INSTRUCTIONS AND PARTS MANUAL

MM-1
PROGRAMMABLE PIPE CUTTING MACHINE

Please record your equipment identification information below for future reference. This information can be found on your machine nameplate.

Model Number   _____

Serial Number   _____

Date of Purchase _____

Whenever you request replacement parts or information on this equipment, always supply the information you have recorded above.

Bug-O Systems is committed to empowering our customers by providing operator controlled mechanized solutions for their welding, cutting and custom applications.

BUG-O SYSTEMS
### A DIVISION OF WELD TOOLING CORPORATION

$C\!E$

SAFETY

> **PROTECT YOURSELF AND OTHERS FROM SERIOUS INJURY OR DEATH. KEEP CHILDREN AWAY. BE SURE THAT ALL INSTALLATION, OPERATION, MAINTENANCE AND REPAIR PROCEDURES ARE PERFORMED ONLY BY QUALIFIED INDIVIDUALS.**

ELECTRIC SHOCK CAN KILL.

1) The equipment is not waterproof. Using the unit in a wet environment may result in serious injury. Do not touch equipment when wet or standing in a wet location.

2) The unused connectors have power on them. Always keep the unused connectors covered with the supplied protective panels. Operation of the machine without the protective panels may result in injury.

3) Never open the equipment without first unplugging the power cord or serious injury may result.

4) Verify the customer supplied power connections are made in accordance with all applicable local and national electrical safety codes. If none exist, use International Electric Code (IEC) 950.

5) Never remove or bypass the equipment power cord ground. Verify the equipment is grounded in accordance with all applicable local and national electrical safety codes. In none exist, use International Electric Code (IEC) 950.
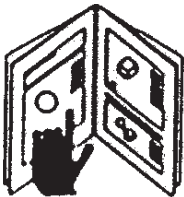
READ INSTRUCTIONS.

Read the instruction manual before installing and using the equipment.

EQUIPMENT DAMAGE POSSIBLE.

1) Do not plug in the power cord with out first verifying the equipment is OFF and the cord input voltage is the same as required by the machine or serious damage may result.

2) Always verify both the pinion and wheels are fully engaged before applying power or equipment damage may occur.

3) Do not leave the equipment unattended.

4) Remove from the work site and store in a safe location when not in use.

FALLING EQUIPMENT can cause serious personal injury and equipment damage.

Faulty or careless user installation is possible. As a result, never stand or walk underneath equipment.

MOVING PARTS can cause serious injury.

1) Never try to stop the pinion from moving except by removing power or by using the STOP control.

2) Do not remove any protective panels, covers or guards and operate equipment.

HIGH FREQUENCY WARNINGS

> ## SPECIAL PRECAUTIONS ARE REQUIRED WHEN USING PLASMA, TIG OR ANY WELDING PROCESS THAT USES HIGH FREQUENCY TO STRIKE AN ARC.

> **WARNING:** HIGH FREQUENCY CAN EFFECT MACHINE OPERATION AND THEREFORE, WELD QUALITY.
>
> **Read the precautions below before installing and using the equipment.**

PRECAUTIONS:

1) Some plasma or welding cables are strong sources of high frequency interference. NEVER lay a plasma or welding cable across the controls of the machine.

2) Always physically separate the plasma or welding cable leads from the machine cables. For example, the plasma or welding cable leads should NEVER be bundled with a pendant cable or the machine power cord. Maximize the separation between any machine cables and the plasma or welding cables.

3) Strictly follow the grounding procedures specified for the plasma or welding unit. NOTE: Some plasma and welding units produce exceptionally large amounts of high frequency noise. They may require a grounding rod be driven into the earth within six feet (2 meters) of the plasma or welding unit to become compatible with an automatic cutting or welding process.

4) If the high frequency is produced using a spark gap, adjust the points so the gap is as small as possible. The larger the gap, the higher the voltage and the higher the interference.

5) Some plasma or welding units will inject high frequency interference into the AC power line. Use separate power line branches whenever possible to power the plasma or welding source and the machine. Do not plug them into the same outlet box.

6) High frequency noise may enter the machine through the plasma or welding supply remote contactor leads. Some plasma and welding sources can produce noise spikes of up to several thousand volts. These sources are not compatible with automated cutting and welding equipment. It is recommended that the remote contactor leads on these plasma or welding sources not be connected to the machine. An alternate solution is to purchase a separate remote contactor isolation box.

MM-1 PROGRAMMABLE PIPE CUTTING MACHINE

INSTRUCTIONS AND PARTS MANUAL

TABLE OF CONTENTS

INTRODUCTION

The MM-1 Programmable Pipe Cutting Machine is a 2 axis programmable machine designed to automate the cutting of profiles, holes, and shapes on pipe with diameters from 4" to 16" (10 to 40 cm). The machine rotates the pipe on a roller bed with a three-jaw chuck while simultaneously moving the cutting torch back and forth along the pipe's axis. Preprogrammed shapes such as saddle, offset saddles, laterals, miter cuts, and holes can be made simply by selecting the type of cut from the menu, then entering the diameters of the pipe being processed and pressing the START / RESUME button to cut the pipe. The machine eliminates the need for templates, layouts, or time-consuming calculations. In addition irregular shapes can be plotted, programmed and saved for future use.

TECHNICAL DATA

Power Requirement:	120 VAC/50-60/1
	240 VAC/50-60/1
Speed Range:	0 to 3 rpm
Cutting Diameter:	4" to 16"
	(100 to 400 mm)
Pipe Weight Capacity:	1600 lbs. (726 kg)
Net Weight:	550 lbs. (250 kg)
Shipping Weight:	750 lbs. (340 kg)

DIMENSIONS

137"
(3480mm)

55"
(1397mm)

36"
(914mm)
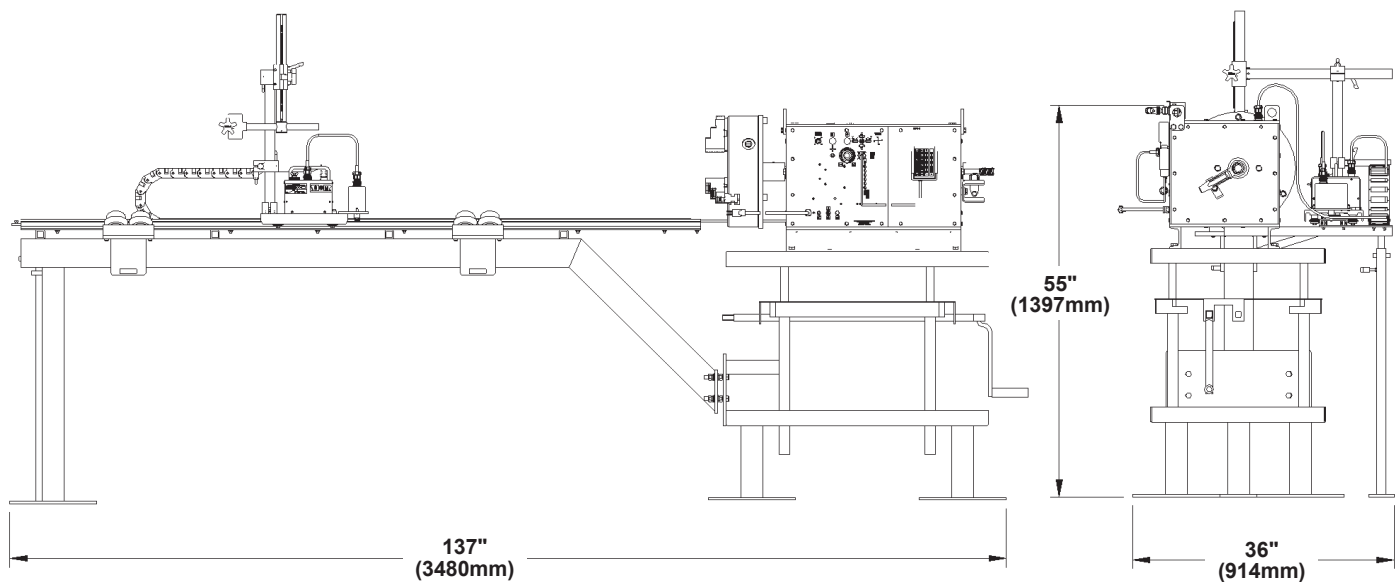
SETUP

The MM-1 is shipped in its major components for easy installation. The major components are the **Adjustable Table and Headstock, Drive Carriage, Standard Arm Assembly**, and two **Roller Block Assemblies**. Follow the set-up sequence as follows:

STEP 1: Position the Adjustable Table and Headstock in the desired location. Level the Adjustable Table and Headstock left to right and front to back. The machine is to be operated from a separate power line; it can be supplied for voltage ratings of 120, 240 VAC. Verify which model you have prior to applying power.

STEP 2: Loosely mount the Standard Pipe Bed Assembly to the Adjustable table. Ensure that a minimum of a ½" (13 mm) gap exists between the mount plate on the Adjustable Table and the first hex nut on each of the four threaded studs protruding from the mount plate. This gap is to ensure enough adjustment when aligning the Standard Pipe Bed Assembly to the Adjustable Table in a later step.

STEP 3: Level the Standard Arm Assembly left to right and front to back. To level the machine left to right position a level across the width of the Standard Arm Assembly and level as needed. To level the Standard Arm Assembly from front to back place a level along the length of the arm and level as needed. (If any additional arm sections were ordered attach them to the Standard Arm Assembly and level as directed above).

STEP 4: Align the Standard Arm Assembly to the Headstock. To align the Standard Arm Assembly to the Headstock place the supplied laser pointer into the three jaw adjustable chuck. Turn on the machine by switching the "ON/OFF" switch to the "ON" position. Place the Tar-git at the end of the Standard Arm Assembly farthest away from the Headstock, centered on the 4" box tubing. Locate the top dead center of the three jaw adjustable chuck by using the Manual Jog switch on the control panel to rotate the chuck. Stop the machine when laser dot reaches its highest point on the Tar-git. Slide the plastic "slide" up or down the scale to the desired height. (The Adjustable Table may be adjusted up or down so that the Laser is visible on the Tar-git). The laser dot should be in the center of the Tar-git. If the laser dot is centered then the four nuts on the Adjustable Table mounting plate can be tightened down. However, if the laser dot is not centered the Standard Bed Assembly must be aligned to the Headstock. To align the Standard Arm Assembly to the Headstock simply adjust the eight hex nuts as needed until the laser dot is located in the center of the Tar-git. Repeat this procedure at several points along the length of the bed to insure it is aligned with the chuck. It may also be necessary to loosen the four bolts that secure the headstock to the lift table and move the headstock unit to obtain alignment. (If any additional arm sections were ordered align them as directed above. All arm sections must be aligned with each other as well as with the Headstock).

STEP 5: Once the Adjustable Table, Headstock, and Standard Arm Assembly have all been leveled and aligned the machine can then be bolted to the floor. This is to ensure that the machine remains in place during operation.

STEP 6: Install the Drive Carriage on the rail. To install the Drive Carriage onto the rail ensure that the Drive Carriage clutch is disengaged. Then the Drive Carriage must be backed onto the rail, encoder first on the end of the rail farthest away from the Headstock. The wheels of the Drive Carriage are to fit firmly into the "v" grooves on the sides of the rail and the encoder gear engaged with the rack on the top of the rail. Slide the Drive Carriage to the mid point of the rail and attach the Cable Support to the Drive Carriage. Attach the control cable to the Drive Carriage and the Headstock. Engage the Drive Carriage clutch so that the drive pinion engages the gear located on the top of the rail. Position your cutting torch into the Torch Holder and run any supply hoses or cable through the Cable Support.
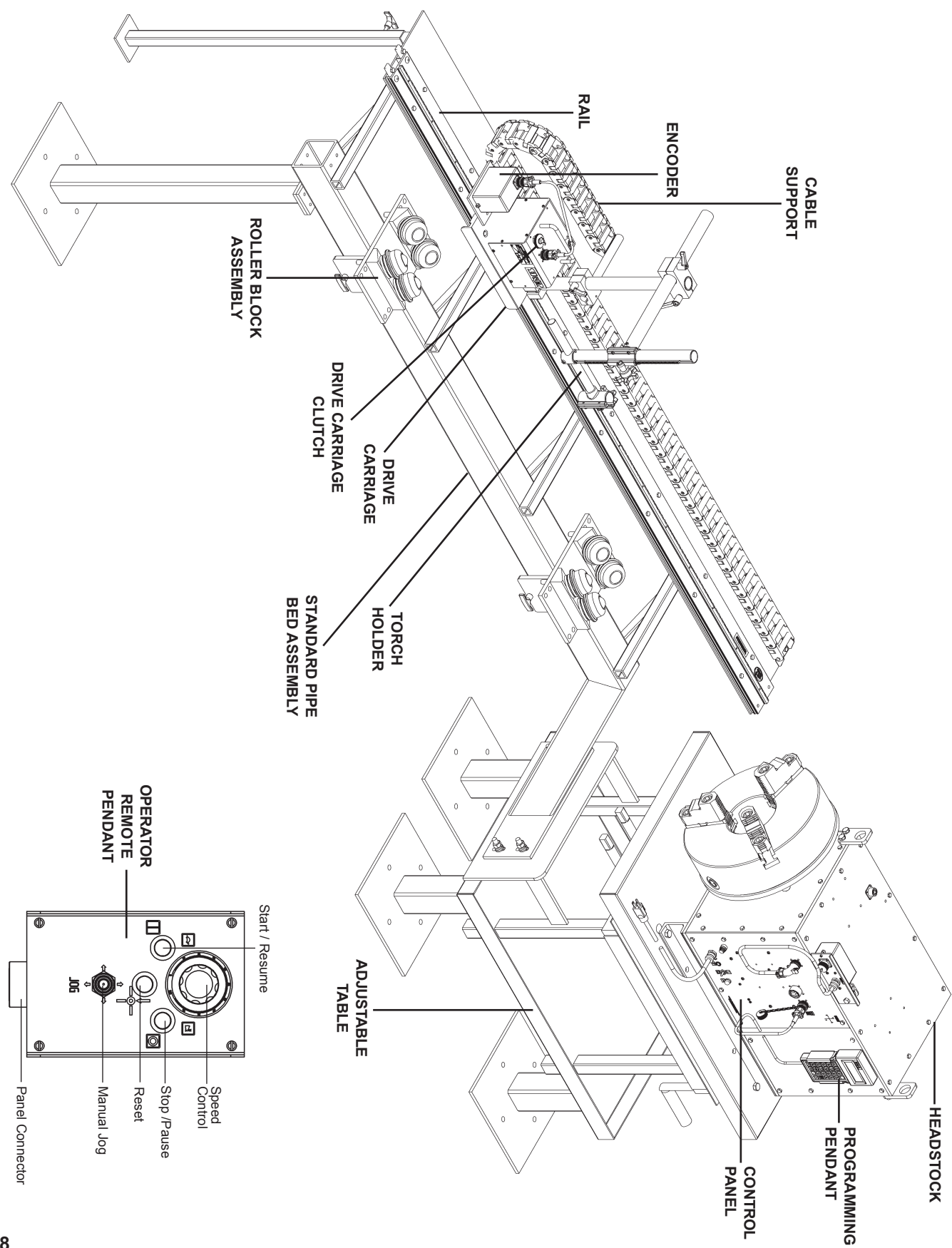
SETUP, CONT'D.

STEP 7: Test communication. To test the communication of the machine first, press the restart button. Then, use the Manual Jog switch located on the control pendant to rotate the chuck in both directions and to move the Drive Carriage up and down the rail. After each jog, the machine should return to the start point.

STEP 8: Placing the Pipe on the rollers. Position the two Roller Block Assemblies on the Standard Arm Assembly so that one is located at either end of the pipe. Ensure that the Roller Block Assemblies are not positioned directly under the cut, or will in anyway interfere with the cut. Place the pipe onto the rollers and raise or lower the Adjustable Table so that the pipe can be chucked. Ensure that the table is at the proper height so that the pipe will be seated level on the Roller Block Assemblies. Position the torch so that it is centered in line with the chuck axis.

NOTE: The machine can be used with oxy-fuel or plasma torches. If the machine is set-up for oxy-fuel cutting, use a three-hose cutting torch and run the hoses to the quick action manifold. Plug the solenoid into the contact output located on the control panel. The solenoid controls the cutting oxygen. If the machine is set-up for plasma cutting, it will be equipped with a rotary ground, contact relay, and holding clamp for a plasma torch. Plug the contact relay into the contact output located on the control panel. Wire the trigger leads for the plasma machine to the supplied connector and plug into the contact relay box. The suggested method of plasma cutting is air plasma. Run the gas hose or plasma cable through the Cable Support to the cutting torch. Plug the programming pendant cable into the pendant control connection located on the control panel. Place the programming pendant in the pendant holster located to the right of the control panel.

STEP 9: Program the machine for the desired cut. (Refer to the programming and making a cut sections in this manual).

