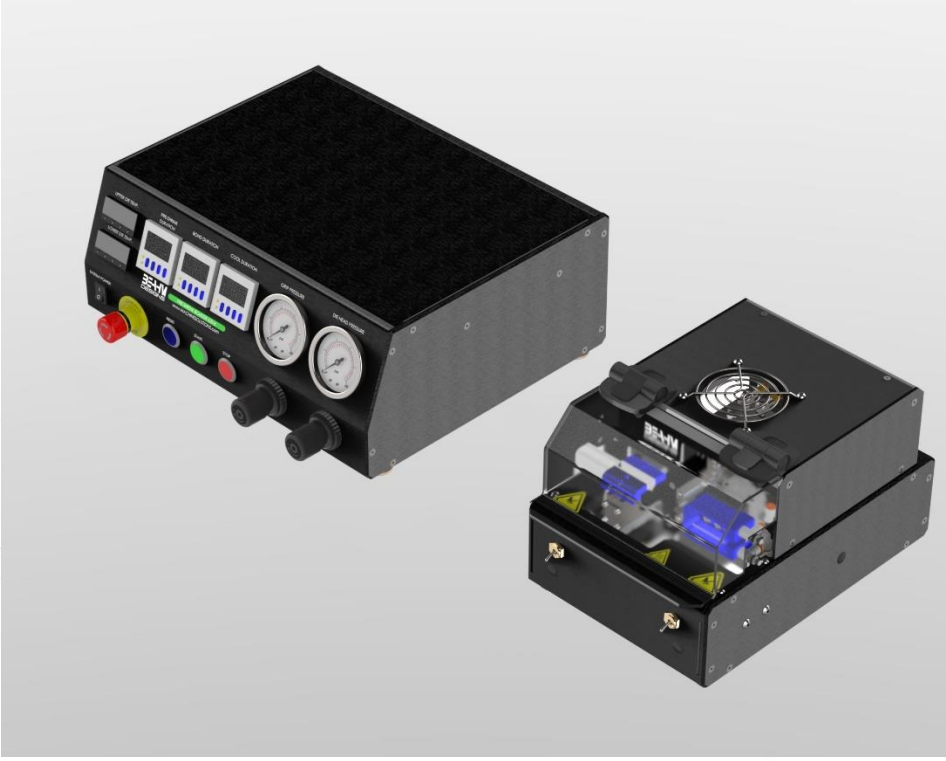
MACHINE SOLUTIONS INC.

USER MANUAL

BEAHM DESIGNS SPLIT DIE BONDER

MODEL 620-B



BEAHM DESIGNS

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WELCOME

Machine Solutions, Inc. (MSI) would like to take this opportunity to thank you for purchasing your new 620-B Split Die Bonder machine. At MSI, we are dedicated to bringing innovative process development solutions to both medical device and nonmedical organizations. The MSI proprietary segmental technology has been successfully implemented in manufacturing clean rooms on five continents, and continues to expand – meeting, growing, and facilitating the abilities of device companies around the globe. MSI looks forward to helping your organization provide life-improving devices to your customers, today and tomorrow.

MACHINE DESCRIPTION

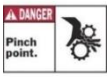
The Beahm Designs Inc. Model 620-B Split Die Balloon Bonder is a system for the purpose of pre-shrinking the protective sleeve and then thermal bonding or welding thermoplastic components to other materials by means of a pair of heated dies while providing protection of the balloon or region one of the materials from the process heat by means of a cooling chamber and by retracting the dies during loading and unloading of the materials. The system features two die heads that remain at a constant process temperature vs. cycling the heat on and off. Each die head features one half of the bond diameter and are “opened” or separated from each other to allow the components to be positioned within the bored diameter. Digital timers control the bond and cool durations and integrated tooling secure the components during the process.

SAFETY

- Use of eye protection when working with compressed gases and heated materials is advised.
- The maximum observed Sound Pressure Level is below 70 dBA.
- Die jaws will become hot during operation and, depending on temperature set point, can cause severe skin burns if contact occurs.

Caution: high voltage. Remove power and use safety precautions when servicing.

Caution: hot surface. Contact may cause burn. Allow to cool before servicing.



Caution: pinch point. Keep hands and body parts clear while in operation.

USER ALERTS

Do not use the equipment other than as prescribed. Examples: Do not attempt to sit on or climb on the equipment. Do not place heavy objects or containers of liquid on the machine. Do not insert any foreign objects into the machine and do not attempt to bypass any guards or otherwise operate the machine in any manner other than that in which it is explicitly intended.

Note: The equipment is not for use with materials that can decompose or ignite below the maximum operating temperature of the machine. Hazards are materials that outgas hazardous substances and or ignite. (260°C/500°F).

Note: This equipment is not for use in an ATEX environment.

CONTENTS

Included with the system are the following contents:

- Die Base and Control Unit
- IEC Power Cord
- Compressed Air Supply Hose Assembly

INSTALLATION

1. Place the system on a level, sturdy surface.
2. Connect the electrical and pneumatic cables to the die base unit.
3. Connect the power cord to the main control unit.
4. Connect the air supply hose assembly to the system and then to a clean, dry, and filtered compressed air source.

SET UP AND CONFIGURATION

Proper sizing of the thermal dies and alignment of the tooling are crucial to optimizing process results and repeatability. The following guidelines are the recommended methods. However, all applications vary, and several iterations of tooling process development may be required and may not follow all the recommended guidelines.

Pre-Shrink Diameter

- It is preferable that the die heads are not smaller than the sleeve expanded O.D. to avoid pinching.
- Measure the sleeve O.D., expanded or prior to shrink.
- Add .001”-.005” to this dimension.
- Bore this diameter through the die heads at the pre-shrink location.

Die Head Diameter

- In most applications the bore of the die heads should be in contact with the heat shrink or other protecting sleeve covering the bond area.
- A .002”-.003” interference is usually sufficient.
- Use the following steps to determine the bore diameter.
    1. Assemble the components to be bonded.
    2. Install the protective sleeve over the bond area, if using heat shrink then pre-shrink the sleeve.
    3. Measure the diameter at the bond area.
    4. Subtract .002”-.003” from this measurement.
    5. Bore this diameter through the die heads.

