

Computer Weld Technology, Inc.

10702 Old Bammel N Houston Rd.
Houston, TX 77086
Phone: (713) 462-2118
Fax: (713) 462-2503
Email: cwt@cweldtech.com

WOC-500™

WELD OSCILLATOR CONTROL

Operation / Installation Manual

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1.0 OVERVIEW.....	1
2.0 INSTALLATION.....	3
2.1 OSCILLATOR CONTROL.....	3
2.2 PENDULUM OSCILLATOR	4
2.3 LINEAR SLIDE.....	5
2.4 CABLES.....	6
2.5 REMOTE CONTROL FUNCTIONS	7
3.0 OPERATION.....	8
3.1 OPERATIONAL SEQUENCES	8
3.2 PENDULUM DESCRIPTION	9
3.3 LINEAR SLIDE DESCRIPTION.....	9
4.0 WOC-500 OFF-LINE SERIAL TERMINAL PORT PROTOCOL.....	10
4.1 SERIAL TERMINAL PORT INTERFACE.....	10
4.2 PORT PROTOCOL.....	10
4.3 TERMINAL COMMANDS.....	10
5.0 WOC-500 PROGRAMMABLE SEQUENCE PROTOCOL	13
5.1 PROGRAMMABLE SEQUENCES	13
5.2 SPECIFIC COMMAND FUNCTION	13
5.3 RELAY OUTPUTS.....	13
5.5 AVAILABLE COMMAND	14
5.6 FACTORY DEFAULTS.....	19
APPENDIX A PENDULUM OSCILLATOR PARTS AND INSTALLATION.....	20
APPENDIX B WOC-500 CONTROL ASSEMBLY	34
APPENDIX C OSCILLATOR MOTOR CABLE ASSEMBLY	42
APPENDIX D REMOTE I/O INTERFACE.....	43
APPENDIX E SLIDE MOTOR CABLE ASSEMBLY.....	45
APPENDIX F LSA-2007	47

1.0 OVERVIEW

The Computer Weld Technology Weld Oscillator Control (WOC-500) is a compact, lightweight, weld torch manipulation control system comprised of the micro-controller based Weld Oscillator Control (WOC-500) and a stepper motor driven Pendulum Oscillator Assembly (POA) or the Linear Slide Assembly (LSA) . This system is capable of providing independent control of all torch movements in the horizontal plan.

The WOC-500 provides a user definable 50 sequence Programmable Logic Controller (PLC) with four (4) 24-vdc inputs and two N.O. relay contacts. Using the PLC the user can provide external program control and simple power source interface. A RS-232 serial port is provided for off-line programming and system configuration. The RS-232 port can also be used to remote control the WOC-500.

The Weld Oscillator Control (WOC-500) provides the necessary command signals to the stepper motor powered drive to permit the selection of the following functions from the front panel of the oscillator control box.

CONTROL	FUNCTION
RUN	Enables oscillation.
JOG	Jog the center position in a CW or CCW direction.
SPEED	Control the speed of the oscillation.
LEFT DWELL	Control the dwell time on the left side of the oscillation pattern.
RIGHT DWELL	Control the dwell time on the right side of the oscillation pattern.
WIDTH	Control the width or amplitude of the weave pattern.

The Pendulum Oscillator Assembly (POA) is a stepper motor driven mechanical assembly that provides the oscillation motion for weld torch manipulation. The oscillator has a single 5/8-inch diameter output shaft for attachment of the user supplied welding torch. The oscillator module can be installed in any position and with a maximum rotational displacement of $\pm 15^\circ$.

The Linear Slide Assembly (LSA) is a stepper motor driven mechanical assembly that provides the motion for weld torch manipulation. The Heavy Duty LSA provides 7" of vertical motion and has a weight capacity of 45 lbs @ 3" from the face of the carriage. The Torch Slide Assembly module can be installed in any position using the mounting bracket. The mounting bracket can be installed on the bottom or in the center of the back of the slide.

WOC-500™ SPECIFICATIONS

Dimensions	6.62"H X 4.12"W X 8.75"L (168mm X 105mm X 222mm)
Weight	5.5 lbs (2.5kg)
Power Requirements	115 vac or 42 vac 50/60 Hz @ 220 va
Dwell Time	0.02 to 2.0 seconds (left and right)
Velocity	0.24° to 60° per second
Width	$\pm 0.06^\circ$ to 15°

PENDULUM OSCILLATOR SPECIFICATIONS

Dimensions	4.50"H X 3.37"W X 4.00"L (114mm X 86mm X 102mm)
Weight	3 lbs (1.36kg)
Velocity	0.24° to 60° per second
Output Shaft Rotational Torque	820 ounce/inches
Output Shaft Holding Torque	1657 ounce/inches
Approximate Weight Limit	15 lbs at 3" from center of output shaft

HEAVY DUTY SLIDE SPECIFICATIONS

Dimensions	17.08"H x 5.00"W x 2.63"D (434mm X 127mm x 67mm)
Max Travel	7.25" (184mm)
Weight	9-1/2 lbs (4.32kg)
Velocity	0.2 – 1.5 inch/sec
Weight Capacity	45 lbs @ 3" from slide face

2.0 INSTALLATION

2.1 OSCILLATOR CONTROL

The Oscillator control assembly should be located to allow easy operator access to the front panel. The control is provided with four 10-32 captive PEM nuts located on the left side of the enclosure. Figure 1 shows the physical mounting dimensions.

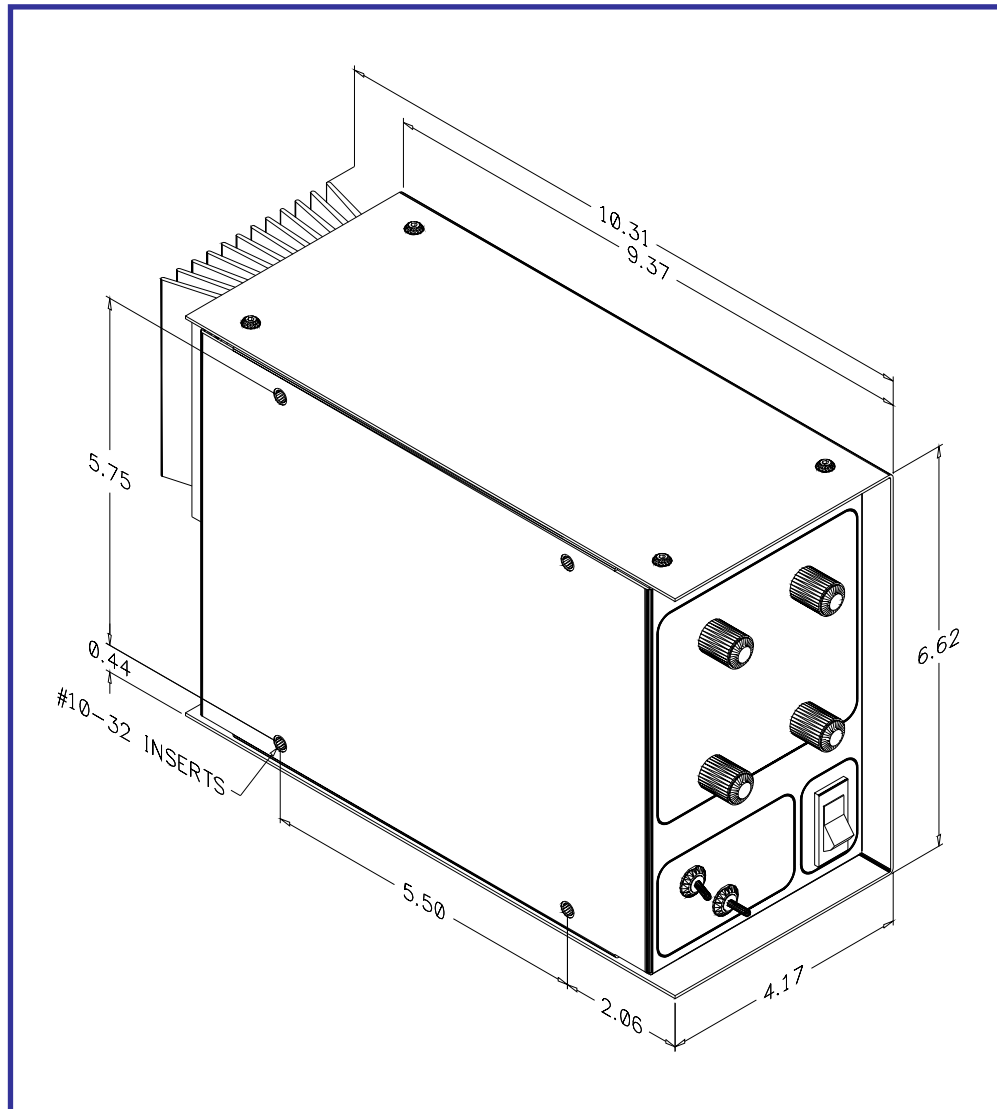


FIGURE 1 - Control Physical Dimensions

2.2 PENDULUM OSCILLATOR

Install the pendulum oscillator on the user supplied welding torch adjustment bracket. The pendulum oscillator may be mounted in any position. The physical oscillation can occur in any position within the 360° rotation of the output shaft. The pendulum oscillator may be installed using the supplied Trans-Torque coupler or any user supplied mounting bracket. The Trans-Torque coupler will grip any 5/8" diameter shaft and can be located in either of the two 1" diameter-mounting holes. See Figure 2 for mounting locations and physical dimensions.

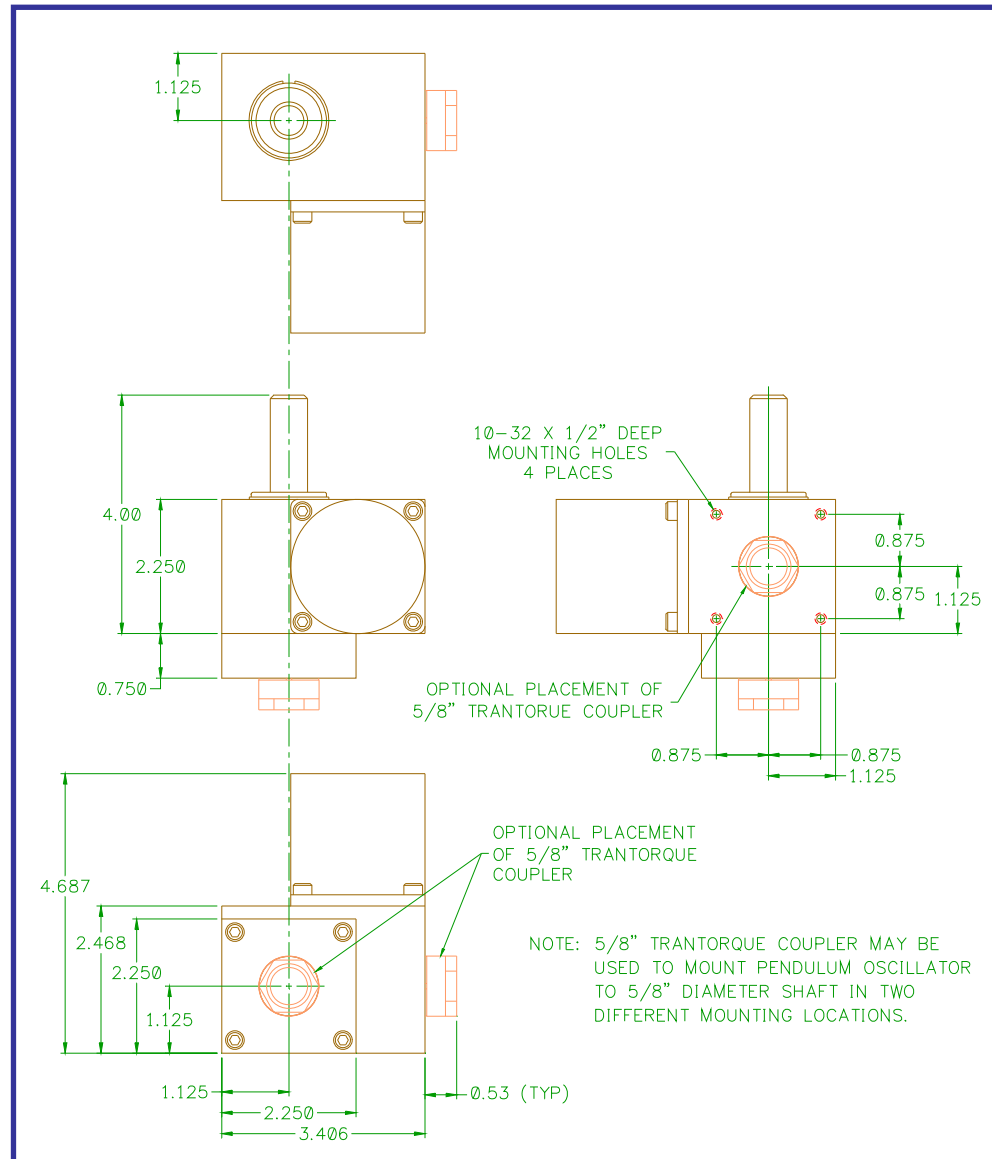


FIGURE 2- Pendulum Oscillator Physical Dimensions

2.3 LINEAR SLIDE

Install the linear slide using the four threaded 5/16-18 mounting holes located in the rear of the slide. See Figure 3 for mounting hole locations and physical dimensions.

NOTE: The sensor is a user requested option and not installed on all slide units.

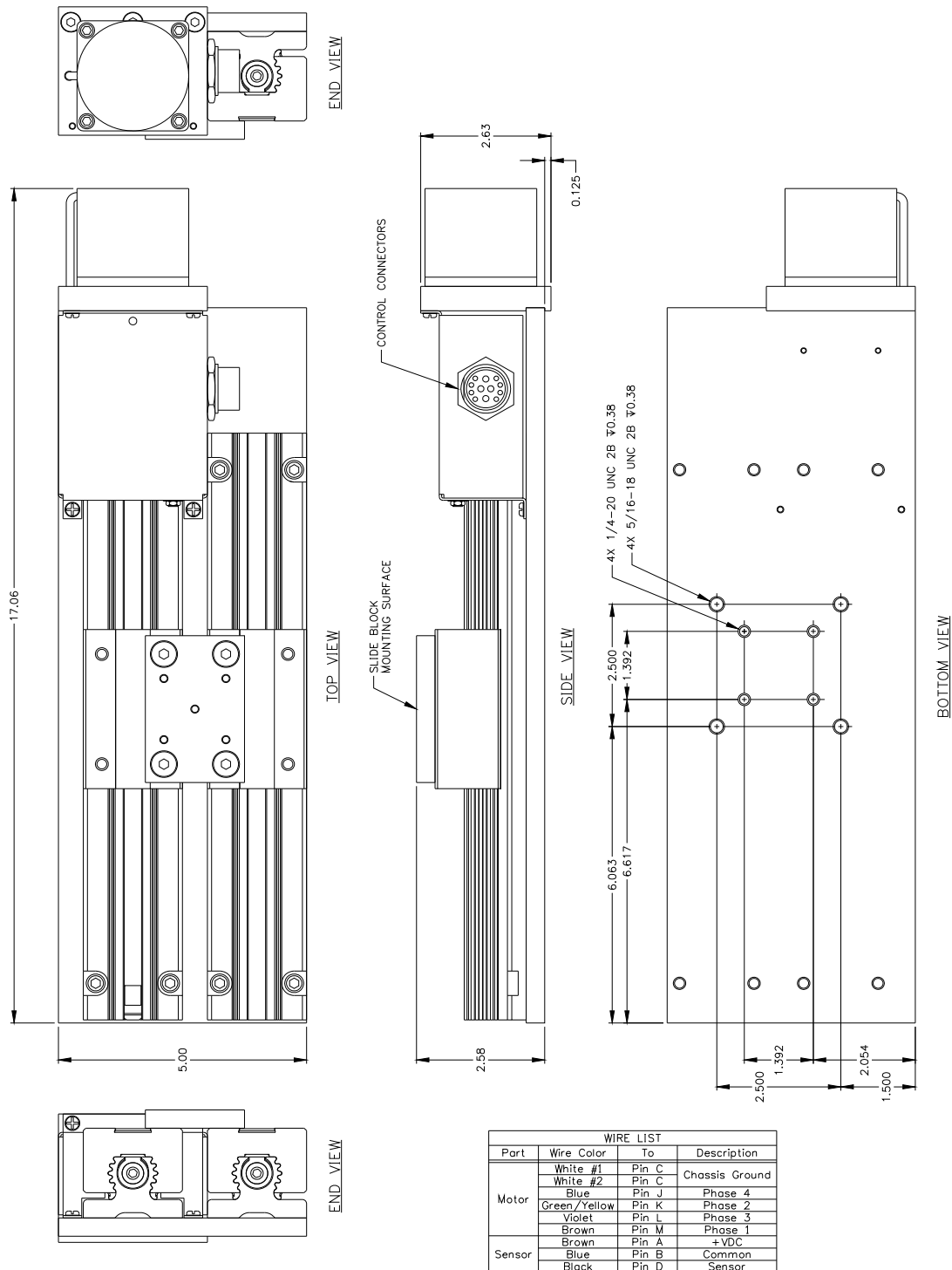


FIGURE 3- Linear Slide Physical Dimensions

2.4 CABLES

Refer to Figure 4 for the following cable installation. Connect the oscillator motor cable to the mating connector on the rear of the control enclosure and to the oscillator assembly. Connect the power cable to the rear mating connector on the control enclosure. If the WOC-500 is to be used to control the welding power source connect a suitable remote control cable to DB9 I/O rear panel connect. Refer to Appendix D for samples interconnect drawings for various weld power supplies. This completes the cable installation.

