 17 | X drive reference output. | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 18, then maximums are the same as for pin 15. |
| CABLE CONNECTOR PIN 11 | 18 | X drive reference input. | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| CABLE WIRE LABELS 25,26 | 25, 26 | Preheat Gas solenoid power contacts. These are normally open dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| CABLE WIRE LABELS 27, 28 | 27, 28 | Start Cut contacts. These are dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| CABLE WIRE LABELS 29, 30 | 29, 30 | Enable Cut contacts. These are dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| CABLE WIRE LABEL 31 | 31 | Sense return for pins 32 and 33. Input. | 115 VAC @ 30 mA |
| CABLE WIRE LABEL 32 | 32 | Oxygen Cut Sense input. Signals 2.5RS that the cutting oxygen is operating. | 115 VAC @ 15 mA See operator manual "MACHINE INTERFACE-SENSING INPUT". |
| CABLE WIRE LABEL 33 | 33 | Plasma Cut Sense input. Signals 2.5RS that the plasma oxygen is operating. | 115 VAC @ 15 mA See operator manual section "SD61-SYSTEM CONFIGURATION" and "MACHINE INTERFACE – SENSING INPUT". |
| CABLE WIRE LABEL 34 | 34 | Protective ground from machine power source. Input | Chassis Ground |
| CABLE WIRE LABEL 35 | 35 | Neutral conductor of machine's power source. Input | 0 VAC @ 0.25 A |
| CABLE WIRE LABEL 36 | 36 | Input pin for powering the 2.5RS from a 115 VAC machine power source. Input | 115 VAC @ 0.25 A |
| CABLE WIRE LABEL 37 | 37 | Input pin for powering the 2.5RS from a 230 VAC machine power source. Input | 230 VAC @ 0.110 A |

HANCOCK TRACKER 2.5RS with MNJ-10380 using:
MO-04459 INTERFACE CARD
MO-03561 CABLE KSO TYPE

2.5RS BACK PANEL 37 PIN "EXT DRIVE" CONNECTOR:

PRODUCT SPECIFICATIONS

| “EXT DRIVE” CONN- ECTOR PIN No. | Description | Ratings |
|--|---|--|
| 1 | Signal Ground | 0 V |
| 2 | Power Ground | 0 V |
| 3 | Positive supply power output | +24 VDC @ 40 mA |
| 5 | Negative supply power output | -24 VDC @ 40 mA |
| 6 | Analog Ground | 0 V |
| 9 | Speed reference input from customer potentiometer. | Nominal: 0 to +5 V peak. Limits: 2.4 to +7.7 V peak @ 0.06 mA |
| 10 | Reference input | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| 11 | Burny™ speed reference output | 7.2 VDC @ 15 mA if Burny™ reference is used. If customer signal is selected, see pin 10 for specifications. |
| 12, 13 | NC Run output (low true) input | Sinks 500 mA @ 50 V. High impedance to negative voltages. -50 V maximum. These pins are isolated from each other with common cathode diodes. |
| 14 | Y drive reference output. | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 15, then maximums are the same as for pin 15. |
| 15 | Y drive reference input. | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| 16 | Jog enable input. | Logic HI is 4.90 V minimum, 24 V maximum, Logic LO is 1.35 V maximum, 0 V minimum. 1 mA maximum. |
| 17 | X drive reference output. | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 18, then maximums are the same as for pin 15. |
| 18 | X drive reference input. | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| 25, 26 | Preheat Gas solenoid power contacts. These are normally open dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 27, 28 | Start Cut contacts. These are dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 29, 30 | Enable Cut contacts. These are dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 31 | Sense return for pins 32 and 33. Input. | 115 VAC @ 30 mA |
| 32 | Oxygen Cut Sense input. Signals 2.5RS that the cutting oxygen is operating. | 115 VAC @ 15 mA See operator manual section “MACHINE INTERFACE – SENSING INPUT”. |