Die Head Width

- The die head width can vary greatly between applications. Since the 620-B is most used for Balloon and Lap Joints, the die head width should be sized equal or slightly greater than the length of the overlap of the materials.

Grip/Positioning Nests

- This is the most forgiving of the tooling. The included, standard vee configurations are more than adequate for most applications. More important than the guide design and dimensions is alignment with the die heads.
- Refer to the maintenance section for the alignment procedure.
- Customized nests and tooling are available.
- Contact Machine Solutions sales to review the application and request a quote.

System Options

Many optional accessories are available to enhance the functionality of the system and improve process yield. Contact Beahm Designs' sales department or visit our web site www.machinesolutions.com for more information on available accessories and to request a quote.

Examples of available accessories are:

-Vision systems with or without on-screen crosshair line generators.
-Laser line generators.
-Extended product support trays/guides.
-Product grip nests/alignment tooling.

Installation instructions are included with each specific accessory.

System Controls And Features

Located on the front panel are the following controls and/or displays and their function.

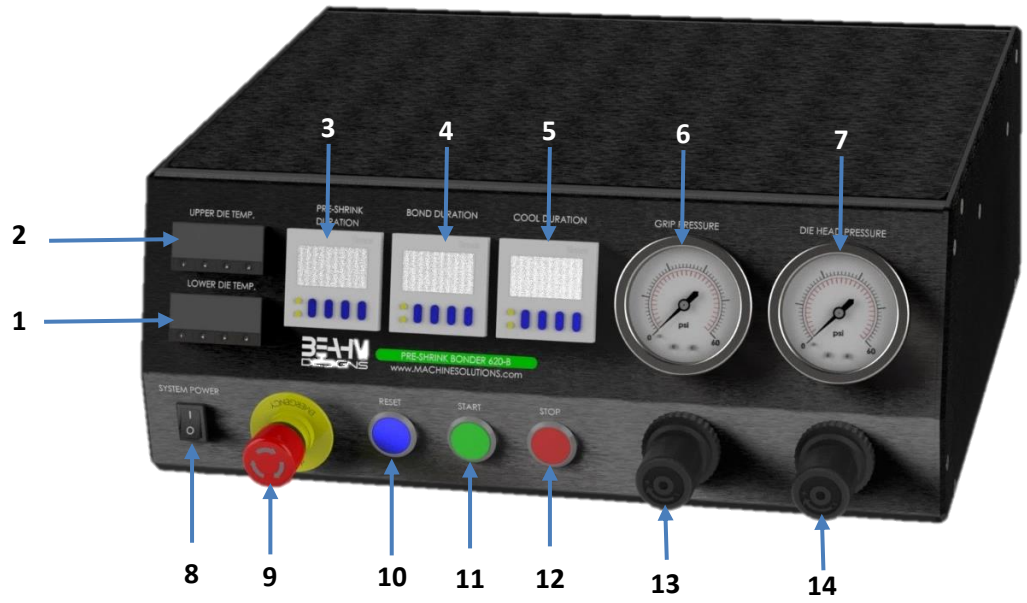


Figure 1: 620-B CE Front Panel

Table 1: Controls and Functions

Item	Function
1	Controls the temperature of the lower die head
2	Controls the temperature of the upper die head
3	Controls the duration that the die heads pre-shrink the sleeve onto the joint
4	Controls the duration that the die heads are closed and/or in contact with the product
5	Controls the duration the cooling air flows
6	Displays the grip pressure
7	Displays the pressure applied to the die head actuation cylinder
8	Toggles system power and air on and off

9	Disrupts power to heaters and internal components.
10	Initializes machine after E-Stop.
11	Initiates process sequence.
12	Interrupts the process sequence.
13	Regulates the pressure to the product grips.
14	Regulates the pressure of the die head actuation cylinder.

Located on the front panel of the remote box are the following controls and/or displays and their function.

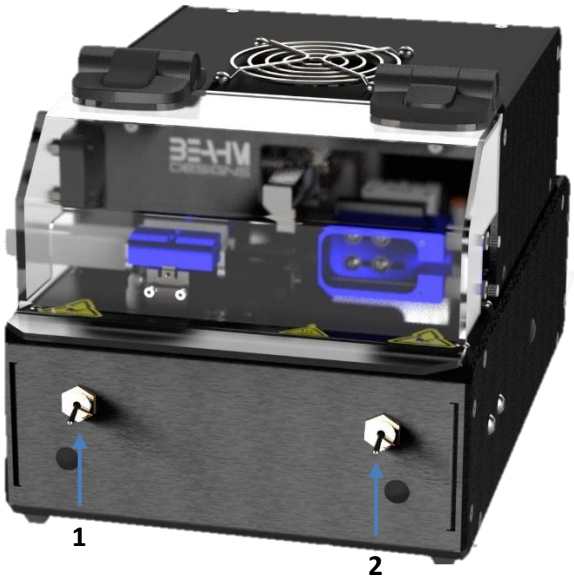


Figure 2. 620-B CE Remote Box

Table 2: Remote Box Controls and Features

Item	Function
1	Toggles the gripper open/close.
2	Toggles the cooling shield assembly open/close.

RUN PROCESS

1. Position the components to be processed such that the balloon or region to be cooled during the process is within the cooling chamber.
2. Position the bond region outside of the shield assembly and in-line with the die heads.
3. Activate (close) the shield assembly.
4. Depress the **START** button or **foot** switch to initiate the process sequence.
5. Upon completion of the cooling cycle, deactivate (open) the shield assembly and remove the materials.

PARAMETER SETTINGS

Temperature Controller

Note: Verify what model temperature controller is on the machine

- Refer to page 15, Omron Temperature Controller.
- Refer to page 19, Omega Platinum Temperature Controller.
- Refer to page 20, Eurotherm Temperature Controller.

Setting Pre-Shrink Duration

- Depress the upper or lower half of the corresponding time digit to change its value. Depress the **STOP/RESET** switch to reset the timer to the new value.

Setting Bond Duration

- Depress the upper or lower half of the corresponding time digit to change its value. Depress the **STOP/RESET** switch to reset the timer to the new value.

Setting Cool duration

- Depress the upper or lower half of the corresponding time digit to change its value. Depress the **STOP/RESET** switch to reset the timer to the new value.