SETUP DIAGRAM

RAIL

ENCODER

CABLE
SUPPORT

ROLLER BLOCK
ASSEMBLY

DRIVE CARRIAGE
CLUTCH

DRIVE
CARRIAGE

STANDARD PIPE
BED ASSEMBLY

TORCH
HOLDER

ADJUSTABLE
TABLE

HEADSTOCK

PROGRAMMING
PENDANT

CONTROL
PANEL

OPERATOR
REMOTE
PENDANT

Start / Resume

Speed
Control

Stop /Pause

Reset

Manual Jog

JOG

Panel Connector

SUGGESTED ROLLER POSITIONS
(Based on pipe diameter)

∅ 16

∅ 10

POSITION #3
10"-16" PIPE

∅ 10

∅ 6

POSITION #2
6"-10" PIPE

POSITION #3
POSITION #2
POSITION #1

POSITION #1
POSITION #2
POSITION #3

∅ 6

∅ 4
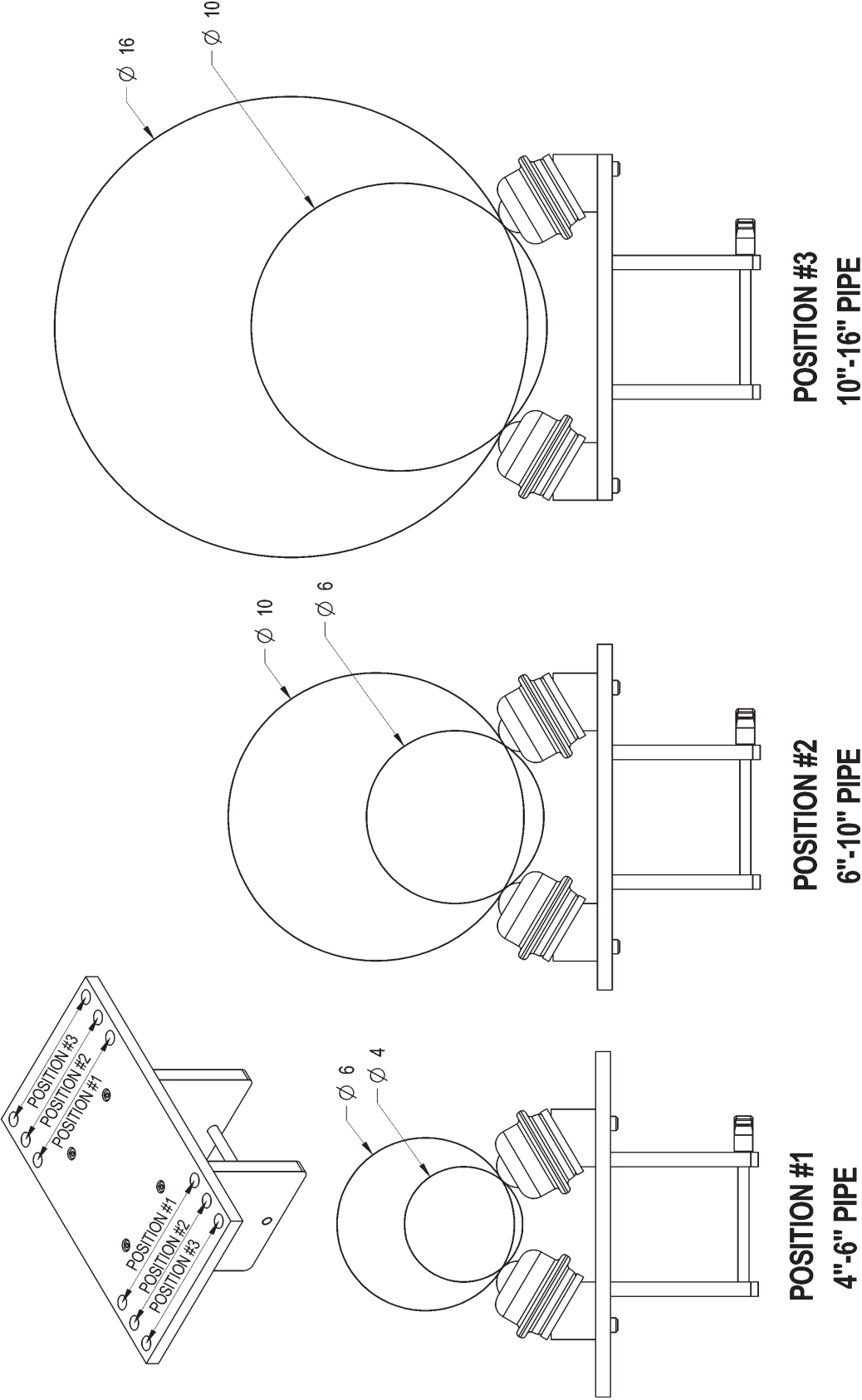
POSITION #1
4"-6" PIPE

MACHINE CONTROLS

START / RESUME: Push to start cutting or resume cutting after a pause. If the torch has been manually positioned off the cut path, the machine will move the torch towards the cut and swing it into the cut line when reached.

STOP / PAUSE: Computer control is interrupted until the START / RESUME button is activated. If pressed while running, the torch is shut off and the machine stops. Pressing the START / RESUME button again will resume the cut. When the STOP / PAUSE button is activated, the machine can be manually positioned by the MANUAL JOG switch; this does not change the home reference position unless the RESET button is pressed.

RESET: Resets the computer when pressed and makes whatever position the machine is in the home position. If the torch or pipe is moved by the MANUAL JOG switch, upon releasing it, the machine will return to the home position.

SPEED KNOB: Controls the tangential speed of the torch along the cut, from zero to maximum. The speed will depend on the diameter of the pipe. When the torch arm is moving in or out, the rotational speed will slow down to keep the resultant speed constant.

MANUAL JOG: When toggled up or down the pipe will jog in the corresponding direction. When toggled left or right the torch arm will move in the corresponding direction.

CONTACT OUTPUT: When the machine is set-up for plasma cutting the contact relay box connection is made here. When the machine is set up for oxy-fuel cutting, the manifold solenoid connection is made here.

PENDANT CONTROL CONNECTION: The programming pendant connection is made here.

POWER CORD: Connect the appropriate voltage 120, 240, or 42 VAC to the machine. Verify which model you have before applying power.

POWER INDICATOR LIGHT: Indicates that power is being supplied to the machine.
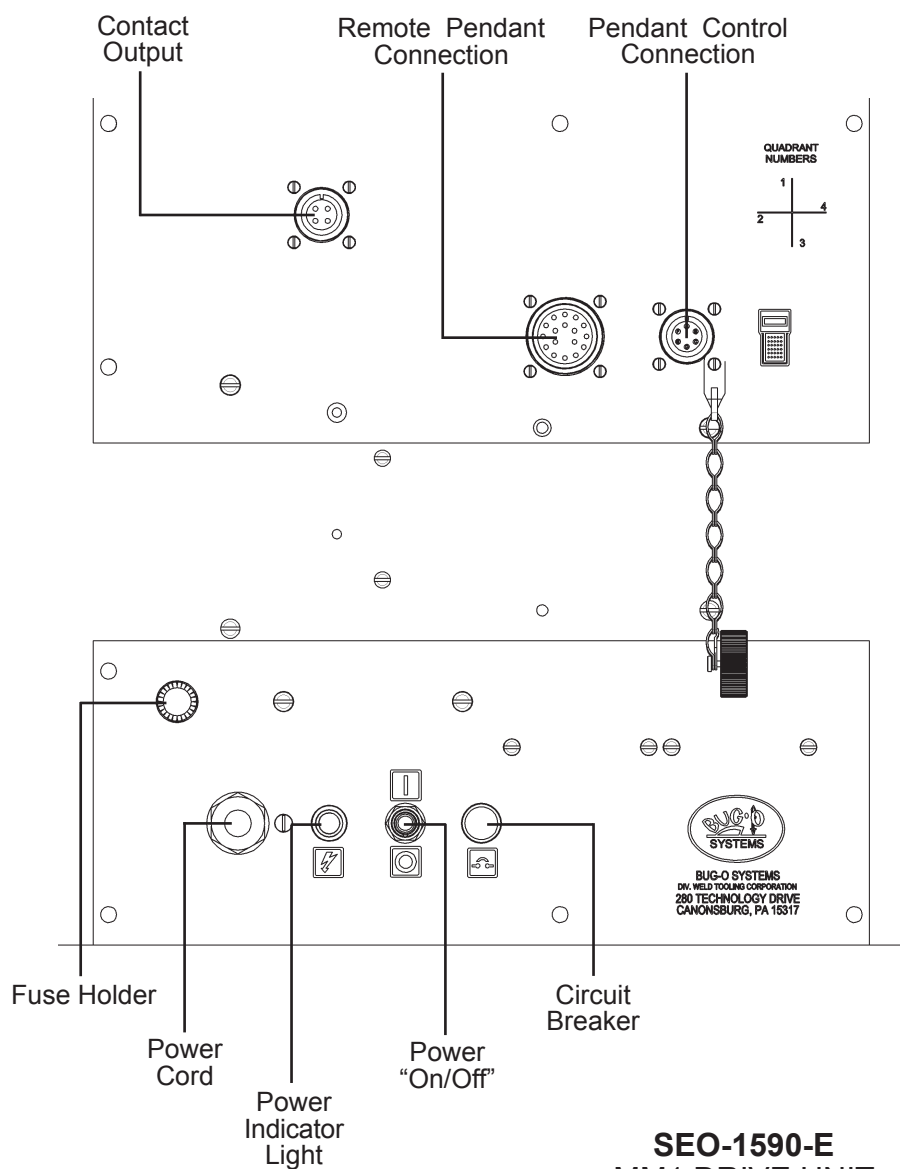
POWER ON / OFF: Switches power "ON" or "OFF".

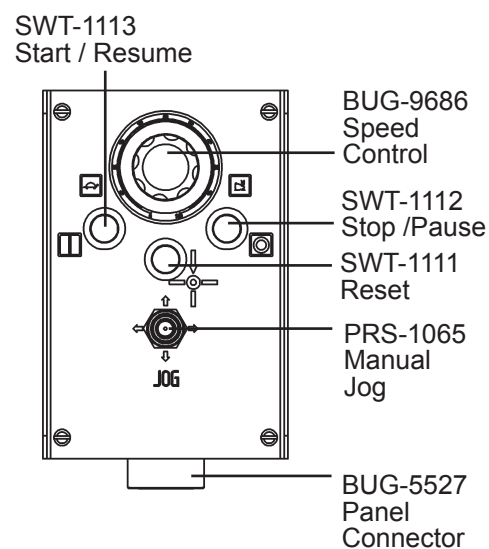**CIRCUIT BREAKER:** Protects the machine against overload or electrical faults.

MIRROR IMAGE SWITCH: Enables the user to cut mirror image cuts of various cut types. Simply program the cut with the switch on the standard cut position "S", then toggle the switch to the mirror image position "M" to cut a mirror image of the programmed cut.

MACHINE CONTROLS, CONT'D.

CBO-4160 (120 VAC) or CBO-4162 (240 VAC)
MM1 PANEL

Contact Output

Remote Pendant Connection

Pendant Control Connection

QUADRANT NUMBERS

BUG-O SYSTEMS
DIV. WELD TOOLING CORPORATION
280 TECHNOLOGY DRIVE
CANONSBURG, PA 15317

Fuse Holder

Power Cord

Power Indicator Light

Power "On/Off"

Circuit Breaker

CBO-4170
MM1 OPERATOR REMOTE PENDANT

SWT-1113 Start / Resume

BUG-9686 Speed Control

SWT-1112 Stop /Pause

SWT-1111 Reset

PRS-1065 Manual Jog

JOG

BUG-5527 Panel Connector

CBO-4171-_
MM1 PENDANT CABLE

BUG-5552 Cable Connector

900-3-016

BUG-5552 Cable Connector

SEO-1590-E
MM1 DRIVE UNIT

BUG-O SYSTEMS
3001 W. CARSON ST. PGH. PA 15204 USA
MODEL:
S/N:

Mirror Image Switch
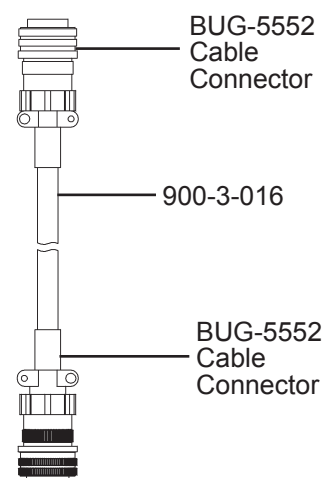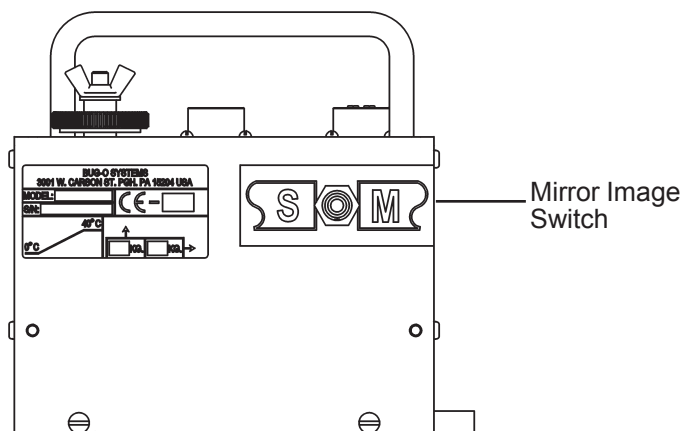
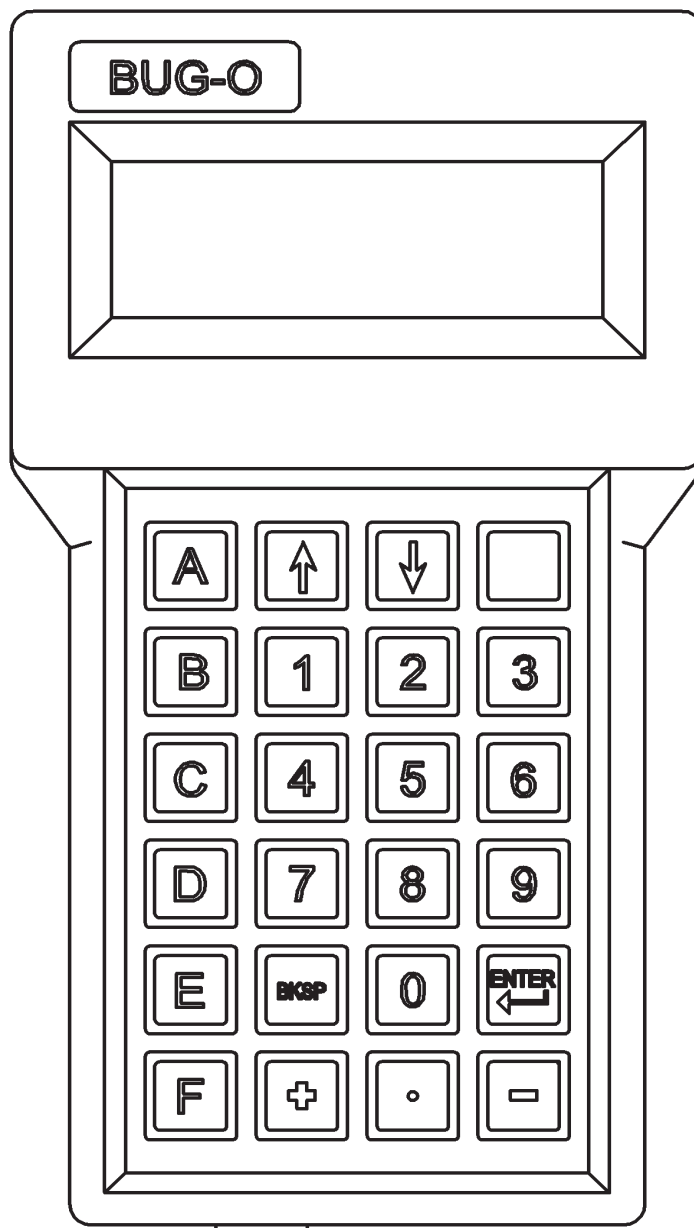# PROGRAMMING PENDANT CONTROL

This is the Pendant Control with keypad and display, which plugs into the Pendant Control Connection on the control panel.

ALPHA KEYS: Press Keys A, B, C, D, or E for the function desired, as described in the programming section of this manual.

DIGIT KEYS: Use the digit keys to enter pipe diameters or dimensions.

ENTER: Push the enter button to store the numeric value entered.

BACKSPACE: The backspace key removes the last digit keyed in before pushing the enter button, if a correction is required.

PROGRAMMING PENDANT CHARACTER MAP (Direct and Shifted Characters)

Shift Key

A	↑	↓	
B	1	2	3
C	4	5	6
D	7	8	9
E	BKSP	0	ENTER
F	+	·	-

G	H	I	
J	K	L	M
N	O	P	Q
R	S	T	U
V	W	X	Y
Z	@	(SP)	!
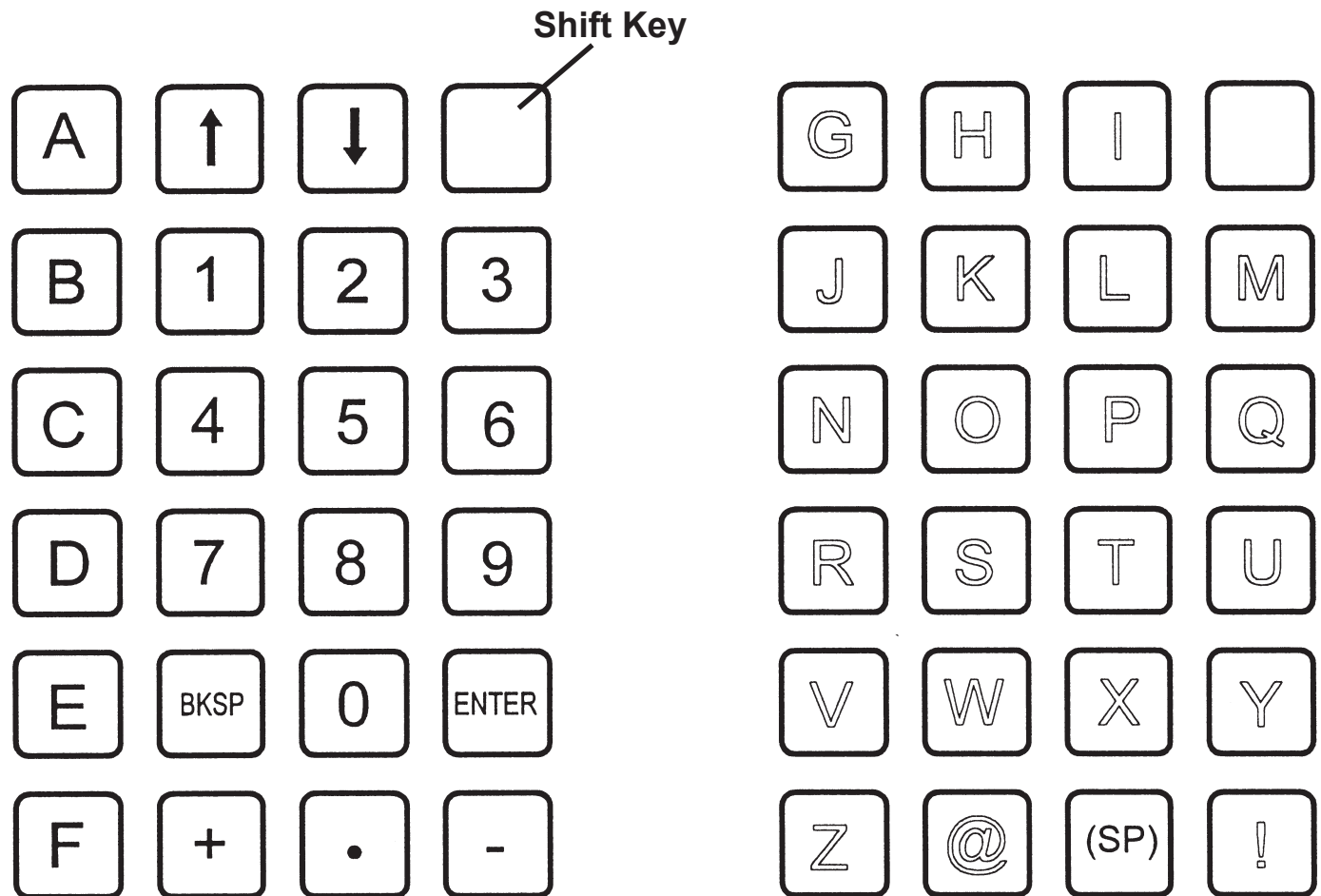
U: set Units, inch or metric
R: set Ratio
T: Test drives & encoders, function
V: Version Number

SHIFTED CHARACTER SET
E.g. to type U for units, press
Shift Key, then "9"

PROGRAMMING MODES

The machine runs in either the SHAPE PROGRAM, for custom programmed shapes, or the PIPE PROGRAM, for pipe intersections.

To switch functions:

1. Press "C" on the pendant keypad
2. Release the key immediately
3. Press "F" immediately (within half a second)

The machine should change to the other program:

> **EXAMPLE:** If the machine is in the PIPE PROGRAM, the Message "PIPE PROG" should be displayed on the pendant display. If the machine was in the SHAPE PROGRAM, the message "SHAPE PROG" should be displayed in the pendant display.

