

INSTRUCTIONS AND PARTS MANUAL

PROGRAMMABLE SHAPE MACHINE

Bug-O Systems is guided by honesty, integrity and ethics in service to our customers and in all we do.

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.

LIT-PSM-IPM-0611



BUG-O SYSTEMS

A DIVISION OF WELD TOOLING CORPORATION



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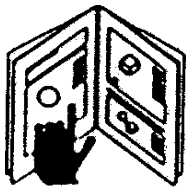
SAFETY

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. If 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 without 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. Remove from the worksite 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.

PROGRAMMABLE SHAPE MACHINE

INSTRUCTIONS AND PARTS MANUAL

TABLE OF CONTENTS PAGE

PAGE

5,6.....	Description & Operation
7.....	Shape Programming
8.....	Segment Types
9,10.....	Data Entry Required For Programming
11.....	Auxiliary Modes
12.....	Set % Speed, Fraction Of Set Speed
13.....	Example: Obround Shape
14.....	Repeat Function Example
15.....	Hand Held Pendant
16.....	Panel Controls
17.....	Rail Installation
18.....	Exploded View / BUG-6150 / Shape Machine
19.....	Parts List / Main Machine
20.....	Exploded View / BUG-6170 / Cover Assembly
21.....	Parts List / BUG-6170 / Cover Assembly
22.....	Exploded View / BUG-6160 / Base Assembly
23.....	Parts List / BUG-6160 / Base Assembly
24.....	Wiring Diagram / Programmable Shape Machine
25.....	Electrical Component Chart
26.....	Pendant Cable Wiring Diagram
27.....	Plasma Cutting
28.....	Operation Checklist & Trouble Shooting Guide
29.....	Programmed Diagnostics
30.....	Keypad Character Map
31.....	Warranty

-----CAUTION-----
DO NOT LEAVE EQUIPMENT
UNATTENDED WITH POWER ON.
BE CERTAIN POWER IS OFF WHEN
NOT IN USE!

PROGRAMMABLE SHAPE MACHINE

This is a 2-axis machine that runs on a track and carries a cutting torch on a motorized cross-arm. It can be used for flame or plasma cutting, or welding, of a variety of shapes programmed and stored in memory.

Description

The machine has 20 storage areas in memory for different programmed shapes, numbered 0 to 20. At any time, one of these shape numbers is the current one, and will stay current even when power is shut off and turned back on, until the shape number is changed by the operator.

All programming is done with the hand-held terminal provided; this may be plugged into the connector on the rear of the machine or unplugged at any time. The terminal is not needed to run the machine once programmed.

Shapes are built up only from the segments provided: 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 a number of times, also count as one segment each if used.

In normal operation, first position the machine at the starting point. Next turn on the preheat gases, and wait until the required preheat is reached. Push the Run 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 welding or plasma cutting, an external contact relay is used instead of the cutting oxygen solenoid).

Operation:

When first plugged in, the position the machine is in becomes the reference Start position. Now there are 3 options (the pendant terminal is not needed for the first two):

1. MOVE

To change the Start position, push the STOP/PAUSE button, move the machine manually to the required position using the toggle switches, and push the RESET button.

2. RUN

Push the START/RUN button to cut a shape.

3. PROGRAM (entry or change)

The Programming operation is selected by pressing keys A,B,C,D, and E.

A: All segments

Data entry for new shape consists of total number of segments

Data for each : Type (arc, x/y line or slope)

Quadrant 1-4

Size (radius, or x/y dimension) See SHAPE PROGRAMMING for details.

For example, a 2 inch diameter circle could be 4 Segments:

1. 2, 1, 100 Counterclockwise arc quadrant 1 1.00 inch radius
2. 2, 2, 100 Counterclockwise arc quadrant 2 1.00 inch radius
3. 2, 3, 100 Counterclockwise arc quadrant 3 1.00 inch radius
4. 2, 4, 100 Counterclockwise 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 terminal to re-program 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.

PROGRAMMABLE SHAPE MACHINE (CONT'D.)

C: Change Shape Number

Press C on terminal 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 there.

D: DISPLAY Shape Data

Press D to display the data for the current shape.

The terminal display shows 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. Acceleration occurs when the machine approaches the end of each segment. This is useful when the shape has sharp corners, to prevent overshoot, 99 is maximum slowdown, 0 is no slowdown.

IMPORTANT:

1. Once the STOP/PAUSE button is pressed, computer control is halted until the RUN or the RESET BUTTON is pressed. Therefore the programming cannot be done with the handheld terminal 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 new value, push E.

STEP BY STEP INSTRUCTIONS FOR OPERATION

1. Set up the main track that the machine is to run on parallel to work-piece. Slide the machine onto the track, front end first, so that the brass encoder gear on the underside engages the gear rack with all four wheels guiding the track. Connect the gas hoses to the manifold on the rear end.
2. Plug the machine into the power line of correct voltage, and push the Reset button.
3. Push the red STOP/PAUSE button and use the toggle switches to move the machine and cross rail to the starting position. Press the RESET button to make this the starting point.
4. Set the speed knob for correct speed. Speed can be checked by moving the machine manually using the toggle switches.
5. If the required shape has not been programmed, refer to SHAPE PROGRAMMING, and enter the program. If the shape has been programmed, turn on the preheat gases, set the torch height and ignite the torch.
6. When the work piece is heated enough, press the black RUN button. The solenoid will turn on the cutting oxygen, the machine will start moving along the programmed shape, and at the end of the shape it will stop and turn off the solenoid. Manually turn of the preheat gases. The machine is now ready for the next cut.

SHAPE PROGRAMMING

1. Draw the required shape on paper to some convenient scale.
2. Refer to the Segment Chart (Chart #1) 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 or off, or delay.
4. Number all the segments in sequence, including other operations if any, and make a table with required data. Example for a clockwise circle starting from the top:

(dimensions described for metric version)

Seg. 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 powered up and pendant plugged in, select which shape number this will be: say we want No. 3. Push C : display reads "Shape No._", Push 3 for No. 3, press ENTER key (backward arrow)
The program is now in Shape No. 3
6. Push A: display reads "Total segments?", Push 4 for 4 segments and ENTER. Display reads "1 Type?" waiting for Segment 1 data.
7. Push 1 for type, clockwise arc. (Refer to Chart #1).
Display reads "Quadrant?"
Push 1 for quadrant 1.
Display reads "mm x 10"
Push 3, 0, 0, ENTER, for 300, which is 30.0 mm.
Segment 1 has now been entered,
Display reads "2. Type?", asking for data for segment 2.
8. Repeat above steps to enter data for all segments, in sequence. Display will read "Ready" after all segments are entered. The shape program is now stored in memory as shape No. 3, and the machine is ready to cut the shape.

DATA ENTRY REQUIRED FOR PROGRAMMING

To program a complete new shape (press "A").

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

For each segment, ENTER

Type: select from 1 through 8

Quadrant: 1, 2, 3 or 4; refer to chart

Size: one or more dimensions per segment as described below; 100 per inch or 10 per mm (depending on machine version); or for time, 100 per second of delay.
Eg. 150 = 1.5", or for metric 375 = 37.5 mm.

Detailed description of Types:

Type 1. Clockwise, 90° arc segments.

Quadrant determined by which quarter of a full circle makes the arc. (See Chart #1).

Dimensions required: Radius only (See Chart #2).

Type 2. Counterclockwise, 90° arc segments.

Quadrant determined by which quarter of a full circle makes the arc. (See Chart #1).

Dimensions required: Radius only (See Chart #2).

Type 3. Line along X or Y axis.

Quadrant determined by direction of movement. (See Chart #1)

(East: 1, North: 2, West: 3, South: 4)

Dimensions required: Length only (See Chart #2).

Type 4. Angled straight line.