Adjusting Gripper Pressure

- Rotate the regulator knob clockwise or counterclockwise until the pressure gauge displays the desired value.

Adjusting Die Head Pressure

- Rotate the regulator knob clockwise or counterclockwise until the pressure gauge displays the desired value.

OMRON TEMPERATURE CONTROLLER

Note: Verify what model temperature controller is on the machine

The parameter settings for the temperature controllers have been pre-configured prior to shipment from Machine Solutions, Inc. However, if further details are required, refer to the Omron operating instructions for the model-E5GC temperature controllers included with the manufacturer's literature (delivered with the machine).

Figure 3. Omron E5GC Temperature Controller

Setting Temperature Controller Parameters

The parameter settings, as defined by Machine Solutions, Inc. for specific operational functionality of the individual temperature control units, are detailed below. It is recommended that these parameter settings remain as they appear in the sections to follow. If parameters are changed incorrectly and cannot be restored, please contact service@machinesolutions.com.

Retuning the Temperature Controller

Re-tune the temperature controller if dies are changed or modified, or to correct instability at process temperature.

1. Start with machine at ambient temperature.
2. Power on the machine. Ensure the heater switch (if applicable) is switched to "off" for the next two steps. If machine is not equipped with heater switch, ensure steps are completed quickly to minimize pre-heating.
3. Set controller to process temperature.
4. Follow the procedure shown in Figure 4.
5. If applicable, switch heater switch to "on" once controller is back to home screen. Controller will wait for temperature to stabilize before starting.
   Note: Autotune is active when light next to "TUNE" is lit. The procedure may take up to 30 minutes.

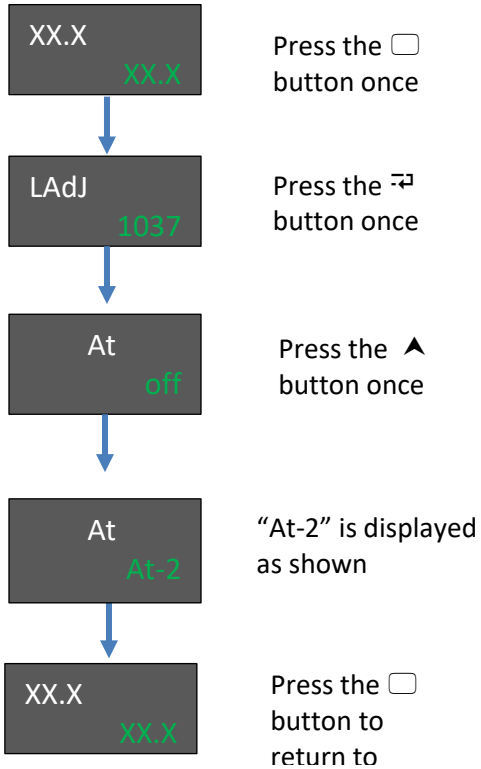


Figure 4. Auto Tune Enable

Configuration of Temperature Controller Alarm

Even after a successful autotune, temperatures may still have a small degree of instability. Temperatures may also drop unexpectedly if there is a fault with the equipment or if accessories are accidentally unplugged. To ensure the equipment notifies operators in the case of an unexpected temperature change, the temperature controllers are programmed with an alarm. Machine Solutions, Inc. recommends a temperature tolerance of ±2.5°F, allowing the temperature to either rise or drop by as much as 2.5°F before the alarm activates. The procedure for configuring the temperature controller alarm is outlined in Figure 5.

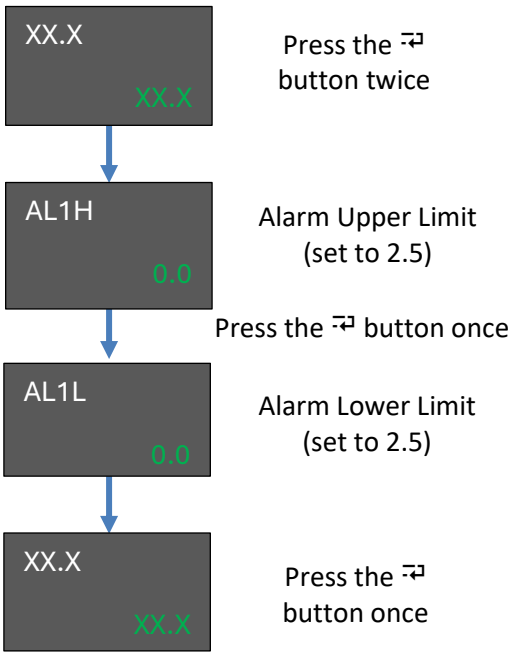


Figure 5. Temperature Alarm Setup

Setting Temperature Controller Offset

If there is a difference between the temperature measured by the thermocouple and the actual temperature of the head, then you may wish to adjust the temperature display with an offset.

There may be a temperature disparity between the temperature controller readout and the actual temperature at the working surfaces of the machine's dies (measured with an external standard). A temperature offset may be desired to reduce or eliminate this disparity.

Offset range -199.9 to 999.9 °F/°C

The following diagram, Figure 6, shows the procedure for inputting a known temperature offset:

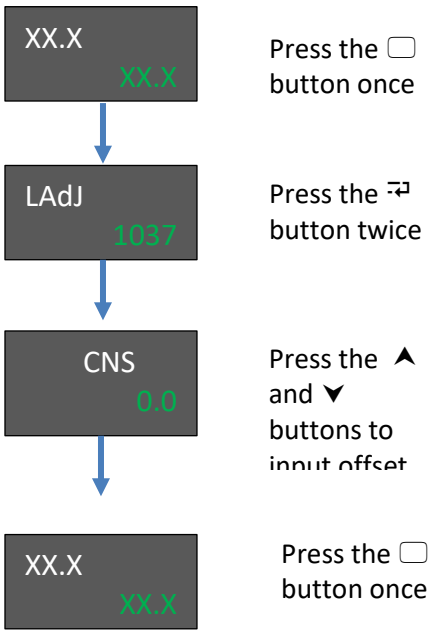


Figure 6. Temperature Offset

OMEGA PLATINUM TEMPERATURE CONTROLLER

Note: Verify what model temperature controller is on the machine.