SAVING PROGRAMS

The machine has 10 storage areas numbered cut 0 to 9 in memory, either PIPE PROGRAMS or SHAPE PROGRAMS can be saved in memory. To switch to a different cut number, Push "C" on the pendant keypad and enter the desired number. Program data is retained until reprogrammed. At any time, one of these numbers are selected, it will stay selected even when power is shut off and turned back on, it will not change until the program number is changed by the operator.

PROGRAMMING, DATA ENTRY

When entering data with the pendant keypad, multiply inches, degrees, or seconds by 100 and enter the number without a decimal point. For metric dimensions, multiply mm X 10 or cm X 100.

Example: 350 for 3.5 inches,
            800 for 80 mm, on metric machines
            1500 for 15 degrees

Press the return button after the number is entered.

DATA REQUIRED, (Saddle Cuts, Offset Cuts, Laterals, and Miters)

TYPE 1: Requires A. Small diameter (pipe being cut)
  B. Large diameter (pipe it fits on)

TYPE 2: Requires A. Small diameter
  B. Large diameter
  C. Offset distance between centerlines

TYPE 3: Requires A. Small diameter
  B. Large diameter
  C. Offset distance
  D. Angle between pipes

TYPE 4: Requires A. Small diameter
  B. Cutback distance
  C. Angle of miter cut

TYPE 5: Requires A. Small diameter (branch pipe)
  B. Large diameter (pipe being cut)
  C. Angle

For plasma cutting, a value for the time delay is also required to allow for the delay in striking the arc. A commonly used delay is 3 seconds (enter 300 on the pendant keypad).

When entering diameters, use the diameter of the surface along whose intersection the cut has to be made. Usually they will be the inside diameter of the pipe being cut, and the outside diameter of the pipe it fits on. This will also allow for any bevel, if necessary.

In TYPE 4 miter cut, cutback refers to the distance on the centerline when making two cuts opposed to each other, for the middle piece of an elbow. If only one cut is to be made, enter 0 or just press RETURN for cutback.

NOTE: If the STOP / RESUME button is pressed, the machine will be in pause mode, and cannot be programmed. Press the reset button to get back to the ready mode for programming.

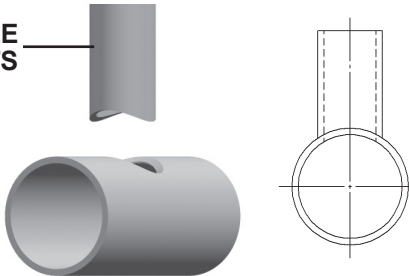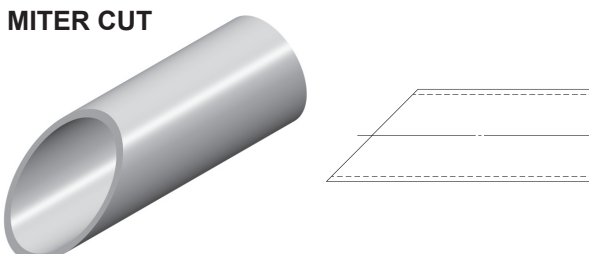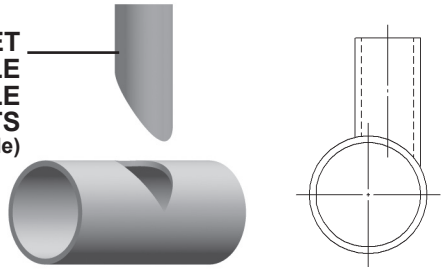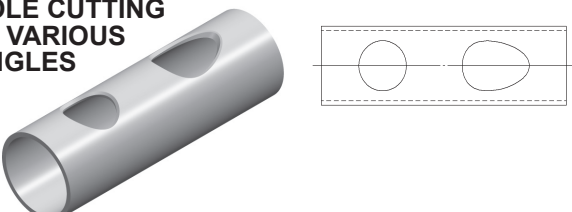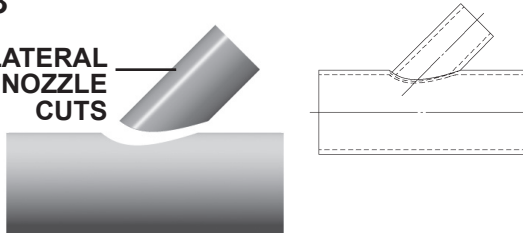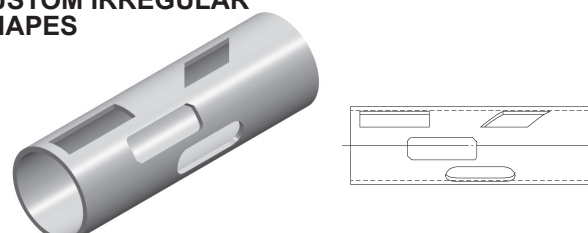## PROGRAMMING, (Saddle Cuts, Offset Cuts, Laterals, and Miters)

NOTE: All programming is done using the **PENDANT CONTROL**.
For programming use the following "Alpha Keys".

Push   A: To select the type of cut and enter dimensions.
           B: To enter the time delay (for plasma cutting).
           C: To change Cut Number in memory (numbers 0 – 9).
           D: To display the type and dimensions of the cut.
           E: To enter end of cut slowdown.

To program a "Pipe Program" cut, select one of the five "Digit Keys" corresponding to the type of cut you wish to make:

       TYPE 1: Saddle Cut (centerline).
       TYPE 2: Offset Cut (hillside).
       TYPE 3: Lateral Cut (offset or centerline, for centerline, put offset = 0).
       TYPE 4: Miter Cut.
       TYPE 5: Holes (see next page).
       *   Irregular Shapes (see programming shapes).

CUT TYPES

TYPE 1
SADDLE NOZZLE CUTS

TYPE 2
OFFSET SADDLE NOZZLE CUTS
(Hillside)

TYPE 3
LATERAL NOZZLE CUTS

TYPE 4
MITER CUT

TYPE 5
HOLE CUTTING AT VARIOUS ANGLES

SHAPE PROGRAM CUSTOM IRREGULAR SHAPES

PROGRAMMING, CUTTING HOLES (Type 5)

To program TYPE 5 Holes utilizing the "Pipe Program". The machine is programmed to cut holes in pipes for branch joints, either square (t-joints) or angled (laterals). The joint must be on Centerline.
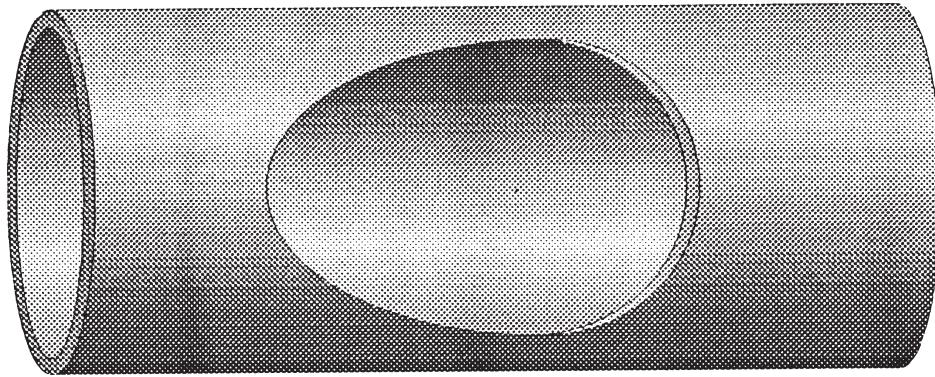
The Display will ask for:

1. The small diameter, and then the large diameter. Enter the diameter of the branch pipe for small diameter, as shown in the diagram below, and the diameter of the pipe being cut for the large diameter.

2. Next the display will ask for the angle. Enter the angle, in degrees X 100 (e.g. for 60 degrees, enter 6000). For square cuts you must enter 9000 (for 90 degrees).

Small Diameter

Angle

Large Diameter
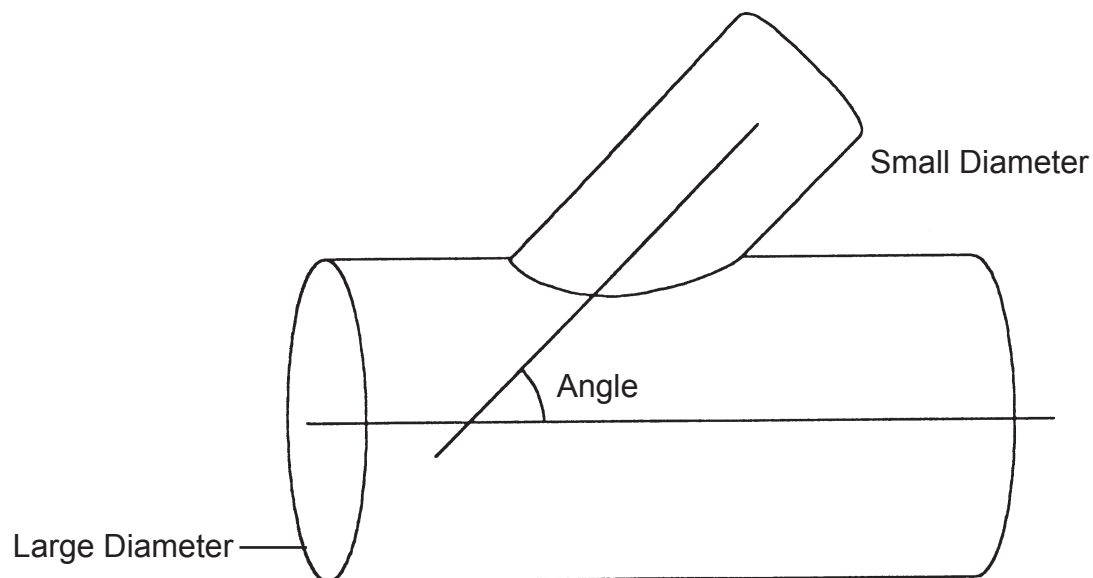
PROGRAMMING SHAPES

The following pages describe the shape programming capabilities of the machine. Cuts of any arbitrary shape can be programmed, by building up the shape from a sequence of straight lines and circular arcs.

For every change of pipe diameter in the machine, the new diameter has to be entered into the machine. If the machine is set to cut a square hole on a 4" (102 mm) pipe, and an 8" (203 mm) diameter pipe is put into the chuck, the hole will be rectangular, stretched out to twice the dimension in the circumferential direction.

> **NOTE:** The pipe diameter is a background setting and affects all programs.

Press "E" on the pendant keypad to enter the diameter; the display will prompt you for the pipe diameter first, and then the segment end slowdown. The shapes are laid out on a flat surface as if the pipe had been slit and opened up flat, and the cut line developed on it.

> **NOTE:** If the "SHAPE MACHINE PC" program is used to download shapes, the pipe diameter can be entered by clicking "PIPE FUNCTIONS" and then set pipe diameter before downloading the program to the machine. This can be done directly from the computer if desired, by clicking the "BUG-O STUFF" menu and then clicking "COMM TERMINAL". From there, press E (upper case) and follow the prompts. The machine must be connected to the PC for "COMM TERMINAL" function; turn power "ON" and press the RESET button on the machine control panel.

When using the hand held pendant, shapes are built up only from the segments provided (see Shape Programming Chart): circular arcs and straight lines, square or inclined, by selecting type and quadrant for each segment. A shape can have up to 50 segments. Some other operations, like solenoid "ON / OFF", TIME DELAY, or REPEAT another shape, also count as one segment each, if used.

In normal operation, first position the torch at the starting point. Next turn on the preheat gases, and wait until the required preheat is reached. Press the START / RESUME button, the machine will turn on the cutting oxygen and start cutting the current shape. At the end of the shape the machine will turn off the cutting oxygen and stop. Manually turn off the preheat gases.

When plasma cutting, and external contact relay is used instead of the cutting oxygen solenoid. A delay to allow for striking the arc should be the first segment programmed.

DATA REQUIRED, (Programming Irregular Shapes)

To program a completely new shape (Press "A").

Count the number of segments or operations and enter the total.

For each segment, enter the following:

TYPE: Select digit keys 1-8
QUADRANT: 1, 2, 3, or 4 (refer to Programming Segment Chart)
SIZE: One or more dimensions per segment as described below:
100 X inch or 10 X mm (depending on the machine version):
or for time, 100 X second of delay.
(E.g. 150 = 1.5", or for metric 375 = 37.5mm)

DESCRIPTION OF SEGMENT TYPES (Refer to Programming Segment Chart)

TYPE 1: Clockwise, 90-degree arc segments.
Quadrant determined by which quarter of a full circle makes the arc.
Dimensions required: Radius only.

TYPE 2: Counter-clockwise, 90-degree arc segments.
Quadrant determined by which quarter of a full circle makes the arc.
Dimensions required: Radius only.

TYPE 3: Line along X or Y-axis.
Quadrant determined by direction of movement.
(East: 1, North: 2, West: 3, South: 4).
Dimensions require length only.

TYPE 4: Angled straight line.
Quadrant determined by direction of movement.
(Northeast: 1, Northwest: 2, Southwest: 3, Southeast: 4).
Dimensions required:
1. X-dimension, movement along the X-axis
2. Y-dimension, movement along the Y-axis

TYPE 5: Function or Operation.
Quadrant determined by function selected.

1. WELD / OXYGEN "ON": turns on the contact relay or oxygen solenoid.
Dimensions required: None.

2. WELD / OXYGEN "OFF": turns off the contact relay or oxygen solenoid.
Dimensions required: None.

3. PAUSE: Machine stops and waits until START / RESUME button is pushed.
Dimensions required: None.

4. DELAY: Machine stops and holds position for a programmed period of
time up to 99.99 seconds.
Dimensions required: time in .01 second units. (E.g. 250 for 2.5 seconds)

DATA REQUIRED, CONT'D.

TYPE 6:   Special Functions.
Quadrant determined by function selected.

1. REPEAT: Another complete shape will be repeated a specified number
of times. The "Shape No." of the repeated shape MUST BE LOWER
then the "Shape No___." of the current shape being programmed.
Therefore it CANNOT BE USED IN "Shape No. 0".

Data required: 1. "Shape No. __" To be repeated.
2. Number of times repeated.

2. CALL PIPE CUT
This function allows a PIPE cut to be inserted into the SHAPE program
segment sequence. For instance: Move back a certain distance, call PIPE cut
to make a hole, then move somewhere else and continue cutting.

When programming with the Hand held Terminal, the display will only ask for
"Cut No.?" The PIPE cut has to be programmed separately (either before or after
programming the SHAPE), and the Cut No. it is programmed into entered as data. For
example: Program a fishmouth PIPE CUT Type 1, 4.00" on 8.00", in Cut No. 2. When
entering Type 6, Quad 2 in the Shape Program, it will ask for "Cut No.?; just enter "2."

3. AUXILIARY MODES: Provide commands to turn "ON / OFF" two line-switching
outputs independently, and also switching speeds from set speed to rapid
traverse and back. Mode numbers are from 0 to 7. Refer to the Mode Chart in
this manual to select a mode.

4. SET PERCENT SPEED: Used to change the speed of the machine in the
middle of a shape to a lower speed. Refer to The Set Percent Speed section of
this manual.

TYPE 7:   Clockwise arc, must be less than 180 degrees.
Quadrant determined by direction of end point of arc relative to the start point.

Dimensions required:
1. X-dimension, offset along the X-axis from start to end point.
2. Y-dimension, offset along the Y-axis from start to end point.
3. Radius of the arc.

TYPE 8:   Counter-clockwise arc, must be less than 180 degrees.
Quadrant determined by direction of end point of arc relative to the start point.

Dimensions required:
1. X-dimension, offset along the X-axis from start to end point.
2. Y-dimension, offset along the Y-axis from start to end point.
3. Radius of the arc.

AUXILIARY MODES: Type 6, Quadrant 3

Auxiliary Modes are additional controls to independently turn the two internal solid-state relay outputs "ON and OFF", and to switch the machine into rapid traverse mode or set speed.

The machine is shipped with OUTPUT (1) wired to the external relay or solenoid connector. By default, this output turns "ON" when the START / RESUME button is pressed to run a shape, and turns "OFF" at the end. The output is taken from screws (3) and (4) on the 4-terminal strip on the controller inside the machine.
ONLY OUTPUT (1) IS NORMALLY USED.

OUTPUT (2) is present at screws (1) and (2) on the controller, but not wired. By default the output is "OFF" when a shape is started, until turned "ON" by command TYPE 5, QUADRANT 1. Both the Plasma Kit and the Oxyfuel Kit use only output (1). Subsequently while running, the TYPE 5 "ON" and "OFF" commands turn both outputs "ON" and "OFF" together, and both then "OFF" at the end.

When programming TYPE 6 QUADRANT 3, a mode number is required to be entered. The eight auxiliary modes, numbered 0 through 7, allow the setting of a mode with any combination of outputs "ON" or "OFF" and choice of set speed by the speed knob or maximum speed regardless of the setting. The combinations are listed in the table below:

MODE CHART:

MODE NO.	OUTPUT 1	OUTPUT 2	SPEED
0	OFF	OFF	SET
1	OFF	ON	SET
2	OFF	OFF	HI
3	OFF	ON	HI
4	ON	OFF	SET
5	ON	ON	SET
6	ON	OFF	HI
7	ON	ON	HI

SET PERCENT SPEED: Type 6, Quadrant 4

Selecting TYPE 6, QUADRANT 4 allows the speed to change to a fraction of the set speed. The display will read "Speed %", and data entry is accepted from 1 to 99. Entering 0 or return will make the speed 100%, which is the same as the set speed.

When the program reaches a TYPE 6, QUADRANT 4, segment while running, the speed will change to the percent entered, and continue at this setting until there is a later TYPE 6, QUADRANT 4, segment which changes it to another % setting or back to 100%.

NOTE: If TYPE 6, QUADRANT 3, has been set for HI (rapid traverse), then this setting will cut down the HI speed to the same %. Settings below 10% are not recommended.

PROGRAMMING SHAPES OPERATION

When power is turned "ON", the position of the torch becomes the reference START position. There are three options (the hand held pendant is not needed for the first two):

1. **MOVE**
    To change the start position, press the STOP / PAUSE button, move the machine manually to the desired START position using the MANUAL JOG switch, and press the RESET button.

2. **RUN**
    Press the START / RESUME button to cut a shape.

3. **PROGRAM** (entry or change)
    The programming operation is selected by pressing the alpha keys A, B, C, D, and E.

A: All segments, data entry for a new shape consists of the total number of segments.
Data for each: Type   (arc, X/Y line or slope)
       Quadrant 1-4
       Size   (radius, or X/Y dimension)

  NOTE: See writing a shape program for more details.
  For example, a 2" (51 mm) diameter circle could be four segments:
  1. 2, 1, 100 Counter-clockwise arc, quadrant 1, 1.00 inch radius
  2. 2, 2, 100 Counter-clockwise arc, quadrant 2, 1.00 inch radius
  3. 2, 3, 100 Counter-clockwise arc, quadrant 3, 1.00 inch radius
  4. 2, 4, 100 Counter-clockwise arc, quadrant 4, 1.00 inch radius

  The data should be tabulated on paper from a diagram before entering.

B: **PROGRAM** (Segment:)
Press "B" on the pendant keypad to reprogram a single segment. This is useful if there is an error in data for just one segment, so the whole shape does not have to be re-entered.

C: **CHANGE** (Shape number:)
Press "C" on the pendant keypad to change the current shape number, and enter the desired number at the prompt. The program switches to the new number in memory, and to whatever shape is stored in that memory location.

D: **DISPLAY** (Shape Data:)
Press "D" on the pendant keypad to display the data for the current shape.
The pendant display shows the total number of segments, and data for each segment one by one each time you press ENTER.

E: **END** of (Segment Slowdown:)
Press "E" to set deceleration value for the shape, when the machine approaches the end of each segment. This is useful when the shape has sharp corners, to prevent overshoot. 99 is the maximum slowdown, 0 is no slowdown.

IMPORTANT:
1. Once the STOP / PAUSE button is pressed, computer control is halted until the RUN / RESUME or the RESET button is pressed. Therefore the programming cannot be done with the pendant in this state: the RESET button should be pressed first.

2. After pushing "A" and programming a new shape, END of Segment Slowdown will still have the old value unless reprogrammed. To set a new value, push "E".

WRITING A SHAPE PROGRAM

The shape to be cut on the pipe must first be laid out flat as if the pipe was slit along the length and opened up flat.
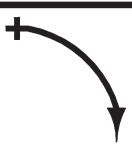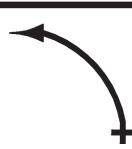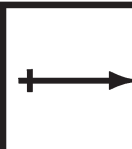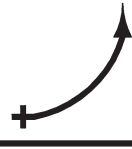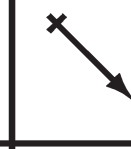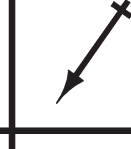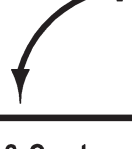
1. Draw the required shape on paper to some convenient scale.

2. Refer to the Segment Chart and divide the shape into straight line and arc segments.

3. Decide on the operation sequence and mark any other operations such as turning torch "ON / OFF", or DELAY.

4. Number all the segments in sequence, including other positions if any, and make a table with the required data.

Example: For a clockwise circle starting from the top. (Dimensions described for metric version)

Segment No.	Type	Quadrant	Dimensions
1.	1	1	300 (30 mm)
2.	1	4	300
3.	1	3	300
4.	1	2	300

5. With the machine turned on, select which shape number this will be saved in memory as, for instance, No. 3.
    Push "C", display reads Shape No. __.
    Push 3 for No. 3, press the ENTER key (backward arrow).
    The program is now saved as Shape No. 3.

6. Push "A" the display will read "Total Segments ?"
    Push 4 for 4 segments and press the ENTER button.
    The display will read "1 Type ?" waiting for segment 1 data.

7. Push 1 for type, clockwise arc. (Refer to Programming Segment Chart)
    The display reads "Quadrant ?"
    Push 1 for quadrant 1.
    The display reads "mm X 10"
    Push 3, 0, 0, Enter, for 300, which is 30.0 mm.
    Segment 1 has now been entered.
    The display will read "2 Type ?" asking for data for Segment 2.

8. Repeat the steps above to enter data for all segments, in sequence. The display will read "Ready" after all segments have been entered. The shape program is now stored in memory as "Shape No. 3", and the machine is ready to cut the programmed shape.

Segment Type and Line Chart

Quadrant	1. Clockwise 90 Deg Arc	2. Counter-Clockwise 90 Deg Arc	3. X or Y Axis Line	4. Oblique Line	5. Functions	6. Functions	7. Clockwise Partial Arc	8. Counter-Clockwise Partial Arc
#4					Time Delay	Percent Speed		
#3					Wait for Start Button	Auxilliary Mode		
#2					Weld / Oxy Off	Cut Number		
#1					Weld / Oxy On	Repeat Another Step		

Segment Types:

A. All Segments - Build New Shape   B. Reprogram One Segment   C. Change Shape Number

D. Display Current Shape Data   E. End of Segment Slowdown

MAKING A PIPE CUT

To make a pipe cut:

1. Set up the machine with pipe in position and power "ON"

2. Program the desired cut. (Refer to the programming sections in this manual).

    EXAMPLE: Press C for "CUT" select # 0-9
                              Press A, Select type of cut from pg 16-17
                              To Select Saddle Cut Enter (1)
                              Enter Small Diameter
                              Enter Large Diameter
                              Program is complete

3. Press the STOP / PAUSE button and use the MANUAL JOG to move the torch to the starting point.

4. Press the RESET button to fix the starting point.

5. For oxy-fuel, turn on and ignite the pre-heat gasses, and wait until proper preheat is achieved to start the cut. Press the START / RESUME button, and the solenoid for cutting oxygen or plasma trigger is turned on and the machine starts the cut (after the delay which has been set for plasma).

NOTE: (TYPE 4, MITER)
If a cutback dimension has been entered, the machine will make one cut, shut off the gas or arc, back up for the given distance, and rotate 180 degrees. The machine will pause until the START / RESUME button is pressed again, and them repeat the same cut but rotated 180 degrees from the first cut.

To make a dry run without cutting:

1. Press the STOP / PAUSE button and hold it down.

2. Press the START / RESUME button and hold it down.

3. Release the STOP / PAUSE button quickly, after step two above.

4. Release the START / RESUME button.

The machine will move along the programmed cut without turning on the contacts for plasma, or the cutting solenoid.

PROGRAMMING EXAMPLE

To cut a slot in a pipe like the one shown below:

1. The cut is split into segments of straight lines and circular arcs that make up the desired pattern.

2. Next, these segments should be listed in a table (as shown), with the Type, Quadrant, and required Dimensions (refer to the Programming Segment Chart).

3. To program the shape, press "A" on the pendant keypad, then enter the total segments at the prompt (6 for this example).

4. Next enter the data for each segment such as Type, Quadrant, and Dimensions, as prompted.

5. Finally enter an End of Segment slowdown value, and the display will read "Ready".

6. **IN THE SHAPE PROGRAM, FOR THE FIRST CUT OF A GIVEN DIAMETER, THE PIPE DIAMETER MUST BE ENTERED.** Press "E" on the pendant keypad, the display will prompt for the pipe diameter, and then the Slowdown value.

Segment	Type	Quadrant	Dimension
1	1	3	400
2	3	2	600
3	1	2	400
4	1	1	400
5	3	4	600
6	1	4	400

The first **Segment** is a clockwise 90 degree arc, which is **Type 1, Quadrant 3** and the required Dimension is the radius, set here as 40 mm.

26
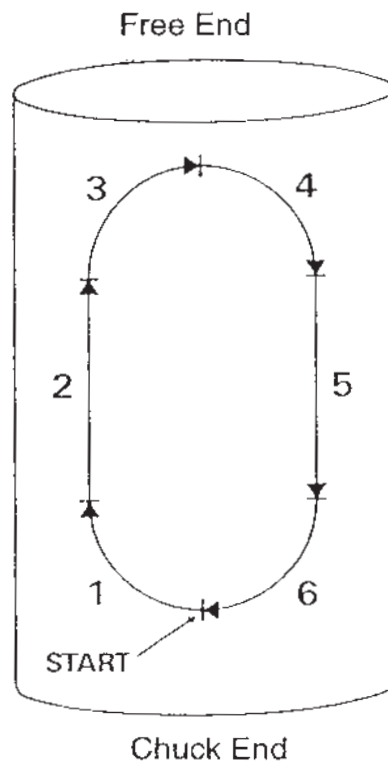
NOTES ON PROGRAMMING

MM-1 BURNING MACHINE / EXPLODED VIEW / PARTS LIST

*4

*5

See detail "B"

See detail "A"

7

2

6

6

8

1

3
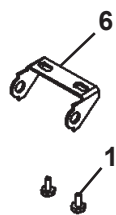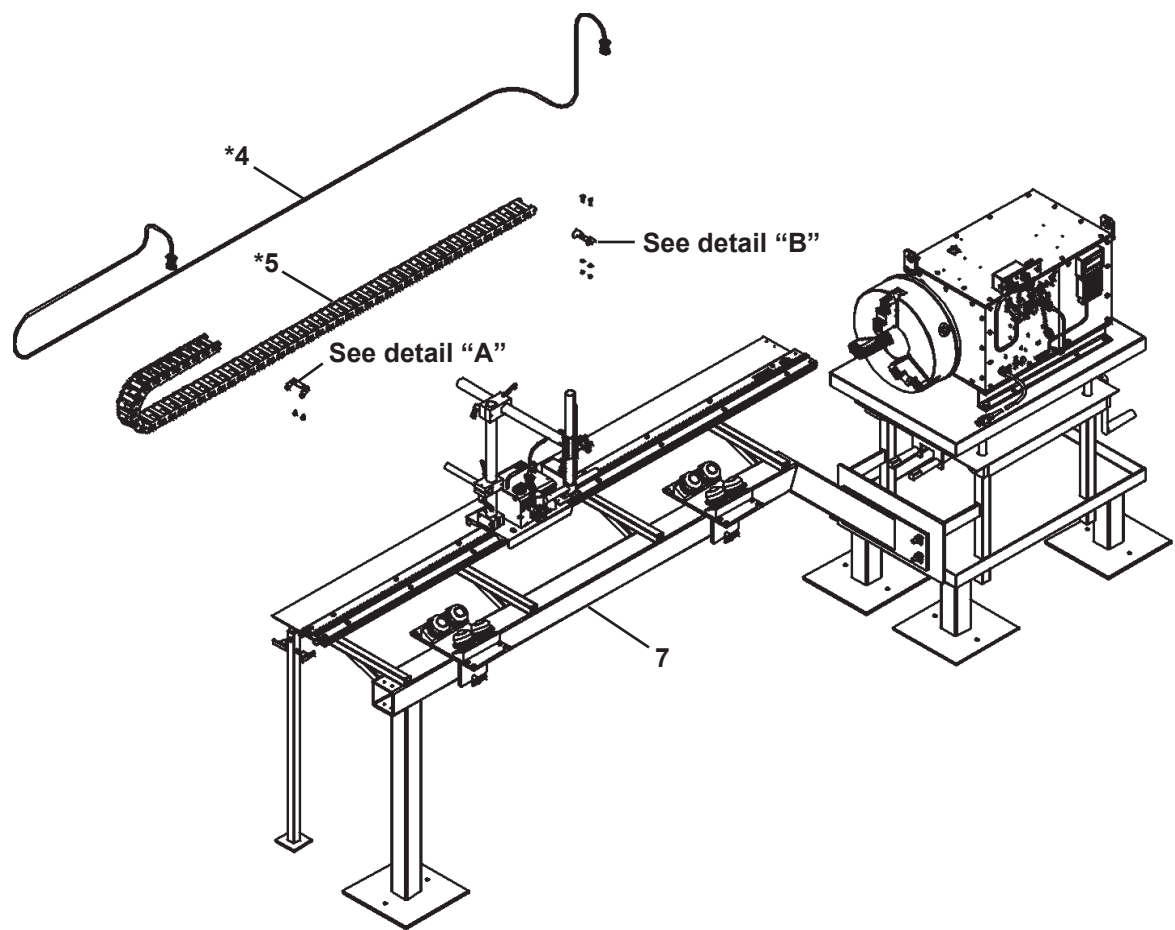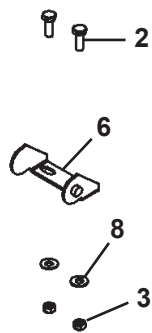
DETAIL "A"
SCALE 1:4

DETAIL "B"
SCALE 1:4

ITEM	QTY	PART NO.	DESCRIPTION
1	2	FAS-0355	Hex Hd Cap Scr 1/4-20 x 1/2"
2	2	FAS-0357	Hex Hd Cap Scr 1/4-20 x 3/4"
3	2	FAS-1351	Hex Nut 1/4-20
4*	1	MUG-1634-14	Shielded Cable 14'
5*	8'	MUG-1678	Cable Carrier
6	1	MUG-1679	Cable Carrier Bracket
7	1	SEO-3500-COM	MM-1 120 VAC Common
8	2	WAS-0240	1/4" SAE Flat Washer

* Item length varies depending on the number of additional (SEO-3390) extensions that are in use. Please specify the number of extensions when reordering so that the proper length will be supplied.

MM-1 BURNING MACHINE COMMON / EXPLODED VIEW / PARTS LIST
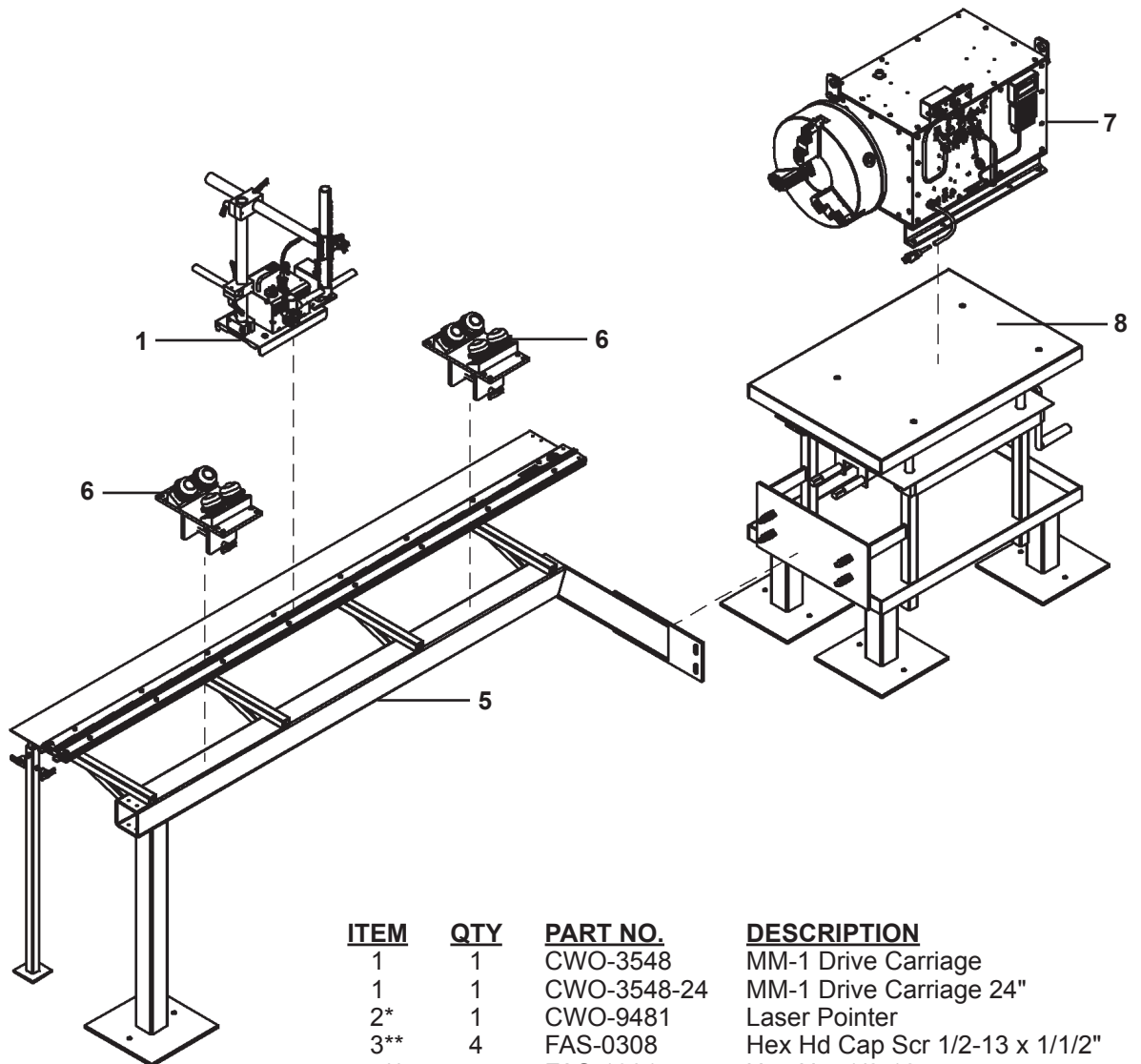
ITEM	QTY	PART NO.	DESCRIPTION
1	1	CWO-3548	MM-1 Drive Carriage
1	1	CWO-3548-24	MM-1 Drive Carriage 24"
2*	1	CWO-9481	Laser Pointer
3**	4	FAS-0308	Hex Hd Cap Scr 1/2-13 x 1/1/2"
4**	4	FAS-1301	Hex Nut 1/2-12
5	1	SEO-3350	MM-1 Standard Pipe Bed Assembly
6	2	SEO-3590	Roller Block Assembly
7	1	SEO-4550	MM-1 120 VAC Head Stock
8	1	SEO-5480	MM-1 Table Assembly
9*	1	TAR-1100	TAR-GIT 24"
10**	8	WAS-0280	1/2" SAE Flat Washer
11**	4	WAS-0281	1/2" Lock Washer

*   Item not shown, used for alignment.
**   Item not shown, used to mount item seven.

CWO-3548/CWO-3548-24 MM-1 DRIVE CARRIAGE / EXPLODED VIEW / PARTS LIST

SEO-1590-E EXPLODED VIEW
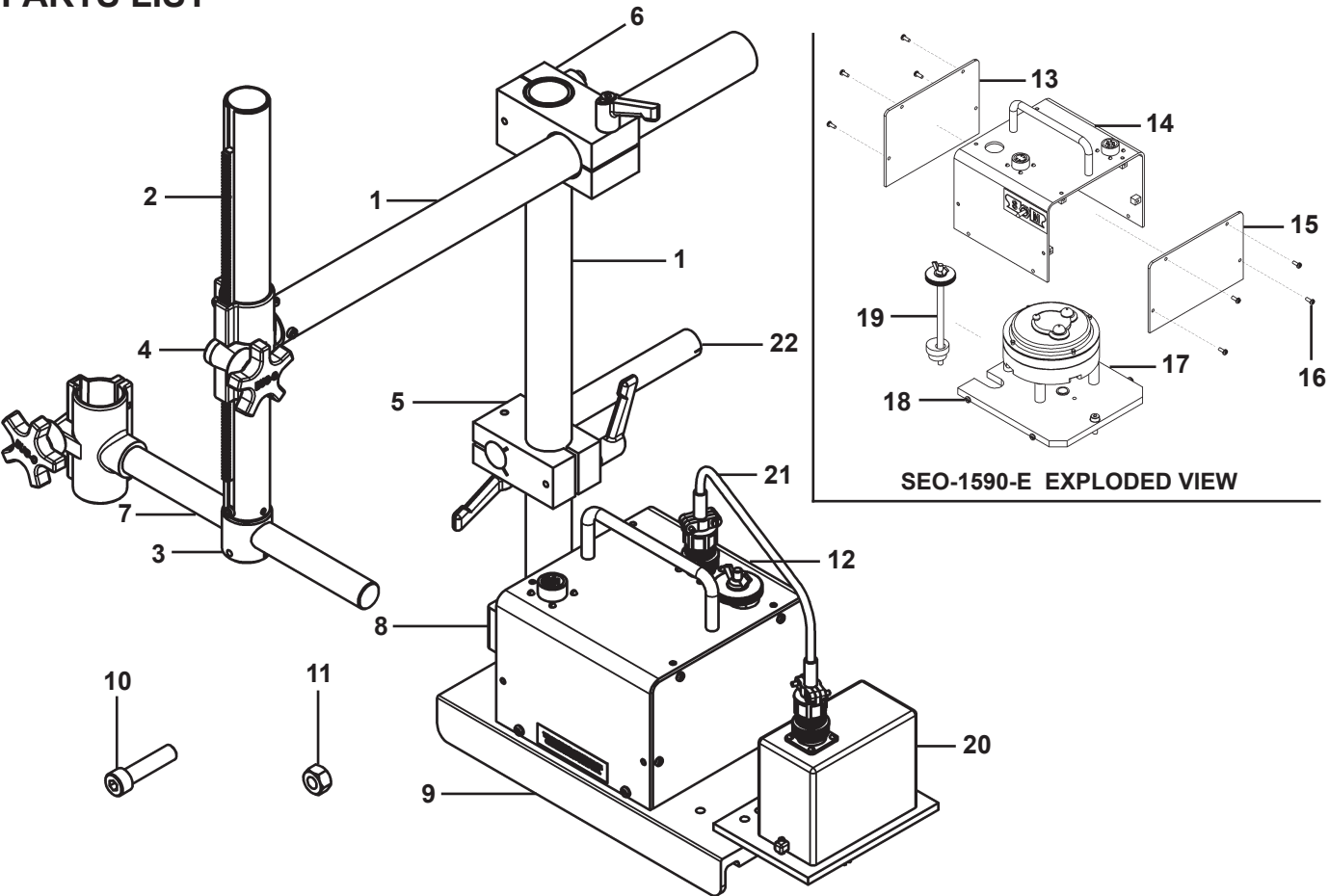
ITEM	QTY	PART NO.	DESCRIPTION
1	2	BUG-3310-20	Tube 20"
1	2	BUG-3310-30	Tube 30" (For 24" Machine)
2	1	BUG-3320-15	H.D. Tube Rack 15"
3	1	BUG-5164	Clamp Assembly
4	1	BUG-5179	Torch Holder Assembly
5	1	BUG-5182	Right Angle Clamp
6	1	BUG-5186	Right Angle Clamp
7	1	BUG-5188-10	Torch Holder Assembly w/Post
8	1	BUG-5189	Clamp Block Assembly
9	1	BUG-5250	Carriage 12"
10	2	FAS-0559	Soc Hd Cap Scr 1/4-20 x 1"
11	2	FAS-1351	Hex Nut 1/4-20
12	1	SEO-1590-E	Drive Unit
13	1	BUG-5112	Front End Plate
14	1	SEO-1585	Drive Cover Assembly
15	1	BUG-2988	Left Side Panel
16	8	FAS-0114	6-32 x 3/8 Pan Hd Scr
17	1	BUG-5115-E	Drive Base (100:1)
18	4	FAS-0124	8-32 x 3/8 Pan Hd Scr
19	1	BUG-5120	Cam Clutch Assembly
20	1	MUG-1595	Encoder Assembly
21	1	MUG-1621-1.5	Cable 18"
22	1	SEO-3549	Cable Carrier Rod

Note: Items 10 and 11 are used to fasten item 9 to item 20.

CWO-3548 & CWO-3548-24 MM-1 DRIVE CARRIAGE / WIRING DIAGRAM / PARTS LIST

SEO-1590-E DRIVE UNIT (100:1)

NOTE: WIRE PER MOT-0000
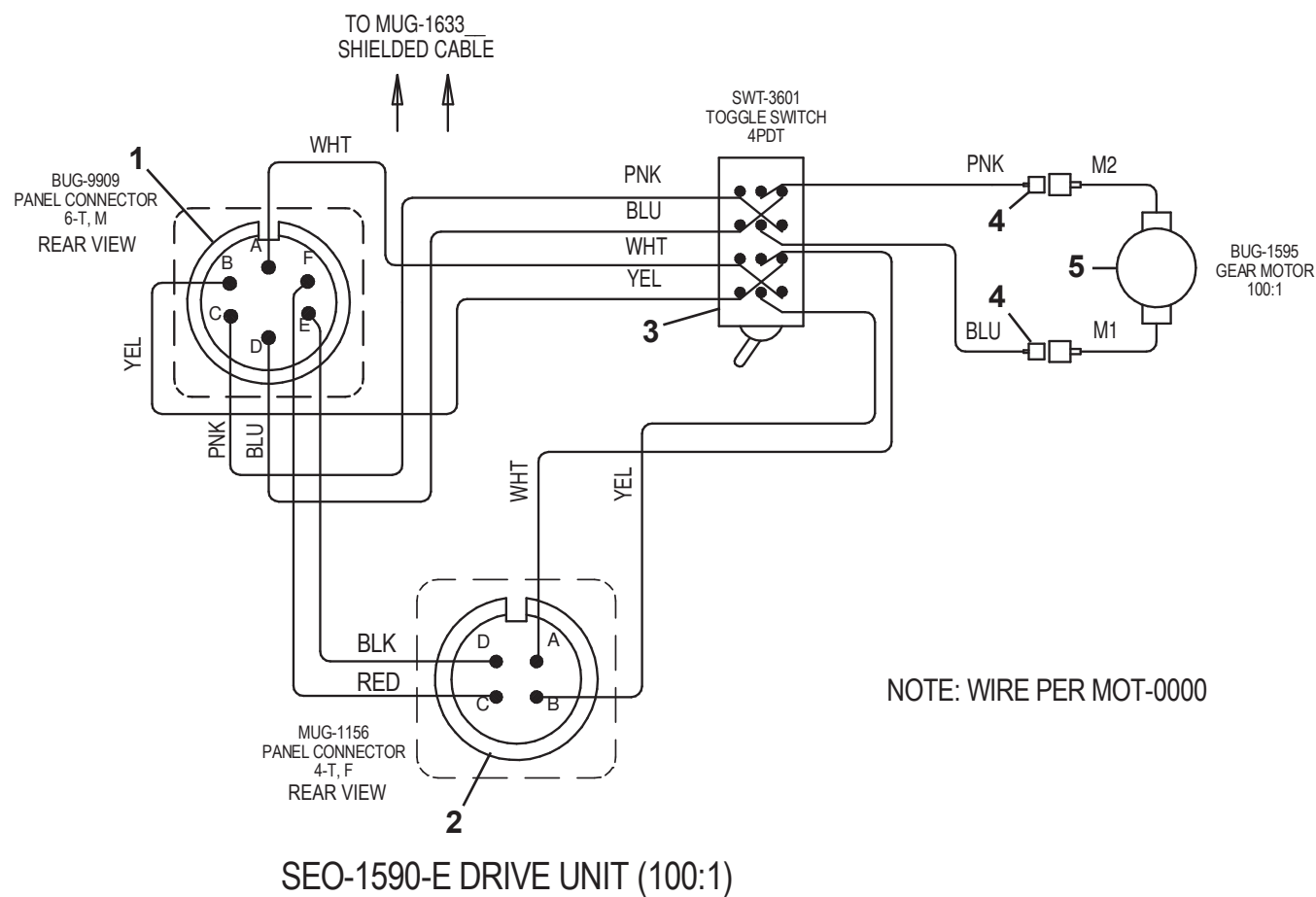
ITEM	QTY	PART NO.	DESCRIPTION
1	1	BUG-9909	Panel Connector 6-T, M
2	1	MUG-1156	Panel Connector 4-T, F
3	1	SWT-3601	Toggle Switch 4PDT
4	2	GOF-3036	QD Female
5	1	BUG-1595	Gear Motor (100:1)
6	1	MUG-1621-1.5	Cable 18" (not shown)

SEO-3350 MM-1 STANDARD ARM / EXPLODED VIEW / PARTS LIST
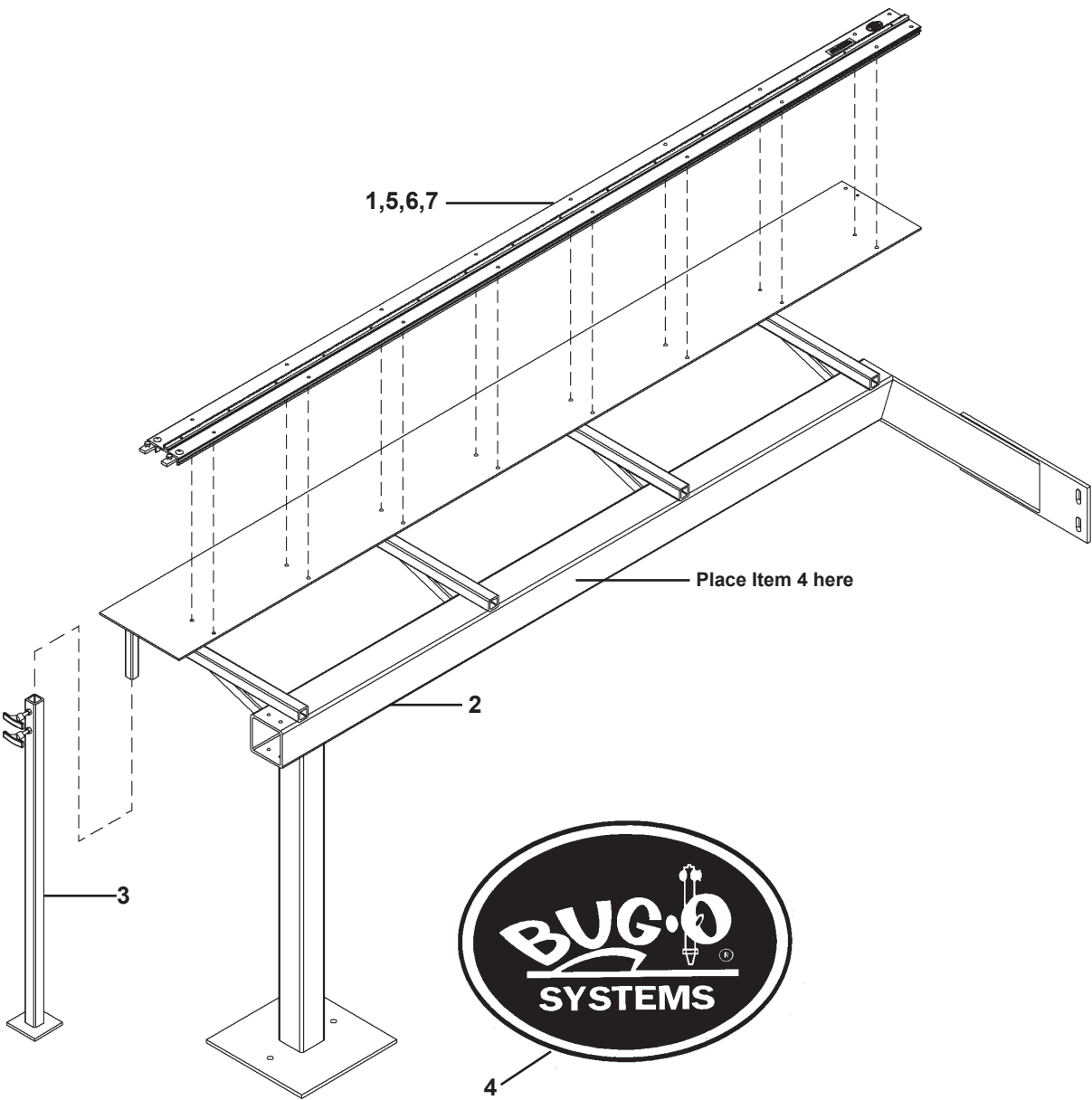
1,5,6,7

Place Item 4 here

2

3

4

BUG·O SYSTEMS

ITEM	QTY	PART NO.	DESCRIPTION
1	1	ARR-1080	Hvy Duty Alum Rigid Rail
2	1	CWO-3349	MM-1 Pipe Bed Assembly
3	1	CWO-3780	MM-1 Stabilizer Leg Assembly
4	2	CWO-5411	Bug-O Decal
5	16	FAS-1351	Hex Nut 1/4-20
6	16	FAS-2353	Hex Hd Cap Scr 1/4-20 x 1-1/2"
7	16	WAS-0240	1/4-20 SAE Washer

SEO-3350-24 MM-1 24" CAPACITY STD ARM ASSEMBLY / EXPLODED VIEW / PARTS LIST
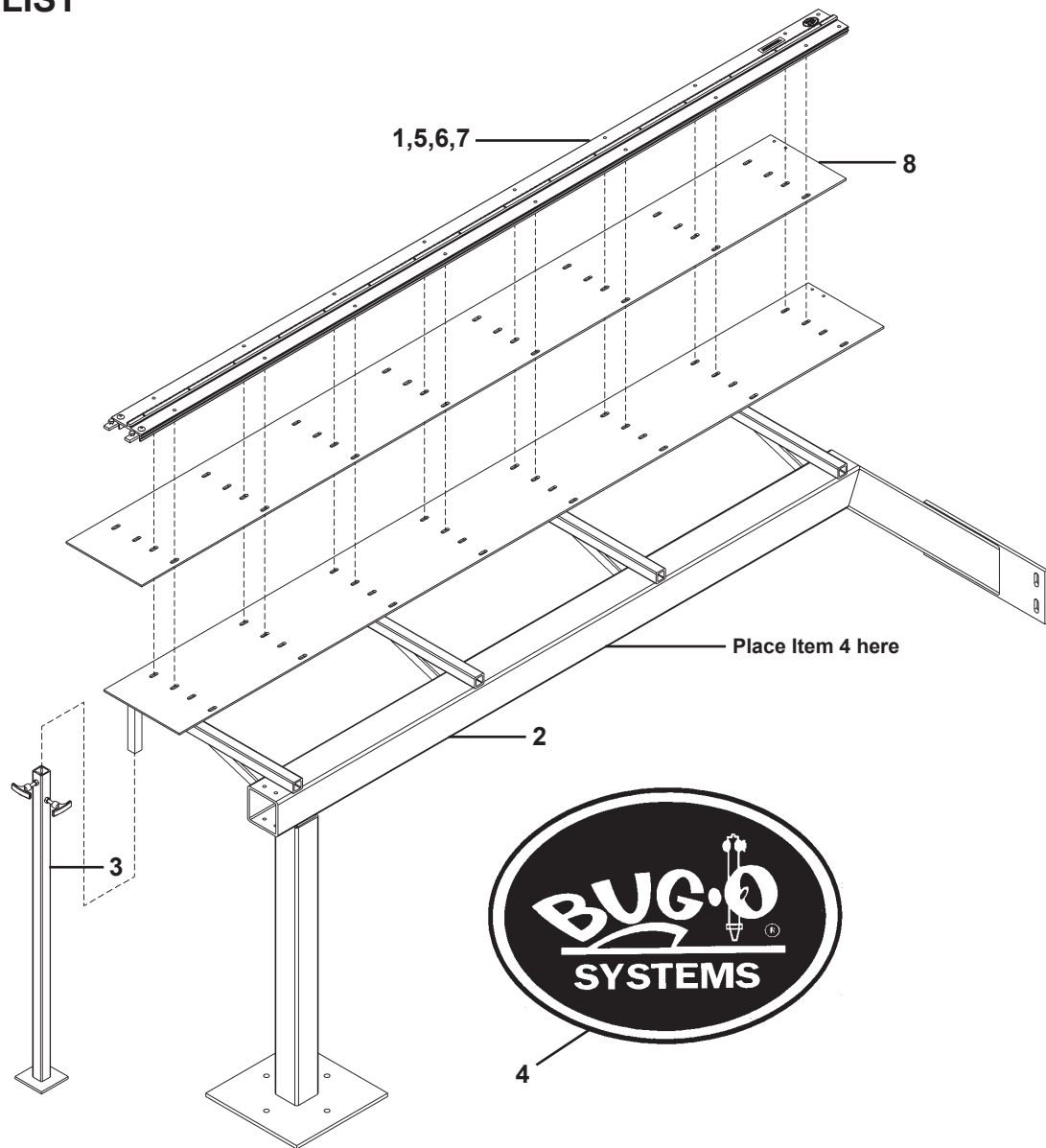
1,5,6,7

8

Place Item 4 here

2

3

4

BUG·O SYSTEMS

ITEM	QTY	PART NO.	DESCRIPTION
1	1	ARR-1080	Hvy Duty Alum Rigid Rail
2	1	CWO-3349	MM-1 Pipe Bed Assembly
3	1	CWO-3780	MM-1 Stabilizer Leg Assembly
4	2	CWO-5411	Bug-O Decal
5	16	FAS-1351	Hex Nut 1/4-20
6	16	FAS-2354	Hex Hd Cap Scr 1/4-20 x 3"
7	16	WAS-0240	1/4-20 SAE Washer
8	1	CWO-3344	MM-1 Rail Backer Plate

SEO-3390 MM-1 8' BED EXTENSION / EXPLODED VIEW / PARTS LIST
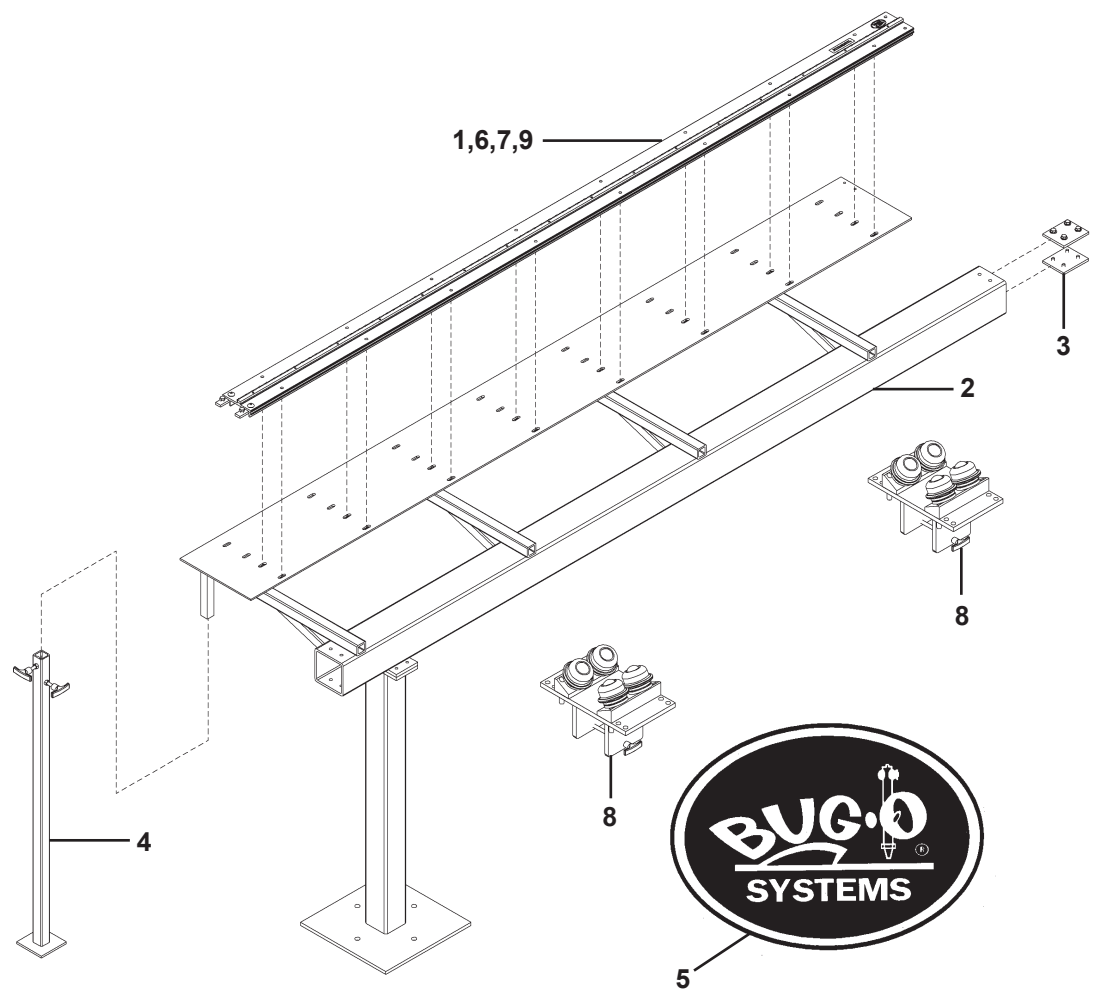
ITEM	QTY	PART NO.	DESCRIPTION
1	1	ARR-1080	Hvy Duty Alum Rigid Rail
2	1	CWO-3392	MM-1 Pipe Bed Extension 8'
3	2	CWO-3410	MM-1 Splice Plate Assembly
4	1	CWO-3780	MM-1 Stabilizer Leg Assembly
5	2	CWO-5411	Bug-O Decal
6	16	FAS-1351	Hex Nut 1/4-20
7	16	FAS-2353	Hex Hd Cap Scr 1/4-20 x 1-1/2"
8	2	SEO-3590	Roller Bearing Assembly
9	16	WAS-0240	1/4 SAE Washer