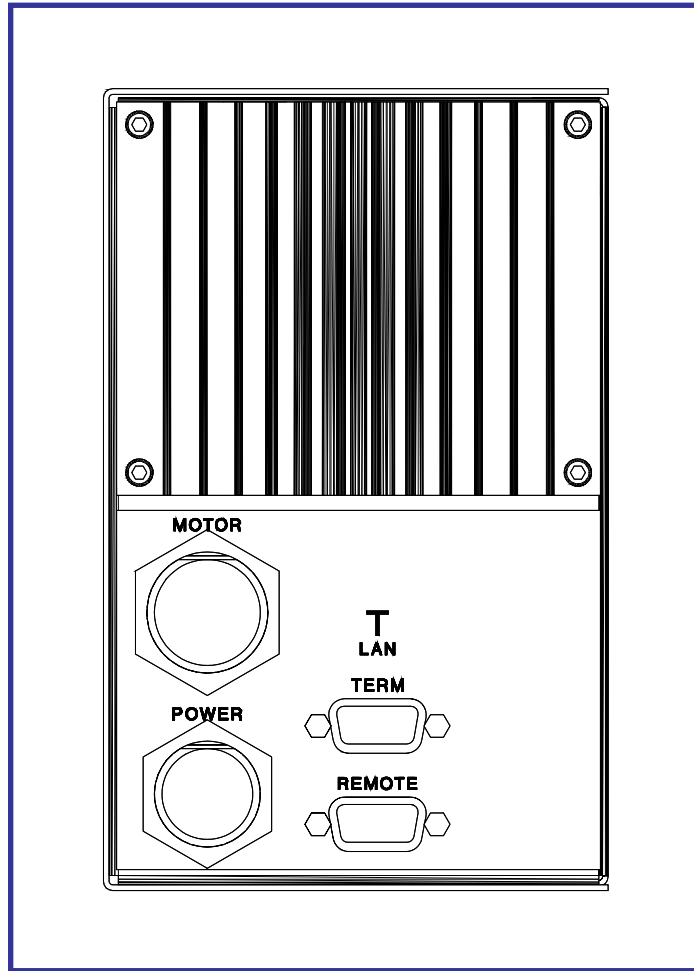


FIGURE 4 - Rear Control Panel Layout

The Oscillator control has a DB-9S remote control connector located on the rear panel. This remote input can be used with the PLC to provide remote control of the WOC-500. Figure 5 shows the pin-out for the remote connector and the Input/Output configuration for the I/O port.

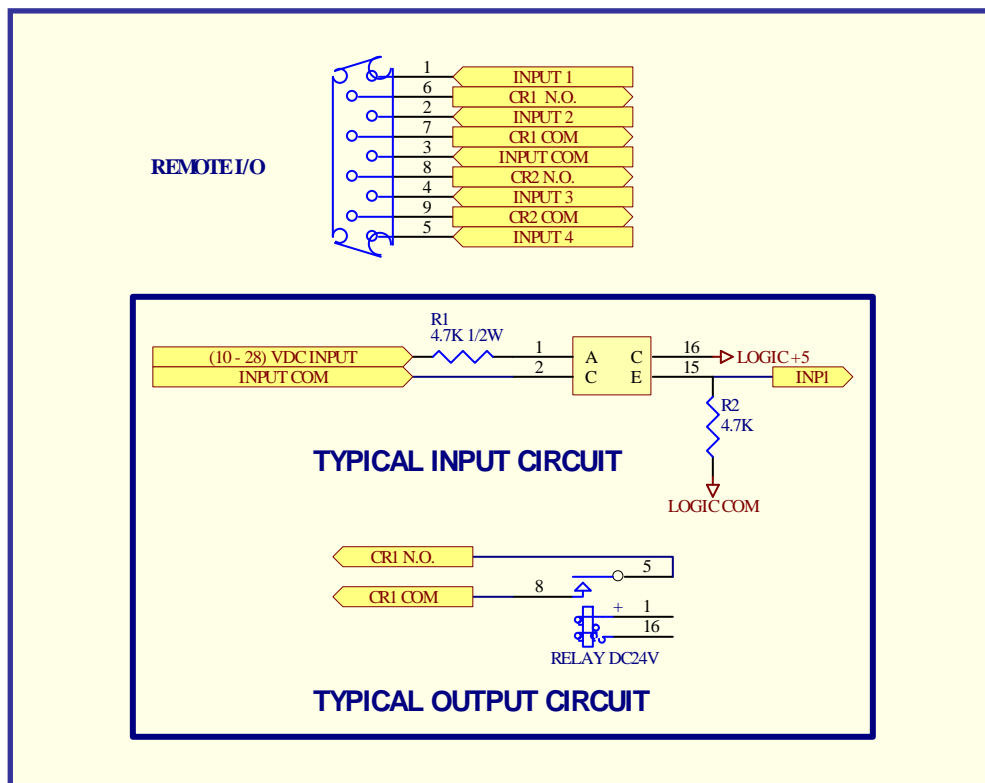


FIGURE 5 - Remote Input/Output Configuration

2.5 REMOTE CONTROL FUNCTIONS

The following is a functional description of the remote control functions:

PIN	FUNCTIONS
1	INP1 - 24 vdc remote input 1 (24vdc @ 5.0 ma. Active High)
2	INP2 - 24 vdc remote input 1 (24vdc @ 5.0 ma. Active High)
3	INP COM - Digital input signal common
4	INP3 - 24 vdc remote input 1 (24vdc @ 5.0 ma. Active High)
5	INP4 - 24 vdc remote input 1 (24vdc @ 5.0 ma. Active High)
6	CR1-A - CR1 relay Normally Open (N.O.) output (Default weld contactor)
7	CR1-B - CR1 common output (Default Weld contactor)
8	CR2-A - CR2 relay Normally Open (N.O.) output (Default arc active)
9	CR2-B - CR2 common output (Default arc active)

3.0 OPERATION

3.1 OPERATIONAL SEQUENCES

The following operational sequence is based on the default PLC program provided with the unit. The operation may vary based on user defined PLC code. Refer to Section 5 for PLC programming information. Figure 5 shows the location of the operator controls. To operate the control, turn the main power switch to the "Up" position. The power switch will illuminate indicating that the unit is operational. To start the oscillation turn the "RUN" switch to the "On" position. The oscillator will begin to oscillate. To change the oscillation width, adjust the "WIDTH" control. To change the oscillation speed, adjust the "SPEED" control. To change the right oscillation dwell time, adjust the "RIGHT DWELL" control. To change the left oscillation dwell time, adjust the "LEFT DWELL" control. To move the center of the oscillation pattern, use the "JOG" switch. Holding the "JOG" switch in the "CW" direction will move the center of oscillation in the CW direction. Holding the "JOG" switch in the "CCW" position will move the center of oscillation in the CCW direction. To stop the oscillation set the "RUN" switch to the "OFF" position.

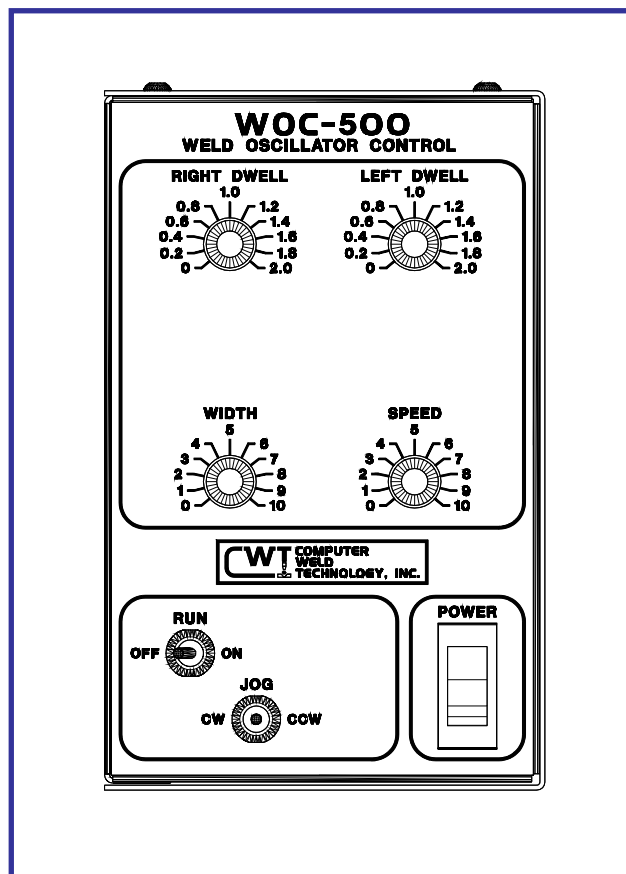


FIGURE 5 - Front Control Panel Layout

3.2 PENDULUM DESCRIPTION

The pendulum oscillator is a stepper motor device and the rotation is generated as a result of incrementing the motor armature position in 0.75° steps. As the speed of the oscillation is changed, there will be an audible change in the drive motor. The motor noise will change in pitch and level depending on the speed selected. This is a normal operating condition when using a stepper motor.

If the maximum load on the pendulum oscillator shaft is exceeded the motor will not make the incremental step. This excessive loading may cause the motor to lose synchronization and the center position may appear to drift. If the load is high enough, the motor will stall. This stall condition will cause the oscillator to produce a very audible noise. This condition will not damage the mechanical drive or the electronic control.

3.3 LINEAR SLIDE DESCRIPTION

The Linear Slide is a stepper motor device and the rotation is generated as a result of incrementing the motor armature position in 0.75° steps. As the speed of the oscillation is changed, there will be an audible change in the drive motor noise. The motor noise will change in pitch and level depending on the speed selected. This is a normal operating condition when using a stepper motor.

If the maximum load on the linear slide is exceeded the motor will not make the incremental step. This excessive loading may cause the motor to lose synchronization and the center position may appear to drift. If the load is high enough, the motor will stall. This stall condition will cause the oscillator to produce a very audible noise (ratchet). This condition will not damage the mechanical drive or the electronic control.

The normal operational temperature of the motor housing can reach 130F under normal load.

4.0 WOC-500 OFF-LINE SERIAL TERMINAL PORT PROTOCOL

4.1 SERIAL TERMINAL PORT INTERFACE

The RS-232 communications port is used to off-line program the WOC-500 PLC sequences drive motor parameters and the operating parameters for the WOC. The Protocol is a simple ASCII command string that allows the user to upload or download the various parameters. The serial port is configured for the following data format:

Baud Rate: 9600, Full Duplex
Word Length: 8 Data Bits, One Stop and no parity
Hand Shaking: None

4.2 PORT PROTOCOL

The Protocol consists of a command string and optional data bytes. The command string is an Alpha character an option number followed by a "=" or "?" followed by optional data and terminated with an ASCII "cr" (0dh). The "=" will indicate that data is being sent to the select parameter by the host controller. The "?" will indicate a request for data from the WOC to the Host controller. If the host is up-loading data to the WOC the data will be placed after the "=" character and will be an ASCII string terminated with an ASCII "cr" (0dh). The following is an example of sending a new step motor speed to the WOC-500:

V1=1000(cr) - Sent from Host

To read the WOC step motor speed, send the following command:

V1?(cr) - Sent from Host
1000(cr) - Received from WOC

4.3 TERMINAL COMMANDS

The following is a summary of the RS-232 serial Commands supported by the WOC-500:

COMMAND	DESCRIPTION
---------	-------------

A1 - A4 Read WOC-500 Analog Inputs. The following is a summary of the analog command functions:

A1 - Width Pot analog input (255 = 5.12 vdc Motor Steps = Value * Scale Factor (M6)).

A2 - Speed Pot input (255 = 5.12 vdc Step Rate = Value * Rate Multiplier (M5)).

A3 - Right Dwell Pot analog input (255 = 2.55 seconds).

A4 - Spare analog input (255 = 2.55 seconds).

A5 - Left Dwell Port analog input (255 = 2.55 seconds).

A6 - Spare analog input (255 = 5.12 vdc).

A7 - Current sensor excitation current (255 = 255 ma.)

A8 - Set motor Excitation current reference (255 = 2.55 amps).

M0 - M5 Set system control mode functions:

M0 - Set programmable sequence number to value.

M1 - Read Switch input status (1 = on, 0 = off)

BIT 0 = Remote INP1 (value= 1).
BIT 1 = Remote INP2 (value= 2).
BIT 2 = Remote INP3 (value= 4).
BIT 3 = Remote INP4 (value= 8).
BIT 4 = "CW" rotate switch input (value= 16).
BIT 5 = "CCW" rotate switch input (value= 32).
BIT 6 = "RUN" switch input (value= 64).
BIT 7 = Spare switch input (value= 128).

M2 - Set output relays CR1 - CR2 (1=on, 0=off).

BIT 0 = Relay CR1 (value= 1)
BIT 1 = Relay CR2 (value= 2)

M3 - Set Step motor current value ### amps (.55 - 2.55 amps).

M4 - Set Current sensor excitation value (1 - 255).

M5 - Set motor step rate multiplier value. Motor speed = $[1 / (\text{Value} \times \text{Rate})]$.

M6 - Step motor scale factor (Steps / Distance).

M7 - Analog input automatic scan starting parameter (0 - 5). When the value is set to zero the front panel pot values will be used. To disable the pot controls set the scan value to 6. This will enable off-line programming of the oscillator parameters.

M8 - CWT LAN Id number. Set an LAN ID value will disable the RS-232 communications and enable the LAN communications routines (Range 1 - 4).

M9 - Enable WOC auto sequence routines.

Command	Function
M9=1	Enable Auto sequence input
M9=2	Clear Auto sequence input
M9=3	Set Initialize sequence input
M9=4	Calculate maximum position based on external limit switch inputs.

S1 - S75 Programmable Sequence Commands - See Section 5.0 for description of programmable sequence commands and data format.

V1 - V9 Write/Read double byte variables:

V1 = Oscillator speed value.

V2 = Current Drive Position (Scaled step motor count).

V3 = Move position value. Decrement by the step motor drive command.

V4 = Maximum oscillator position limit.

V5 = Oscillator center position.

V6 = Oscillator width.

V7 = Maximum Oscillation width limit used by the adaptive width tracking mode 1.

V8 = Minimum Oscillation width limit used by the adaptive width tracking mode 1.

V9 = Current torch to work position.

V10= Maximum cross seam correction limit.

V11= Maximum torch to work correction limit.

In addition to the terminal commands the WOC-500 supports several special control key functions. These functions are used to save the programmed data in the EEPROM and to clear any pending terminal commands. The following commands are generated by pressing the CTRL" and specified letter key at the same time. When sending any of the following control codes, the WOC-500 will respond with an ASCII "CR". The following is a summary of the special control character function supported by the WOC-500:

Control Code	Command Function
^W	Save current parameters and sequence values to WOC-500 EEPROM
^C	Reset the terminal serial port and clear any pending terminal commands.
^S	Up-load stored sequence commands from WOC to terminal.
^R	Load sequence commands from EEPROM to RAM

5.0 WOC-500 PROGRAMMABLE SEQUENCE PROTOCOL

5.1 PROGRAMMABLE SEQUENCES

The WOC programmable sequence consists of a 3-byte command. The First byte is the command byte followed by a two-byte value:

{Byte1}, {Byte2 (MSB):Byte3 (LSB)}

The value bytes must be set even if not required by the command. The value bytes may be branch addresses or real data passed to the selected function. The Command and value must be separated by a comma. The MSB byte and LSB byte of the value may be separated by a colon (":"). The colon will cause the MSB and LSB byte to concatenate to form a single two-byte value.