Quadrant determined by direction of movement. (See Chart #1)

(NE: 1, NW: 2, SW: 3, SE: 4).

Dimensions required: (1) X-dimension; movement along X axis.
(2) Y-dimension; movement along Y axis.

Type 5. Functions.

Quadrant determined by selecting function. (See chart #1)

1. Weld/oxygen ON.

Turn ON weld contact relay or cutting oxygen solenoid

Dimensions required: None.

2. Weld/oxygen OFF.

Turn off weld contact relay or cutting oxygen solenoid.

Dimensions required: None.

3. Pause.

Machine stops and waits until START/RUN button is pushed again.

Dimensions required: None.

4. Delay.

Machine stops and holds position for a programmed time period, up to 99.99 seconds.

Dimensions required: time in .01 second units. (eg. 2.5 seconds = 250)

DATA ENTRY REQUIRED FOR PROGRAMMING (CONT'D.)

Type 6. Special Functions.

Quadrant determined by selecting functions.

1. Repeat:

Another complete shape will be repeated the specified number of times.

Shape number of the repeated shape MUST BE LOWER than the Shape number of the current shape being programmed. Therefore it CANNOT BE USED IN SHAPE No. 0.

Data required:

- (1) Shape number to be repeated.
- (2) Number of times.

2. Ellipse:

This is provided for making a complete true ellipse, always starting from the left (West extremity) and moving clockwise.

Dimensions required:

- (1) Diameter along X-axis.
- (2) Diameter along Y-axis.

3. Auxiliary modes:

Provides commands to turn ON or OFF two line-switching outputs independently, and also switch speeds from set speed to Rapid Traverse and back. Mode numbers are from 1 to 8; see Chart #3 to select mode.

4. Set percent speed.

Used to change speed of the machine in the middle of a shape to a lower speed. See Chart #3.

Type 7: Clockwise arc, must be less than 180°.

Quadrant determined by direction of end point of arc relative to the start point. (See chart #2)

Dimensions required:

- (1) X-dimension; offset along X-axis from start to end point.
- (2) Y-dimension; offset along Y-axis from start to end point.
- (3) Radius of arc.

Type 8. Counterclockwise arc, must be less than 180°.

Quadrant determined by direction of end point of arc relative to the start point. (See chart #2)

Dimensions required:

- (1) X-dimension; offset along X-axis from start to end point.
- (2) Y-dimension; offset along Y-axis from start to end point.
- (3) Radius of arc.

AUXILIARY MODES: TYPE 6, QUADRANT 3

This function allows the 2 internal Solid State Relay outputs to be independently turned ON and OFF, providing control of 2 output signals; and also to switch the machine between Rapid Traverse mode and Set Speed.

The machine is shipped with OUTPUT (1) wired to the amphenol connector for the external relay or solenoid, using pins A and C. By default, this Output turns ON when the START button is pressed to run a shape, and turns OFF at the end of the shape. Both the contact relay and cutting solenoid use only Output (1).

OUTPUT (2) is present across pins A and D on the amphenol connector, but is not used by the standard relay box - a custom box has to be made to use this output. By default the output is OFF when a shape is started, until specifically turned ON by the Solenoid/Weld ON command Type 5, Quad 1.

Subsequently while running, the Type 5 ON and OFF commands turn both OUTPUTS On and Off together, and both turn Off at the end.

When programming Type 6 Quad 3, a Mode Number is required to be entered. The 8 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 setting. The combinations are listed in the table below:

AUXILIARY MODES 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

Chart #3

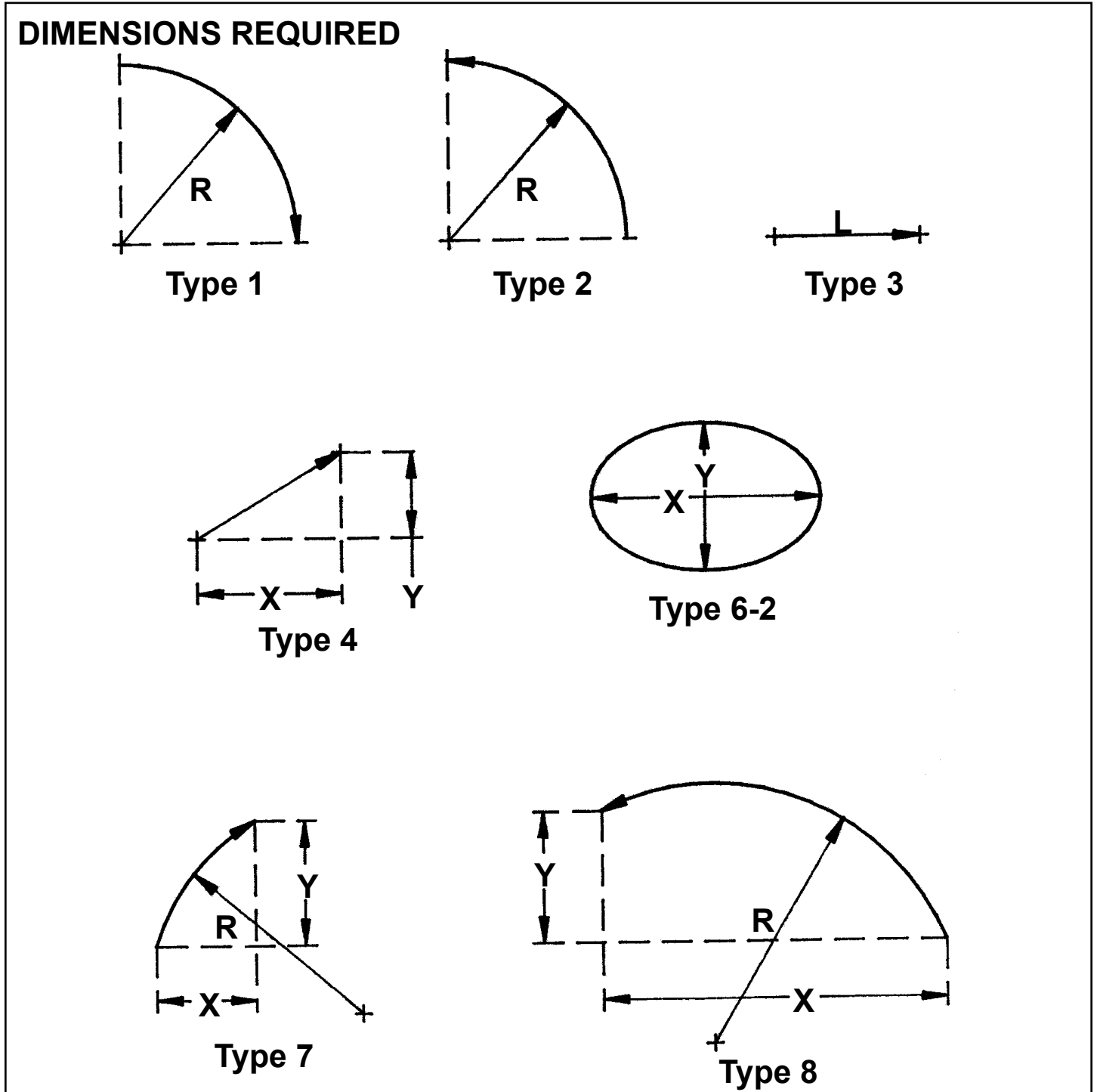
SET % SPEED, FRACTION OF SET SPEED: TYPE 6, QUADRANT 4

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

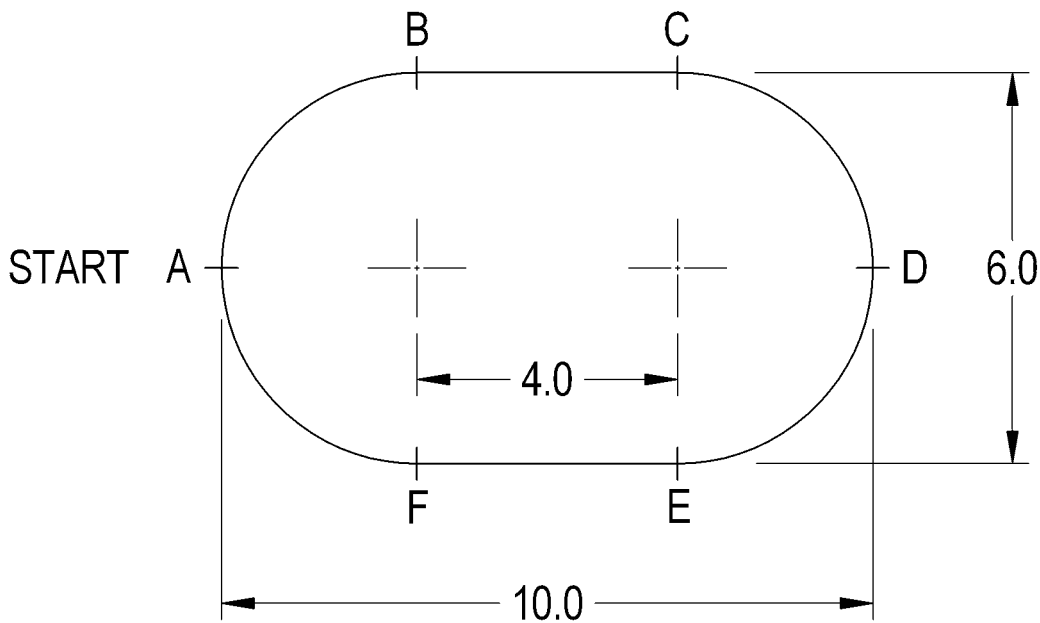
When the program reaches a Type 6-3 segment while running, the speed will change to the percent entered, and continue at this setting until there is a later Type 6-3 segment which changes it to another % setting or back to 100 %.

Note: If Type 6-3 has been set for Hi (rapid traverse) then this setting will cut down the Hi speed to the same percent.

Settings below 10% are not recommended.



EXAMPLE: OBROUND SHAPE



**Cutting path:
A-B-C-D-E-F-A**

Total Number of Segments = 6

Seg	No	Type	Quadrant	Size	Comment
AB	1	1	2	300	CW Arc, 3.00" rad
BC	2	3	1	400	X-axis line, 3.00"
CD	3	1	1	300	CW Arc
DE	4	1	4	300	CW Arc
EF	5	3	3	400	X-axis Line
FA	6	1	3	300	CW Arc

AB: Type 1 specifies Clockwise Arc

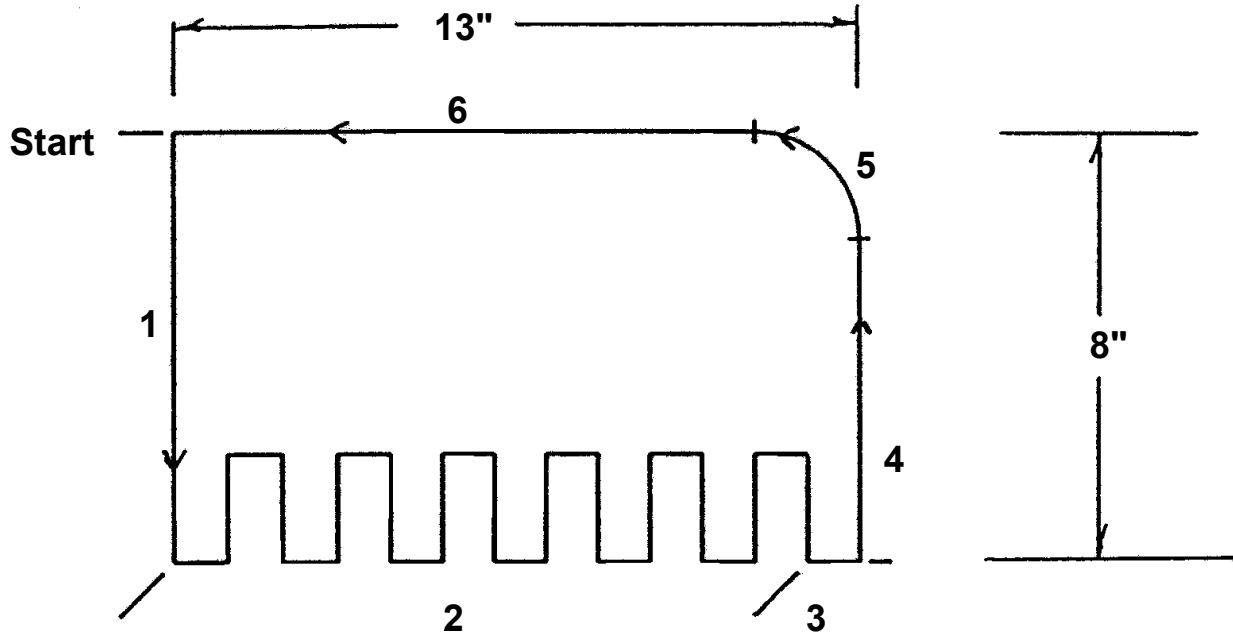
Quadrant No. is 2

Size 300 specifies Radius = 3.00 ins. (Metric: 300 = 30.0 mm)

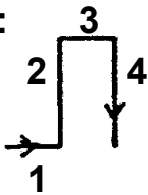
REPEAT FUNCTION EXAMPLE TYPE 6, QUADRANT 1

The shape shown has a rectangular tooth form repeated six times. The required shape is numbered Shape 2, and the four segment repeated tooth is Shape 1 so that it can be called for by Shape 2. (A Repeat in a program must call for a lower number shape).

Shape No. 2:

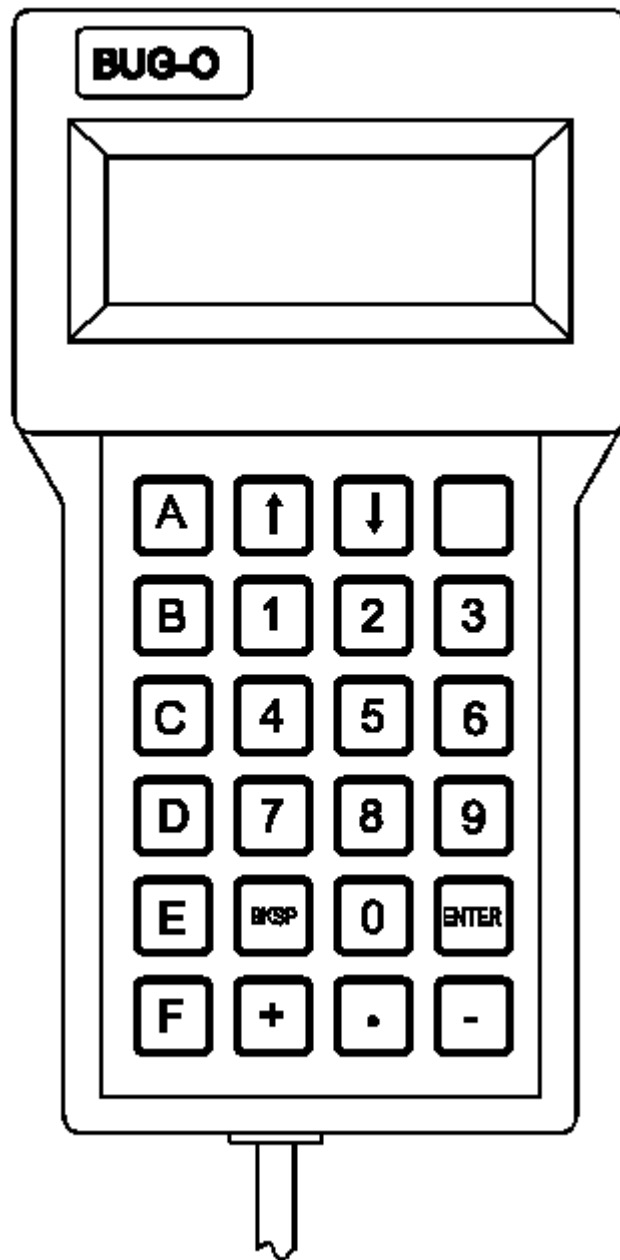


Shape No. 1:



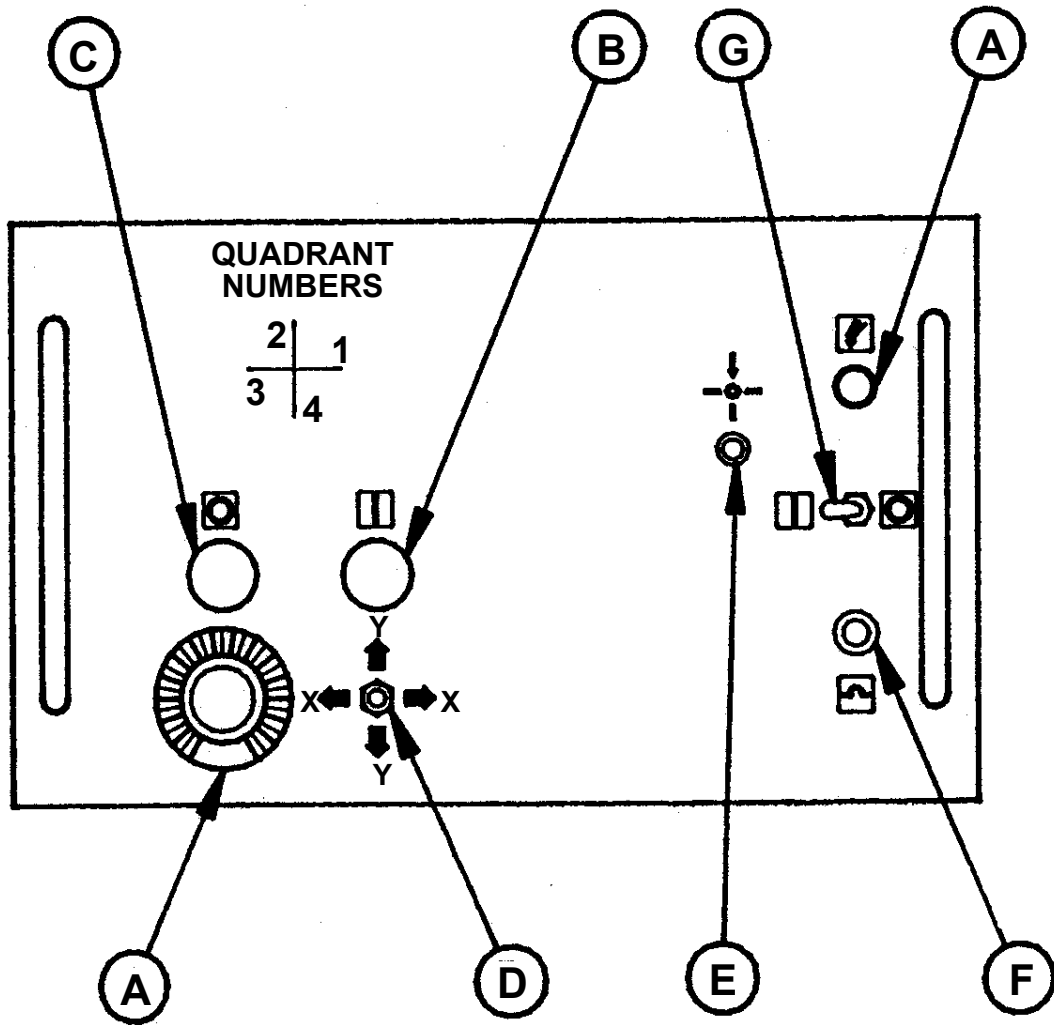
	<u>Segment</u>	<u>Type</u>	<u>Quad.</u>	<u>Dimension</u>	
Shape #1.	1.	3	1	100	
	2.	3	2	200	
	3.	3	1	100	
	4.	3	4	200	
Shape # 2.	1.	3	4	800	
	2.	6	1	1	(Repeat #1) (6 times)
				6	
	3.	3	1	100	
	4.	3	2	600	
	5.	2	1	200	
6.	3	3	1100		

HAND HELD PENDANT



This is a hand held terminal with keypad and display, which plugs into the control panel. Press keys A, B, C, D, or E for the function desired, as described in the Programming instructions on pages 4 & 5. Use the digit keys to enter move distances or other dimensions; push the ENTER button to store the numeric value entered. The BACKSPACE (BKSP) key deletes the last digit before pushing the ENTER button, in case a correction is required.

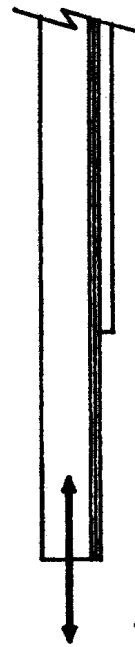
PANEL CONTROLS



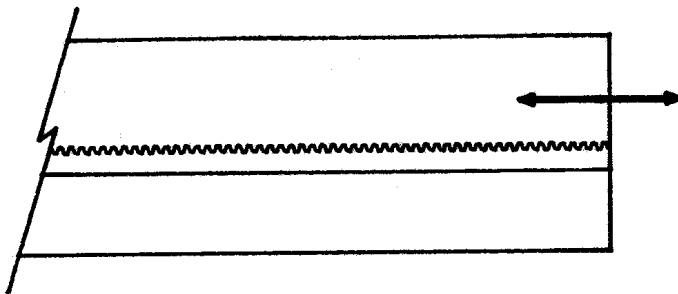
Panel Controls

- A. Speed
- B. Start/Run
- C. Stop/Pause
- D. Manual Jog/Move
- E. Reset
- F. Circuit Breaker
- G. On/Off Switch
- H. Pilot Light

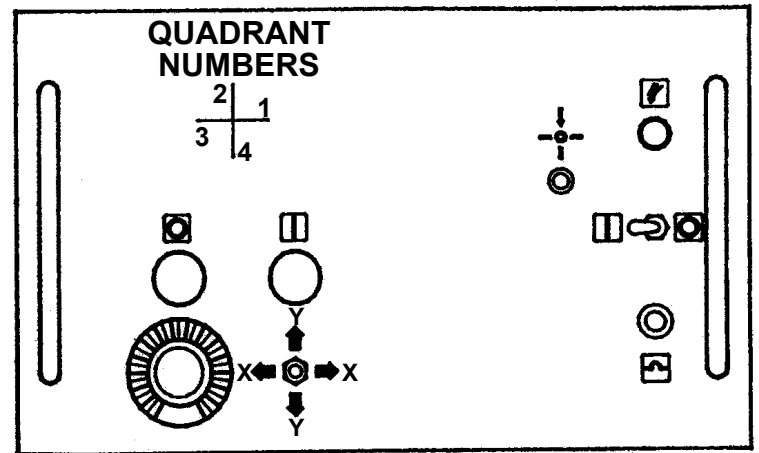
RAIL INSTALLATION



Install and remove cross-arm from this side.



Install and remove track from front of machine.