SEO-3390-24 MM-1 24" CAPACITY 8' BED EXTENSION / EXPLODED VIEW / PARTS LIST
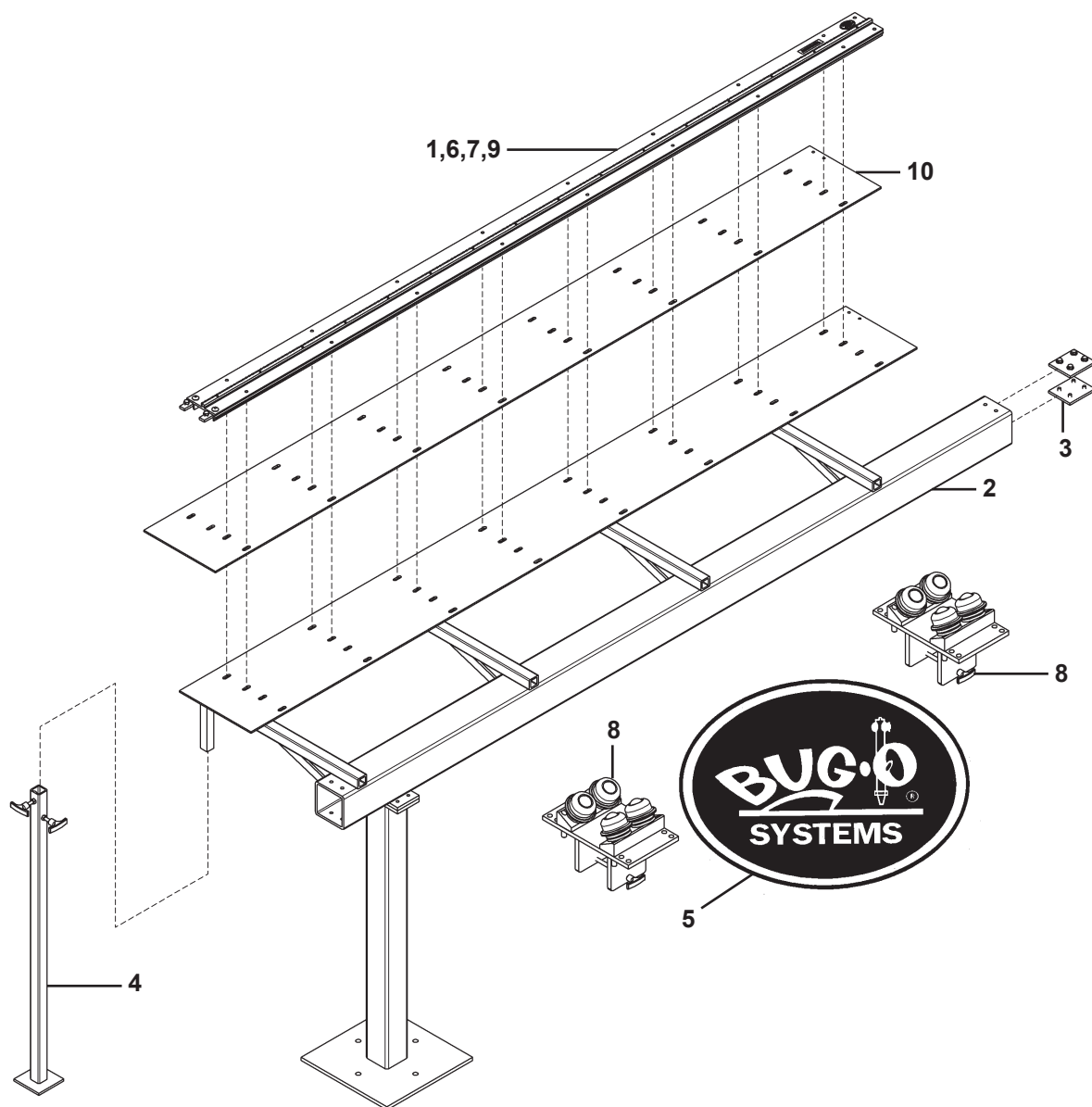
ITEM	QTY	PART NO.	DESCRIPTION
1	1	ARR-1080	Hvy Duty Alum Rigid Rail
2	1	CWO-3392	MM-1 Pipe Bed Extension 8'
3	2	CWO-3410	MM-1 Splice Plate Assembly
4	1	CWO-3780	MM-1 Stabilizer Leg Assembly
5	2	CWO-5411	Bug-O Decal
6	16	FAS-1351	Hex Nut 1/4-20
7	16	FAS-2354	Hex Hd Cap Scr 1/4-20 x 1-3/4"
8	2	SEO-3590	Roller Bearing Assembly
9	16	WAS-0240	1/4 SAE Washer
10	1	CWO-3344	MM-1 Rail Backer Plate

SEO-3590 ROLLER BLOCK ASSEMBLY / EXPLODED VIEW / PARTS LIST
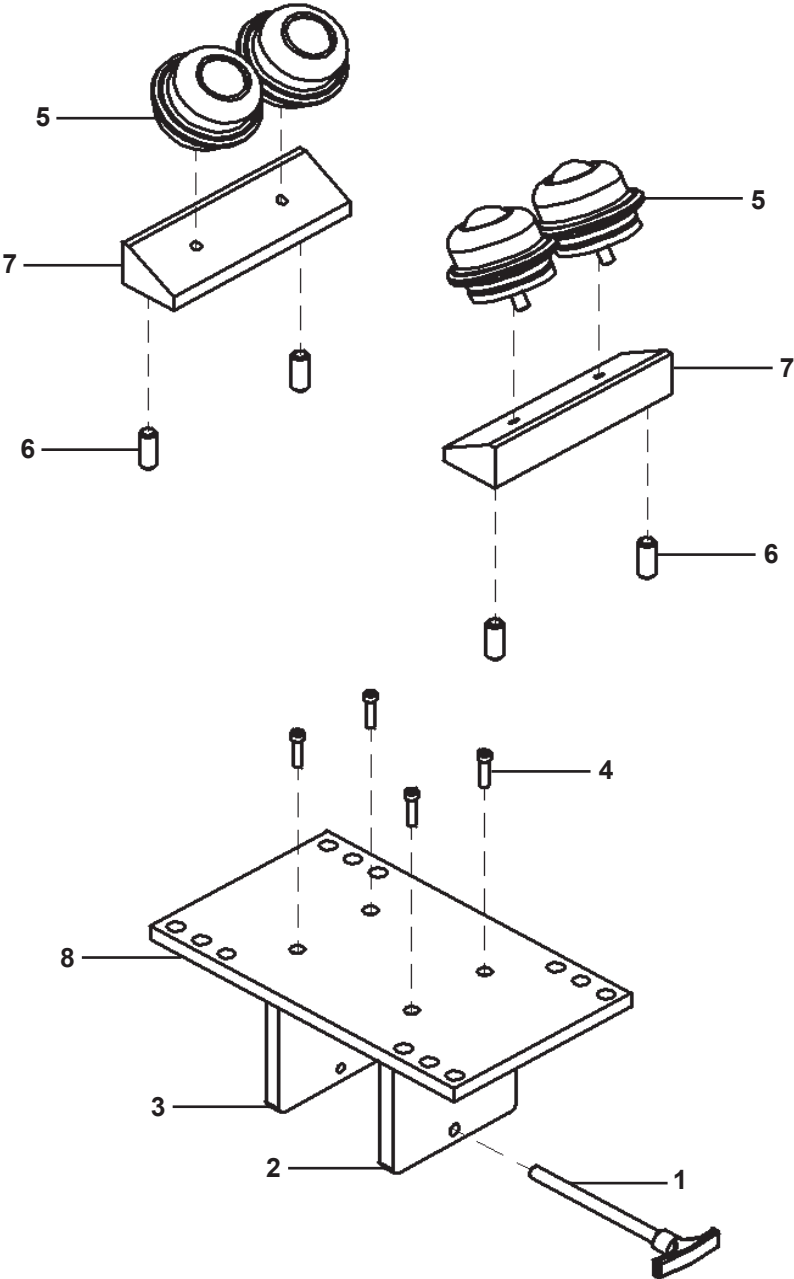
ITEM	QTY	PART NO.	DESCRIPTION
1	1	CWO-3342	T-Handle w/Stud SS 3/8-16
2	1	CWO-3584	Roller Clamp Block "B"
3	1	CWO-3586	Roller Clamp Block "A"
4	4	FAS-0559	Soc Hd Cap Scr 1/4-20x1"
5	4	SEO-3591	Roller Bearing 1-1/2" Ball
6	4	SEO-3592	1/2" Diameter Pin
7	2	SEO-3593	Angle Block
8	1	SEO-3594	Bottom Plate

SEO-4550/SEO-4552 MM-1 HEAD STOCK / EXPLODED VIEW / PARTS LIST

RIGHT SIDE EXTERIOR VIEW
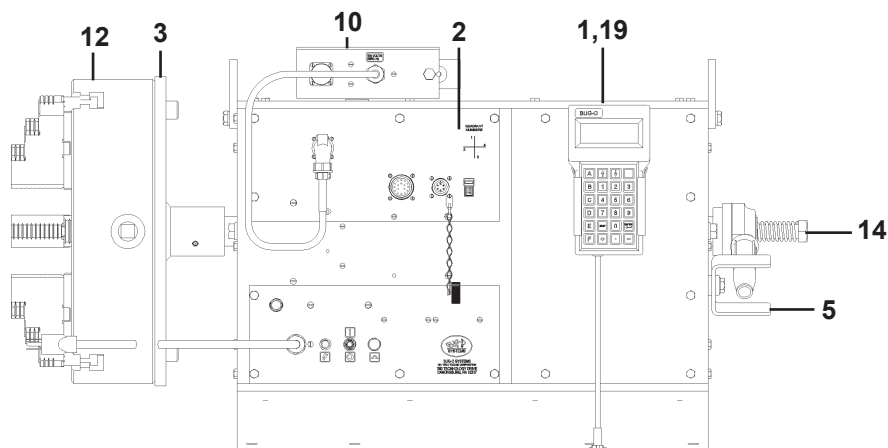
CWO-5925 - jaw extension for 24" models

RIGHT SIDE EXTERIOR VIEW
VARIOUS ITEMS OMITTED FOR CLARITY

SAME SETUP
BOTH SIDES

ITEM	QTY	PART NO.	DESCRIPTION
1	1	BUG-6050	Hand Held Terminal
*2	2	CBO-4160	MM-1 Control Panel (120 VAC)
*2	2	CBO-4162	MM-1 Control Panel (240 VAC)
3	1	CWO-3640	16" Chuck Plate Assembly
4	1	CWO-3730	MM-1 Encoder Assembly
5	1	CWO-3875	Rotary Ground Bracket
6	1	CWO-3985	SE-4 Cabinet Assembly
7	2	CWO-4345	Flange Bearing
8	2	CWO-4946	Lifting Eye
9	1	CWO-5074	1-1/2" ID Trantorque
10	*	CWO-5485	MM-1 Contact Relay (120 VAC)
10	*	CWO-5487	MM-1 Contact Relay (240 VAC)
11	1	CWO-5735	10" Diameter Aluminum Gear
12	1	CWO-5924	Chuck 16" 3-Jaw
13	1	CWO-9196	SE-4 Shaft
14	1	CWO-9216	Rotary Ground
15	1	CWO-9440	MM-1 H.D. Motor Assembly
16	4	FAS-0305	Hex Hd Cap Scr 1/2-13 x 2"
17	4	FAS-1301	Hex Nut 1/2-13
18	4	FAS-0399	Hex Hd Cap Scr 3/8-16 x 1"
19	1	SEO-4165	Terminal Holster Assembly
20	4	WAS-0262	3/8" Split Lock Washer
21	4	WAS-0281	1/2" Split Lock Washer

* Determined by Machine Voltage

CWO-3730 ENCODER ASSEMBLY / EXPLODED VIEW / PARTS LIST
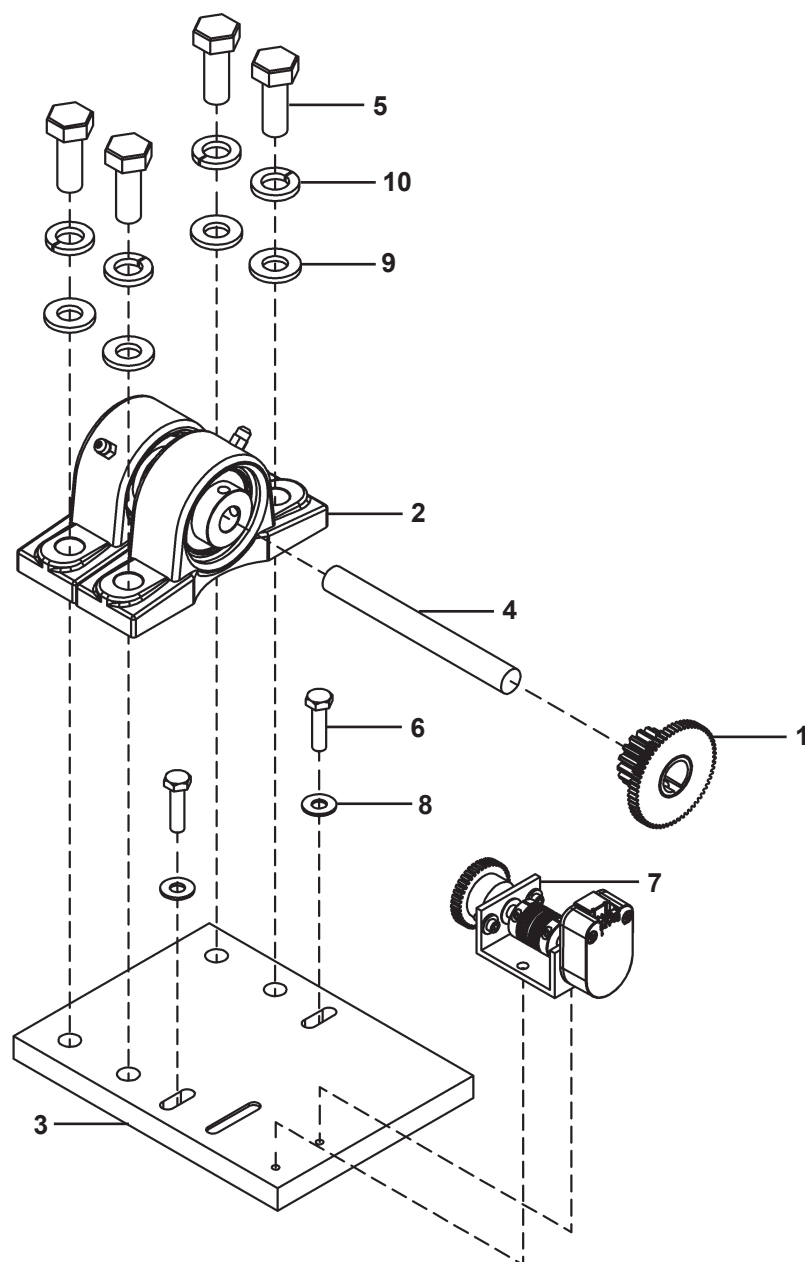
ITEM	QTY	PART NO.	DESCRIPTION
1	1	CWO-3352	MM-1 Encoder Gear Assembly
2	2	CWO-5271	1/2" Pillow Block
3	1	CWO-9441	Encoder Mount Plate
4	1	CWO-9442	Encoder Shaft
5	4	FAS-2301	Hex Hd Cap Scr 1/2-13 x 1-1/4"
6	2	FAS-0359	Hex Hd Cap Scr 1/4-20 x 1"
7	1	SEO-4155	Encoder Assy.
8	2	WAS-0240	1/4" SAE Washer
9	4	WAS-0280	1/2" Washer
10	4	WAS-0281	1/2" Lock Washer

CWO-3985 CABINET ASSEMBLY / EXPLODED VIEW / PARTS LIST

FAS-0357 Hex Hd Cap Scr 1/4-20 x 3/4"
Use Qty. 66 to mount Items 6, 7 8, 9, & 10
to Items 3, 4, & 5.

WAS-0240 1/4" Washer
Use Qty. 66 to mount Items 6, 7, 8, 9, & 10
to Items 3, 4, & 5.
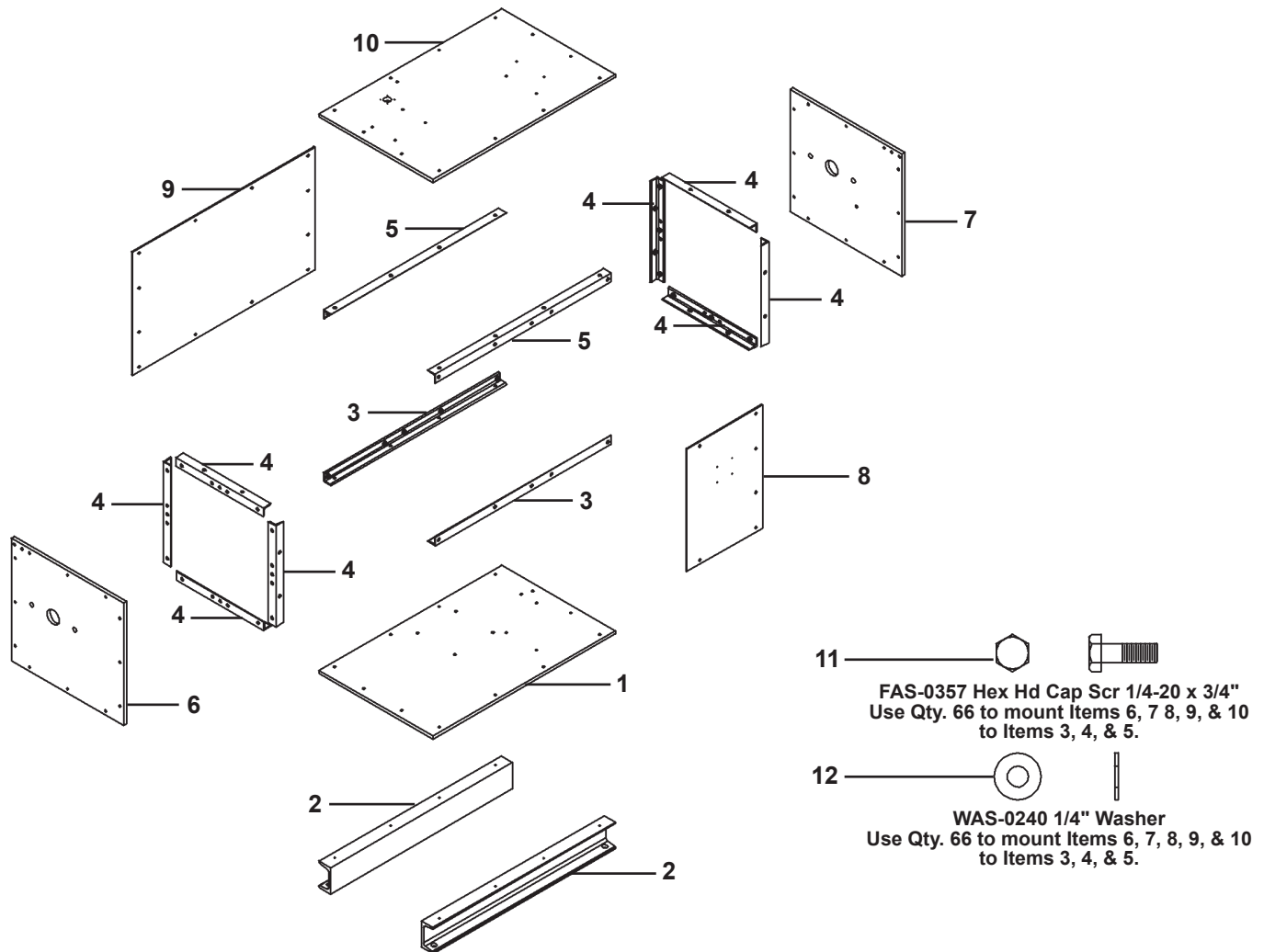
ITEM	QTY	PART NO.	DESCRIPTION
1	1	CWO-5221	Bottom Plate
2	2	CWO-5222	Channel Support Leg
3	2	CWO-5223	L & R Sides to Base Corner Mount Angle
4	8	CWO-5224	F & B Plates Corner Mount Angle
5	2	CWO-5225	L & R Sides to Top Corner Mount Angle
6	1	CWO-5226	Front Plate
7	1	CWO-5227	Back Plate
8	1	CWO-5228	Right Side Plate
9	1	CWO-5229	Left Side Plate
10	1	CWO-5231	Top Plate
11	76	FAS-0357	Hex Hd Cap Scr 1/4-20 x 3/4"
12	66	WAS-0240	1/4" Washer

CWO-9440 MOTOR ASSEMBLY / EXPLODED VIEW / PARTS LIST
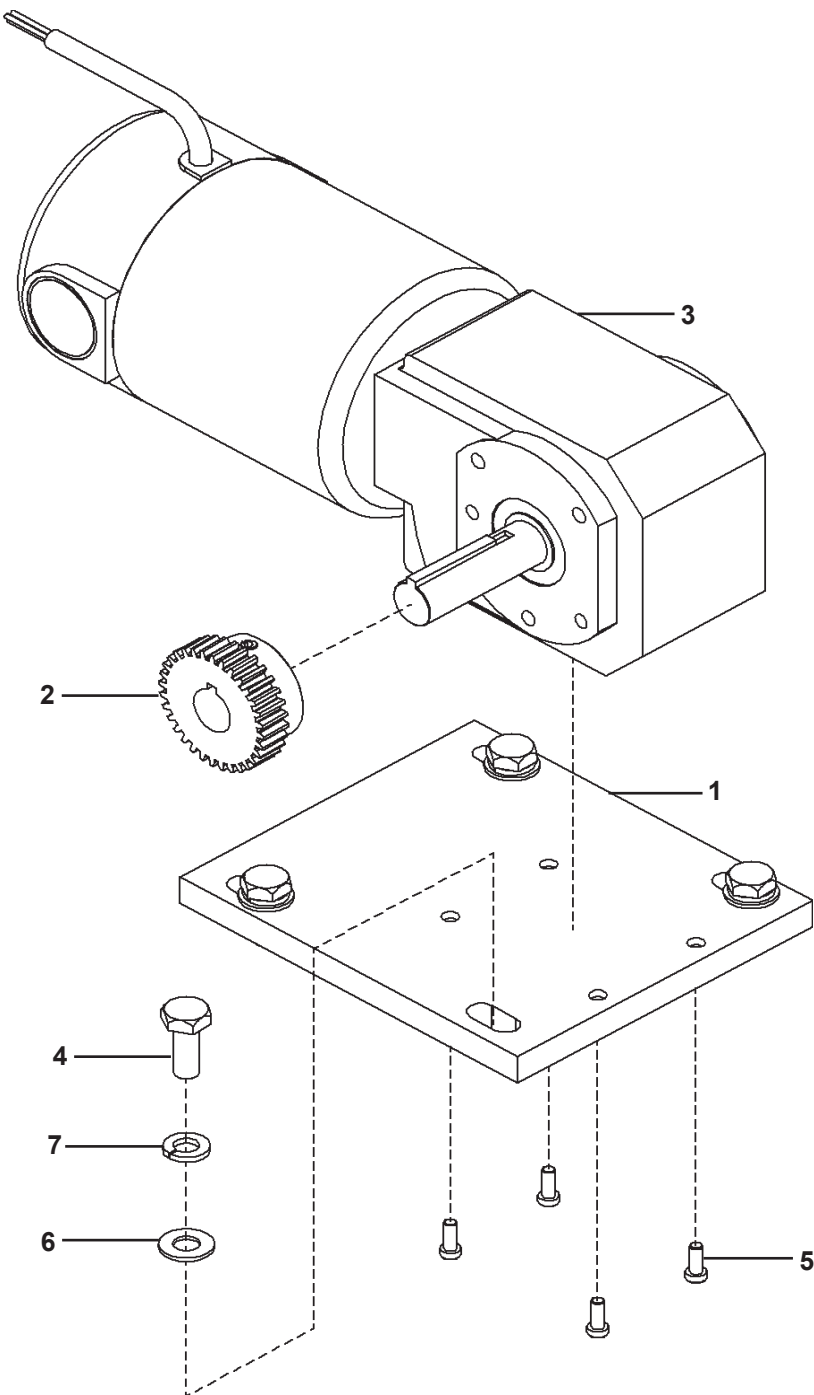
ITEM	QTY	PART NO.	DESCRIPTION
1	1	CWO-9433	Motor Mount Plate H.D.
2	1	CWO-9439	Gear, P.M. Motor 4060
3	1	CWO-9444	Right Angle DC Motor 4062
4	4	FAS-0399	Hex Hd Cap Scr 3/8-16 x 1"
5	4	FAS-0555	Soc Hd Cap Scr 1/4-20 x 1/2"
6	4	WAS-0280	3/8" Washer
7	4	WAS-0262	3/8" Split Lock Washer

BUG-6050 HAND HELD PENDANT / WIRING DIAGRAM / PARTS LIST

BUG-6050-P
HAND HELD PENDANT

BUG-9906
CABLE CONNECTOR,
6-T, MALE

BLK (SHIELD)
RED
BRN
ORG
YEL

(FRONT VIEW)
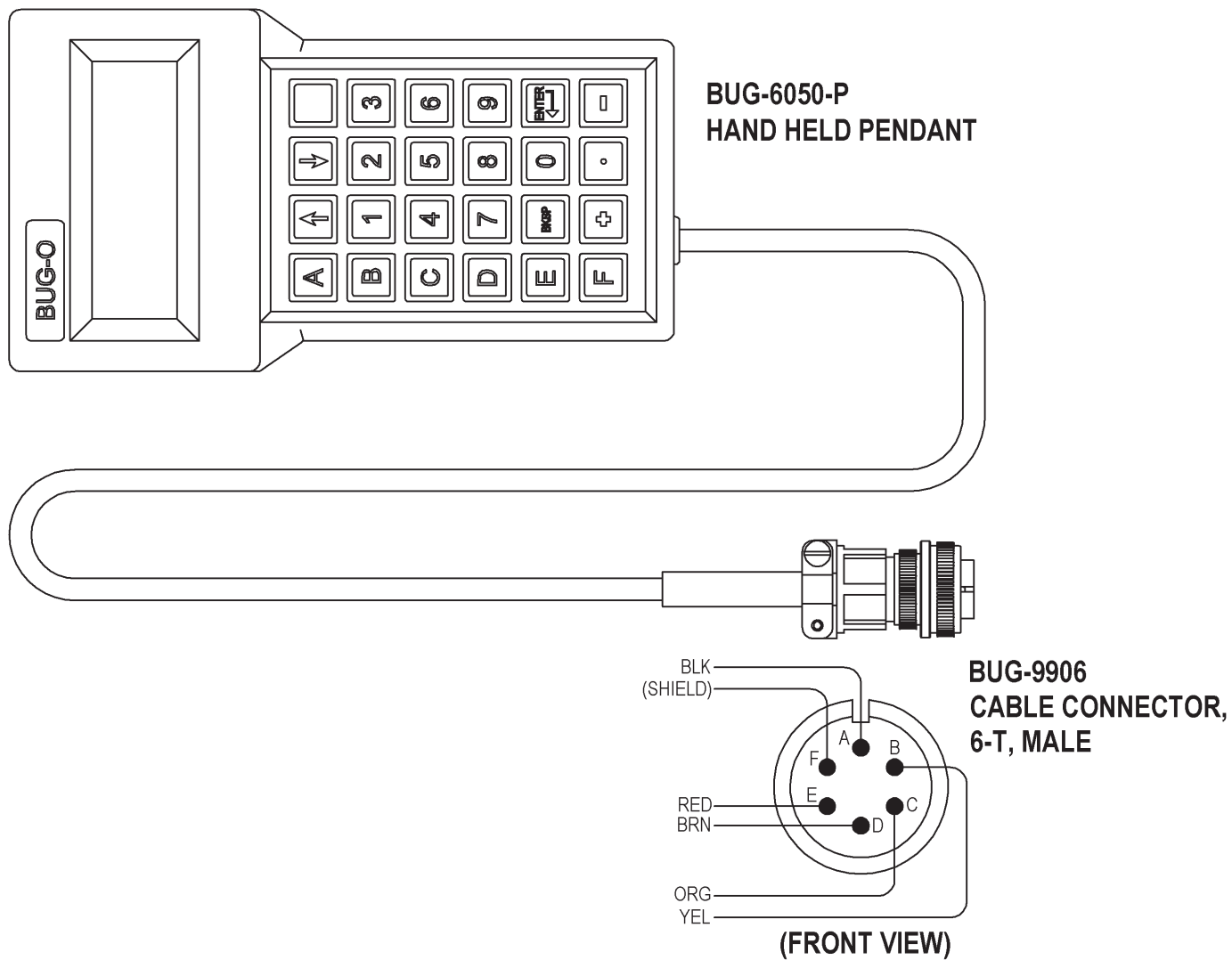
PIN	COLOR	DESCRIPTION
A	Black	Circuit Com
B	Yellow	TX (Transmit)
C	Orange	RX (Receive) 960 Baud
D	Brown	Signal
E	Red	Power (5 V)
F	Bare	Shielded Drain Wire, Touching Foil Shielding

CBO-4119 INTERCONNECTING WIRING HARNESS
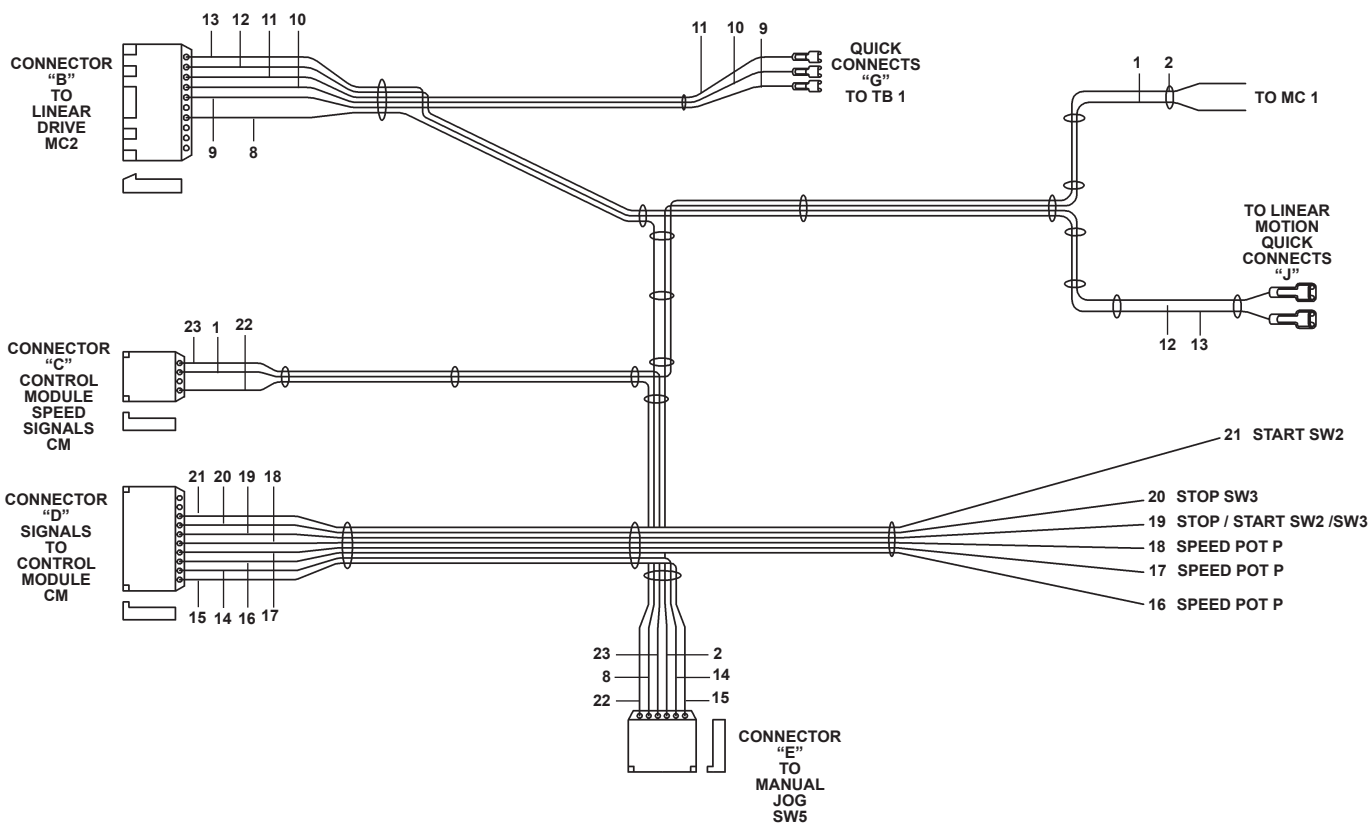
WIRE NO.	COLOR
1	Blue
2	Pink
3	Tan
4	Blue
5	Tan
6	Pink
7	Gray
8	Orange
9	Tan
10	Blue
11	Tan
12	Orange

WIRE NO.	COLOR
13	Brown
14	Brown
15	Gray
16	Blue
17	Yellow
18	White/Blue
19	Blue
20	Red
21	Green
22	Orange
23	Pink

CBO-4160/CBO-4162 MM-1 CONTROL PANEL / WIRING DIAGRAM

ITEM	DESCRIPTION	CBO-4160 120 VAC#	CBO-4162 240 VAC#
	ELECTRICAL COMPONENT CHART		
CB	Circuit Breaker	BUG-2931	BUG-2923
PC	Power Cord	BUG-9445	GOF-3115
PL	Pilot Light	BUG-1415	BUG-1428
T	Transformer	BUG-5218	BUG-5231
VT	Volt Trap	BUG-1393	BUG-1563
MC1	Speed Control Board	CWO-6520	CWO-6522
MC2	Motor Control Board	BUG-1770	
CM	Control Module	SEO-6030-2F	
CN1	Connector (Pendant)	BUG-9902	
CN2	Connector (Aux.)	MUG-1156	
CN3	Connector (Remote)	BUG-5527	
LF	Line Filter	BUG-6069	
P	Potentiometer	BUG-9686	
SW1	Toggle Switch (Power)	ARM-2279	
TB	Terminal Block	BUG-6028	
FU	5 A Fuse	CWO-6076	
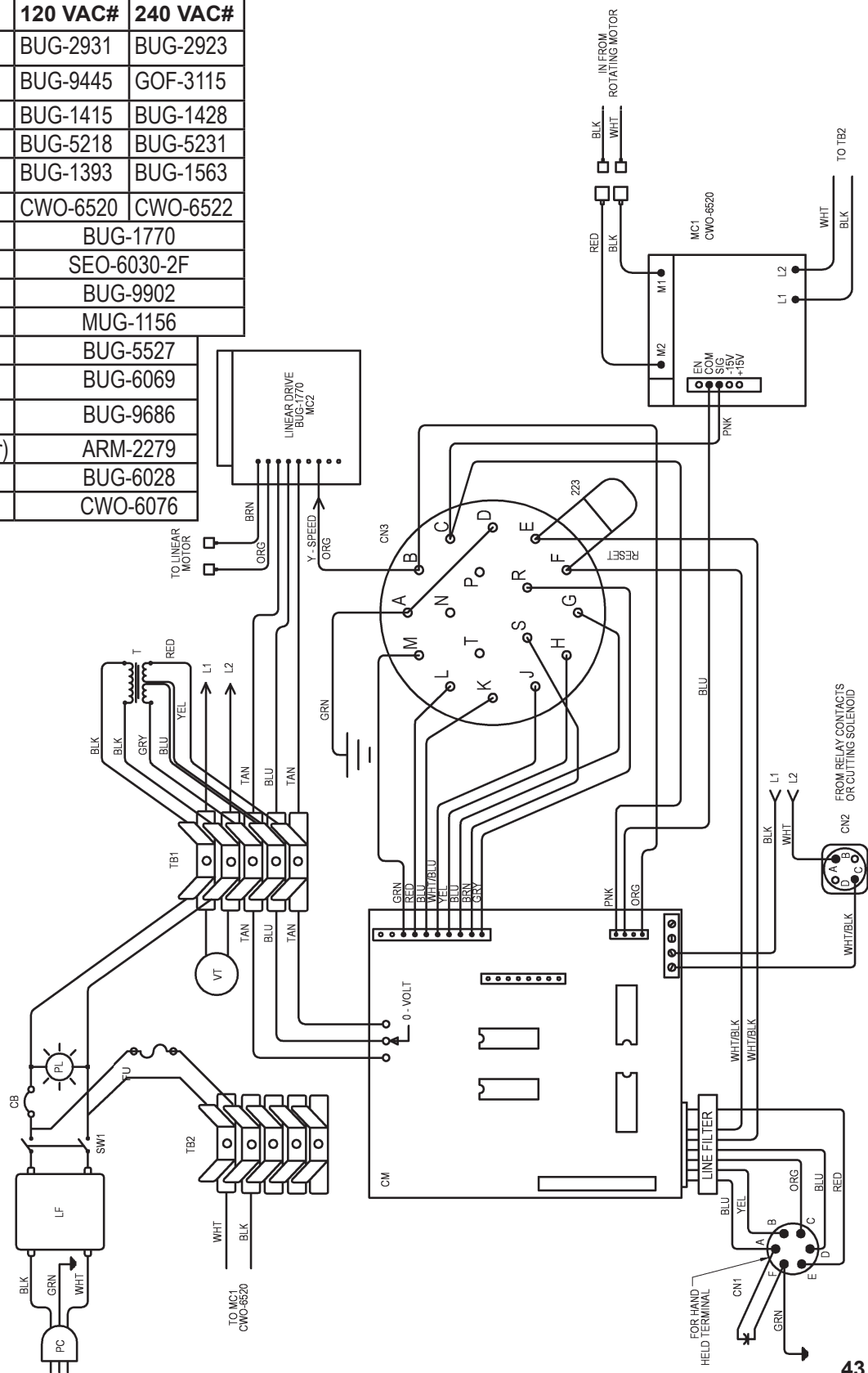
CBO-4170 MM-1 REMOTE PENDANT / WIRING DIAGRAM