5.2 SPECIFIC COMMAND FUNCTION

When setting MSB and LSB bytes for specific command function the MSB and LSB byte may be separated by a ":" or the total value may be specified by the decimal equivalent of the two bytes. To set the decimal value for the MSB and LSB bytes use the following equation:

$$\text{Decimal Value} = (\text{MSB} \times 256) + \text{LSB}$$

The following is an example of how to set sequence 4 to the "SWITCH ON" command (1) and branch to sequence number 10 when "OFF" (MSB) and to test switch input 1 (LSB):

$$\text{Decimal Value} = (\text{MSB} \times 256) + \text{LSB} = (10 \times 256) + 1 = 2561$$

Decimal Command sent to WOC: **S4=1,2561**

Optional Command format: **S4=1,10:1**

5.3 RELAY OUTPUTS

When Setting / Resetting the relay outputs the individual relays are selected by setting the decimal value for each relay and use the result as the value for the command. The following is an example of programming sequence 5 to set relay CR1 and CR2 using the "SET RELAY" command (2):

$$\text{Decimal Value for CR1} = 1 \text{ and CR2} = 3$$

$$\text{Decimal Value} = 1 + 2 = 3$$

Command sent WOC: **S5=2,3**

The following is the decimal value for individual bits used for the relay outputs and switch inputs:

<i>BIT NUMBER</i>	<i>DECIMAL</i>	<i>RELAY</i>	<i>SWITCH INPUT SWITCH</i>
<i>BIT 0</i>	<i>1</i>	<i>CR1</i>	<i>INP1</i>
<i>BIT 1</i>	<i>2</i>	<i>CR2</i>	<i>INP2</i>
<i>BIT 2</i>	<i>4</i>	<i>N/A</i>	<i>INP3</i>
<i>BIT 3</i>	<i>8</i>	<i>N/A</i>	<i>INP4</i>
<i>BIT 4</i>	<i>16</i>	<i>N/A</i>	<i>"CW" Switch</i>
<i>BIT 5</i>	<i>32</i>	<i>N/A</i>	<i>"CCW" Switch</i>
<i>BIT 6</i>	<i>64</i>	<i>N/A</i>	<i>"RUN" Switch</i>
<i>BIT 7</i>	<i>128</i>	<i>N/A</i>	<i>Not used</i>

5.5 AVAILABLE COMMAND

The following is summary of the available commands and the required values:

COMMAND DESCRIPTION

0 NOP - No Operation increment to next sequence

Example: *S20=0,0* *;Skip sequence - No operation.*

1 SWITCH ON - LSB selects switch input MSB is branch to sequence number if switch is "OFF". If MSB is zero, function will wait for switch "ON" condition then increment to next sequence.

Example 1: *S20=1,0:1* *;Wait for input 1 "ON".*

Example 2: *S20=1,40:1* *;If input 1 is "OFF" branch to SEQ40. If "ON" increment to next sequence*

2 SWITCH OFF - LSB selects switch input, MSB is branch to sequence number if switch is "ON". If MSB is zero, function will wait for switch "OFF" condition then increment to next sequence.

Example 1: *S20=2,0:1* *;Wait for input 1 "OFF".*

Example 2: *S20=2,40:1* *;If input 1 is "ON" branch to SEQ40. If "OFF" increment to next sequence*

3 SET RELAY - Set relay output specified by LSB byte (CR1 = 64 and CR2 = 128).

Example 1: *S20=3,2* *;Set CR2 relay output.*

Example 2: *S20=3,3* *;Set CR1 and CR2 relay output*

4 CLEAR RELAY - Clear relay output specified by LSB byte (CR1 = 64 and CR2 = 128).

Example 1: *S20=4,2* *;Reset CR2 relay output.*

Example 2: *S20=4,3* *;Reset CR1 and CR2 relay output*

5 DELAY TIME - Delay program execution by time specified by the value. The value specified is in 10 msecond increments. (Example: 13,50 Set delay time to 0.50 seconds)

Example: *S20=5,20* *;Delay for 0,20 seconds.*

- 6 AUTO EXECUTE** - If the Auto execute input is active branch to LSB sequence. If the Auto Execute input is not active branch to sequence number specified by the MSB. If MSB is 0 the function will wait until the input becomes active. If input is active the function will branch to the sequence number specified by the LSB byte. If the LSB is 0 the function increment to the next sequence.
- Example: S20=6,10:20 ;If the auto active flag is set jump to SEQ 20 else jump to SEQ 10.*
- 7 INITIALIZE** – If the Initialize input is active branch to LSB sequence. If the Initialize input is not active branch to sequence number specified by the MSB. If MSB is 0 the function will wait until the input becomes active. If input is active the function will branch to the sequence number specified by the LSB byte. If the LSB is 0 the function increment to the next sequence.
- Example: S20=7,10:20 ;If the initialize flag is set jump to SEQ 20 else jump to SEQ 10.*
- 8 CLEAR INITIALIZE** - Clear initialize input.
- Example: S20=8,0 ;Clear Initialize Flag.*
- 9 HALT MOVE** - Halt current move command and stop stepper drive motor.
- Example: S20=9,0 ;Halt current move command and stop motor drive.*
- 10 SET SPEED** - Value equal new drive velocity [LSB] (1 - 255).
- Example: S20=10,20 ;Set motor speed to low speed ($[1 / (Value * Rate)]$).*
- 11 SET POSITION** - Set current position to value specified by [MSB:LSB].
- Example: S20=11,1000 ;Set current position to 1000.*
- 12 SAVE POSITION** - Save current position encoder count to temporary position register and increment to next sequence.
- Example: S20=12,0 ;Save current position.*
- 13 RESTORE POSITION** - Move to position saved in temporary position register and increment to next sequence.
- Example: S20=13,0 ;Restore save position and move oscillator to the saved position.*
- 14 MOVE TO POSITION** - Move to position and increment to next sequence.
- Example: S20=14,1000 ;Move oscillator to position specified.*
- 15 SET MAXIMUM POSITION** - Set maximum position limit to value specified.
- Example: S20=15,10000 ;Set oscillator maximum to position 10000.*
- 16 LOAD POSITION TO MAX** - Set maximum position limit to current position.
- Example: S20=16,0 ;Load current oscillator position to Max position.*
- 17 JOG POSITION CW** - Add value specified to current position and move to new position.
- Example: S20=17,100 ;Jog current position 100 steps in the CW direction.*

- 18 JOG POSITION CCW** - Subtract value specified from current position and move to new position.
- Example: S20=18,100 ;Jog current position 100 steps in the CCW direction.*
- 19 MOVE COMPLETE** - Has drive completed the last move command? If the MSB byte is set the function will jump to the selected sequence number if the move is not complete. If the LSB byte is zero the function will wait for the move to be completed then increment to the next sequence or branch to the sequence number set by the LSB.
- Example 1: S20=19,0 ;Wait for oscillator move complete*
Example 2: S20=19,40:0 ;Is oscillator move complete? No - Branch to SEQ 40
- 20 SET LOOP COUNTER** - Load selected loop counter (0-4) with starting value. MSB byte is the value to load and the LSB byte is the selected counter. There are 5 Loop counters available.
- Example: S20=20,25:1 ;Load Loop counter 1 with a value of 25.*
- 21 INCREMENT LOOP COUNTER** - Increment the selected counter (0 - 4) and set the condition code register. The LSB byte selects the loop counter to Increment.
- Example: S20=21,1 ;Increment Loop counter 1 and set condition code register.*
- 22 DECREMENT LOOP COUNTER** - Decrement the selected counter (0 - 4) and set the condition code register. The LSB byte selects the loop counter to decrement.
- Example: S20=22,1 ;Decrement Loop counter 1 and set condition code register.*
- 23 CLEAR LOOP COUNTER** - Clears the selected loop counter (0 - 4). The LSB byte selects the desired loop counter to be cleared and sets the condition code register.
- Example: S20=23,1 ;Clear Loop counter 1 and set condition code register.*
- 24 JUMP TO SEQUENCE** - Jump to sequence specified by LSB byte.
- Example: S20=24,40 ;Jump to sequence S40.*
- 25 JUMP SUBROUTINE** - Jump to specified sequence number subroutine. The sequence subroutine must be terminated with a return from subroutine command (32). The WOC allows nesting of up to 5 subroutines. All commands may be used in subroutines.
- Example: S20=25,40 ;Jump to subroutine at sequence S40.*
- 26 RETURN FROM SUBROUTINE** - Returns the sequence counter to the "jump subroutine" sequence number plus 1. If a return subroutine command is executed with out a "jump subroutine" the sequence counter will be incremented to the next sequence.
- Example: S20=26,0 ;Return from subroutine.*
- 27 COMPARE VALUE TO POSITION** - Compares the value (MSB, LSB) to the current position and set the condition code register. The comparison is a subtraction of the current position from the command value (CURRENT POSITION - COMMAND VALUE). The current position is unchanged as a result of the command. Only the condition code register is set.

Example: **S20=27,1000** ;Compare current position to 1000 and set condition code register.

- 28 COMPARE SWITCH INPUT** - Compares the current WOC-500 switch inputs to the binary value specified in the LSB byte (SWITCH - VALUE) and sets the condition code register.

Example: **S20=28,3** ;Compare input to 3 (Input 1 and 2 active) and set condition code register.

- 29 COMPARE LOOP VALUE** - Compares the loop counter specified by the LSB byte to VALUE).

Example: **S20=29,10:1** ;Compare Loop counter 1 to 10 and set condition code registers.

- 30 BRANCH NOT EQUAL** - Branch to sequence specified by LSB byte as a result of the previous parameter value not being equal to command value or not equal zero. As specified by the condition code register. If not zero, increment to next sequence number.

Function: (Parameter != Compare) then Branch to Seq #

Example: **S20=30,40** ;If comparison parameter is not equal to value branch to SEQ 40.

- 31 RANCH IF LOWER** - Branch to sequence specified by LSB as a result f the previous parameter value being less than the command value. As specified by the condition code register. If not less than stored value, increment to next sequence number.

Function: Parameter < Compare then Branch to Seq #

Example: **S20=31,40** ;If comparison parameter < value branch to SEQ 40.

- 32 BRANCH IF HIGHER** - Branch to sequence specified by LSB byte as a result of the previous parameter value being greater than the command value. As specified by the condition code register. If not greater than parameter value, increment to next sequence number.

Function: Parameter > Compare then Branch to Seq #

Example: **S20=32,40** ;If comparison parameter > value branch to SEQ 40.

- 33 BRANCH IF EQUAL** - Branch to sequence specified by LSB byte as a result of the previous parameter value being equal to the command value (Note: result of comparison is zero). As specified by the condition code register. If not equal to parameter value, increment to next sequence number.

Function: Parameter = Compare then Branch to Seq #

Example: **S20=33,40** ;If comparison parameter = value branch to SEQ 40.

- 34 BRANCH IF HIGHER OR EQUAL** - Branch to sequence specified by LSB byte as a result of the previous parameter value being greater than or equal to the command value. As specified by the condition code register. If not greater than command value, increment to next sequence number.

Function: Parameter >= Compare then Branch to Seq #

Example: **S20=34,40** ;If comparison parameter => to value branch to SEQ 40.

- 35 BRANCH IF LESS THEN OR EQUAL** - Branch to sequence specified by LSB byte as a result of the previous parameter value being less than or equal to the command value (Note: result of comparison is zero). As specified by the condition code register. If not equal to parameter value, increment to next sequence number.

Function: Parameter <= Compare then Branch to Seq #

Example: S20=35,40 ;If comparison parameter <= to value branch to SEQ 40.

- 36 START OSCILLATOR** - Start the mechanical oscillation based on current width, speed, and dwell parameters.

Example: S20=36,0 ;Start oscillation.

- 37 STOP OSCILLATOR** - Halt the current oscillation and move oscillator to the current center position.

Example: S20=37,0 ;Stop oscillation.

- 38 CR1 ON/OFF** - Activate CR1 based on the [LSB] specified input. If the [LSB] input is active set CR1. If the [LSB] byte specified input is inactive reset CR1.

Example: S20=38,1 ;Set/Reset CR1 based on input 1 status

- 39 CR2 ON/OFF** - Activate CR2 based on the [LSB] specified input. If the [LSB] input is active set CR2. If the [LSB] byte specified input is inactive reset CR2.

Example: S20=39,1 ;Set/Reset CR2 based on input 1 status

- 40 OSCILLATOR ON/OFF** – Activate the Oscillator based on the [LSC] specified input. If the [LSB] input is active start the Oscillator. If the [LSB] byte specified input is inactive stop the oscillator.

Example: S20=40,1 ;Start/Stop the oscillator based on input 1 status

- 41 JOG CW ON/OFF** - Jog the oscillator center position in the CW direction by the value specified in the [MSB] byte. The [LSB] specifies the input to test. If the [LSB] specified input is active jog the center position by the value specified in the [MSB] byte. If the [LSB] byte is inactive the change center position is unchanged.

Example: S20=41,10:1 ;If INP 1 is active increment center position 10 steps in the CW direction

- 42 JOG CCW ON/OFF** - Jog the oscillator center position in the CCW direction by the value specified in the [MSB] byte. The [LSB] specifies the input to test. If the [LSB] specified input is active jog the center position by the value specified in the [MSB] byte. If the [LSB] byte is inactive the change center position is unchanged.

Example: S20=42,10:1 ;If INP 1 is active increment center position 10 steps in the CCW direction

- 43 INCREMENT WIDTH ON/OFF** - Increase the oscillator width by the value specified in the [MSB] byte. The [LSB] specifies the input to test. If the [LSB] specified input is active increase the width by the value specified in the [MSB] byte. If the [LSB] byte is inactive the width is unchanged.

Example: S20=43,10:1 ;If INP 1 is active increment width 10 steps

- 44 INCREMENT WIDTH ON/OFF** - Decrease the oscillator width by the value specified in the [MSB] byte. The [LSB] specifies the input to test. If the [LSB] specified input is

active Decrease the width by the value specified in the [MSB] byte. If the [LSB] byte is inactive the width is unchanged.