ATTENTION: PRIOR TO MAKING ADJUSTMENTS, PLEASE SEE THE APPENDIX FOR FURTHER INFORMATION ABOUT THE OMEGA PLATINUM TEMPERATURE CONTROLLER. THE TEMPERATURE CONTROLLERS HAVE BEEN PRE-PROGRAMMED.

Adjusting Temperature on Temperature Controller(s)

Use the PRoG (Programming Mode) Menu

Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Notes
SP1	_____						Process goal for PID

	Note: If not at Level 1, push the ⇧ button to get to that level. **Level 1 = INIt, PRoG, and oPER**
◀▶	Navigate to **PRoG** (Programming Mode).
↵	Select **PRoG**.
◀▶	Navigate to **SP1** (Setpoint 1 parameter).
↵	Select the **SP1**.
◀▶	Set the desired temperature.
↵	Confirm the value. The heaters will ramp to correct temperature.

Resetting the Temperature Controller

Refer to Appendix A on page 30 for resetting the Omega temperature controller and all temperature control settings.

EUROTHERM TEMPERATURE CONTROLLER MODEL 3216

Note: Verify what model temperature controller is on the machine.

Note: Auto-tuning can be performed at any temperature set point within the system operating specifications. This machine needs to be auto tuned at the temperature and air flow that your product will be processed at.

Auto-Tuning

1. Ensure heater power is off and heater is at room temperature.
2. Enter the process temperature setpoint using th ▼ o ▲ buttons.
3. Press ⟳ until ***R.TUN*** is displayed.
4. Press ▼ or ▲ to select On.
5. Press ⟳ to begin the auto tune process.
6. Turn heater power ON.

Please note, after following this sequence, auto tune can take several minutes to start and complete.

A full description of auto-tune and the purpose of other parameters in the level 2 list is given in the 3200 Manual located online at https://www.eurotherm.com/download/3200-engineering-manual-ha028651-iss-15/

Switching from Fahrenheit to Celsius

1. Press and hold the page button (left most) until Lev 1 appears.
2. Press up arrow to Lev 2 appears.
3. Press scroll to code 0.
4. Press up arrow key for code 2.
5. Press scroll button until units appear.
6. Press up or down arrow key to select C.

MAINTENANCE

Note: Ensure the machine is unplugged for any servicing or maintenance work.
Note: Perform these steps ONLY when the die heads are at room temperature.

Caution: pinch point/crush hazard. Keep fingers, hands, and clothing clear of moving parts.

Caution: hot surface. Contact may cause burn. Allow to cool before servicing.

Cleaning

1. Use 99% isopropyl alcohol to wipe down the outside of the machine. Do not attempt to clean the inside of the machine. The machine should not be washed down.
2. Cleaning should be with a soft dry cloth only.

Exchanging Die Heads

1. Remove Upper enclosure/Heat Shield assembly.
2. With the die heads in the open and retracted position, remove the upper rear die head fastener.
3. Slide the die head assembly forward and remove the upper front die insert fastener.
4. Close the die heads and remove the lower front die insert fastener.
5. Slide the die head assembly into the retracted position.
6. Remove the lower rear die insert fastener.
7. Slide the die head assembly into the forward (extended) position open the die heads.
8. Position the lower replacement die insert in the lower die head base.
9. Install the lower front fastener.
10. Position the upper die insert in the upper die head base.
11. Install the upper front fastener.
12. Slide the die head assembly to the rearward (retracted) position.
13. Install the upper rear.

Exchanging Vee Guide/insert(s)

1. Remove the two fasteners in the guide/insert and remove the guide/insert.
2. Install the replacement guide/insert.
3. Re-install the mounting fasteners.
4. Verify alignment.

Aligning Tooling

Note: Alignment should be performed on a prepared product subassembly.
Note: Alignment MUST be performed with system power off and die-heads at ambient temperature.
Note: Alignment MUST be performed on a flat and reasonably level surface.

1. Prepare a product/materials assembly.
2. Position the assembly within the vee guide and shield assembly.
3. Remove the upper enclosure/shield assembly.
4. Manually extend the die assembly slide fully forward ensuring that the end stop damper is fully compressed.
5. Close the die around the material subassembly.
6. Adjust the Z-axis and Y-axis of the vee guide assembly until the material assembly is aligned with the die head bore.
7. Adjust the Z-axis and Y-axis of the shield assembly until it is aligned with the die head bore.
8. Open the dies and remove the product/material subassembly.
9. Replace the upper enclosure/shield assembly.

Fuse Replacement

1. To replace a blown fuse, turn off machine power by unplugging the power cord from the machine.
2. Remove the insert.
    a. Using a flat head screwdriver, push the fuse insert inward and turn counterclockwise to release.

Figure 7. Removing Fuse Insert

3. Fuse replacement.
    a. Remove the old fuse and replace it with the new one.

Figure 8. Fuse Replacement

4. Insert replacement.
    a. Using a flat head screwdriver, seat the insert by pushing inward and turning clockwise.

Figure 9. Fuse Insert Replacement

DIAGNOSTICS AND TROUBLESHOOTING

Table 3. Diagnostics and Troubleshooting

Issue	Possible Causes	Solution
Temperature not stable	• Thermal Nozzle replaced • Thermocouple loose	• Auto-tune (MSI recommends auto-tune to process temperature starting from ambient temperature.) • Re-install thermocouple
"S.ERR" displayed (Omron temperature controller)	• T.C sensor break	• Replace thermocouple • Verify complete T.C. path
"Open" displayed (Omega temperature controller)		
"S.br" displayed (Eurotherm temperature controller)		
No heat at dies	• Defective heating element • Defective power control	• Replace heating element
.Err code in display	• Temperature controller software failure	• Replace temperature controller
System will not power on	• IEC power cord not fully Connected • Fuse needs to be replaced	• Verify installation • Replace fuse

SPECIFICATIONS

Table 4: System Specifications

Description	Range	Accuracy
Temperature	Ambient-500° F	± 2 °F
Pre-Shrink duration	1-9999 seconds	+/- 1 sec.
Bond duration	1-9999 seconds	+/- 1 sec.
Cool Duration	1-9999 seconds	+/- 1 sec.
Balloon Shield Pressure	0-100 psi	± 10 psi
Die Extend/Retract Pressure	0-100 psi	± 10 psi
Die Head Pressure	0-60 psi	± 2 psi
Gripper Pressure	0-60 psi	± 2 psi

Facility Requirements

- Voltage: 120-240 VAC 50/60 Hz.
- Wattage: 500 max.
- Compressed Air: 60-125 psi, 0.5 CFM, filtered 50 micron or greater, oil and water free.