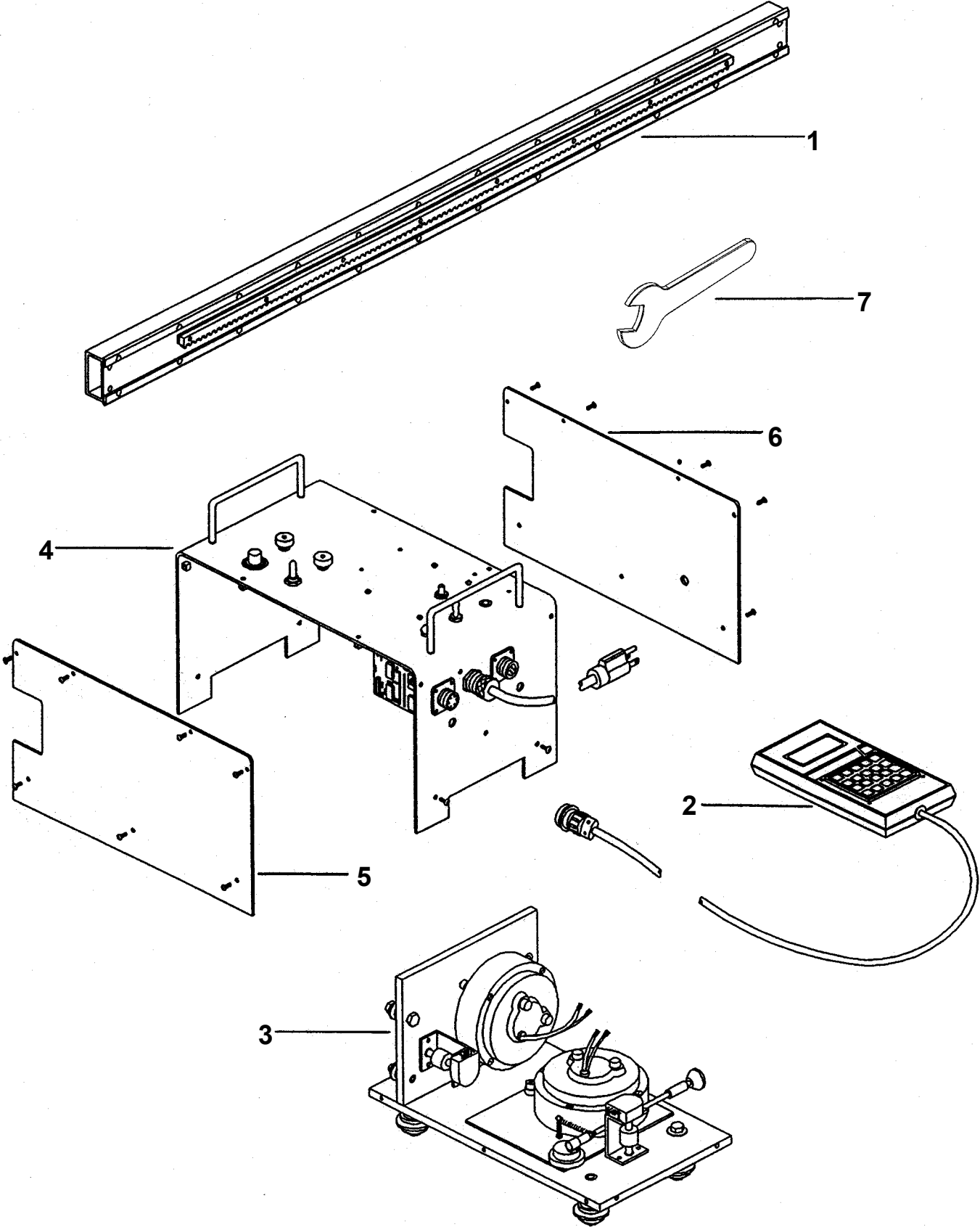
RAIL INSTALLATION

Before use, the cross-arm has to be inserted into the machine and the machine installed on the main track.

Declutch the main drive and slide the machine onto the main track in the direction shown. Be careful to align the wheels with the grooves in the rail. When the rail passes through the second pair of wheels the rack will engage the X-encoder gear under the machine. Roll the machine into position and push the clutch knob in to engage the tractor drive (X axis).

Insert the cross arm through the side of the machine in the direction shown. The grooved wheels will guide the arm until it is stopped by the cross-drive pinion. Push the RESET button, then push the RED Pause button. Set the speed to a low value, push in the cross-arm, and use the manual joystick to drive it in. As the rail goes through, see that the rack does not bind on the Y-encoder gear; if it hits a high spot, back off and carefully try again.

EXPLODED VIEW / BUG-6150 / SHAPE MACHINE



PROGRAMMABLE SHAPE MACHINE

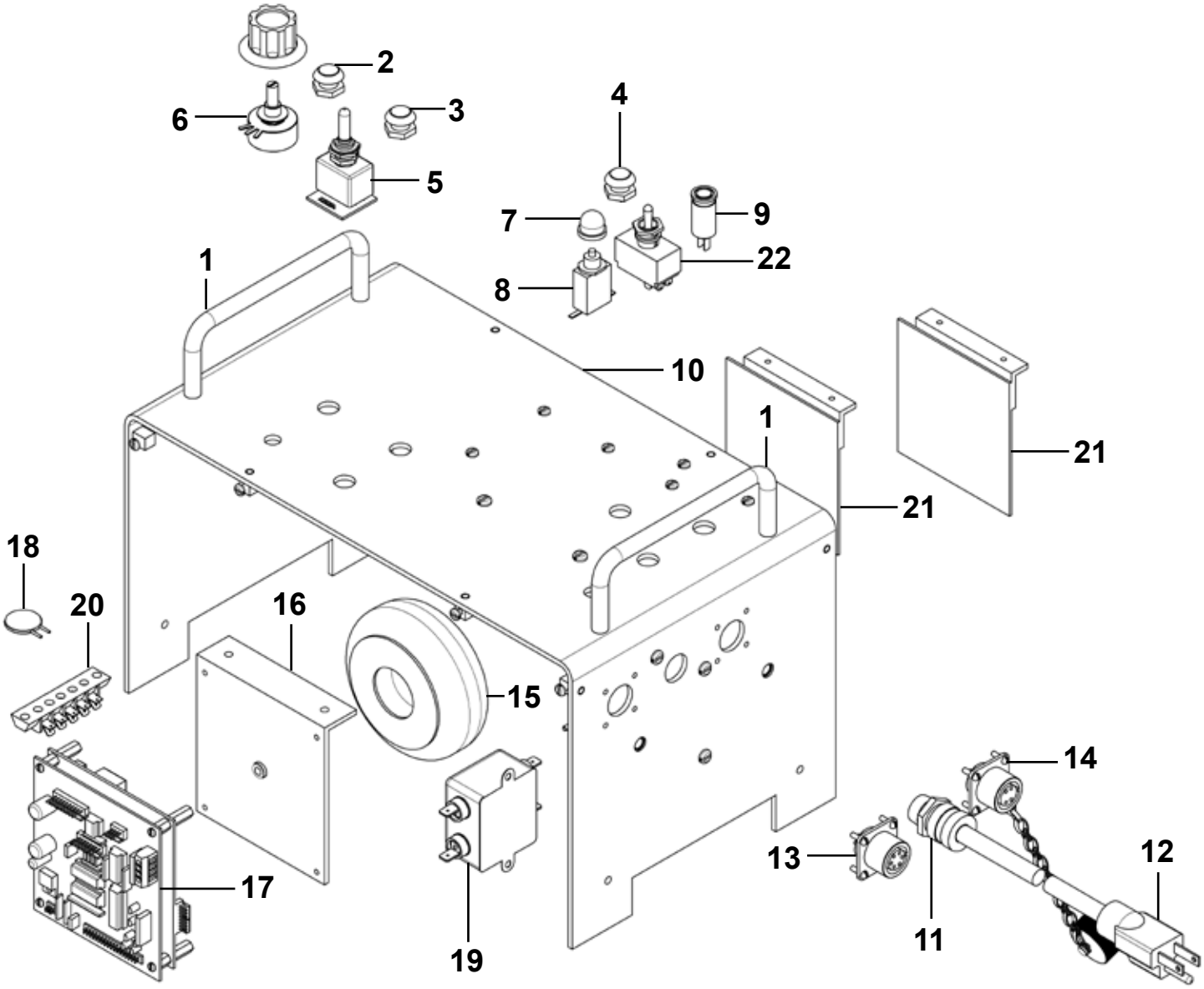
Model:

BUG-6150	120 VAC
BUG-6150-E	120 VAC (Plasma)
BUG-6152	240 VAC
BUG-6152-E	240 VAC (Plasma)
BUG-6154	42 VAC
BUG-6154-E	42 VAC (Plasma)

Includes:

1	ABR-1050	V-Guide Ways, 40"
2	BUG-6050	Hand Held Terminal
3	BUG-6160	Base Assy (150:1)
	BUG-6160-E	Base Assy (100:1)
4	BUG-6170	Cover Assy 120 VAC
	BUG-6172	Cover Assy 240 VAC
	BUG-6174	Cover Assy 42 VAC
5	BUG-6173	Left Side Panel
6	BUG-6175	Right Side Panel
7	BUG-9447	Wrench

EXPLODED VIEW / BUG-6170 / COVER ASSEMBLY



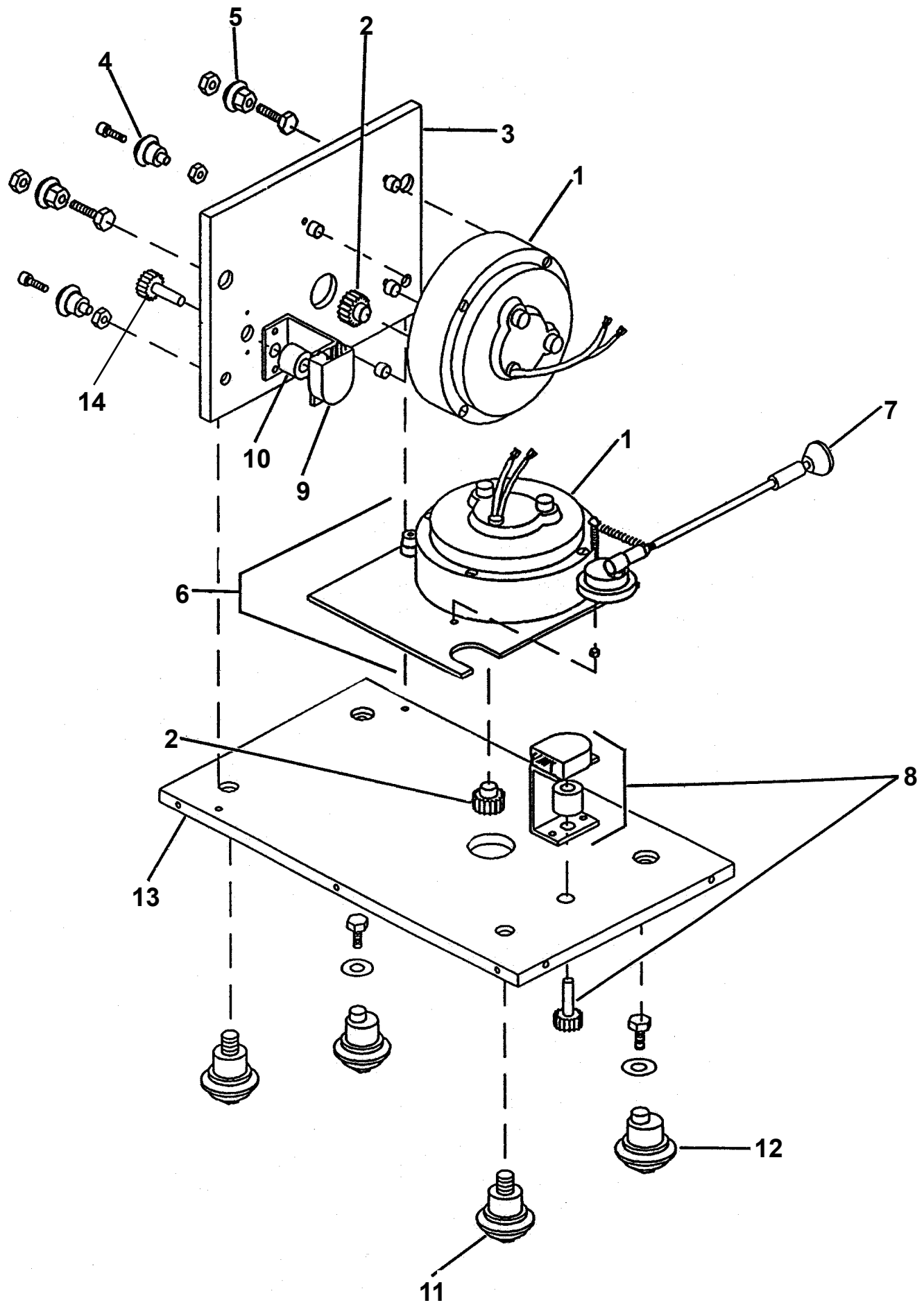
SHAPE MACHINE

COVER ASSEMBLY BUG-6170

1	GOF-3019	Handle
2	SWT-1112	PB Switch Red
3	SWT-1113	PB Switch Green
4	SWT-1111	PB Switch Black
5	PRS-1065	Joystick Switch
6	BUG-9686	Potentiometer Control
7	BUG-2924	Reset Button-Seal
8	BUG-2923 *	.7 Circuit Breaker 120V
9	BUG-1415 *	Pilot Light 120V
10	BUG-6171	Cover
11	BUG-9446	Cord Grip
12	BUG-9445 *	Power Cord 120V
13	BUG-9902	Panel Connector, 6-T, P
14	MUG-1156	Panel Connector, 4-T, F
15	BUG-5218 *	Transformer 120V
16	BUG-6029	Bracket
17	BUG-6030	Control Module
18	BUG-1393 *	Volt Trap 120V
19	BUG-6031	Filter
20	BUG-6028	Terminal Block
21	BUG-1770	Motor Control Board
22	ARM-2279	Toggle Switch (Power)

* See Electrical Component Chart for 42 and 240 VAC Part Numbers.