SPEED
BUG-9686
(REAR SHOWN)

STOP
SWT-1112

START
SWT-1113

RESET
SWT-1111

WHT/BLU

YEL

BLU

JOYSTICK CONNECTOR
CNN-0126

WHT/BLK

BLU

WHT/BLK

RED

GRN

ORG

PNK

BRN

GRY

A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T
	Y SPD	X SPD				0V	SV	8V	0V	5V (PU)	5V (PU)			-SV	SV	

PANEL CONNECTOR, 17-T, F
BUG-5527
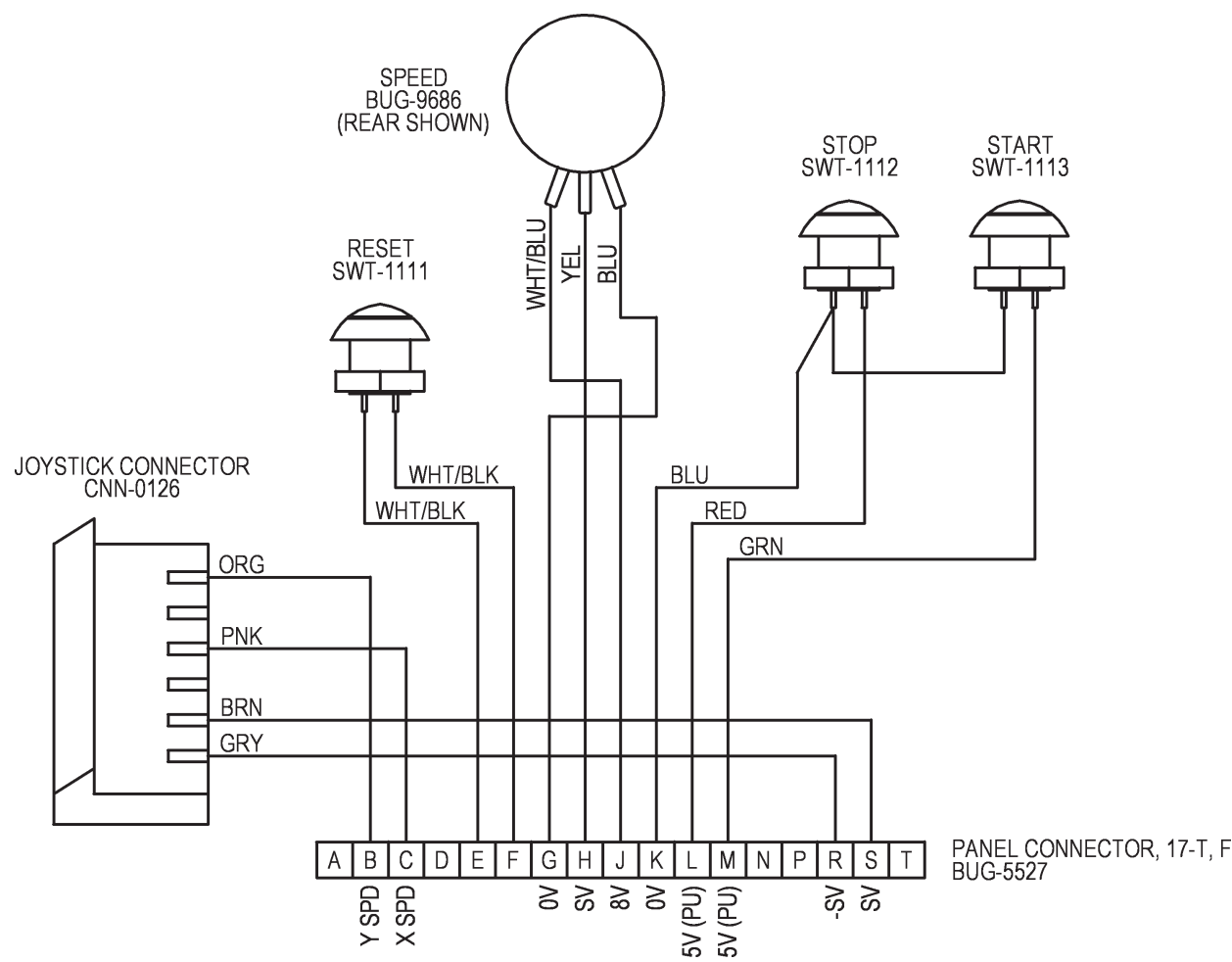
CBO-4171-__ MM-1 PENDANT CABLE: WIRING DIAGRAM

(DRAIN)

RED
PAIR 5
BLK

BLK
PAIR 1
RED

RED
PAIR 4
BLK

(DRAIN)

RED
PAIR 6
BLK

BLK
PAIR 2
RED

BLK
PAIR 3
RED

PENDANT END CONNECTOR
(FRONT VIEW)

(DRAIN)

RED
PAIR 5
BLK

BLK
PAIR 1
RED

RED
PAIR 4
BLK

(DRAIN)

RED
PAIR 6
BLK

BLK
PAIR 2
RED

BLK
PAIR 3
RED

PANEL END CONNECTOR
(FRONT VIEW)
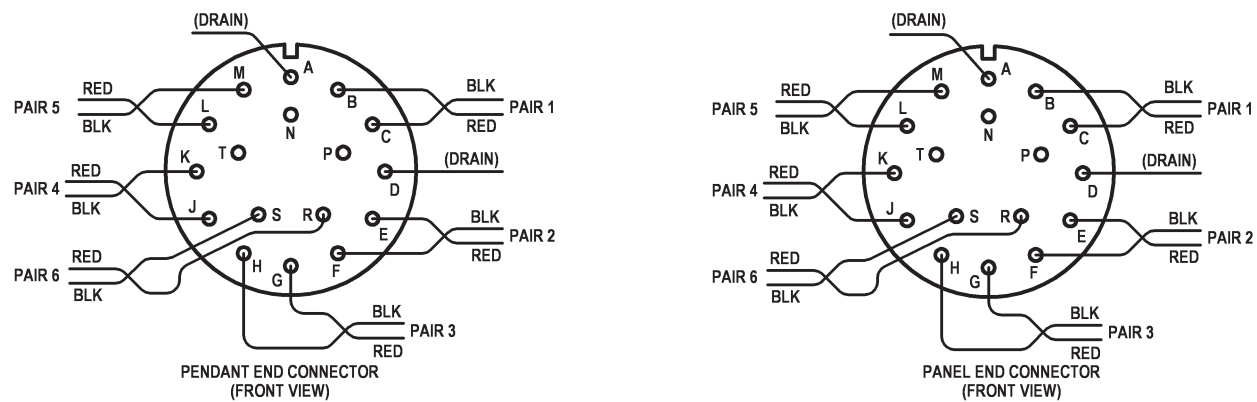
SEO-4123 ENCODER WIRING HARNESS / WIRING DIAGRAM / PARTS LIST

BUG-9902

C1 (2)
TRIM LEAD TO
MINIMUM LENGTH

(8) BUG-6106

CNN-0128

ORG 18"LG
YEL 18" LG
BLU 18" LG
BRN 18" LG

A
B
C
F
E
D

BRN18" LG
BLU 18" LG
YEL 18" LG
ORG 18" LG

(6) TIE WRAPS

BRN 14" LG
ORG 14" LG

(2) GOF-3037

CBP-1598-2

BRN
BLU
ORG
YEL
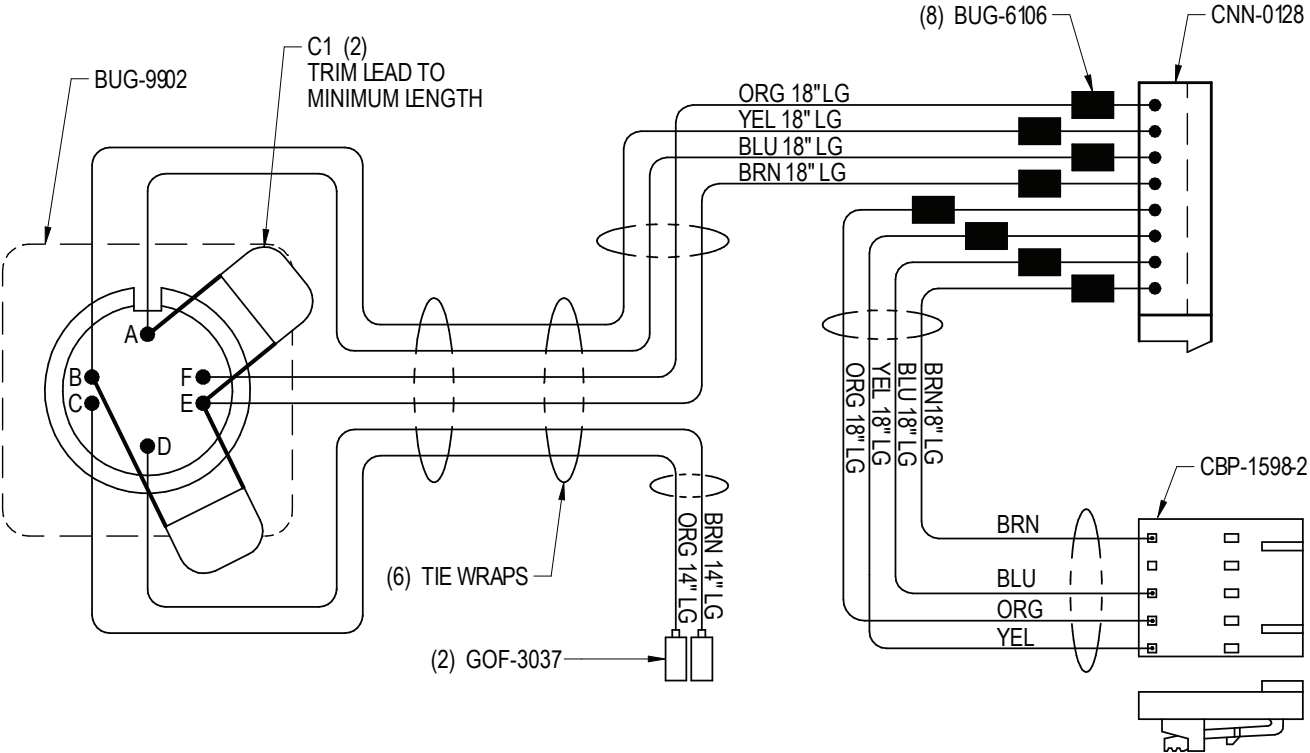
CN2 CONTACT OUTPUT CONNECTOR

When the machine is set-up for plasma cutting, an external contact relay box is connected to CN2. When the machine is set up for oxy-fuel cutting, a manifold solenoid is connected to CN2.

CN2 outputs 120VAC or 240VAC (CN2 output voltage depending upon system input voltage) across pins A & C when the system is activated. For oxy-fuel applications, this can drive a manifold solenoid directly.

For plasma cutting applications, an external relay box is connected to CN2 providing 2 sets of independent relay contacts.

Note: The solenoid & relay activation voltage must match the system input voltage.
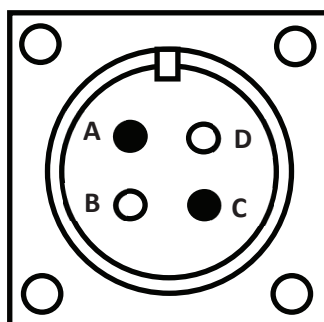
CN2
(FRONT VIEW)

OPERATION CHECKLIST AND TROUBLESHOOTING

1. Plug in the machine to the required voltage source and turn "ON / OFF" switch to the "ON" position. Operate the "MANUAL JOG" switch in all four directions. This overrides any speed command from the computer control. If the drive runs in the corresponding direction, and the speed can be varied with the "SPEED CONTROL" this indicates:
   • The speed control board is operating properly
   • The controller circuit is supplying the required voltages

   If only one motor does not run correctly and the other one does, then it is likely that the motors speed control is faulty.

   If both do not operate properly, then there may be a component on the control module that prevents proper voltages from being supplied to the "MANUAL JOG" switch.

   A bad connection in the speed signal line to the speed board may also run the motor in one direction at full speed.

Manual controls must function properly before checking the computer controls.

2. Attach the Handheld Pendant and push the "RESET" button on the control panel. The display should read "Reset OK". Press the "D" Key on the Pendant keypad and press "Return" until the display shows the Cut No. and the data for that programmed cut. If the Pendant display functions, this indicates:
   • The communication line is functioning
   • The computer is operating its program

   If the message "Reset OK" comes up but pressing "D" on the pendant keypad or any other key has no effect, there could be a false signal coming in from the "STOP / RESUME" button, due to a wire short or damage switch.

3. Disconnect the Handheld Pendant and turn the "ON / OFF" switch to the "OFF" position.

   Toggle the "MANUAL JOG" switch in all four directions after pushing the "RESET" button. When the "MANUAL JOG" switch is let go, the machine should go back to its original position.

   This confirms that the computer control is running its program, and also interfacing correctly with the encoders and the speed signal outputs to the speed boards.

   If one motor returns home and not the other, then the computer may not be receiving the encoder signals properly from that axis encoder. This may be due to:
   • A fault in the encoder
   • The encoder pickup gear not being engaged with the gear rack
   • The coupling connecting the gear to the encoder may be loose
   • The pins in the encoder plug may not be making a good connection

   If the motor returns home from one direction but not from the other, the speed control may be faulty and drive only in one direction.

PROGRAMMED DIAGNOSTICS FOR THE MM-1

Some simple diagnostic tests are available in the program, by using the Hand Held terminal. These require using the "Shift" key on the keypad; refer to the keypad character map for shifted characters, to use these commands.

First, change function to the PIPE PROGRAM to perform the following tests.

Press "T" for Test
  • The display should show "D-E-F"

Next press   D to check Drives
               E for Encoders
               F to Finish; get back to main menu

After selecting either D or E, for Drive or Encoder, the display will read "Axis No."

Press 1 for Axis 1: rotation, or 2 for Axis 2: longitudinal motion.

If Drive was selected, the corresponding axis selected should run
               1 second forward   (display will show 'F')
               2 second back (display will show 'B')
The drive should move at the speed set by the speed pot, regardless of whether encoder pulses are being counted.

If Encoder was selected, the encoder count of the corresponding encoder (1 or 2) should scroll up continuously in the display Press any key to stop.
     Rotating the encoder in either direction will increase or decrease the displayed count, if the computer is successfully counting the pulses from it. The encoder can be rotated manually if disengaged, or by using the joystick to move in the desired direction.

     Note: the count is in hexadecimal notation (number base 16),
     (10 H =16 decimal, 400 H = 1024 decimal).

     1 rotation of the encoder corresponds to 400 (HEX) counts

Program Version:
Press "V" to determine the Version. No; e.g. SE2F20, which will show on the display.

WARRANTY

Limited 3-Year Warranty*	**Model** _____ **Serial No.** _____ **Date Purchased:** _____ **Where Purchased:** _____

For a period ending one (1) year from the date of invoice, Manufacturer warrants that any new machine or part is free from defects in materials and workmanship and Manufacturer agrees to repair or replace at its option, any defective part or machine. HOWEVER, if the invoiced customer registers the Product Warranty by returning the Warranty Registration Card supplied with the product within 90 days of the invoice date, or by registering on-line at www.bugo.com, Manufacturer will extend the warranty period an additional two (2) years which will provide three (3) total years from the date of original invoice to customer. This warranty does not apply to machines which, after Manufacture's inspection are determined by Manufacturer to have been damaged due to neglect, abuse, overloading, accident or improper usage. All shipping and handling charges will be paid by the customer.

The foregoing express warranty is exclusive and Manufacturer makes no representation or warranty (either express or implied) other than as set forth expressly in the preceding sentence. Specifically, Manufacturer makes no express or implied warranty of merchantability or fitness for any particular purpose with respect to any goods. Manufacturer shall not be subject to any other obligations or liabilities whatsoever with respect to machines or parts furnished by Manufacturer.

Manufacturer shall not in any event be liable to Distributor or any customer for any loss of profits, incidental or consequential damages or special damages of any kind. Distributor's or customer's sole and exclusive remedy against Manufacturer for any breach of warranty, negligence, strict liability or any other claim relating to goods delivered pursuant hereto shall be for repair or replacement (at Manufacturer's option) of the machines or parts affected by such breach.

Distributor's Warranty:

In no event shall Manufacturer be liable to Distributor or to any customer thereof for any warranties, representations or promises, express or implied, extended by Distributor without the advance written consent of Manufacturer, including but not limited to any and all warranties of merchantability or fitness for a particular purpose and all warranties, representations or promises which exceed or are different from the express limited warranty set forth above. Distributor agrees to indemnify and hold Manufacturer harmless from any claim by a customer based upon any express or implied warranty by Distributor which exceeds or differs from Manufacturer's express limited warranty set forth above.

HOW TO OBTAIN SERVICE:
If you think this machine is not operating properly, re-read the instruction manual carefully, then call your Authorized BUG-O dealer/distributor. If they cannot give you the necessary service, write or phone us to tell us exactly what difficulty you have experienced. BE SURE to mention the MODEL and SERIAL numbers.

*Bug-O System's warranty applies to Bug-O components only. Where other brands of power sources, wire feeders or sub components are a part of Bug-O Equipment, please refer to that specific Manufacturer's manual for warranty specifications on their components.