CRITICAL PARTS

For replacement or spare parts, please contact us at service@machinesolutions.com, or call 928-556-3109.

Table 5: Critical Parts List

Part Number	Description	Quantity
1330445-003	4-WAY VALVE 24 VDC	2
1348043-001	GRADE A GAUGE	2
1343250-001	VALVE, 2-WAY, MAC, SOLENOID	3
1143311-001	RELAY, SOLID STATE, DIN MOUNT 20A DC/AC	2
1143303-001	TIMER, OMRON, DIGITAL, 24 VDC, COLOR LCD	3
119106-001	RELAY, PLC, 24VDC, DIN RAIL	4
1145619-001	RELAY, 24VDC INTEGRATED	2
1161899-001	CONTROLLER, TEMP, OMEGA, 1/32 DIN, 24 VDC	2
110114-002	CONTROLLER, TEMP, OMRON	2
120V - 1153590-001 220V - 1157788-001	HEATER, CARTRIDGE	2 2
1143133-001	THERMOCOUPLE, K TYPE	2
110092-005	FUSE, CYLINDER, TIME LAGE, 10A, 3AG	2

CUSTOMER SUPPORT AND SATISFACTION

Machine Solutions Inc. is proud of the advanced engineering and quality construction of each piece of equipment that we build. It is our goal to provide equipment that exceeds the expectations of the customer. By implementing the highest standards and applying our experience to provide a quality product, we maintain an ongoing, positive working relationship with all our customers.
Machine Solutions Inc. welcomes your comments and inquiries about our products and services.

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E-Mail: Service@MachineSolutions.com

WARRANTY AND LIMITATIONS

General Warranty

Machine Solutions Inc. (MSI) warrants its products to be free from defects in material and workmanship in normal everyday use and service for a period of one year from the date of shipment from the factory in Flagstaff, Arizona. MSIs obligation under this warranty shall be limited to the repairing or replacing of the product or parts thereof which upon MSIs inspection reveals them to be defective. MSI reserves the right and option to refund the purchase price in lieu of repair or replacement upon evaluation of the returned original part. Modifications, misuse, attempted repairs by others, improper calibration or operation shall render this guarantee null and void. MSI MAKES NO OTHER WARRANTY REGARDING THIS PRODUCT, INCLUDING ANY EXPRESS OR IMPLIED WARRANTY. SPECIFICALLY, THERE IS NO WARRANTY OF MERCHANTABILITY OF THIS PRODUCT OR OF THE FITNESS OF THE PRODUCT FOR ANY PURPOSES. THE SUITABILITY OF THIS PRODUCT FOR ANY PURPOSE PARTICULAR TO THE CUSTOMER IS FOR THE CUSTOMER, IN ITS SOLE JUDGEMENT, TO DETERMINE. MACHINE SOLUTIONS, INC. ASSUMES NO RESPONSIBILITY FOR THE SELECTION OR USE OF THIS PRODUCT BY CUSTOMER. This product has not been tested or approved by the U.S. Food and Drug Administration or any other agency of the U.S. government. This product is not a consumer product as that term is defined in the Magnuson-Moss Warranty – Federal Trade Commission Improvement Act, 15 U.S.C. § 2301 et seq.

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The equipment and its incorporated technology (collectively referred to herein as the Technology), is protected under issued and pending patents. The Technology is valuable and proprietary technology, including trade secret technology, belonging to MSI. Much of the Technology is nonpublic and confidential. As our customer, you agree to further assist MSI in the protection of our intellectual property as follows: You agree to keep the Technology you receive confidential at all times, and shall not, without the prior written consent of MSI, disclose the Technology, in whole or in part, to any person outside of your company. You further agree that you shall not reverse engineer, disassemble, decompile, or copy the Technology without the prior written consent of MSI.
In addition, you agree that the equipment will not be used to manufacture anything other than products in which you hold intellectual property rights free of infringement of others. You may not use the equipment to manufacture any product infringing on another's patented rights. By accepting and using the equipment, you agree to defend and indemnify Machine Solutions, Inc., its officers, directors, employees and agents, from and against any claims of infringement as a result of your use of the equipment.

Regulatory Matters

All equipment validations, product validation, final product QC testing and other testing required by the U.S Food and Drug Administration are the sole responsibility of the customer. Machine Solutions, Inc. shall have no responsibility or liability for the performance of any interventional product on which this equipment is used.

APPENDIX A

Omega Platinum Temperature Controllers

ATTENTION: The initialization portion of the Omega Temperature Controller(s) has been password-protected. Some reasons for this practice to be implemented are:

- Prevent unauthorized Access.
- Avoid Tampering.
- Mitigate user errors.
- User accountability.

For additional information, please contact service@machinesolutions.com

Temperature Controller Layout and Description of Button Actions

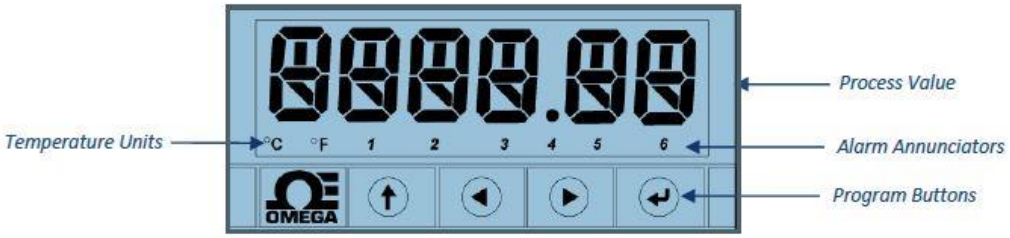

Figure A-1. Controller Layout

The UP button moves up a level in the menu structure. Pressing and holding the UP button navigates to the top level of any menu (**oPER**, **PRoG**, or **INIt**). This can useful if you get lost in the menu structure.

The LEFT button moves across a set of menu choices at a given level (up in the Section 4 menu structure tables). When changing numerical settings, press the LEFT button to make the next digit (one digit to the left) active.

The RIGHT button across a set of menu choices at a given level (down in the Section 4 menu structure tables. The RIGHT button also scrolls numerical values up with overflow to 0 for the flashing digit selected.

The ENTER button selects a menu item and goes down a level, or it enters a numerical value or parameter choice.

Figure A-2. Description of Button Actions

INIt	Initialization Mode: These settings are rarely changed after initial setup. They include transducer types, calibration, etc.
PRoG	Programming Mode: These settings are frequently changed. They include Set points, Control Modes, Alarms, etc.
oPER	Operating Mode: This mode allows users to switch between Run Mode, Standby Mode, Manual Mode, etc.

Figure A-3. Level 1 Menu

Auto Tune Temperature Controller(s)

Please note, the Omega temperature controllers have been auto tuned and are set for optimal performance. Contact Machine Solutions for further diagnostics and instructions.

The Autotune function will select the tuning algorithm depending on the stability of current process and the error difference between current process and the Control Setpoint (SP1). If the process is relatively stable (i.e: at room temperature), a bump test will be performed to determine the plant characteristics. If the process is hot, or if the process is within 10% of Control Setpoint, limit cycle oscillation will be performed with the tuning setpoint taken at the process value when the Autotune function is triggered. Autotuning may be performed as many times as needed or when the operating conditions (i.e: process load, or setpoint) have changed significantly. To obtain good tuning results, ensure the process is stable prior to triggering autotune function. The process is stable when it is at ambient temperature, or it is tracking Control Setpoint (SP1) in auto mode.

Note: Ensure the temperature is at room temperature prior to starting the Auto Tune process.

Use the PRoG (Programming Mode) Menu for Steps 1-7

1. Setpoint 1 Configuration (PRoG > SP1 > #)

Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Notes
SP1	_____						Process goal for PID

	Note: If not at Level 1, push the ⇧ button to get to that level. **Level 1 = INIt, PRoG, and oPER**
◀▶	Navigate to **PRoG** (Programming Mode).
↵	Select **PRoG**.
◀▶	Navigate to **SP1** (Setpoint 1 parameter).
▶	Select the **SP1**.
◀▶	Set the process goal value.
↵	Confirm the value.

2. (PRoG> Pld > A.to > 5.00)

Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Notes
Pld	A.to	**5.00**					Set timeout time for autotune

	Note: If not at Level 1, push the ⇧ button to get to that level. **Level 1 = INIt, PRoG, and oPER**
◀▶	Navigate to **PRoG** (Programming Mode).
↵	Select **PRoG**.
◀▶	Navigate to **Pld**.
↵	Select **Pld**.
◀▶	Navigate to **A.to**.
↵	Select **A.to**
↵	Set to **5.00** minutes or above

3. (PRoG> Pld > GAIN > _P_ > **2.77**)

Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Notes
Pld	GAIN	_P_	**2.77**				Manual Proportional Band setting

	Navigate back to level 3 by pushing the ⇧ button.
◀▶	Navigate to **GAIN**.
↵	Select **GAIN**.
◀▶	Navigate to **_P_**
↵	Select **_P_**
↵	Enter **2.77**

4. (PRoG > Pld > GAIN > _I_ > **0.08**)

Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Notes
Pld	GAIN	_I_	**0.08**				Manual Integral Factor setting

◀▶	Navigate to **_I_**
↵	Select **_I_**
↵	Enter **0.08**

5. (PRoG> Pld > GAIN > _d_ > 23.87)

Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Notes
Pld	GAIN	_d_	**23.87**				Manual Derivative Factor setting

◀▶	Navigate to **_d_**
↵	Select **_d_**
↵	Enter **23.87**

6. (PRoG > Pld > AdPt > **ENbL**)

Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Notes
Pld	AdPt	**ENbL**					Enable fuzzy logic adaptive tuning

	Navigate back to level 3 by pushing the ⇧ button.
◀ ▶	Navigate to **AdPt**
↵	Select **AdPt**
◀ ▶	Navigate to **ENbL**
↵	Select **ENbL**

To Begin AutoTune

7. (PRoG > Pld > tUNE > **StRt**)

Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Notes
Pld	tUNE	**StRt**					Enable fuzzy logic adaptive tuning

	Navigate back to level 3 by pushing the ⇧ button.
◀ ▶	Navigate to **tUNE**
↵	Select **tUNE**
↵	Select **StRt**
	Auto Tune starts and displays DONE when completed

Changing Temperature Units on the Temperature Controller

Use Initialization Mode (INIt > RdG > °F °C > **°F**)

Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Notes
RdG	°F°C	**°F**					

	Note: If not at Level 1, push the ⇧ button to get to that level. **Level 1 = INIt, PRoG, and oPER**
◀▶	Navigate to **INIt** (Initialization Mode).
↵	Select **INIt**.
◀▶	Navigate to **RdG** (Reading Formats).
↵	Select **RdG**.
◀▶	Navigate to **°F°C** (Temperature Units).
↵	Select **°F°C**.
◀▶	Navigate to **°F**
↵	Select **°F**
⇧	Select up button to go back to level 1
◀▶	Navigate to oPER
↵	Select oPER
↵	“RUN” will be displayed.
	Back to temperature readout and normal operating status.

Resetting the Temperature Controller(s) back to factory defaults.

To reset the Omega controller to factory defaults, enter the INIt (Initialization Mode) Menu and follow the steps below.

Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Notes
F.dFt	**ok?**						ENTER resets to factory defaults

	Note: If not at Level 1, push the ⇧ button to get to that level. **Level 1 = INIt, PRoG, and oPER**
◀▶	Navigate to **INIt** (Initialization Mode).
↵	Select **INIt**.
◀▶	Navigate to **F.dFt**
↵	Select **F.dFt**
◀▶	Navigate to **ok?**
↵	Select **ok?**
	The controller will now be reset. Next, enter the following MSI settings in red.

Resetting the Temperature Controller(s) back to MSI settings.

Use Initialization Mode to set the following parameters 1-7.

1. Thermocouple Input Type (INIt > INPt > t.C. > k)

Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Notes
INPt	t.C.	**k**					Type K thermocouple

	Note: If not at Level 1, push the ⇧ button to get to that level. **Level 1 = INIt, PRoG, and oPER**
◀▶	Navigate to **INIt** (Initialization Mode).
↵	Select **INIt**.
◀▶	Navigate to **INPt** (Input parameter).
↵	Select **INPt**.
◀▶	Navigate to **t.C.** (thermocouple).
↵	Select **t.C.**
◀▶	Navigate to the **K** thermocouple type.
↵	Select **k**.

2. Decimal Point Format (INIt > RdG > dEC.P > FFF.F)

Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Notes
RdG	dEC.P	**FFF.F**					Reading format -999.9 to +999.9

	Note: If not at Level 1, push the ⇧ button to get to that level. **Level 1 = INIt, PRoG, and oPER**
◀▶	Navigate to **INIt** (Initialization Mode).
↵	Select **INIt**.
◀▶	Navigate to **RdG** (Reading Formats).
↵	Select **RdG**.
◀▶	Navigate to **dEC.P** (Decimal-point Format).
↵	Select **dEC.P**.
▶▶	Navigate to **FFF.F** (One decimal place).
↵	Select **FFF.F**.

3. Temperature Units (INIt > RdG > °F°C > °C)

Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Notes
RdG	°F°C	**°C**					Degrees Celsius annunciator

	Note: If not at Level 1, push the ⇧ button to get to that level. **Level 1 = INIt, PRoG, and oPER**
◀▶	Navigate to **INIt** (Initialization Mode).
↵	Select **INIt**.
◀▶	Navigate to **RdG** (Reading Formats).
↵	Select **RdG**.
◀▶	Navigate to **°F°C** (Temperature Units). • **°C - Degrees Celsius (factory default), °C annunciator turned on** • **°F - Degrees Fahrenheit, °F annunciator turned on**
↵	Select **°F°C**.
◀▶	Navigate to **°C**
↵	Select **°C**

4. Filter (INIt > RdG > FLtR > 8)

Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Notes
RdG	FLtR	**8**					Readings per displayed value: 8

	Note: If not at Level 1, push the ⇧ button to get to that level. **Level 1 = INIt, PRoG, and oPER**
◀▶	Navigate to **INIt** (Initialization Mode).
↵	Select **INIt**.
◀▶	Navigate to **RdG** (Reading Formats).
↵	Select **RdG**.
◀▶	Navigate to the **FLtR** (Filter parameter).
↵	Select **FLtR**.
◀▶	Navigate to **8** (0.4 s)**.**
▶	Select **8.**

5. Normal Color (INIt > RdG > NCLR > GRN)

Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Notes
RdG	NCLR	**GRN**					Default display color: Green

	Note: If not at Level 1, push the ⇧ button to get to that level. **Level 1 = INIt, PRoG, and oPER**
◀▶	Navigate to **INIt** (Initialization Mode).
↵	Select **INIt**.
◀▶	Navigate to **RdG** (Reading Formats).
↵	Select **RdG**.
◀▶	Navigate to **NCLR** (Normal Color parameter).
↵	Select **NCLR**.
◀▶	Navigate to **GRN (Green)**.
↵	Select **GRN**.

6. Brightness (INIt > RdG > bRGt > HIGH) Brightness setting = HIGH

Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Notes
RdG	bRGt	**HIGH**					High display brightness

	Note: If not at Level 1, push the ⇧ button to get to that level. **Level 1 = INIt, PRoG, and oPER**
◀▶	Navigate to **INIt** (Initialization Mode).
↵	Select **INIt**.
◀▶	Navigate to **RdG** (Reading Formats).
↵	Select **RdG**.
◀▶	Navigate to **bRGt** (Brightness parameter).
↵	Select **bRGt**.
◀▶	Navigate to **HIGH** (High display brightness).
↵	Select **HIGH**.

7. Safety Features (INIt > SFty > PwoN > RSM)

Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Notes
SFty	PwoN	**RSM**					RUN on power up if not previously faulted

	Note: If not at Level 1, push the ⇧ button to get to that level. **Level 1 = INIt, PRoG, and oPER**
◀ ▶	Navigate to **INIt** (Initialization Mode).
↵	Select **INIt**.
◀ ▶	Navigate to **SFty** (Safety Features).
↵	Select **SFty**.
◀ ▶	Navigate to **PwoN** (Power On Confirmation parameter). **Note: PwoN – Requires confirmation before running automatically at startup**
↵	Select **PwoN**.
◀ ▶	Navigate to **RSM.** **Note: RSM – Program runs automatically at startup if not previously in fault state.**
↵	Select **RSM**.

8. Configure the USB port

CoMM	USb						Configure the USB port

Use Programming Mode (PRoG) to set the following parameters 9-14.

9. Setpoint 1 Configuration (PRoG > SP1 > #)

Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Notes
SP1	_____						Process goal for PID

	Note: If not at Level 1, push the ⇑ button to get to that level. **Level 1 = INIt, PRoG, and oPER**
◀ ▶	Navigate to **PRoG** (Programming Mode).
↵	Select **PRoG**.
◀ ▶	Navigate to **SP1** (Setpoint 1 parameter).
◀	Select the **SP1**.
◀ ▶	Set the process goal value.
▶	Confirm the value.

Sections 10-12 are set for all models except 220B, 320B, 43B, and TF-120
For models 220B, 320B, 43B, and TF-120 skip to Section 13

10. Alarm High/Low setting (PRoG > ALM.1, ALM.2 > type > HI.Lo)

Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Notes
ALM.1	Note: This submenu is the same for all other Alarm configurations.						
	tyPE						
		HI.Lo.					Alarm: process value outside Alarm triggers

	Note: If not at Level 1, push the ⇑ button to get to that level. **Level 1 = INIt, PRoG, and oPER**
◀ ▶	Navigate to **PRoG** (Programming Mode).
↵	Select **PRoG**.
◀ ▶	Navigate to **ALM.1 (**Alarm Configuration 1). Note: Select Alarm Configuration to set up, change, enable, or disable Alarms. Either or both Alarms can be assigned to trigger display color changes, annunciators, and / or outputs. Either or both Alarm configurations can be assigned to multiple outputs. The ALM.1 and ALM.2 configuration menus have all the same settings and function in the same manner.

↵	Select **ALM.1.**
◀ ▶	Navigate to **tyPE** (Alarm Type Parameter). **Note: This parameter will control the basic behavior of the selected alarm.**
↵	Select **tyPE**.
◀ ▶	Navigate to **HILo**
↵	Select **HILo**

11. Alarm high, low, color reference parameters

Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Notes
ALM.1	ALR.H	**2.5**					Alarm high parameter for trigger calculations
ALM.1	ALR.L	**2.5**					Alarm low parameter for trigger calculations
ALM.1	A.CLR	**REd**					Red display when Alarm is active

Alarm High Reference (PRoG > ALM.1 > ALR.H)

	Follow Steps in Section 10. **Note: After selecting HI.Lo setting, tyPE parameter should be showing in window.**
◀ ▶	Navigate to **ALR.H** (Alarm High Reference parameter).
↵	Select **ALR.H**.
◀ ▶	Set the Alarm High Reference value = 2.5 **Note: One arrow moves the digit and the other moves the value.**
↵	Confirm the value.

Alarm Low Reference (PRoG > ALM.1 > ALR.L)

	Follow Steps in Section 10. **Note: After selecting HI.Lo setting, tyPE parameter should be showing in window.**
◀ ▶	Navigate to **ALR.L** (Alarm Low Reference parameter).
↵	Select **ALR.L**.
◀ ▶	Set the Alarm Low Reference value = 2.5 **Note: One arrow moves the digit and the other moves the value.**
↵	Confirm the value.

Alarm Color (PRoG > ALM.1 > A.CLR > REd)

	Follow Steps in Section 10. **Note: After selecting HI.Lo setting, tyPE parameter should be showing in window.**
◀ ▶	Navigate to **A.CLR** (Alarm Color parameter).
↵	Select **A.CLR**.
◀ ▶	Navigate to **REd** (Alarm conditions are displayed in red).
↵	Select the **REd**.

12. Output as Alarm 1 (PRoG > dtR1 > ModE > ALM.1)

Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Notes
dtR.1							**dtR.1** is replaced by output type. For example: oUt#
	ModE		Note: **This submenu is the same for all other outputs.**				
		ALM.1					Output is an Alarm using ALM.1 configuration

	Note: If not at Level 1, push the ⇧ button to get to that level. **Level 1 = INIt, PRoG, and oPER**
◀▶	Navigate to **PRoG** (Programming Mode).
↵	Select **PRoG**.
◀▶	Navigate to **dtR1** (Double Throw Mechanical Relay number 1). Note: All output channels have the same menu structure. However, only those parameters that apply for the type of output being configured appear in that output's menu.
▶	Select **dtR1**.
◀▶	Navigate to **ModE**. Note: ModE – Allows the output to be set up as a control, Alarm, retransmission, or Ramp/Soak event output; the output can also be turned off.
↵	Select **ModE**.
◀▶	Navigate to **ALM.1**. Note: ALM.1 – Set the output to be an Alarm using the ALM.1 configuration
↵	Select **ALM.1.**

Section 13 is for Models 220B, 320B, 43B, and TF-120

13. Turn Off Output Channel (PRoG > dtR1 > ModE > oFF)

Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Notes
dtR.1	ModE	**oFF**					Output does nothing

	Note: If not at Level 1, push the ⇧ button to get to that level. **Level 1 = INIt, PRoG, and oPER**
◀ ▶	Navigate to **PRoG** (Programming Mode).
↵	Select **PRoG**.
◀ ▶	Navigate to **dtR1** (Double Throw Mechanical Relay number 1). **Note: All output channels have the same menu structure. However, only those parameters that apply for the type of output being configured appear in that output's menu.**
◀ ▶	Navigate to **ModE**. **Note: ModE – Allows the output to be set up as a control, Alarm, retransmission, or Ramp/Soak event output; the output can also be turned off.**
↵	Select **ModE**.
◀ ▶	Navigate to **oFF.** **Note: oFF – Turn off the output channel**
↵	Select **oFF**.

14. PID Control Mode (PRoG > dc.1 > ModE > Pld)

Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Notes
dc.1							dc.1 is replaced by output type. For example: oUt#
	ModE						
		Pld					PID Control Mode

	Note: If not at Level 1, push the ⇧ button to get to that level. **Level 1 = INIt, PRoG, and oPER**
◀▶	Navigate to **PRoG** (Programming Mode).
↵	Select **PRoG**.
◀▶	Navigate to **dC1** (DC Pulse output number 1). **Note: All output channels have the same menu structure. However, only those parameters that apply for the type of output being configured appear in that output's menu.**
↵	Select **dC1**.
◀▶	Navigate to **ModE.** **Note: ModE – Allows the output to be set up as a control, Alarm, retransmission, or Ramp/Soak event output; the output can also be turned off.**
↵	Select **ModE**.
◀▶	Navigate to **Pld.** **Note: Pld - Set the output to Proportional-Integral-Derivative (PID) Control Mode.**
↵	Select **Pld**.

15. Increase to SP1 (PRoG > PLD >ACtN > RVRS)

Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Notes
Pld	ACtN	**RVRS**					Increase to **SP1** (i.e., heating)

	Note: If not at Level 1, push the ⇧ button to get to that level. **Level 1 = INIt, PRoG, and oPER**
◀▶	Navigate to **PRoG** (Programming Mode).
↵	Select **PRoG**.
◀▶	Navigate to **Pld.** **Note: Pld – Set the output to Proportional-Integral-Derivative (PID) Control Mode**
↵	Select **Pld**.
◀▶	Navigate to **ACtN.** **Note: ACtN – Determines the action direction for control**
↵	Select **ACtN**.
◀▶	Navigate to **RVRS.** **Note: RVRS – Off when Process Value is > Setpoint, and on when Process Value is < Setpoint (e.g., heating); deadband is applied below Setpoint (factory default)**
↵	Select **RVRS**.

A full description of features can be found here: https://assets.omega.com/manuals/M5451.pdf.