EXPLODED VIEW / BUG-6160 / BASE ASSEMBLY

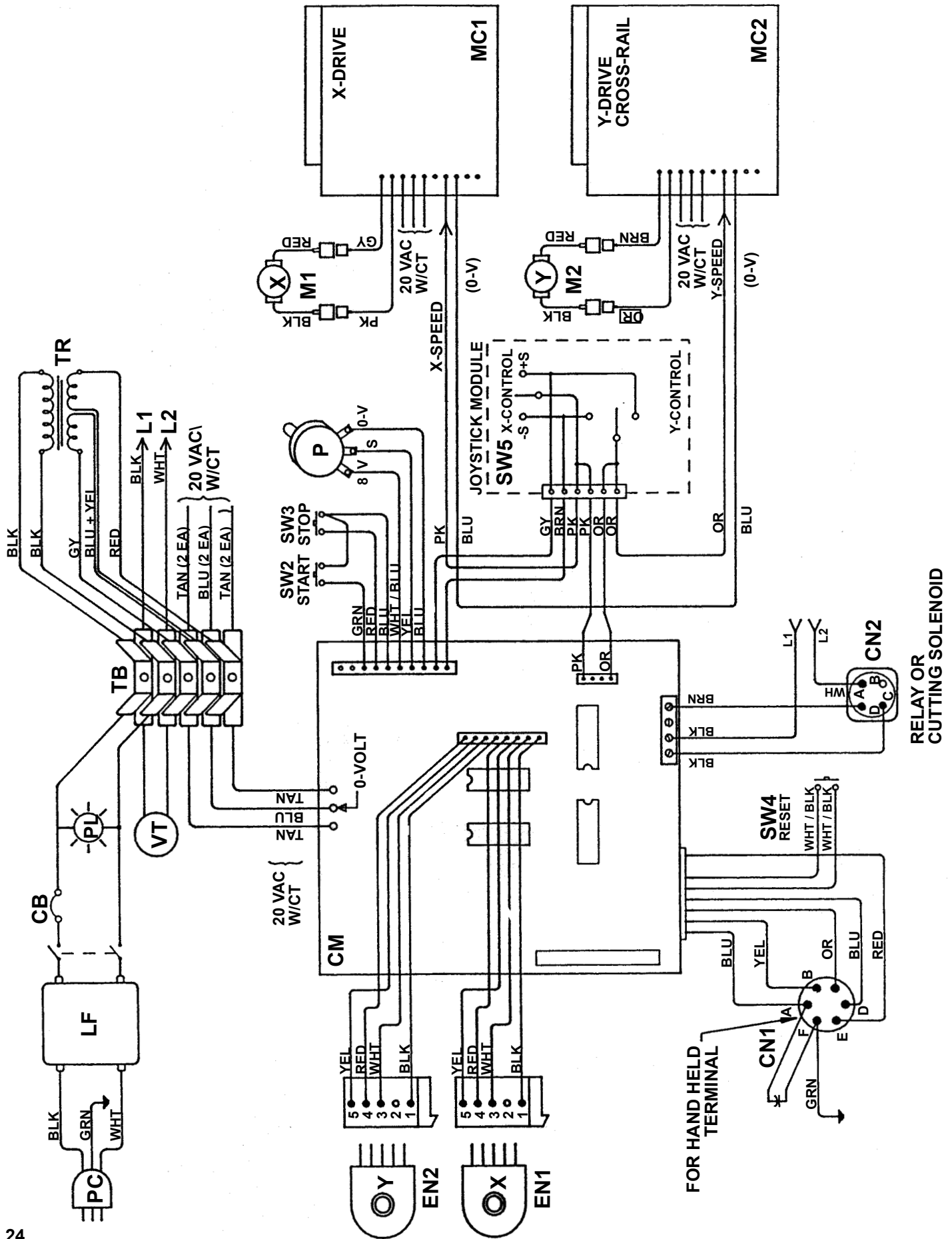


SHAPE MACHINE

BASE ASSEMBLY **BUG-6160**

- | | | |
|----|----------|---|
| 1 | BUG-1550 | Gear Motor, 150:1 |
| | BUG-1595 | Gear Motor, 100:1 |
| 2 | GOF-3014 | Pinion |
| 3 | BUG-6166 | Motor Mount Plate |
| 4 | BUG-5675 | Fixed Leg and Wheel Assy |
| 5 | BUG-5670 | Ext. Adjustable Leg and Wheel Assy |
| 6 | BUG-5356 | Carriage Drive Assy (includes #1 & 2) |
| 7 | BUG-5357 | Clutch Assy |
| 8 | BUG-6040 | Gear / Encoder Assy (Includes #'s 9, 10 & 14) |
| 9 | BUG-6039 | Encoder |
| 10 | BUG-6044 | Flexible Coupling |
| 11 | BUG-2956 | Fixed Leg and Wheel Assy |
| 12 | BUG-1849 | Ext Adjustable Leg and Wheel Assy |
| 13 | BUG-6161 | Base Plate |

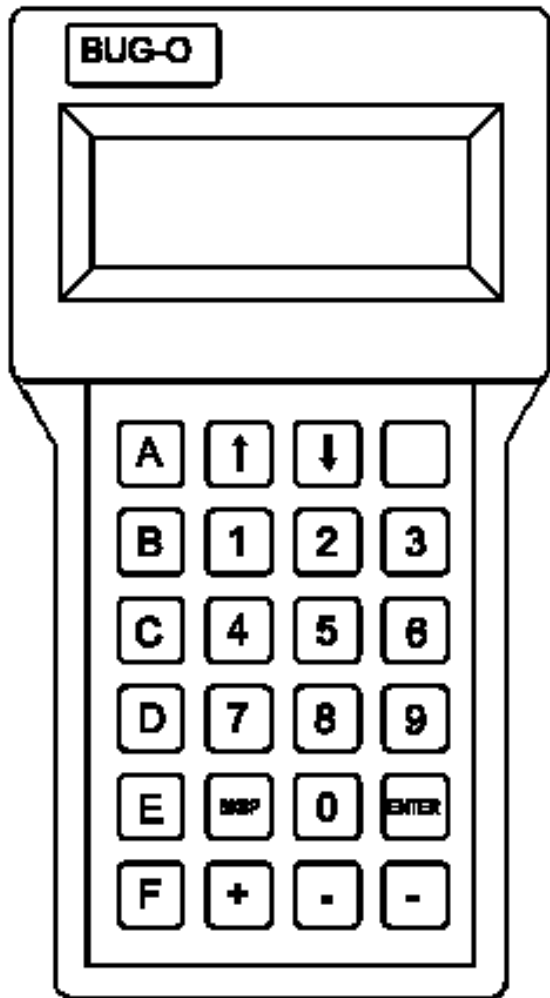
PROGRAMMABLE SHAPE MACHINE / WIRING DIAGRAM



PROGRAMMABLE SHAPE MACHINE / ELECTRICAL COMPONENT

ITEM	DESCRIPTION	BUG-6150 120 VAC	BUG-6152 240 VAC	BUG-6154 42 VAC
PC	Power Cord	BUG-9445	GOF-3115	BUG-9442
CB	Circuit Breaker	BUG-2923 0.7 A	BUG-2952 0.5 A	BUG-2933 2.0 A
PL	Pilot Light	BUG-1415	BUG-1428	BUG-1427
VT	Volt Trap	BUG-1393	BUG-1563	BUG-1393
TR	Transformer	BUG-5218	BUG-5231	BUG-5232
P	Potentiometer		BUG-9686	
SW1	Toggle SW (Power)		ARM-2279	
SW2	PB Switch (Start)		SWT-1113	
SW3	PB Switch (Stop)		SWT-1112	
SW4	PB Switch (Reset)		SWT-1111	
SW5	Joystick Switch		PRS-1065	
TB	Terminal Block		BUG-6028	
LF	Line Filter		BUG-6031	
CM	Control Module		BUG-6030	
MC1, MC2	Motor Control Board		BUG-1770	
EN1, EN2	Encoder		BUG-6039	
CN 1	Connector (Pendant)		BUG-9902	
CN2	Connector (Aux.)		MUG-1156	
M1, M2	Gear Motor 150:1		BUG-1550	
M1, M2	Gear Motor 100:1		BUG-1595	