Example: **S20=44,10:1** ;If INP 1 is active decrement width 10 steps

45 SET WIDTH - Set the oscillator width to the value specified in the [LSB] byte.

Example: **S20=45,10** ;Set oscillation width to 10 steps

***** **Firmware Version 1.33 or Higher Only** *****

46 SET RIGHT DWELL - Set the oscillator Right Dwell value to the value specified by the [LSB] byte.

Example: **S20=46,10** ;Set the Right Dwell time to 0.1 seconds

47 SET LEFT DWELL - Set the oscillator Left Dwell value to the value specified by the [LSB] byte.

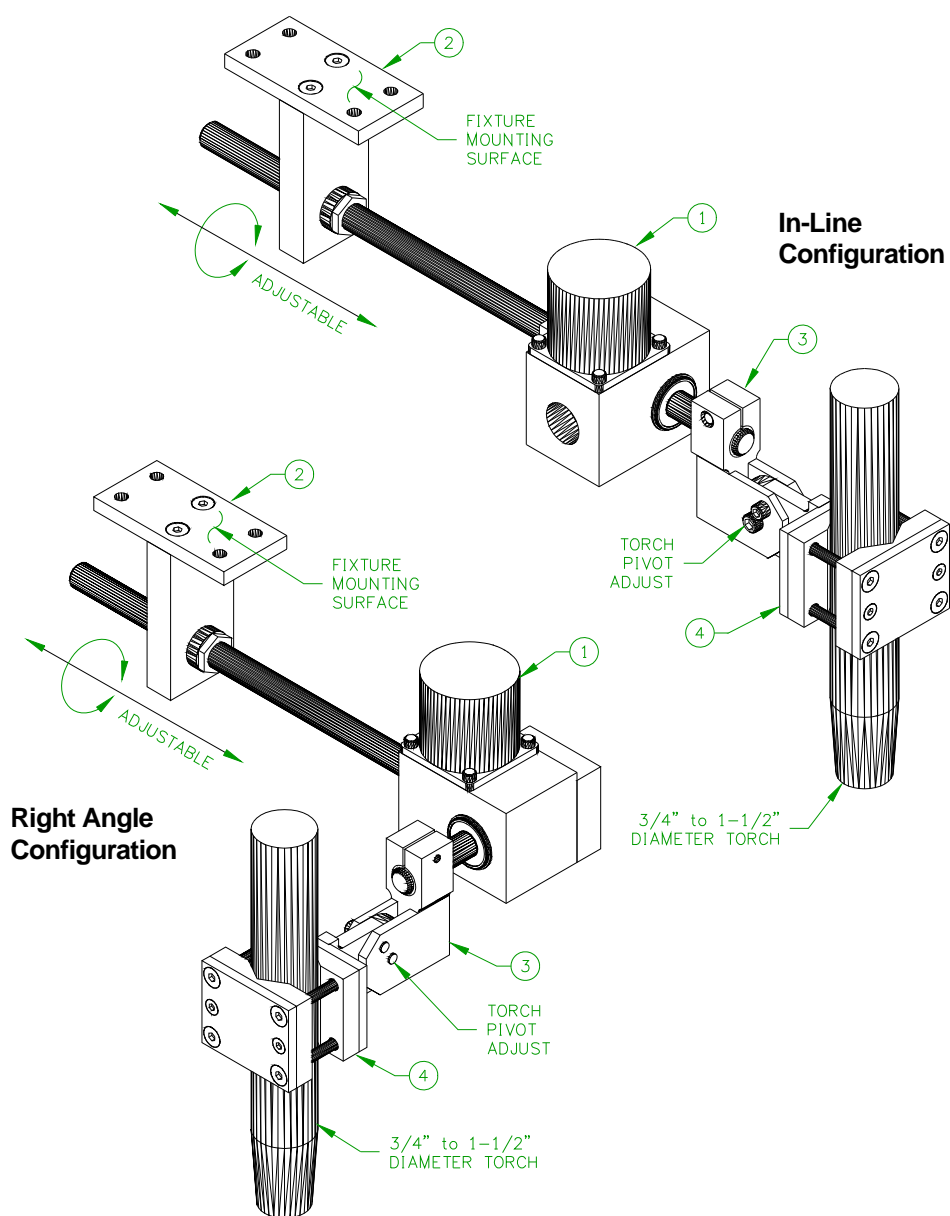
Example: **S20=47,10** ;Set the Left Dwell time to 0.1 seconds

5.6 FACTORY DEFAULTS

As shipped from the factory the WOC-500 has a basic operation PLC program. The PLC code allows the user to start/stop the oscillator "RUN" switch. The PLC code and consist of Sequence 1 - 5. This section checks the various input control switches and will jog the oscillator center, start/stop the oscillator. The following is a listing of the default PLC program provided:

```
=====NON WELD SWITCH TEST ROUTINE=====
S1=4,3                :RESET ALL RELAYS
S2=41,10:16           :IF CW SWITCH ON - JOG OSC CENTER IN 10 STEP CW INCREMENTS
S3=42,10:32           :IF CCW SWITCH ON - JOG OSC CENTER IN 10 STEP CCW INCREMENTS
S4=40,64              :IF RUN SWITCH ON - START/STOP OSCILLATOR
S5=24,1               :Jump to SEQ 1
```

APPENDIX A PENDULUM OSCILLATOR PARTS AND INSTALLATION



ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	E2A5179	Pendulum Oscillator Assembly
2	1	E2A5187	Pendulum Oscillator Adjustable Mount Assembly
3	1	E2A5186	Pendulum Oscillator Adjustable Arm Assembly
4	1	E2A5185	Adjustable Torch Mount Assembly

FIGURE A1: Typical Installation Parts for Pendulum Oscillator

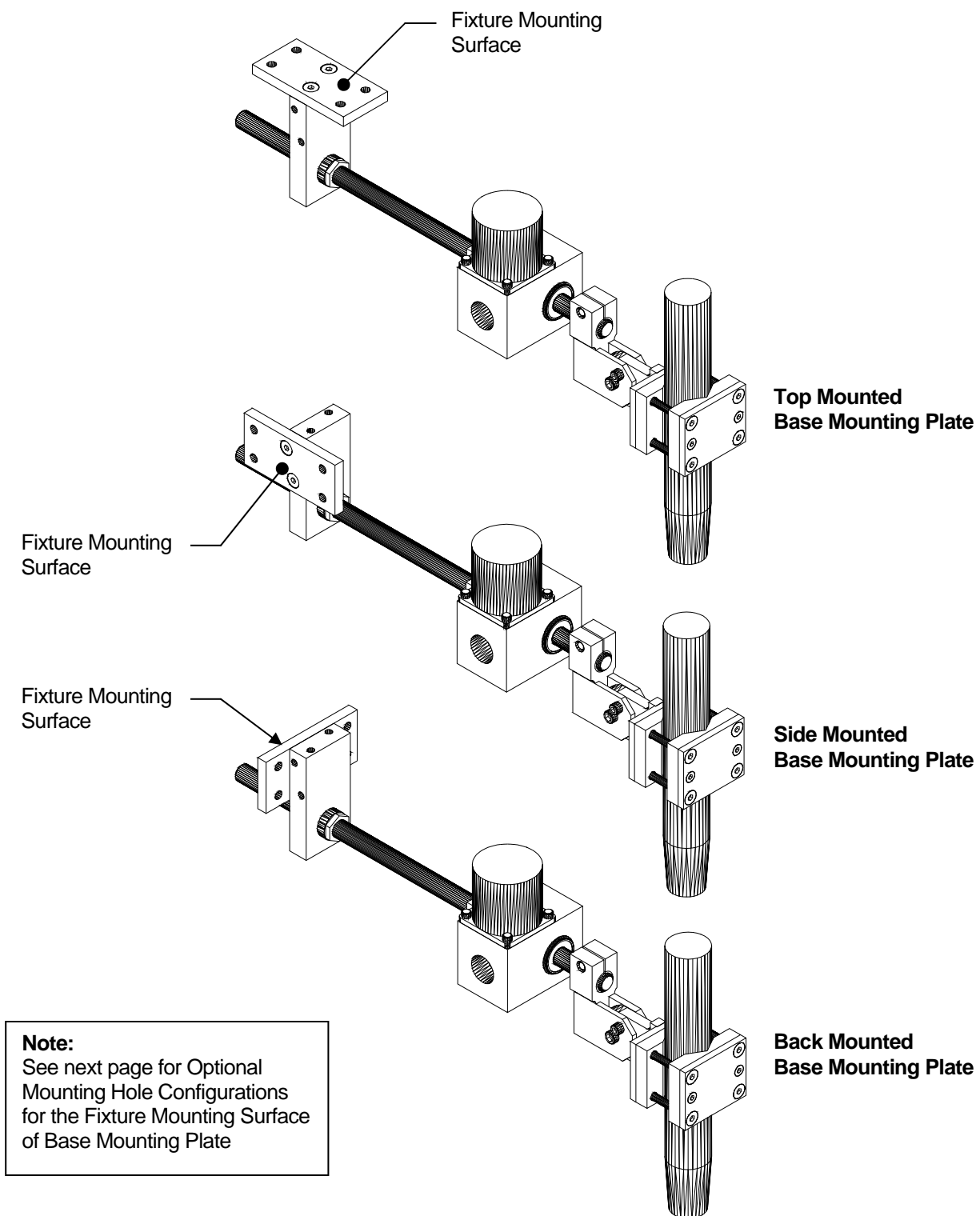
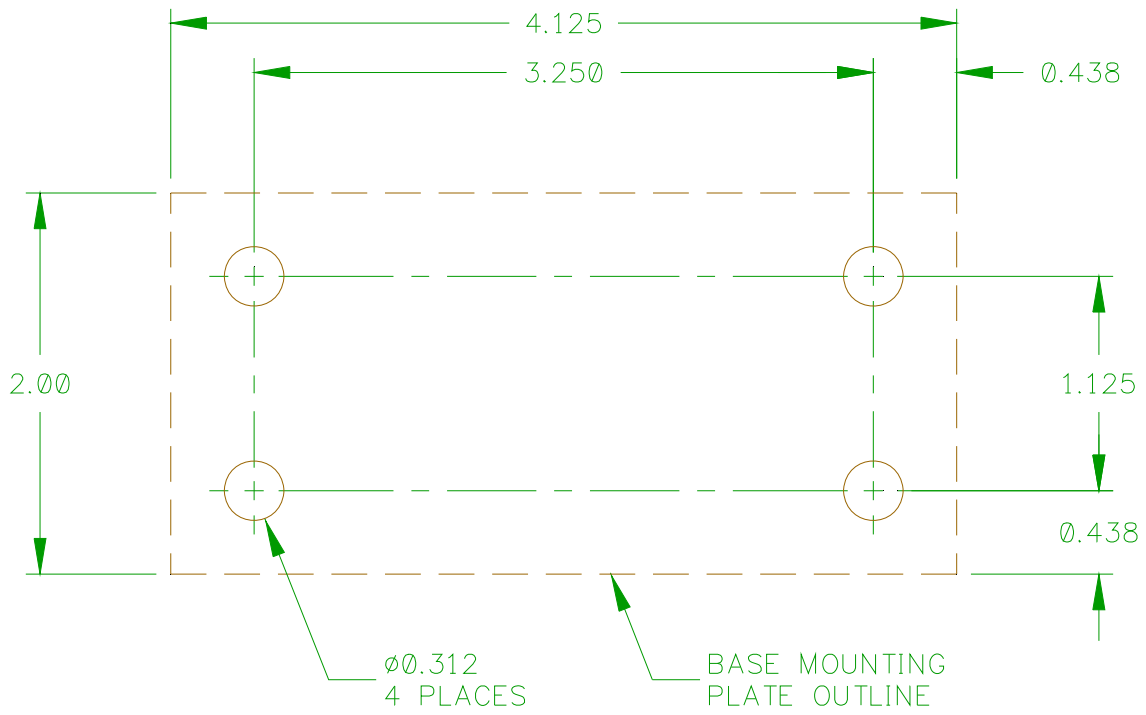
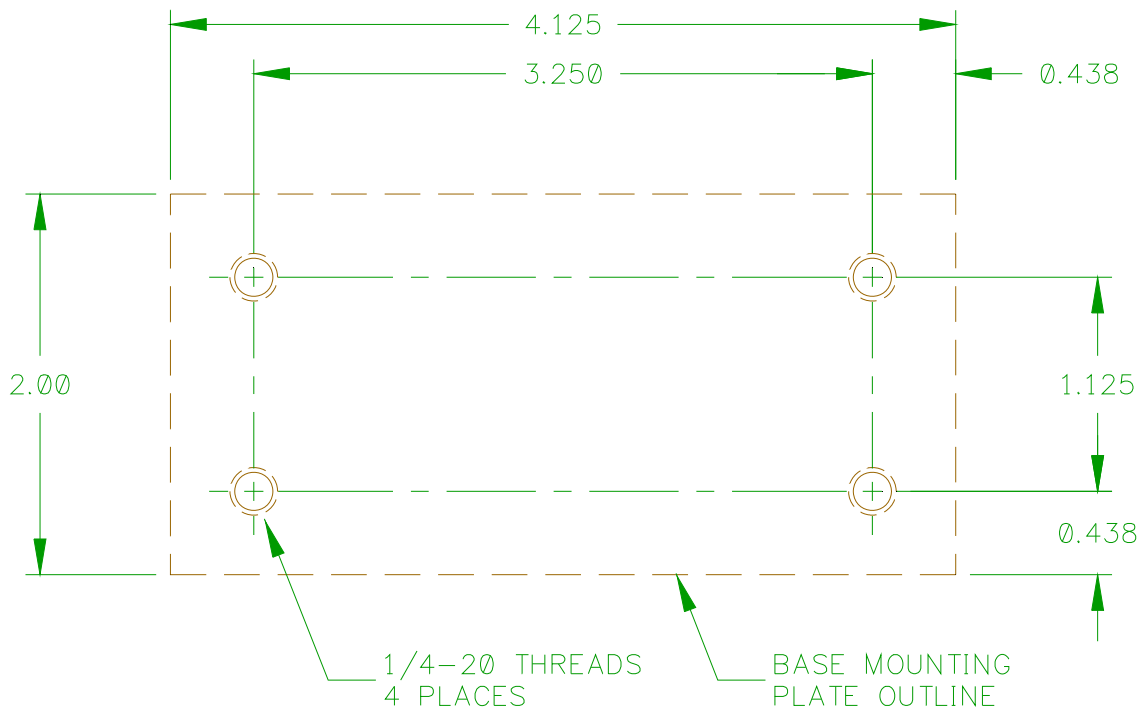


FIGURE A2: Optional Mounting Configurations of Adjustable Mount Assembly – E2A5187

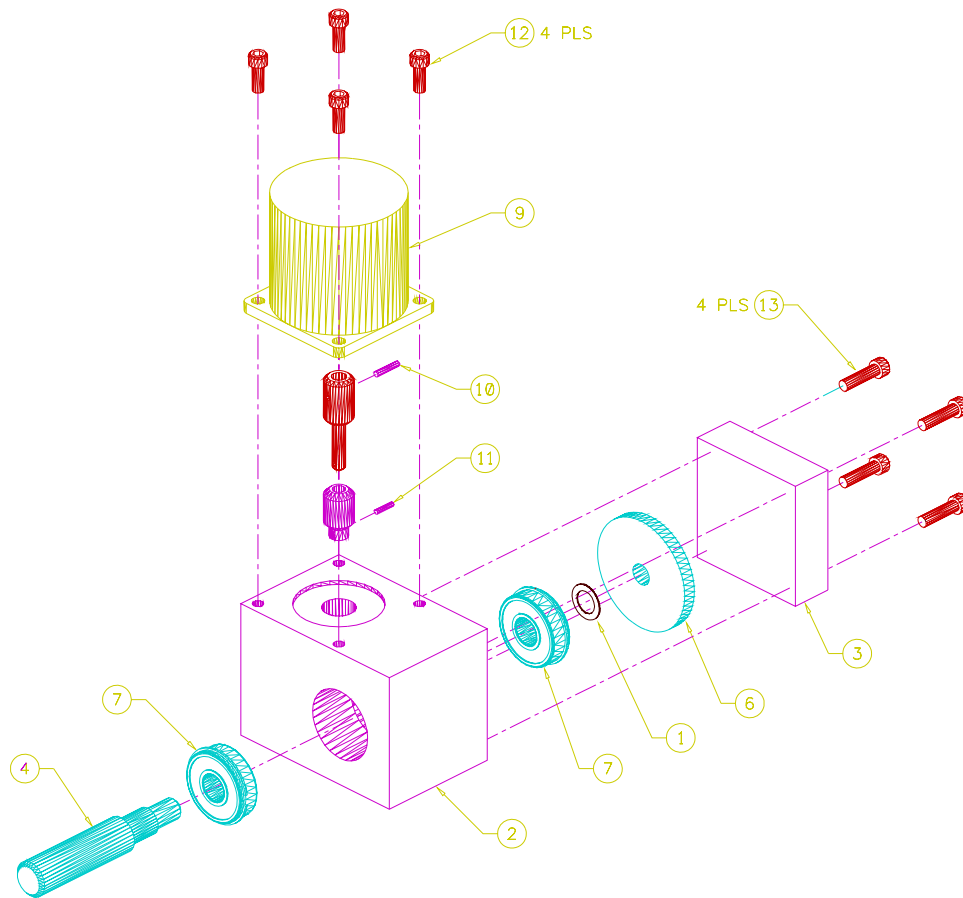


Clearance Hole Mounting



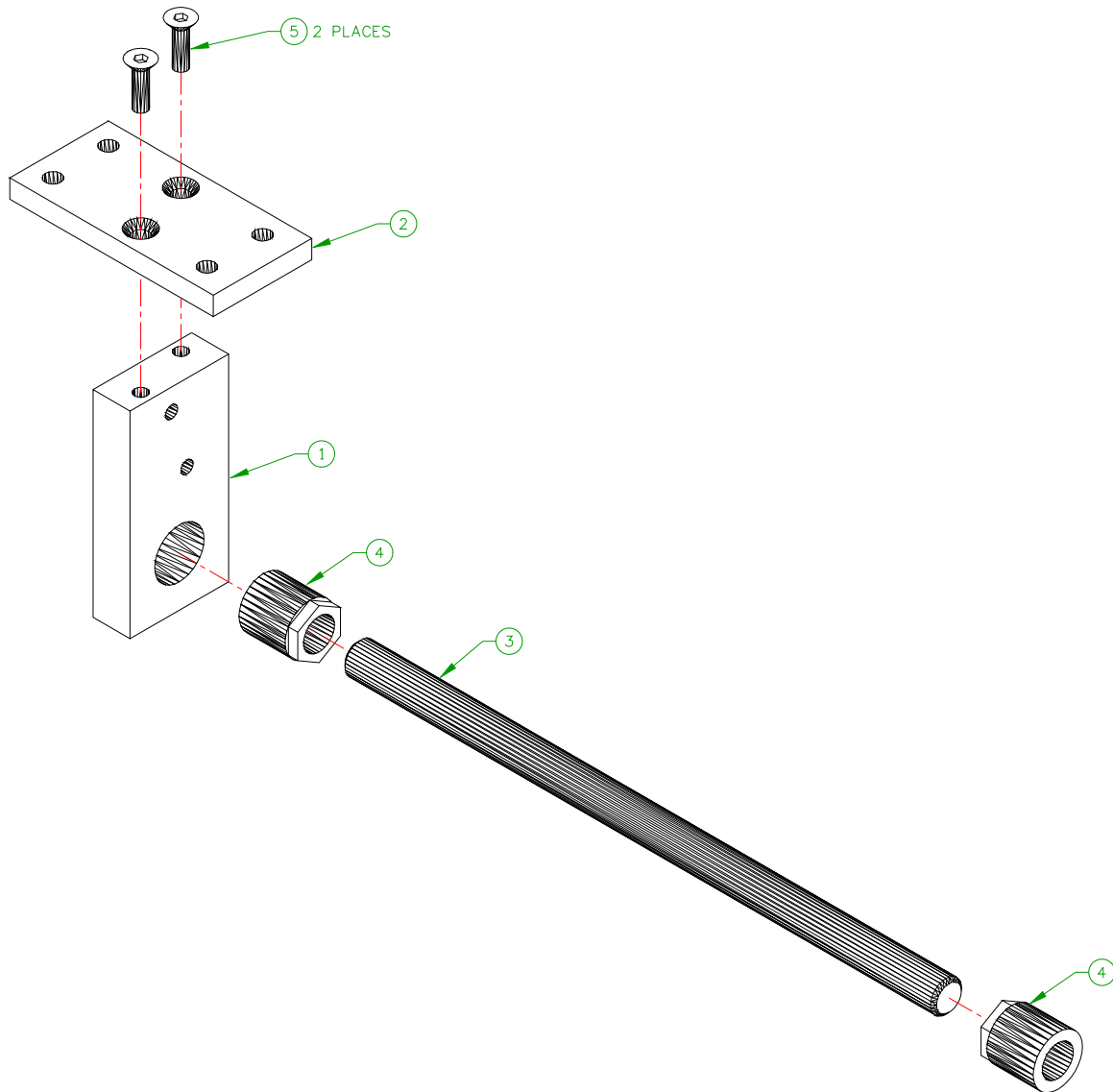
Threaded Hole Mounting

FIGURE A3: Optional Mountings Holes Configurations for Base Mounting Plate



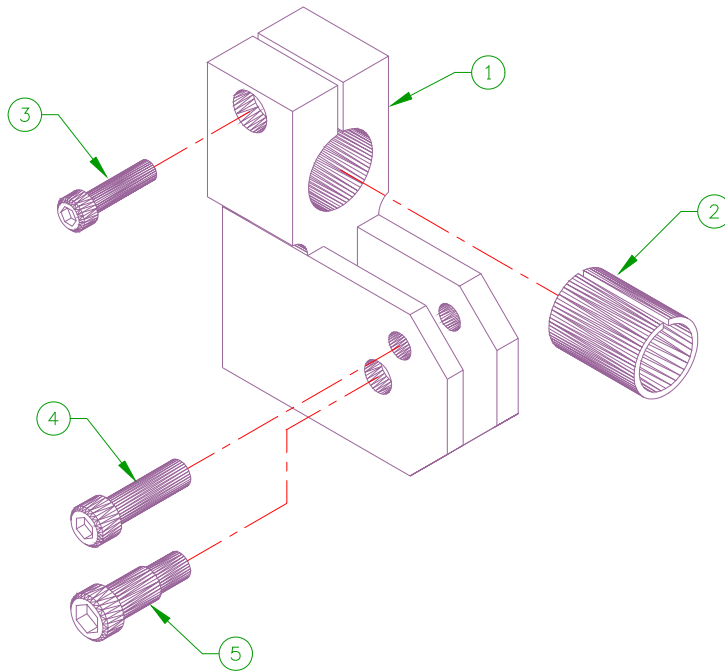
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	E2M5520	Bearing Spacer
2	1	E2M5798	Housing
3	1	E2M5799	Cover
4	1	E2M5800	Output Shaft
5	1	E2M5801	Adaptor Shaft
6	1	E2M5609	Worm Gear
7	2	X2B5054	Bearing
8	1	X2G5021	Worm
9	1	X3M5034	Stepper Motor
10	1		3/32" Dia. x 1/2" Lg. Roll Pin
11	1		5/64" Dia. x 3/8" Lg. Roll Pin
12	4		#10-32 x 5/8" Lg. Socket Cap Hd. Screw
13	4		#10-32 x 1" Lg. Socket Cap Hd. Screw

FIGURE A4: Exploded View of Pendulum Oscillator Assembly - E2A5179



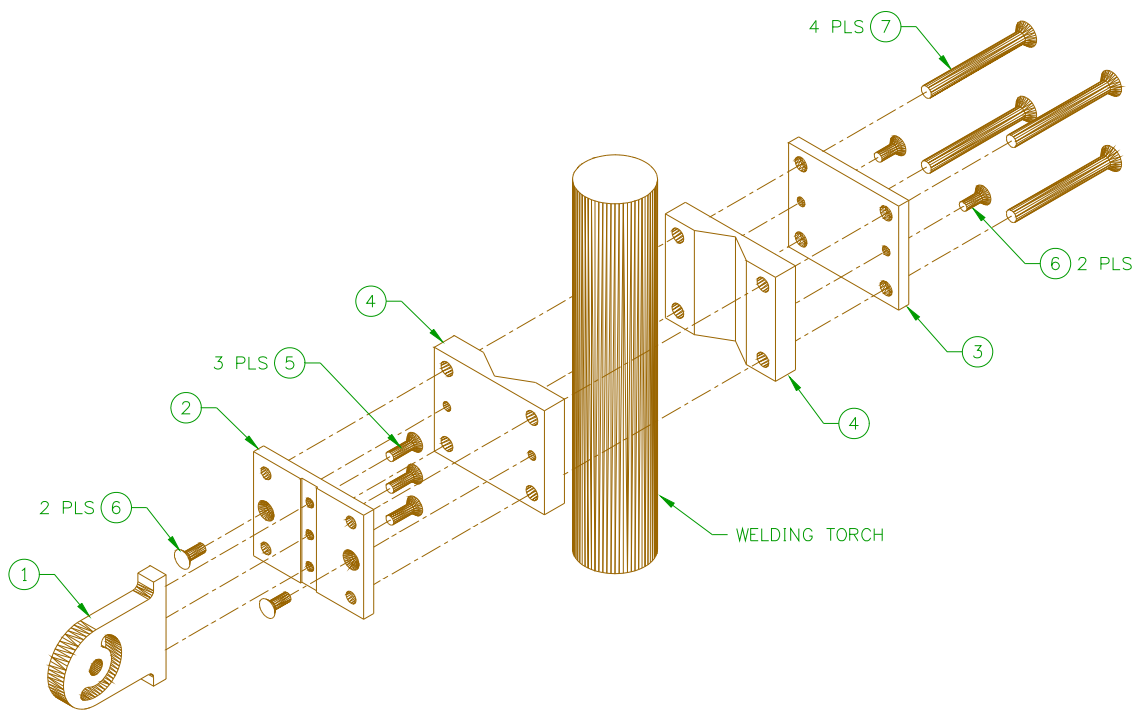
ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	E2M5821	Pendulum Oscillator Shaft Mounting Plate
2	1	E2M5822	Pendulum Oscillator Base Mounting Plate
3	1	X2U5010	5/8" Dia. x 12" Long 303 SS Shaft
4	2	X6B5157	Transtorque Coupling
5	2		1/4-20 x 7/8" Long Socket Flat Head Screw

FIGURE A5: Exploded View of Pendulum Oscillator Adjustable Mount Assembly - E2A5187



ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	S2M5176	Rumble Clutch Bracket
2	1	E2M5812	Pendulum Oscillator Shaft Sleeve
3	1		#10-32 x 3/4" Long Socket Head Cap Screw
4	1		#1/4-20 x 7/8" Long Socket Head Cap Screw
5	1		5/16" Dia. x 1/2" Long x #1/4-20 Shoulder Screw

FIGURE A6: Exploded View of Pendulum Oscillator Adjustable Arm Assembly - E2A5186



ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	E2M5711	Binzel Bracket Arm
2	1	E2M5817	Torch Mount Arm Base
3	1	E2M5818	Torch Mount Clamp Base
4	2	E2M5819	Torch mount Insulator
5	3		#10-32 x 5/8" Long Socket Flat Head Screw
6	4		#10-32 x 1/2" Long Socket Flat Head Screw
7	4		#1/4-20 x 2-1/2" Long Socket Flat Head Screw

FIGURE A7: Adjustable Torch Mount Assembly - E2A5185

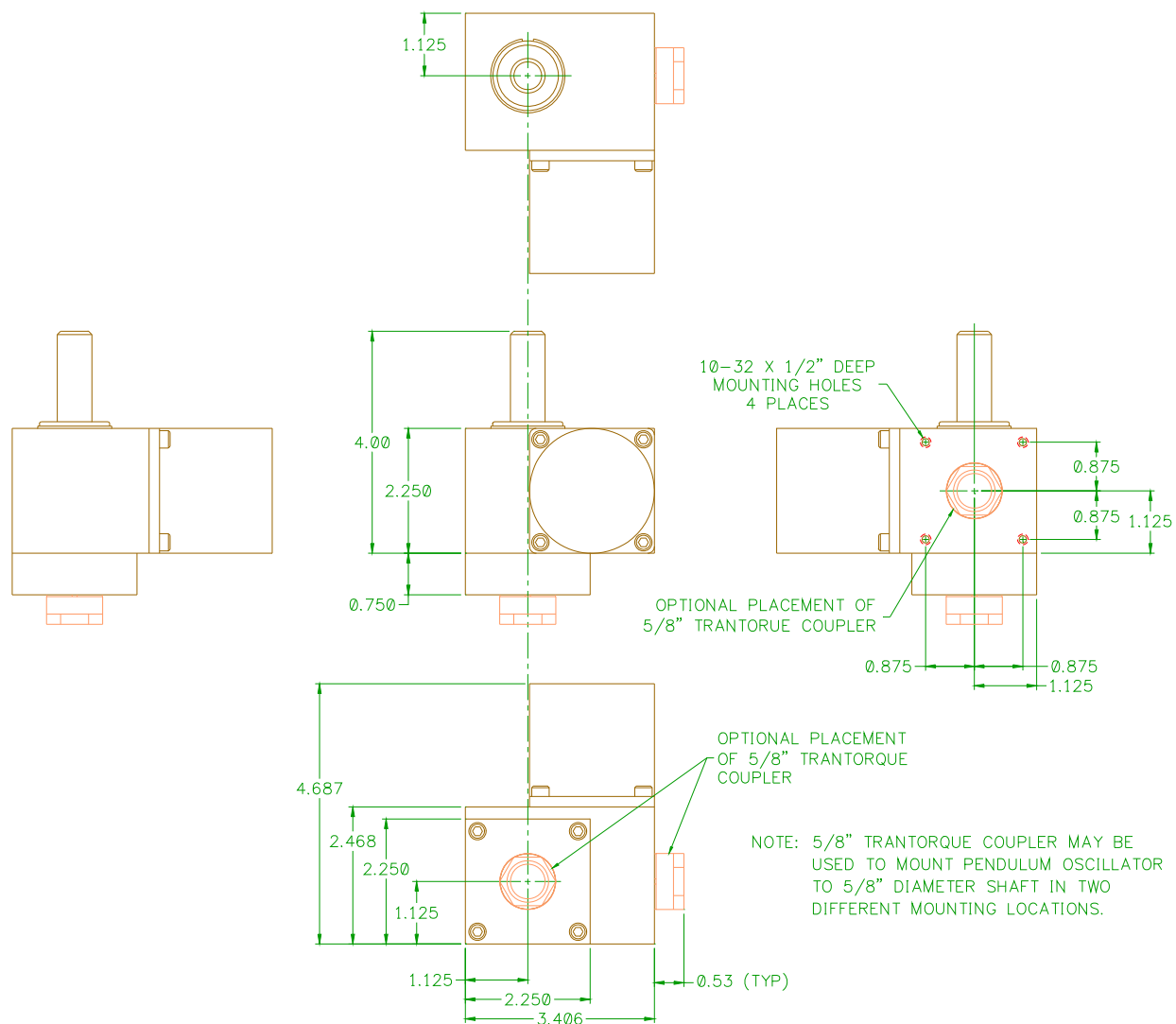


FIGURE A8: Physical Dimensions for Pendulum Oscillator - E2A5179



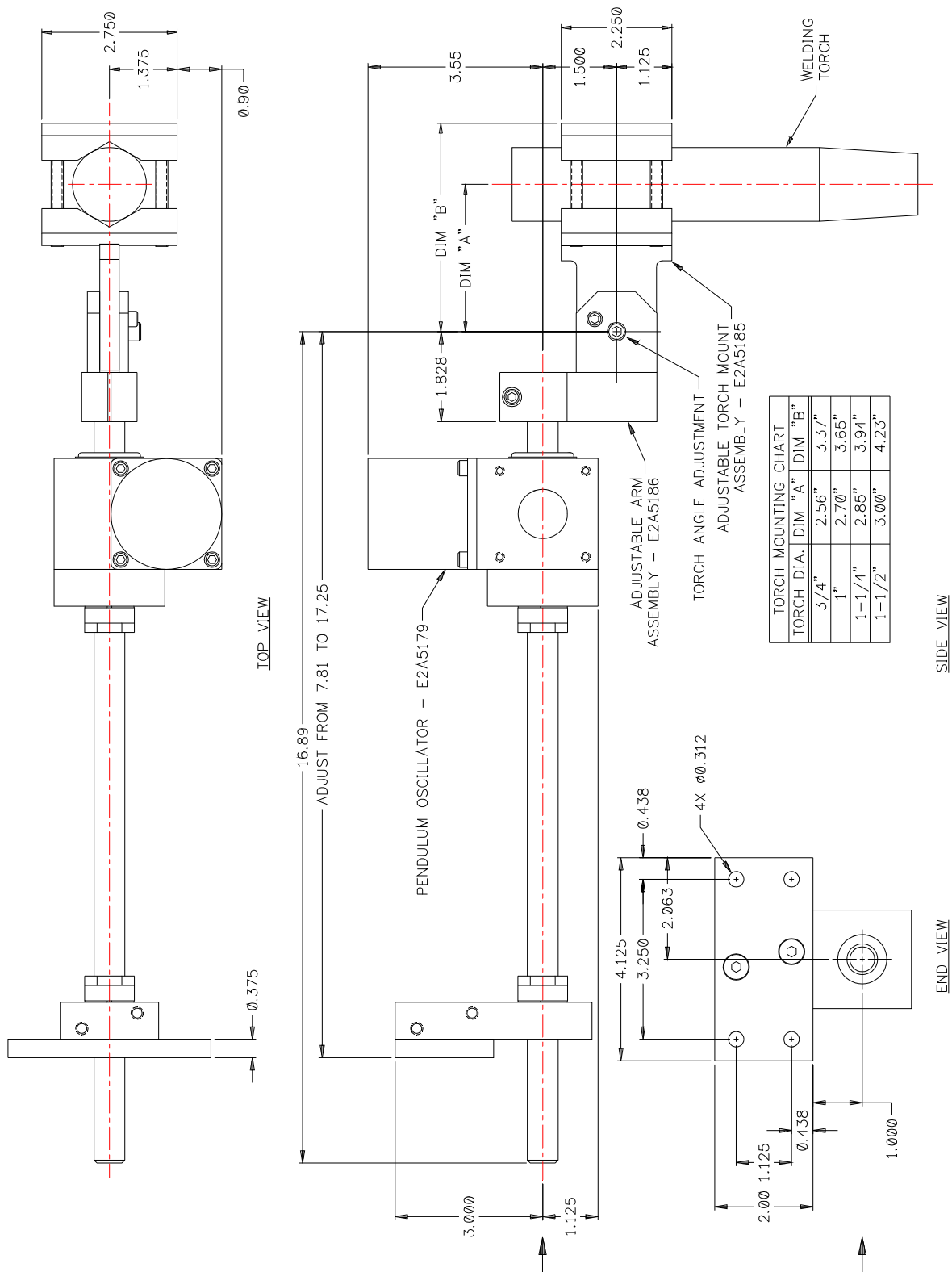


FIGURE A11: In-Line Shaft with Back Mounted Base Mounting Plate

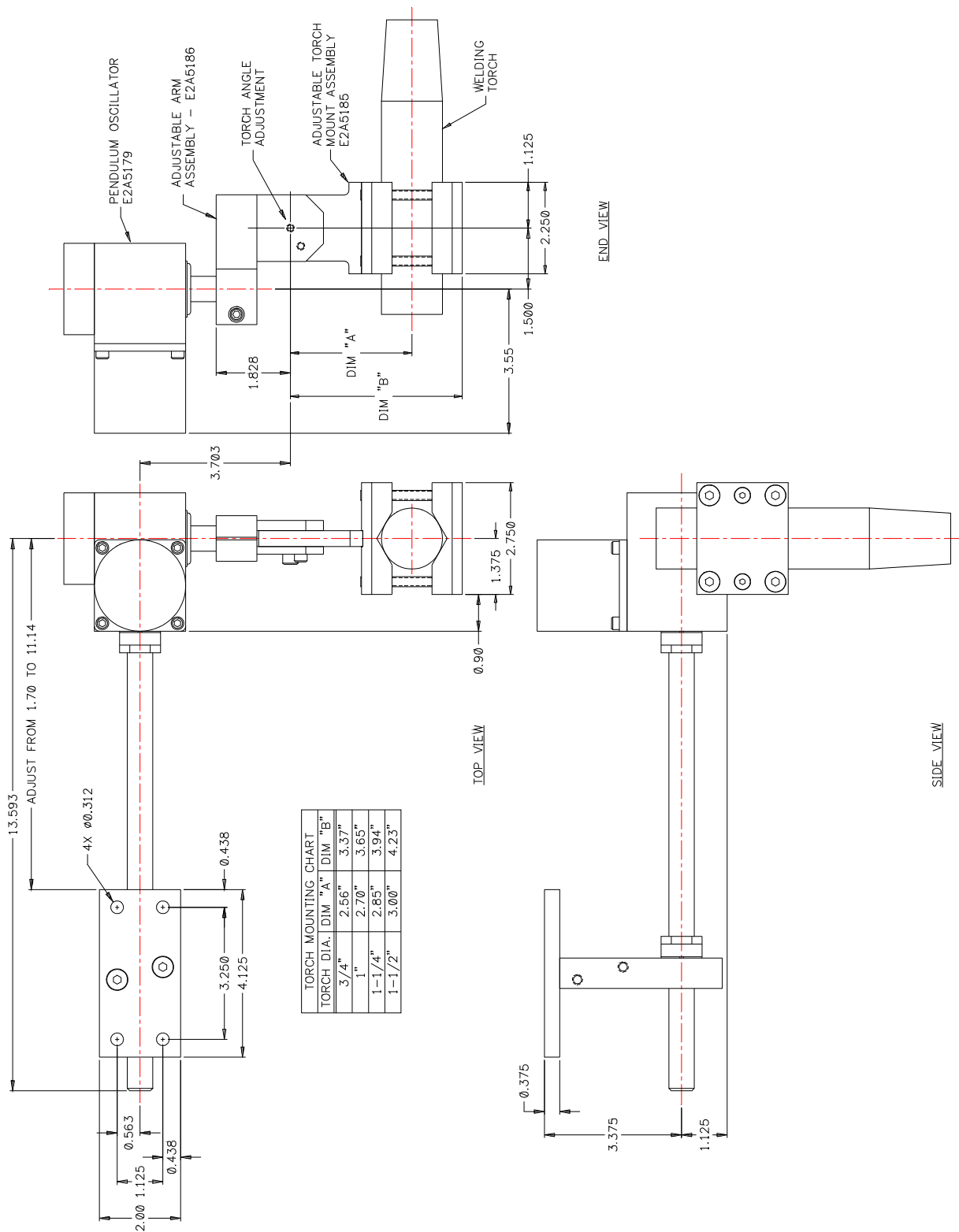


FIGURE A12: Right Angled Shaft with Top Mounted Base Mounting Plate

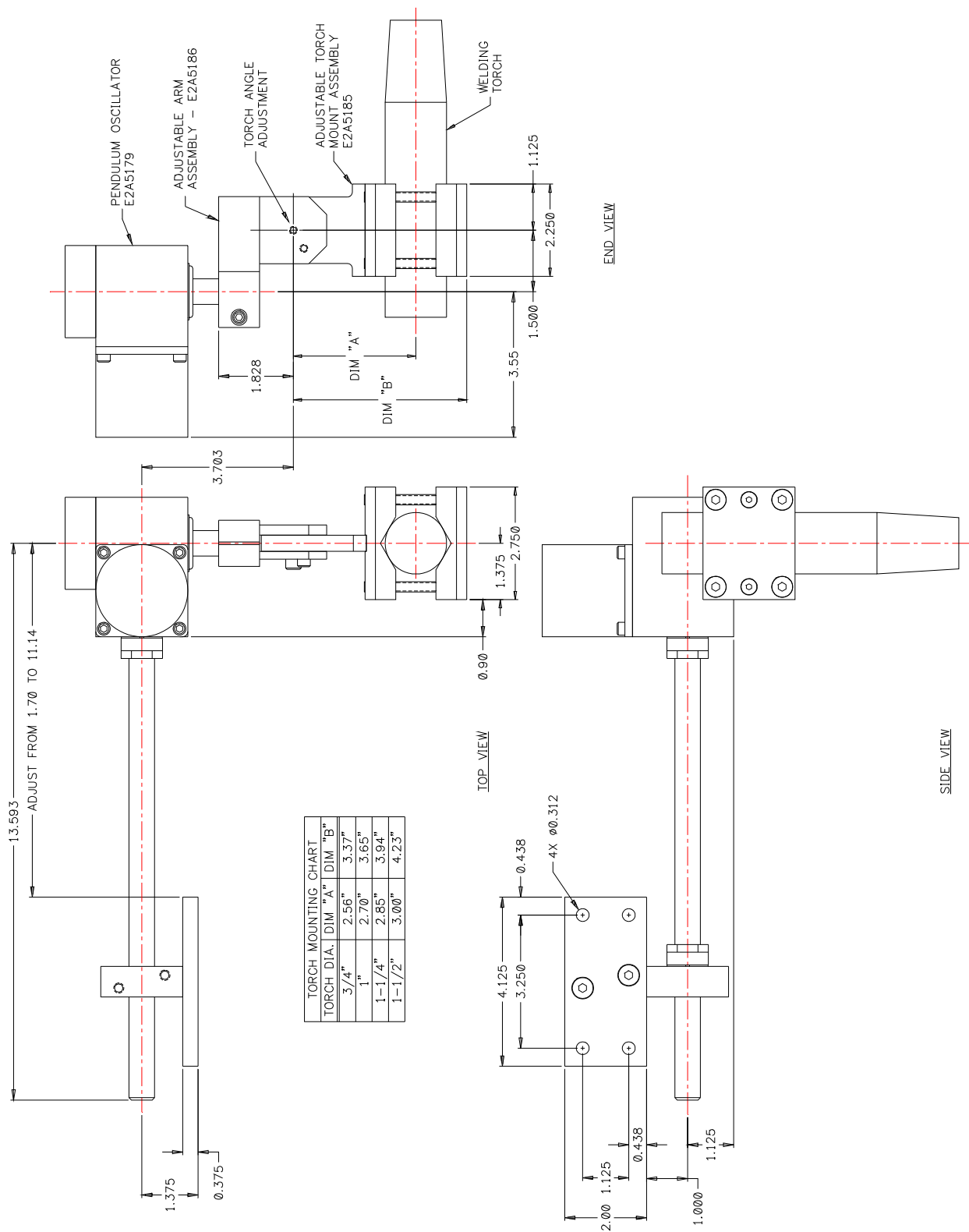


FIGURE A13: Right Angled Shaft with Side Mounted Base Mounting Plate

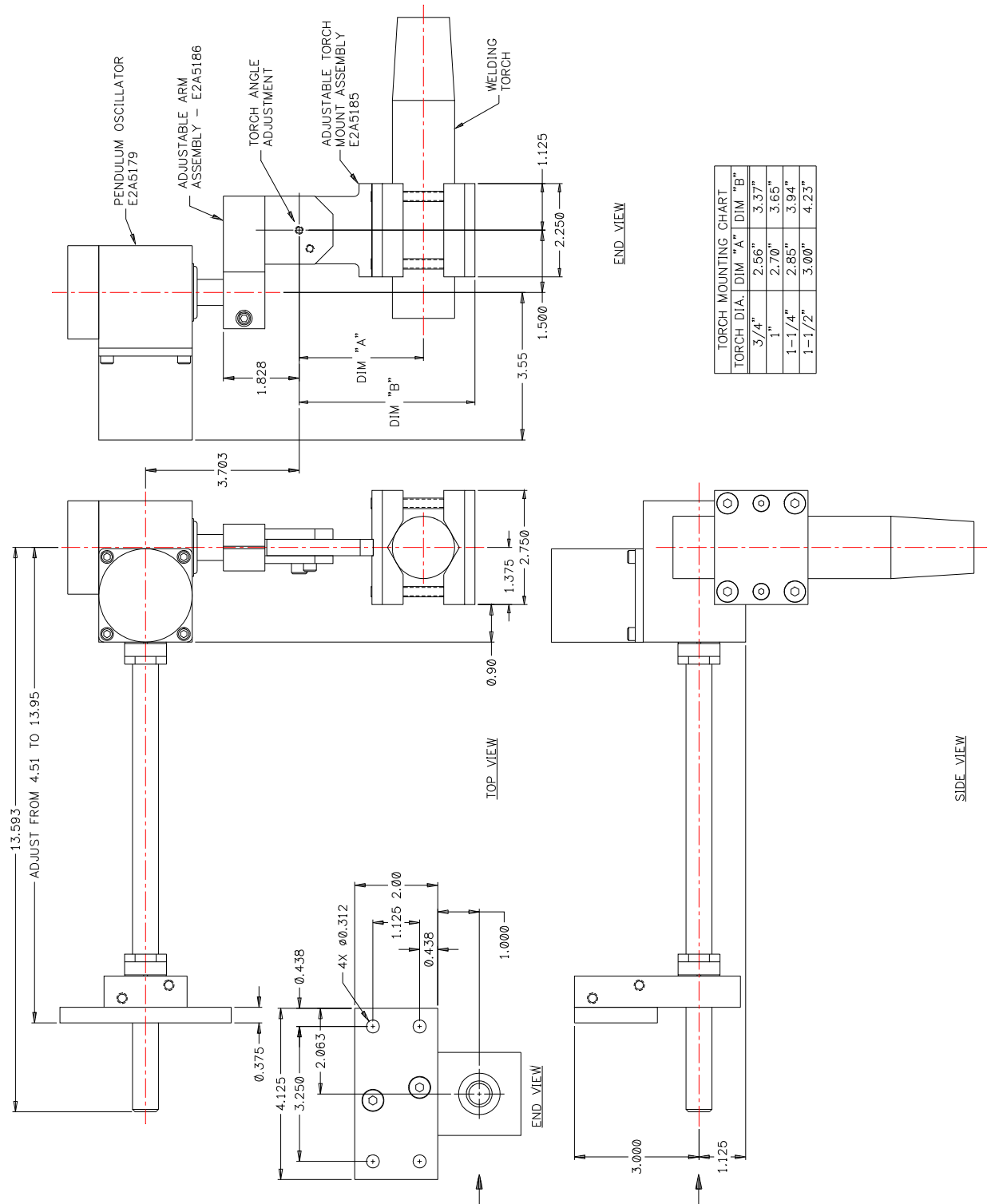


FIGURE A14: Right Angled Shaft with Side Mounted Base Mounting Plate

APPENDIX B WOC-500 CONTROL ASSEMBLY

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	E5A5027	Control P.C.B. Assembly
2	1	E5A5029	Front Panel P.C.B. Assembly
3	1	E3E5010	Cover
4	1	E3E5012	Enclosure
5	1	E3E5013	Front Overlay
6	1	E3E5014	Rear Overlay
7	1	E3W5037	Power In Cable
8	1	E3W5038	Power Out Cable
9	1	E3W5039	Motor Cable
10	1	E3W5042	Term Cable
11	1	E3W5043	Remote Cable
12	1	E3E5015	Heatsink
13	1	E5I5003	Processor
14	2	X3Z5027	D-Sub Screwlock Kit
15	2	X5Z5007	Shoulder Washer
16	6	X6A5015	Knob
17	3	X3Z5038	Dress Nut
18	1	X3S5078	Rocker Switch
19	1	X3T5067	Power Supply
20	2		4-40 X 1/4" Lg. Pan Hd. Screw w/ Lock Washer
21	4		6-32 X 3/8" Lg. Socket Hd. Cap Screw
22	8		6-32 X 1/4" Lg. Pan Hd. Screw w/ Lock Washer
23	1		6-32 Hex Nut
24	8		6-32 X 1/4" Lg. Black Socket Button Hd. Screw
25	A/R		Thermal Compound
26	1.5"		Kapton Tape
27	1	A3W0155	2" 16 Pin IDC Cable

FIGURE B1: WOC-500 Enclosure Assembly P/N: E3A5057

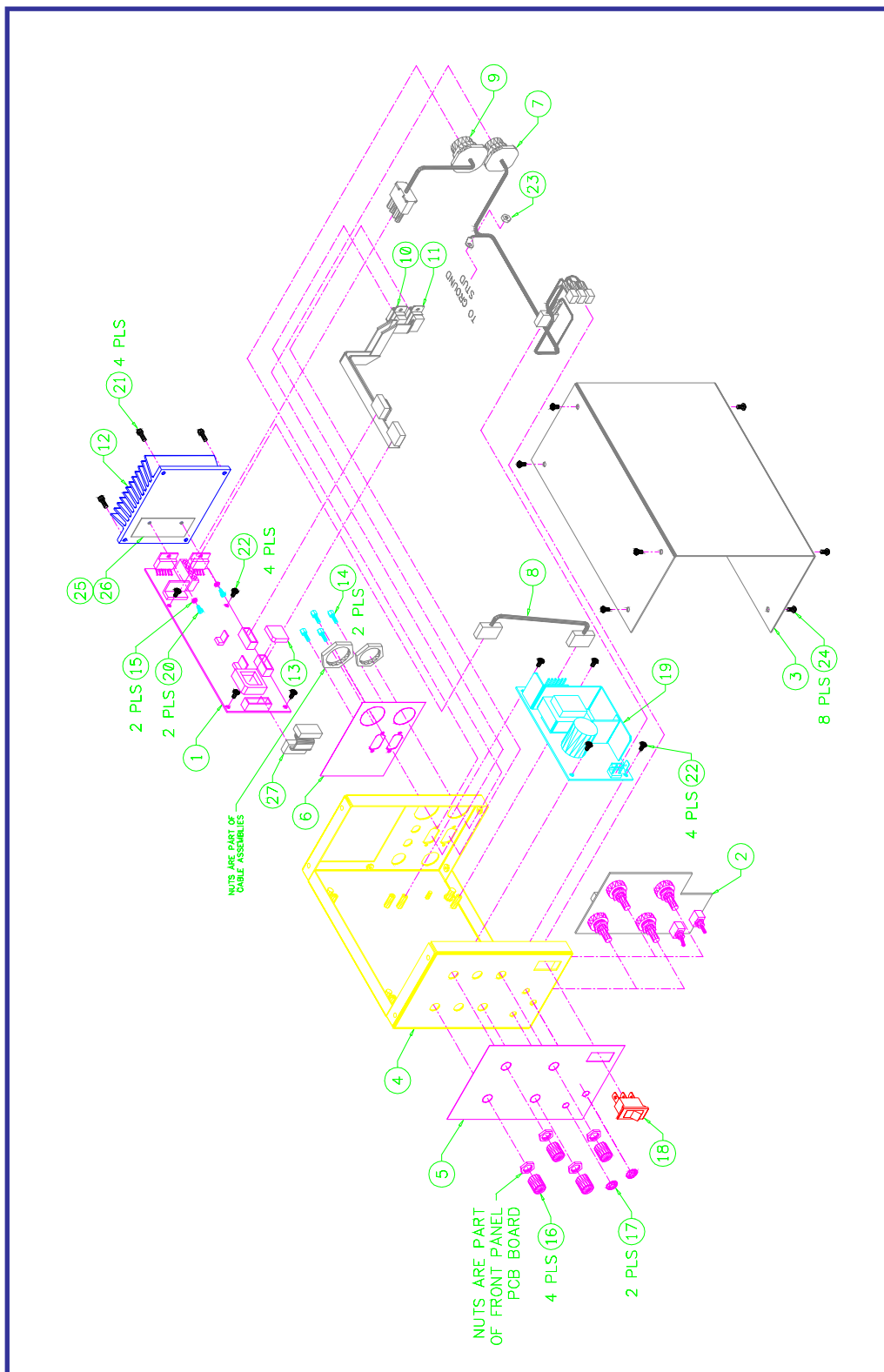


FIGURE B1: WOC-500 Enclosure Assembly P/N: E3A5057

DESCRIPTION	WIRE COLOR	FROM	TO
Hot	Brown	Item 1 - Pin A	Item 5 - E4
Neutral	Blue	Item 1 - Pin B	Item 6 - E6
Neutral	Blue	Item 6 - E6	Item 2 - Pin 3
Ground	Green	Item 1 - Pin C	Item 4 - E1
Ground	Green	Item 4 - E2	Item 5 - E3
Hot	Black	Item 5 - E5	Item 2 - Pin 1

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	X3P5637	3 Circuit Receptacle
2	1	X3P5638	3 Circuit Housing
3	3'	X3W5079	Crimp Terminal
4	2		Solder Terminal
5	3		18 AWG 1/4" Push-On Terminal
6	1		14 AWG 1/4" Push-On Terminal
7	8		Cable Tie
8	1.3'		18 AWG Brown Teflon Coated Wire
9	1.7'		18 AWG Blue Teflon Coated Wire
10	1.4'		18 AWG Green Teflon Coated Wire
11	0.4'		18 AWG Black Teflon Coated Wire

FIGURE B2: Power In Cable Assembly P/N: E3W5037

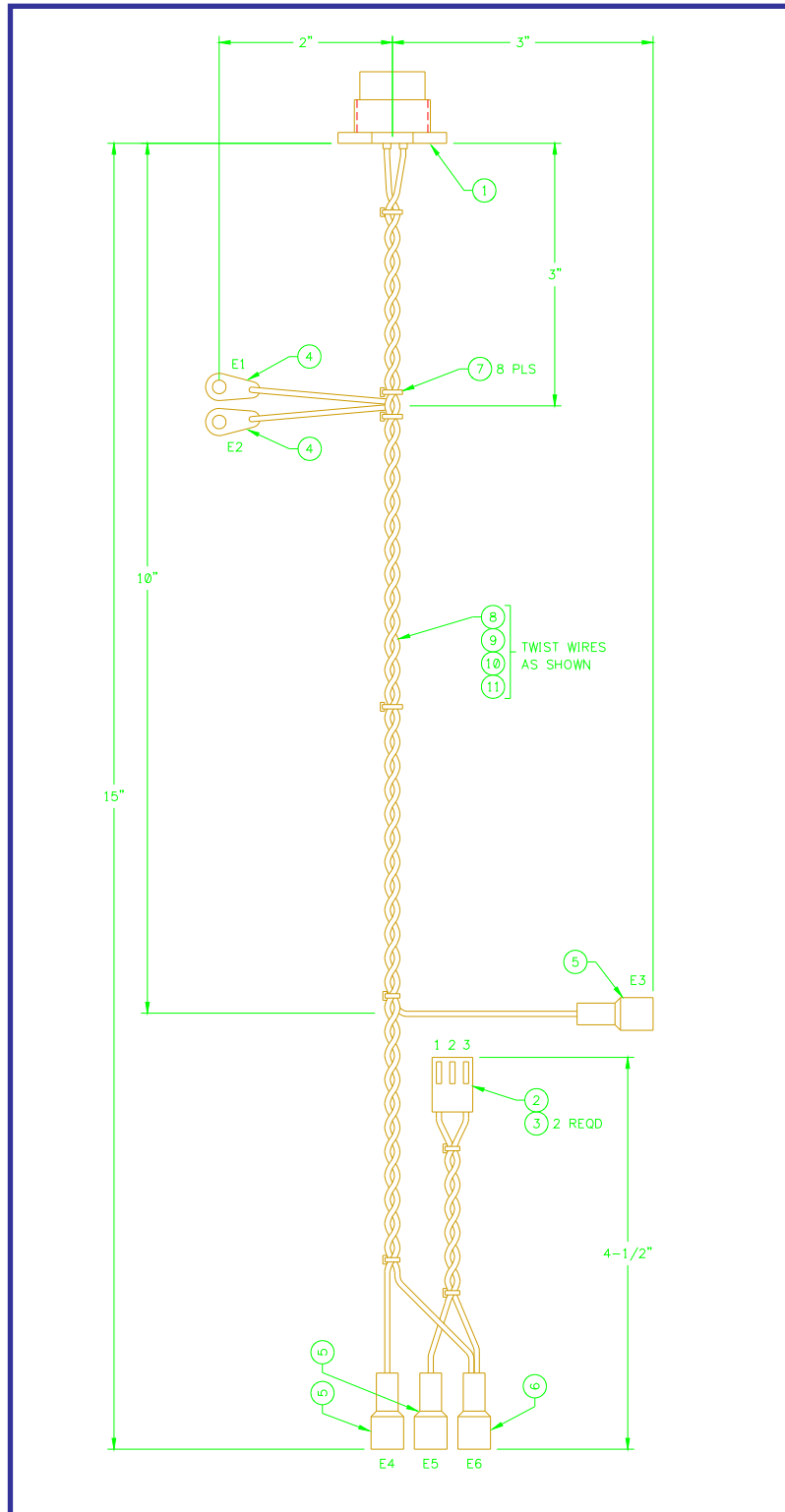


FIGURE B2: Power In Cable Assembly P/N: E3W5037

DESCRIPTION	WIRE COLOR	FROM	TO
+24V	Red	J1 - Pin 1	J2 - Pin 1
+24V	Red	J1 - Pin 2	J2 - Pin 2
+24V	Red	J1 - Pin 3	J2 - Pin 3
Common	Black	J1 - Pin 4	J2 - Pin 4
Common	Black	J1 - Pin 5	J2 - Pin 5
Common	Black	J1 - Pin 6	J2 - Pin 6

ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	X3P5019	6 Circuit Housing
2	12	X3P5077	Crimp Terminal
3	3		Cable Tie
4	1.7'		18 AWG Red Teflon Coated Wire
5	1.7'		18 AWG Black Teflon Coated Wire

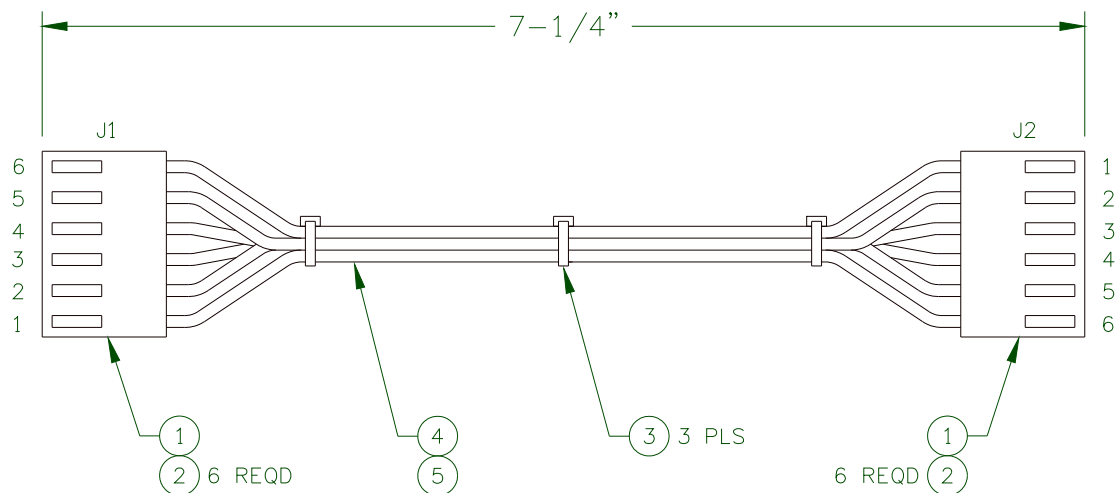


FIGURE B3: Power Out Cable Assembly P/N: E3W5038

DESCRIPTION	WIRE COLOR	FROM	TO
Motor /A	Orange	Item 1 - Pin 2	Item 3 - Pin B
Motor A	Black	Item 1 - Pin 1	Item 3 - Pin A
Motor B	Red	Item 1 - Pin 3	Item 3 - Pin C
Motor /B	Yellow	Item 1 - Pin 4	Item 3 - Pin D

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	X3P5577	4 Circuit Receptacle
2	4	X3P5578	Crimp Terminal
3	1	X3P5639	5 Circuit Receptacle
4	2		Cable Tie
5	0.5'		16 AWG Orange Teflon Coated Wire
6	0.5'		16 AWG Black Teflon Coated Wire
7	0.5'		16 AWG Red Teflon Coated Wire
8	0.5'		16 AWG Yellow Teflon Coated Wire

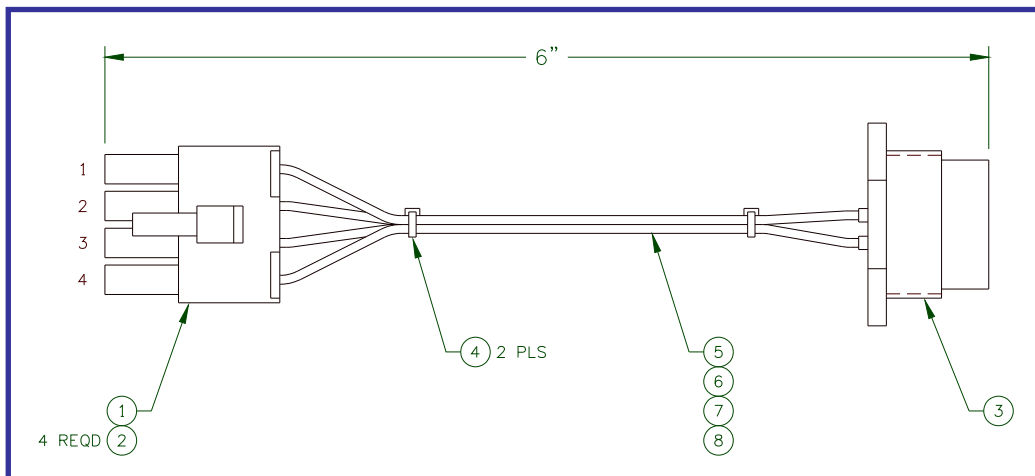


FIGURE B4: Motor Cable Assembly P/N: E3W5039

DESCRIPTION	WIRE COLOR	FROM	TO
DCD	Red	Item 2 - Pin 1	Item 1 - Pin 1
DSR	Gray	Item 2 - Pin 2	Item 1 - Pin 6
TD	Gray	Item 2 - Pin 3	Item 1 - Pin 2
CTS	Gray	Item 2 - Pin 4	Item 1 - Pin 7
RD	Gray	Item 2 - Pin 5	Item 1 - Pin 3
RTS	Gray	Item 2 - Pin 6	Item 1 - Pin 8
DTR	Gray	Item 2 - Pin 7	Item 1 - Pin 4
RI	Gray	Item 2 - Pin 8	Item 1 - Pin 9
COM	Gray	Item 2 - Pin 9	Item 1 - Pin 5
Not Used	Gray	Item 2 - Pin 10	Not Connected

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	X3P5608	9 Circuit D-sub Connector
2	3	X3P5610	10 Circuit IDC Connector
3	1	X3W5073	10 Circuit Flat Cable

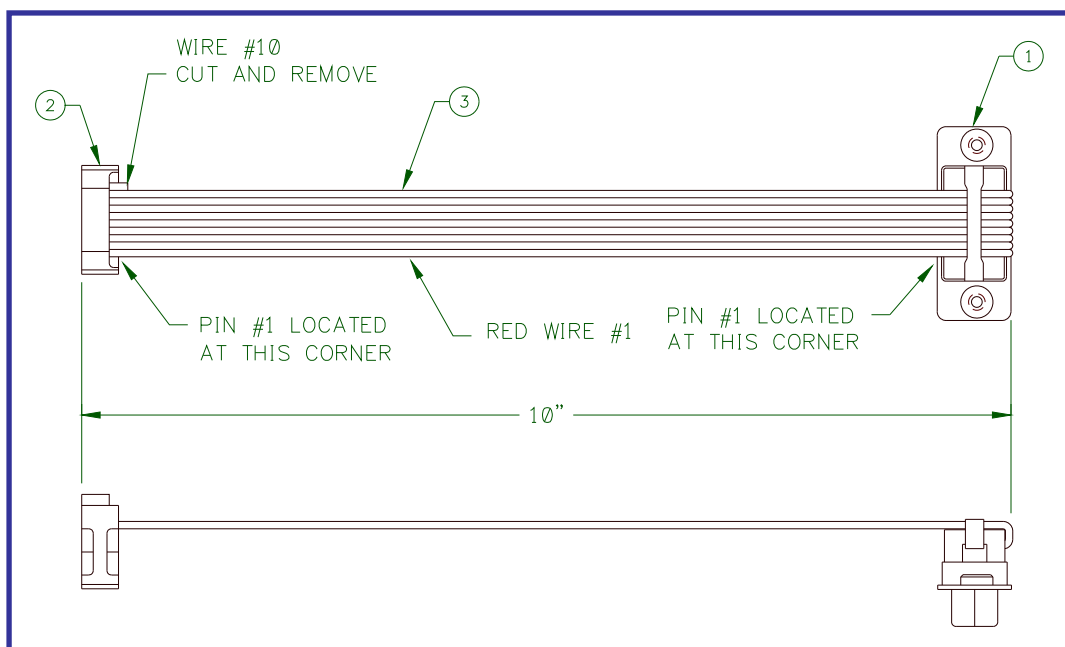


FIGURE B5: Term Cable Assembly P/N: E3W5042

DESCRIPTION	WIRE COLOR	FROM	TO
Input 1	Red	Item 2 - Pin 1	Item 1 - Pin 1
CR1-A	Gray	Item 2 - Pin 2	Item 1 - Pin 6
Input 2	Gray	Item 2 - Pin 3	Item 1 - Pin 2
CR1-B	Gray	Item 2 - Pin 4	Item 1 - Pin 7
Input Common	Gray	Item 2 - Pin 5	Item 1 - Pin 3
CR2-A	Gray	Item 2 - Pin 6	Item 1 - Pin 8
Input 3	Gray	Item 2 - Pin 7	Item 1 - Pin 4
CR2-B	Gray	Item 2 - Pin 8	Item 1 - Pin 9
Input 4	Gray	Item 2 - Pin 9	Item 1 - Pin 5
Not Used	Gray	Item 2 - Pin 10	Not Connected

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	X3P5664	9 Circuit D-sub Connector
2	3	X3P5610	10 Circuit IDC Connector
3	1	X3W5073	10 Circuit Flat Cable

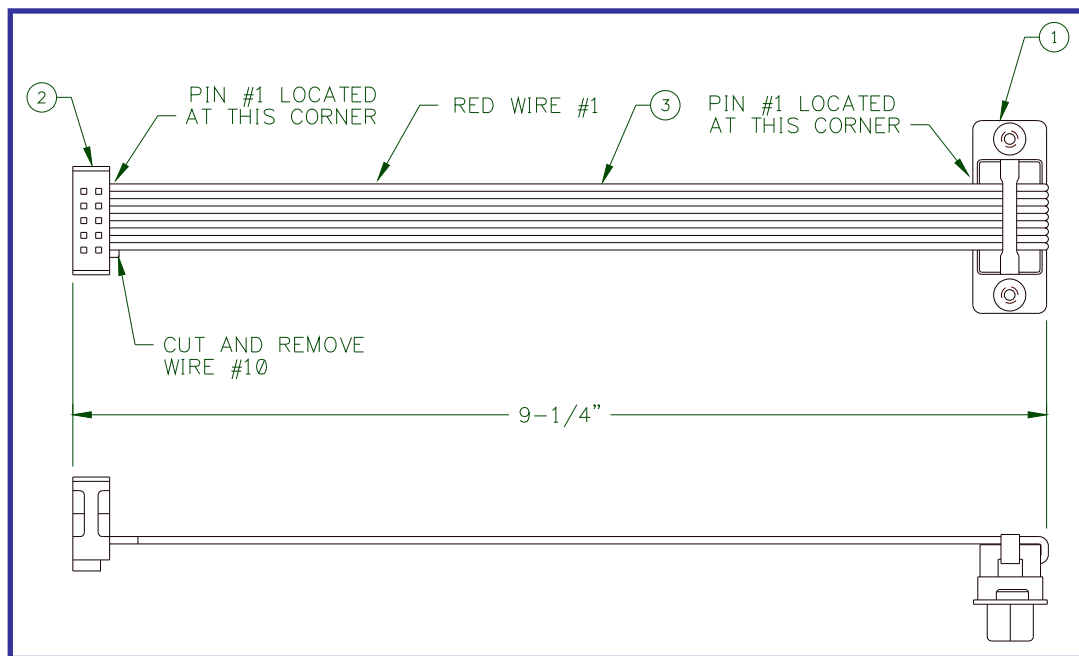


FIGURE B6: Remote Cable Assembly P/N: E3W5043

APPENDIX C OSCILLATOR MOTOR CABLE ASSEMBLY

DESCRIPTION	WIRE COLOR	FROM	TO
Motor A+	White	Item 1 - Pin A	Item 2 - Pin A
Motor A-	Red	Item 1 - Pin B	Item 2 - Pin B
Motor B+	Black	Item 1 - Pin C	Item 2 - Pin C
Motor B-	Green	Item 1 - Pin D	Item 2 - Pin D

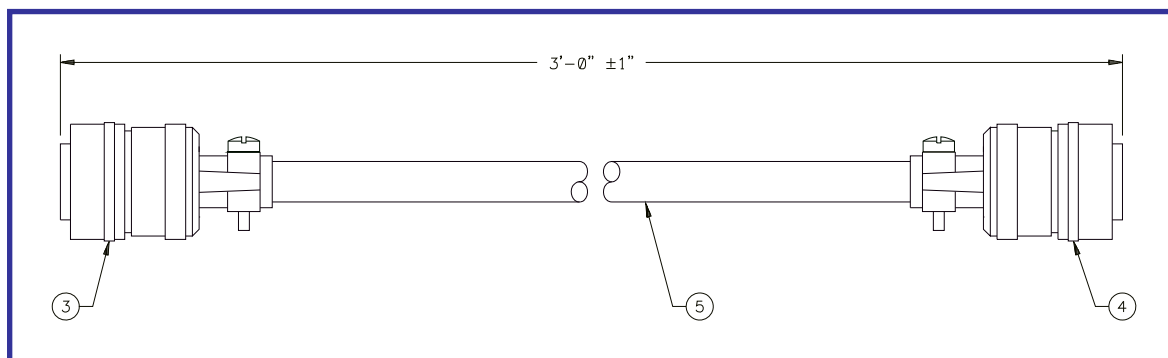


FIGURE C1: Oscillator Motor Cable - E3W5036

APPENDIX D REMOTE I/O INTERFACE

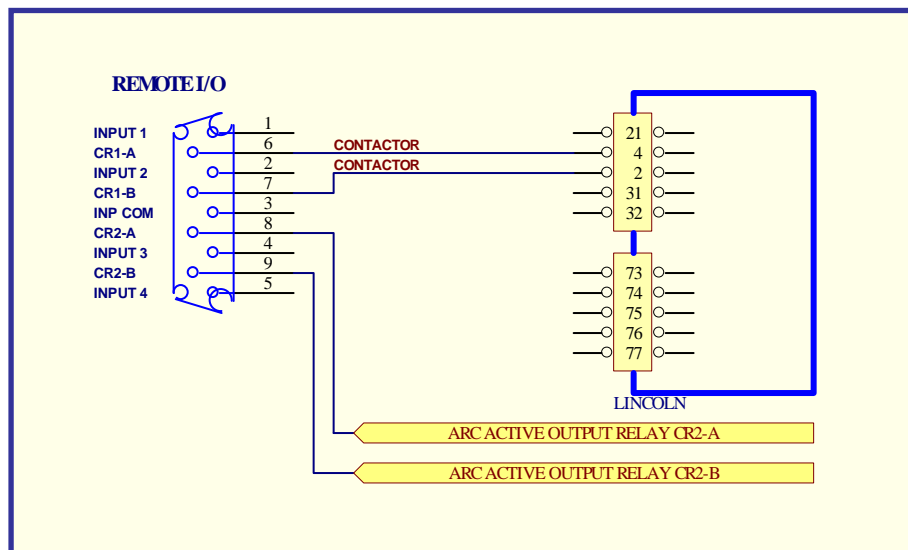


FIGURE D1: Lincoln Power Source Interface

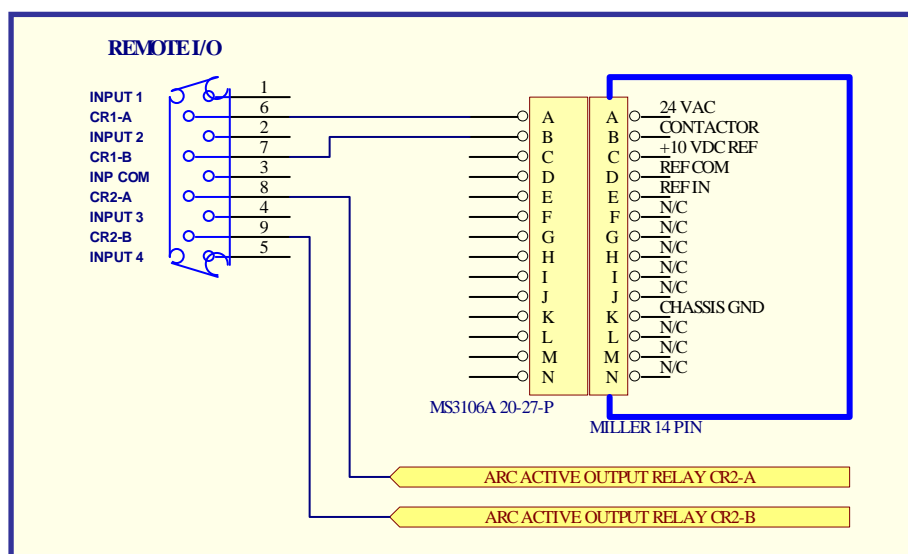


FIGURE D2: Miller Power Source Interface:

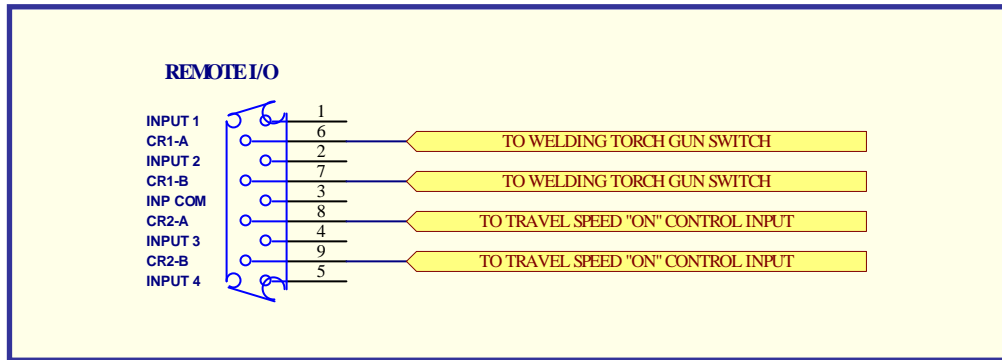
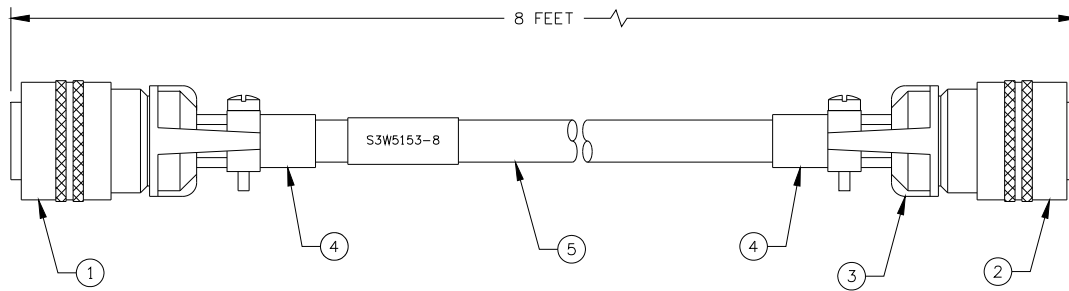


FIGURE D3: Generic Welding Power Source Interface

Connect CR1-A and CR1-B to welding torch gun switch. This will allow the WOC-500 to remote control the welding power source. The arc active relay CR2 can be used to automatically start the travel speed controller. Connect CR2 to the travel forward or run input for the travel speed controller. CR1 and CR2 are N.O.dry relay contacts rated at 120 vac @ 1 amp non-inductive.

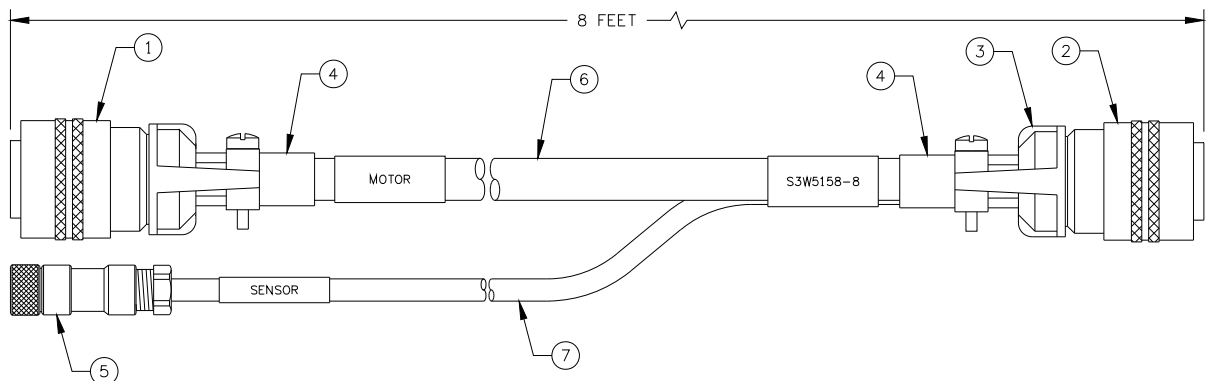
Note: if AC voltage is applied to the relays, install a 0.01 mfd 200 vdc ceramic capacitor across the relay contacts.

APPENDIX E SLIDE MOTOR CABLE ASSEMBLY



DESCRIPTION	WIRE COLOR	FROM	TO
Motor A+	White	Item 1 - Pin A	Item 2 - Pin J
Motor A-	Red	Item 1 - Pin B	Item 2 - Pin L
Motor B+	Black	Item 1 - Pin C	Item 2 - Pin K
Motor B-	Green	Item 1 - Pin D	Item 2 - Pin M

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	X3P5637	5 Circuit Plug
2	1	X3P5696	12 Circuit Plug
3	2	X3P5589	Cable Clamp
4	2	X3P5505	Cable Clamp Boot
5	8'	X3W5079	4 Conductor 16 AWG Cable



DESCRIPTION	WIRE COLOR	FROM	TO
Motor A+	White	Item 1 - Pin A	Item 2 - Pin J
Motor A-	Red	Item 1 - Pin B	Item 2 - Pin L
Motor B+	Black	Item 1 - Pin C	Item 2 - Pin K
Motor B-	Green	Item 1 - Pin D	Item 2 - Pin M
+5VDC	Red	Item 5- Pin 1	Item 2 - Pin A
Encoder	Clear	Item 5- Pin 2	Item 2 - Pin D
Com	Black	Item 5- Pin 3	Item 2 - Pin B

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	X3P5637	5 Circuit Plug
2	1	X3P5696	12 Circuit Plug
3	2	X3P5589	Cable Clamp
4	2	X3P5505	Cable Clamp Boot
5	1	X3P5864	3 Circuit Plug
6	8'	X3W5079	4 Conductor 16 AWG Cable
7	8'	X#W5025	3 Conductor 22 AWG Shielded Cable

FIGURE E1: LSA-2007 MOTOR CABLE ASSEMBLY

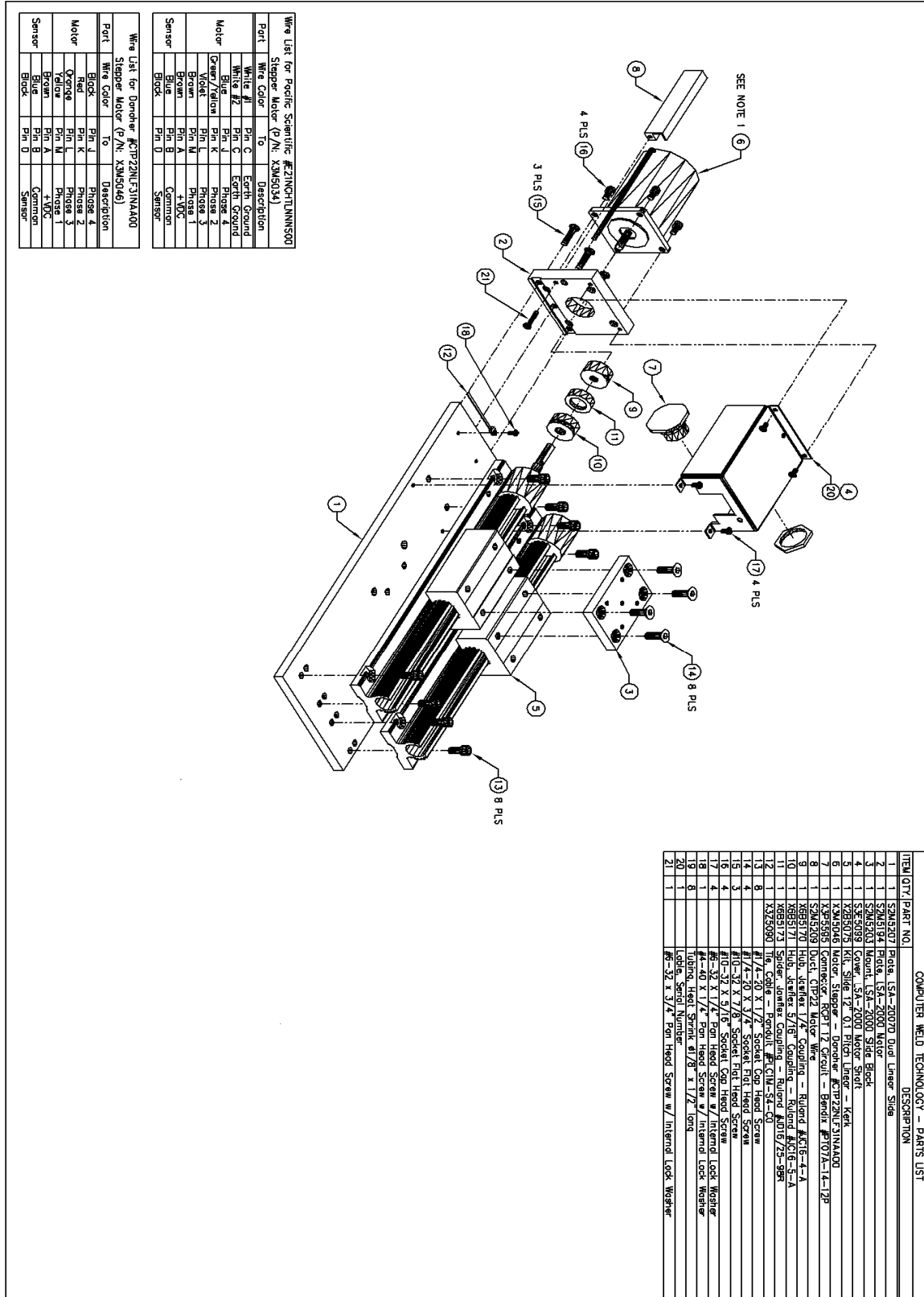


FIGURE F1: LSA-2007 SLIDE ASSEMBLY