2.5RS OPERATION AND MAINTENANCE MANUAL

| | | |
|----|---|--|
| 33 | Sense input | 115 VAC @ 15 mA maximum. See operator manual section "SD61-SYSTEM CONFIGURATION" and "MACHINE INTERFACE – SENSING INPUT". |
| 34 | Protective ground from machine power source. Input | Chassis Ground |
| 35 | Neutral conductor of machine's power source. Input | 0 VAC @ 0.25 A |
| 36 | Input pin for powering the 2.5RS from a 115 VAC machine power source. Input | 115 VAC @ 0.25 A |
| 37 | Input pin for powering the 2.5RS from a 230 VAC machine power source. Input | 230 VAC @ 0.110 A |

| HL 70/80 2.5RS with MNJ-10380 using MO-03502-“X” INTERFACE CARD MO-03561 CABLE KSO TYPE | | SEE RATINGS OF PINS 31 AND 32 FOR THE DIFFERENT SUFFIXES (-0, -1, -2) OF THE MO-03502 –“X” INTERFACE CARD |
|--|---|--|
| 2.5RS BACK PANEL 37 PIN “EXT DRIVE” CONNECTOR: | | |
| “EXT DRIVE” CONNECTOR PIN NO. | DESCRIPTION | RATINGS |
| 1 | Signal Ground | 0 V |
| 2 | Power Ground | 0 V |
| 3 | Positive supply power output. | +24 VDC @ 40 mA Output |
| 5 | Negative supply power output. | -24 VDC @ 40 mA |
| 6 | Analog Ground | 0 V |
| 9 | Speed reference input from customer potentiometer. | Nominal: 0 to +8.1 V peak. Maximum:+5.4 to +10.8 V peak, 0.025 mA |
| 10 | Speed Reference input | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| 11 | Burny™ speed reference output | 7.2 VDC @ 15 mA if Burny™ reference is used. If customer signal is selected, see pin 10 for specifications. |
| 12 | Override output | Pin 12 can sink 500 mA maximum @ 50 V maximum. |
| 13 | Hi true output signals that Burny™ 2.5 reference signal is being used, not the customer reference signal. | +23.4 VDC @ 1 A Output |
| 14 | Y drive reference output. | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 15, then maximums are the same as for pin 15. |
| 15 | Y drive reference input. | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |

PRODUCT SPECIFICATIONS

| | | |
|--------|---|---|
| 17 | X drive reference output. | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 18, then maximums are the same as for pin 15. |
| 18 | X drive reference input. | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| 25, 26 | Preheat Gas solenoid power contacts. These are normally open dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 27, 28 | Start Cut contacts. These are dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 29, 30 | Enable Cut contacts. These are dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 31 | Sense return for pins 32 and 33. Input. | See pins 32 and 33. |
| 32 | Cut Sense input. | Use the specification with the number of the interface board, with suffix. MO-03502-2 use: 24 VAC @ 15 mA MO-03502-0 use: 115 VAC @ 15 mA MO-03502-1 use: 230 VAC @ 15 mA See the operator manual section "MACHINE INTERFACE – SENSING INPUT" and "SD61-SYSTEM CONFIGURATION." |
| 33 | Sense input. | Use the specification with the number of the interface board, with suffix. MO-03502-2 use: 24 VAC @ 15 mA MO-03502-0 use: 115 VAC @ 15 mA MO-03502-1 use: 230 VAC @ 15 mA See the operator manual section "MACHINE INTERFACE – SENSING INPUT" and "SD61-SYSTEM CONFIGURATION." |
| 34 | Protective ground from machine power source. | Chassis Ground |
| 35 | Neutral conductor of machine's power source. Input | 0 VAC @ 0.25 A |
| 36 | Input pin for powering the 2.5RS from a 115 VAC machine power source. Input | 115 VAC @ 0.25 A |
| 37 | Input pin for powering the 2.5RS from a 230 VAC machine power source. Input | 230 VAC @ 0.110 A |

| | |
|---|---|
| <p>HL83 2.5RS with MNJ-10380 using: MO-03502-0 INTERFACE CARD MO-06669-005 J17 PLUG-IN CABLE</p> | <p>SEE RATINGS OF PINS 31, 32 AND 33 BELOW FOR THE DIFFERENT SUFFIXES (-0, -1, -2) OF THE MO-03502 –"X" INTERFACE CARD.</p> |
|---|---|