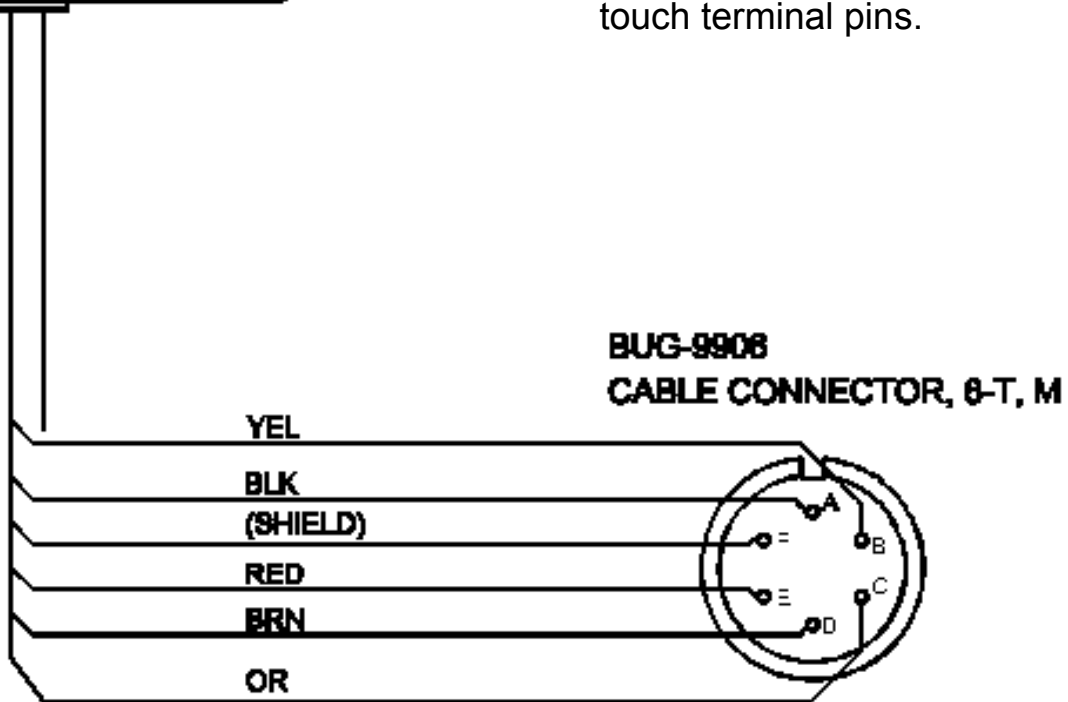
PENDANT CABLE WIRING DIAGRAM



**BUG-6050
HAND HELD TERMINAL**

- A ... BLACK: Circuit Common
- B ... YELLOW: TX (Transmit)
- C ... ORANGE: RX (Receive)
- D ... BROWN: Signal Ground
- E ... RED: Power (5 V)
- F ... SHIELD: Bare Drain Wire, touching Foil Shielding

Note: Other wires trimmed not to touch terminal pins.



**BUG-9908
CABLE CONNECTOR, 8-T, M**

(FRONT VIEW)

PLASMA CUTTING

The Programmable Gantry System can be used successfully for plasma cutting; however it is important to take certain precautions to avoid interference and protect the control circuits. (These comments also apply to TIG welding or any process that uses high frequency to strike an arc). An external relay box is available separately or in the welding kit to provide the contact signal to the plasma source.

PRECAUTIONS:

1. NEVER lay the plasma gun cable across the top of the machine. The further away from the machine it can be routed and supported, the better.
2. See that all grounding procedures specified for the plasma source are followed diligently.
3. If the high frequency is produced using a spark gap, adjust the points so that the gap is as small as possible. The larger the gap, the higher the voltage and stronger the interference.
4. We strongly recommend you disconnect the Hand Held Terminal (programming pendant) when running the machine. Any length of wire acts as an antenna to receive HF radiation, and though the cable is shielded, it is possible for some induced voltage to leak through.
5. Use separate power line branches whenever possible to power the plasma source and the machine. Do not plug them into the same outlet box.
6. Though there is an internal power line filter, an external protective device will always help. Computer equipment line protection boxes are readily available at low cost, with surge suppression and line filtering circuitry. The machine can be plugged into the power line through one of these boxes.

OPERATION CHECKLIST AND TROUBLE SHOOTING

1. Plug in the machine and turn on the POWER SWITCH. Operate the manual joystick in all 4 directions in turn. This overrides any speed command from the computer control. If the drives run in corresponding direction, and the speed can be varied with the Speed Pot, this indicates:
 - a) the speed control boards are OK.
 - b) the controller circuit is supplying the required voltages.

If only one motor runs correctly then it is likely that the other motor's speed control is faulty.

If both do not operate properly then there may be a bad component on the control module that prevents proper voltages to be supplied to the joystick.

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

Manual control must function correctly before checking the computer control.

2. Attach the Handheld Pendant and push the RESET button. The display should read "Reset OK". Push D on the keypad and push "RETURN" till the display shows the Shape No. and data for all segments. If the display functions this indicates:
 - a) the communication line is functioning.
 - b) the computer is operating its program.

If the message "Reset OK" comes up but pushing D or any other key has no effect, there could be a false signal coming in from the STOP button, due to a wire short or damaged switch.

3. Disconnect the Handheld Terminal and power up.

Toggle the joystick in all 4 directions after pushing RESET. When the joystick is let go, the machine should go back to its original position.

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

If one motor returns to home and not the other, then the computer may not be receiving the encoder signals properly from that axis - encoder pick up gear or coupling may be loose or the pins in the encoder plug may not be making good connection.

If a 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 SHAPE MACHINE AND GANTRY

These diagnostics are being included in the various control modules for programmable machines. See character map of keypad for shifted keys to use these commands.

Press “**T**” for Test

The display should show “D-E-F?”

Next press “**D**” to check **D**rives

“**E**” for **E**ncoders

“**F**” to **F**inish; get back to main menu

After selecting either D or E, for Drive or Encoder, the display will show

“Axis No.”

Press 1 for Axis 1: main drive, 2: for Axis 2: cross drive (or 3 for 2nd X- drive on a Gantry).

If drive was selected, the axis selected should run

1 second forward (display shows “F”)

1 second back (display shows “B”)

The drive should move regardless of whether encoder pulses are counted, at the speed set by the speed pot.

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) (10H=16 decimal, 400H =1024 decimal).

Press “**V**” for Version.

The display will show the program version number; e.g. SH005 or XXYOI, etc.

Applicable to new program versions only.

KEYPAD CHARACTER MAP DIRECT AND SHIFTED CHARACTERS

Shift Key

A	↑	↓	↙	G	H	I	
B	1	2	3	J	K	L	M
C	4	5	6	N	O	P	Q
D	7	8	9	R	S	T	U
E	BKSP	0	ENTER	V	W	X	Y
F	+	.	-	Z	@	(SP)	!

SHIFTED CHARACTER SET

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

- U:** set Units, inch or metric
- R:** set Ratio, SE4-P; DO NOT USE
- T:** Test drives & encoders, function
- V:** Version Number

WARRANTY:

LIMITED WARRANTY

MODEL _____
SERIAL NO. _____
DATE PURCHASED: _____

FOR A PERIOD OF TWELVE (12) MONTHS FROM DELIVERY, BUG-O SYSTEMS WARRANTS TO THE ORIGINAL PURCHASER (DOES NOT INCLUDE AUTHORIZED DISTRIBUTORS), THAT A NEW MACHINE IS FREE FROM DEFECTS IN MATERIAL AND WORKMANSHIP AND AGREES TO REPAIR OR REPLACE, AT ITS OPTION, ANY DEFECTIVE PARTS OR MACHINE. THIS WARRANTY DOES NOT APPLY TO MACHINES, WHICH AFTER OUR INSPECTION, ARE DETERMINED TO HAVE BEEN DAMAGED DUE TO NEGLIGENCE, ABUSE, OVERLOADING, ACCIDENT OR IMPROPER USAGE. ALL SHIPPING AND HANDLING CHARGES WILL BE PAID BY CUSTOMER.

BUG-O SYSTEMS MAKES NO WARRANTY OF MERCHANTABILITY AND MAKES NO OTHER WARRANTY, EXPRESSED OR IMPLIED, BEYOND THE WARRANTY EXPRESSLY SET FORTH ABOVE. BUYER'S REMEDY FOR BREACH OF WARRANTY, HEREUNDER, SHALL BE LIMITED TO REPAIR OR REPLACEMENT OF NON-CONFORMING PARTS AND MACHINES. UNDER NO CIRCUMSTANCES SHALL CONSEQUENTIAL DAMAGES BE RECOVERABLE.

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 HE 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.

NOTES: