MACHINE SOLUTIONS INC.

USER MANUAL

BEAHM DESIGNS BALLOON BONDER

MODEL 420-B

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

WELCOME

Machine Solutions, Inc. (MSI) would like to take this opportunity to thank you for purchasing your new 420-B Balloon 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 Thermal Die Bonder with Axial Compression is equipped with dual Pneumatic tubing grips, centerline adjustment, adjustable compression, and variable timed cooling. The 420B provides a low-cost quick tool alternative to RF die bonding. The seven-parameter operation is easy to set-up and use and simplifies system calibration and process validation. This system provides you with fast, highly repeatable bonds. It also allows you to perform highly precise bonds for demanding applications such as short balloon bonds and ultra smooth lap & butt welds. Adjustable clamp pressure varies compression force on joint. Ultra compact design provides you with greater workspace.

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.

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 or otherwise operate the machine in any manner other than that in which it is explicitly intended. 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 to insert any foreign objects into the machine and do not attempt to bypass any guards.

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:

- Axial Compression Thermal Die Bonder
- IEC Power Cord

Installation

1. Place the system on a level, sturdy surface at an ergonomically viable height for the user.
2. Connect the electrical umbilical to the die base unit.
3. Connect the power cord to the main control unit.
4. Connect the air supply to the system and then to a clean, dry, and filtered compressed air source.

CONTROLS AND FEATURES

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

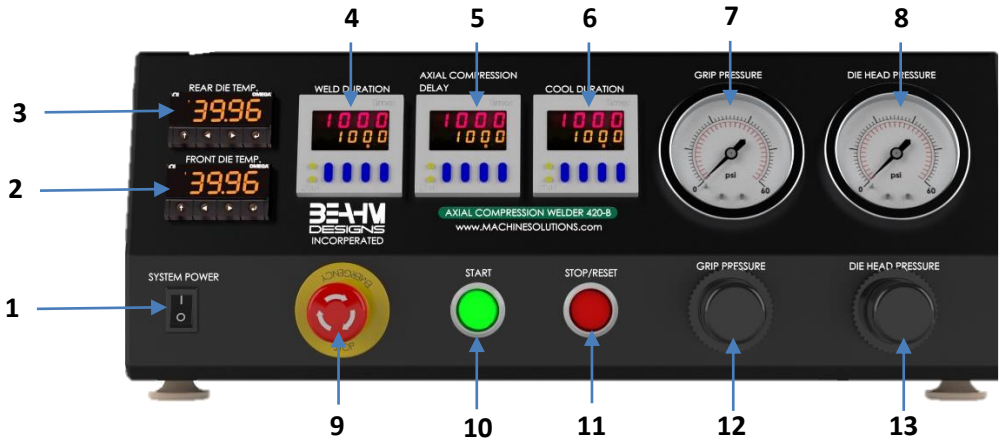

Figure 1. 420-B Front Panel

Table 1. Control and Display Functions

Item	Function
1	Toggles system power and air on and off.
2	Controls the temperature of the front die head.
3	Controls the temperature of the rear die head.
4	Controls the duration that the die heads are closed and/or in contact with the product.
5	Controls compression delay time.
6	Controls the duration the cooling air flows.
7	Displays the grip pressure.
8	Displays the pressure applied to the die head actuation cylinder.
9	Disrupts power to heaters and internal components.
10	Initiates process sequence.
11	Interrupts the process sequence and resets the system timer. Resets the system after power up and if E Stop is depressed
12	Controls the pressure to the product grips.
13	Regulates the pressure of the die head actuation cylinder.

PARAMETER SETTINGS

Pressure Regulator Setting

- Rotate the regulator knob clockwise to increase air pressure, counterclockwise to decrease air pressure output to the die head actuation cylinder.

Process Timer Setting

- Depress the upper half of the blue rocker buttons to increase time duration, depress the lower half of the blue rocker button to decrease the time duration. Depress the timer reset button to accept the new value.

OMEGA PLATINUM TEMPERATURE CONTROLLER

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.

Viewing/Returning to the Current Temperature on Temperature Controller(s)

Use oPER (Operating Mode) Menu

Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Notes
RUN							

	Note: If not at Level 1, push the ⇧ button to get to that level. **Level 1 = INIt, PRoG, and oPER**
◀◀	Navigate to **oPER** (Operating Mode).
↵	Select **oPER**.
◀◀	Navigate to **RUN**.
↵	Select the **RUN**.
↵	Displays the current temperature.

Resetting the Temperature Controller

Refer to Appendix A on page 20 for resetting the temperature controller and all temperature control settings.

RUN PROCESS

Caution: Die jaws will become hot during operation and depending on temperature set-point, can cause severe skin burns if contact occurs.

1. Switch main power on.
2. Set the die temperature on EACH temperature controller.
3. Set heat timer to desired duration in seconds.
4. Set Axial Compression Delay Timer to desired duration in seconds.
5. Set Cool Timer to desired duration in seconds.
6. Adjust Die Head pressure.
7. Adjust Tubing Grip Pressure.
8. Position components to be bonded within thermal jaws.
9. Depress footswitch/push start button.
10. Remove components upon completion of cool duration.

MAINTENANCE

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

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

Caution: Ensure that the die heads are cooled to within 15 degrees of ambient temperature before proceeding with replacement.

Cleaning

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

Exchanging Die Heads

- Loosen the set screw located on the top of each die head and withdraw the thermocouple.
- Remove the four screws at the base of each die head.
- Position new die heads in place of removed die heads, install four screws at the base of each die head. Do not overtighten the screws.
- Install the thermocouple in the rear of each die head and gently tighten the set screw to hold them in place.

DIAGNOSTICS AND TROUBLESHOOTING

Table 2. Diagnostics and Troubleshooting

Issue	Possible Causes	Solution
Temperature not stable.	• Die heads replaced • Thermocouple loose	• Auto-tune (MSI recommends process auto-tune @ temperature.) • Re-install thermocouple(s)
"Open" flashing on temperature controller.	• T.C Sensor Break	• Bad thermocouple • Verify complete T.C. path
Die heads do not close.	• Air pressure is too low • Timer set to "0" • Valve defective	• Increase air pressure • Increase Heat Duration • Replace valve
Die head(s) do not heat.	• Loose connection to main control unit • Defective Temperature controller	• Verify secure connections • Replace temperature controller
.Err code in display.	• Temperature controller software failure	• Replace temperature controller
System will not power on.	• Emergency stop switch depressed • IEC power cord not fully connected	• Rotate switch knob to engage • Verify installation

SPECIFICATIONS

Table 3. System Specifications

Description	Range	Resolution	Accuracy
Temperature Controller	Ambient-500°F	0.1°F/°C temperature; 10 µV process	+/- 0.03% F.S.
Die Temperature	Ambient-500°F	N/A	±10°F
Heat Duration	1-9999 seconds	1.0 sec	± .1 sec
Cool Duration	1-9999 seconds	1.0 sec	± .1 sec
Die Pressure	0-60 psi	1.0 psi	± 1.5% F.S.

Facilities Requirements

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

CALIBRATION

Important Notes:

- **It is recommended that calibration be performed by a certified service, preferably with the system in the location of use. Calibration procedures are the domain of these service providers.**
- **Calibration refers to the process of verifying that each of the systems' instruments that control a process parameter is within manufacturers' specification.**
- **Calibration DOES NOT refer to the process of measuring the temperature at the center of the tooling and "matching" the value to the temperature controller set point.**
- **The measured value at the tooling may not match the temperature controller set point and the.**
    1. Calibrate the temperature controller annually.
    2. Calibrate the timers annually.
    3. Calibrate the pressure gauge annually.

CRITICAL SPARE PARTS

Table 4. Critical Spare Parts

Part Number	Description	Quantity
1153590-001 1157788-001	HEATER, CARTRIDGE, 120VAC, 1.5in, 100w (configuration specific) HEATER, CARTRIDGE, 220VAC, 1.5IN, 100W (configuration specific)	2
1143133-001	THERMOCOUPLE, K TYPE, 0.125 OD	2
1153460-001	SOCKET TIMER	1
1143303-001	TIMER, DIGITAL, LT4H, 24VDC, COLOR LCD, 8 MODES	3
1161899-001	TEMP CONTROLLER	2
1143287-001	RELAY, 24VDC INTEGRATED	2
119106-001	RELAY, MODULE THIN, 24V, DIN RAIL N1PDT	1
1145619-001	RELAY, 24VDC, INTEGRATED, 4PDT	1
1343250-001	VALVE, 2-WAY 24 VCD, MAC	2
1330445-003	VALVE, 5-2, 24VDC, BODY PORTED	3

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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WARRANTY AND LIMITATIONS

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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

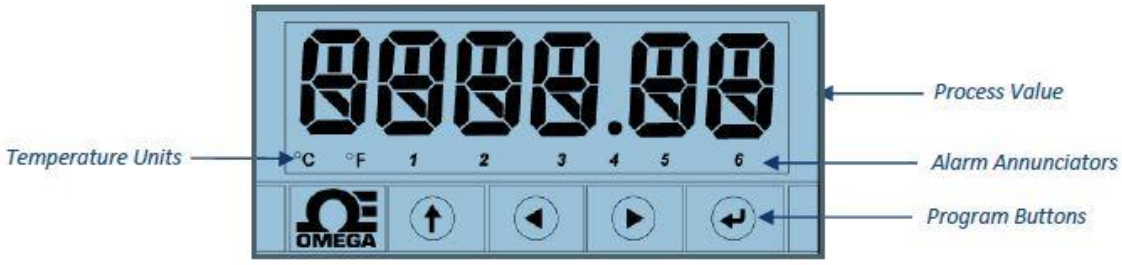

Figure A-1. Controller Layout

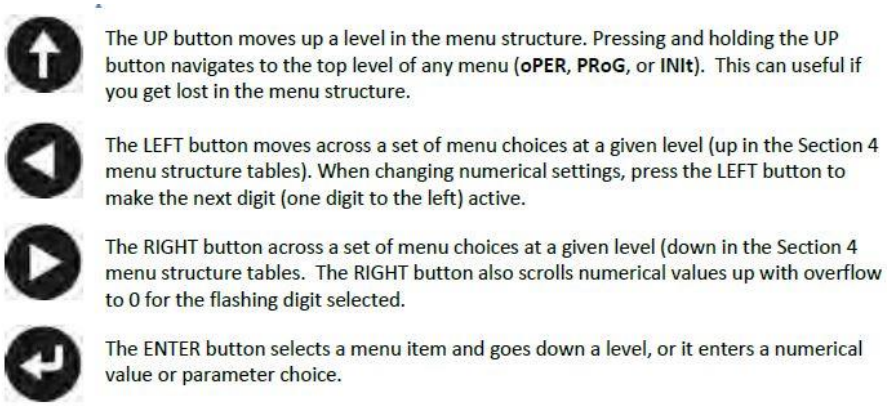

Figure A-2. Description of Button Actions

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.