2.5RS OPERATION AND MAINTENANCE MANUAL

| MO-06669-005 CABLE CONN- ECTOR | "EXT DRIVE" CONNEC TOR PIN NO. | DESCRIPTION | NOMINAL RATINGS |
|--------------------------------------|--|--|--|
| 12 | 1 | Signal Ground | 0 V |
| 13 | 2 | Power Ground | 0 V |
| - | 3 | Positive supply power output. | +24 VDC @ 40 mA Output |
| - | 5 | Negative supply power output. | -24 VDC @ 40 mA |
| 5 | 6 | Analog Ground | 0 V |
| 9 | 9 | Speed reference input from customer potentiometer. | Nominal: 0 to +8.1 V peak. Maximum:+5.4 to +10.8 V peak, 0.025 mA |
| 1 | 10 | Speed reference input. | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| 2 | 11 | Speed reference output | 7.2 VDC @ 15 mA maximum if Burny™ signal is used. If customer signal is selected, see pin 10 for specifications. |
| - | 12 | Override output | Pin 12 can sink 500 mA maximum @ 50 V maximum. |
| - | 13 | Hi true output signals that Burny™ 2..5 reference signal is being used, not the customer reference signal. | +23.4 VDC @ 1 A |
| 3 | 14 | Y drive reference output. | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 15, then maximums are the same as for pin 15. |
| 8 | 15 | Y drive reference input. | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| 4 | 17 | X drive reference output. | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 18, then maximums are the same as for pin 15. |
| 6 | 18 | X drive reference input. | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| 32, 33 | 25, 26 | Preheat Gas solenoid power contacts. These are normally open dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 35, 37 | 27, 28 | Start Cut contacts. These are dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 28, 29 | 29, 30 | Enable Cut contacts. These are dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 34 | 31 | Sense return for pins 32 and 33. Input. | See pins 32 and 33. |

PRODUCT SPECIFICATIONS

| | | | |
|----|----|---|--|
| 30 | 32 | Cut Sense input. | Use the specification with the number of the interface board, with suffix. MO-03502-2 use: 24 VAC @ 15 mA MO-03502-0 use: 115 VAC @ 15 mA MO-03502-1 use: 230 VAC @ 15 mA See the operator manual section "MACHINE INTERFACE – SENSING INPUT." |
| 25 | 33 | Sense input. | Use the specification with the number of the interface board, with suffix. MO-03502-2 use: 24 VAC @ 15 mA MO-03502-0 use: 115 VAC @ 15 mA MO-03502-1 use: 230 VAC @ 15 mA See the operator manual section "MACHINE INTERFACE – SENSING INPUT" and "SD61-SYSTEM CONFIGURATION". |
| - | 34 | Protective ground from machine power source. | Chassis Ground |
| 36 | 35 | Neutral conductor of machine's power source. Input | 0 VAC @ 0.25 A |
| - | 36 | Input pin for powering the 2.5RS from a 115 VAC machine power source. Input | 115 VAC @ 0.25 A |
| 27 | 37 | Input pin for powering the 2.5RS from a 230 VAC machine power source. Input | 230 VAC @ 0.110 A |

**KS07GL 2.5RS MNJ-10380 using:
MO-04359 INTERFACE CARD
MO-03561 CABLE KSO TYPE**

2.5RS BACK PANEL 37 PIN "EXT DRIVE" CONNECTOR:

| "EXT DRIVE" CONNECTOR PIN NO. | DESCRIPTION | NOMINAL RATINGS |
|-------------------------------|--|--|
| 1 | Signal Ground | 0 V |
| 2 | Power Ground | 0 V |
| 3 | Positive supply power output. | +24 VDC @ 40 mA |
| 5 | Negative supply power output. | -24 VDC @ 40 mA |
| 6 | Analog Ground | 0 V |
| 9 | Speed reference input. | Nominal: 0 to +2.17 V peak or 0 to -2.17 V peak. Limits: -1.98 to -2.36 V peak or +1.98 to +2.36 V peak @ 0.04 mA |
| 13 | Output to the "Burny™ control relay" coil on KS07 equipment, acts as pull down to turn on the relay. | Sinks 500 mA @ 50 V. |

2.5RS OPERATION AND MAINTENANCE MANUAL

| | | |
|--------|--|--|
| 14 | Y drive reference output. | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 15, then maximums are the same as for pin 15. |
| 15 | Y drive reference input. | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| 16 | X and Y Enable Drive input. | Logic HI is 4.90 V minimum, 24 V maximum, Logic LO is 1.35 V maximum, 0 V minimum. .25 A maximum. |
| 17 | X drive reference output. | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 18, then maximums are the same as for pin 15. |
| 18 | X drive reference input. | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| 25, 26 | Preheat Gas solenoid power contacts. These are normally open dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 27, 28 | Start Cut contacts. These are dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 29, 30 | Enable Cut contacts. These are dry contacts. | 2 A @ 230 VAC maximum or 2 A @ 30 VDC maximum |
| 31 | Sense return for pin 32 | 230 VAC @ 15 mA See the operator manual section "MACHINE INTERFACE – SENSING INPUT". |
| 32 | Cut Sense input. Signals the 2.5RS that the cutting oxygen is operating. | |
| 34 | Protective ground from machine power source. | Chassis Ground |
| 35 | Neutral conductor of machine's power source. | 0 VAC @ 0.25 A Input |
| 36 | Input pin for powering the 2.5RS from a 115 VAC machine power source. | 115 VAC @ 0.25 A Input |
| 37 | Input pin for powering the 2.5RS from a 230 VAC machine power source. | 230 VAC @ 0.110 A Input |

KSO7GL FOR MESSER 2.5RS WITH MNJ-11126 using: MO-04359 INTERFACE CARD

2.5RS BACK PANEL 37 PIN "EXT DRIVE" CONNECTOR:

| "EXT DRIVE" CONNECTOR PIN NO. | DESCRIPTION | NOMINAL RATINGS |
|--------------------------------------|------------------------------|------------------------|
| 1 | Signal Ground | 0 V |
| 2 | Power Ground | 0 V |
| 3 | Positive supply power input. | +24 VDC @ 40 mA |
| 5 | Negative supply power input. | -24 VDC @ 40 mA |
| 6 | Analog Ground | 0 V |

PRODUCT SPECIFICATIONS

| | | |
|--------|--|--|
| 9 | Speed reference input. | Nominal: 0 to +2.17 V peak or 0 to -2.17 V peak. Limits:-1.98 to -2.36 V peak or+1.98 to +2.36 V peak @ 0.04 mA |
| 13 | Output to the “Burny™ control relay” coil on KS07 equipment, acts as pull down to turn on the relay. | Sinks 500 mA @ 50 V. |
| 14 | Y drive reference output. | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 15, then maximums are the same as for pin 15. |
| 15 | Y drive reference input. | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| 16 | X and Y Enable Drive input. | Logic HI is 4.90 V minimum, 24 V maximum, Logic LO is 1.35 V maximum, 0 V minimum. .25 A maximum. |
| 17 | X drive reference output. | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 18, then maximums are the same as for pin 15. |
| 18 | X drive reference input. | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| 25, 26 | Preheat Gas solenoid power contacts. These are normally open dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 27, 28 | Start Cut contacts. These are dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 29, 30 | Enable Cut contacts. These are dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 31 | Sense return for pin 32 | 230 VAC @ 15 mA See the operator manual section “MACHINE INTERFACE – SENSING INPUT”. |
| 32 | Cut Sense input. Signals the 2.5RS that the cutting oxygen is operating. | |

L-TEC AST 2.5RS with MNJ-10380 using:

MO-05572 INTERFACE CARD

MO-05376 TWO ENDED CABLE

MO-08709 RETROFIT HARNESS

| MO-08709 RETROFIT HARNESS END | 2.5RS 37 PIN BACK PANEL “EXT DRIVE” CONNECTOR PIN NO. | DESCRIPTION | RATINGS |
|-------------------------------------|--|------------------------|---|
| PIN 25 RIBBONS A and B | 6 | Analog Ground | 0 V |
| PIN 23 RIBBON A | 10 | Speed reference input. | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |

2.5RS OPERATION AND MAINTENANCE MANUAL

| | | | |
|-----------------------------|--------|--|--|
| PIN 23 RIBBON B | 11 | BURNY™ speed reference output. | 7.2 VDC @ 15 mA if Burny™ reference is used. If customer signal is selected, see pin 10 for specifications. |
| PIN 4 RIBBONS A and B | 12 | Override output | Sinks 500 mA @ 50 V. |
| PIN 19 RIBBON A | 14 | Y drive reference output. | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 15, then maximums are the same as for pin 15. |
| PIN 19 RIBBON B | 15 | Y drive reference input. | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| PIN 7 RIBBONS A and B | 16 | Input X and Y Enable Drive input. | Logic HI is 4.90 V minimum, 24 V maximum. Logic LO is 1.35 V maximum, 0 V minimum. 1 mA maximum. |
| PIN 26 RIBBON A | 17 | X drive reference output. | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 18, then maximums are the same as for pin 15. |
| PIN 26 RIBBON B | 18 | X drive reference input. | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| BRN WIRES | 25, 26 | Preheat Gas solenoid power contacts. These are normally open dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| RED WIRES | 27, 28 | Start Cut contacts. These are dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| ORG WIRES | 29, 30 | Enable Cut contacts. These are dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| BLU WIRES | 31, 32 | Cut On Sense input. Signals the 2.5RS that the cutting oxygen is operating. | 115 VAC @ 15 mA See the operator manual section "MACHINE INTERFACE – SENSING INPUT" |
| GRN WIRE | 34 | Protective ground from machine power source. | Chassis Ground |
| WHT WIRE | 35 | Neutral conductor of machine's power source. | 0 VAC @ 0.25 A Input |
| BLK WIRE | 36 | Input pin for powering the BURNY™ 2.5RS from a 115 VAC machine power source. | 115 VAC @ 0.25 A Input |

TANAKA 2.5RS with MNJ-10380 PACKAGE using:
MO-09271 INTERFACE CARD
MO-09272 INSTALLATION KIT
MO-03561 CABLE KIT KSO TYPE

PRODUCT SPECIFICATIONS

| 2.5RS BACK PANEL 37 PIN "EXT DRIVE" CONNECTOR: | | |
|---|---|--|
| "EXT DRIVE" CONNECTOR PIN NO. | DESCRIPTION | RATINGS |
| 1 | Signal Ground | 0 V |
| 2 | Power Ground | 0 V |
| 3 | Positive supply power output. | +24 VDC @ 40 mA |
| 4 | +12 V Supply input to encoders | ? |
| 5 | Negative supply power output. | -24 VDC @ 40 mA |
| 6 | Analog Ground | 0 V |
| 9 | Speed reference input. | Nominal: 0 to 10.5 V peak. Limit: 5.28 to 15.84 V peak @ 0.15 mA |
| 10, 11 | BCR contacts. Closed to signal that the 2.5RS is in control | 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| 12,13 | Override output | Pins 12 and 13 can sink a combined 500 mA @ 50 V, but are isolated by diodes so that a signal on one pin will not affect the other pin. |
| 14 | Y drive reference output. | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 15, then maximums are the same as for pin 15. |
| 15 | Y drive reference input. | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| 17 | X drive reference output. | If Burny™ signal selected, output is 1 ma, +/- 15V. If signal selected is customer signal from pin 18, then maximums are the same as for pin 15. |
| 18 | X drive reference input. | Maximums: 30 VDC @ 2 A, or 60 VDC @ 0.5 A; 120 VAC @ 2 A |
| 25, 26 | Preheat Gas solenoid power contacts. These are normally open dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 27, 28 | Start Cut contacts. These are dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 29, 30 | Enable Cut contacts. These are dry contacts. | 2 A @ 230VAC maximum or 2 A @ 30 VDC maximum |
| 31, 32 | Cut On Sense input. Signals the 2.5RS that the cutting oxygen is operating. | 115 VAC @ 15 mA See the operator manual section "MACHINE INTERFACE – SENSING INPUT." |
| 34 | Protective ground from machine power source. | Chassis Ground |
| 35 | Neutral conductor of machine's power source. | 0 VAC @ 0.25 A |
| 36 | Input pin for powering the 2.5RS from a 115 VAC machine power source. | 115 VAC @ 0.25 A |

BACK PANEL "RENC" AND "CENC" 9 PIN ENCODER CONNECTORS:

2.5RS OPERATION AND MAINTENANCE MANUAL

| PIN # | DESCRIPTION | RATINGS |
|-------|--|--|
| 1 | Analog Ground | 0 V |
| 2 | +12 VDC output | This output is derived from the customer's 12 Volt supply that is connected to the 2.5RS 37 pin back panel "Ext Drive" connector, pin 4. It is not normally used, but is for special installations where encoders require 12 Volt power. |
| 3 | <u> </u> X _B input from encoder | 500 mV input sensitivity over range of ±15 V, 2.7 kOhm input impedance. |
| 8 | X _A input from encoder | 500 mV input sensitivity over range of ±15 V, 2.7 kOhm input impedance. |
| 4 | Chassis ground | 0 V |
| 5 | <u> </u> Y _B input from encoder | 500 mV input sensitivity over range of ±15 V, 2.7 kOhm input impedance. |
| 6 | Signal common for differential encoders | 2.3 VDC ± 10% @ 1 mA |
| 7 | 5 VDC to encoder | 5 VDC @ 250 ma |
| 9 | Y _A input from encoder | 500 mV input sensitivity over range of ±15 V, 2.7 kOhm input impedance. |

PART 11 INDEX

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