MACHINE SOLUTIONS INC.

USER MANUAL

BEAHM DESIGNS BENCH TOP DIE NECKER

Model 43-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 43-B Bench Top Die Necker. At MSI, we are dedicated to bringing innovative process development solutions to both medical device and nonmedical organizations. MSI looks forward to helping your organization provide life-improving devices to your customers, today and tomorrow.

MACHINE DESCRIPTION

The Beahm Designs Die Necker progressively reduces tubing diameter by means of a heated die. Tubing is manually drawn through the die to the desired length. The I.D. of the interchangeable dies controls the diameter of the neck tubing.

SAFETY

- Place the system on a level, sturdy surface at an ergonomically viable height for the user.
- Use of eye protection when working with compressed gases and heated materials is advised.
- The maximum observed Sound Pressure Level is below 70 dBA.
- Hot dies 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. Power down machine before disconnecting umbilical.

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.

Note: Power down machine before disconnecting umbilical.

Contents

1. Benchtop Die Necker
2. Power cord

Installation

1. Place the system on a level, sturdy surface at an ergonomically viable height for the user.
2. System power is in the OFF position.
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.
5. Connect the electrical umbilical to the die base unit.

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 19 for resetting the temperature controller and all temperature control settings.

RUN PROCESS

Caution: Die housing and drawing dies 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 die temperature on temperature controller by pressing the UP button once to see "SP1" displayed. Press the Enter button to display temperature. Use Left/Right arrows to set desired temperature. Once the desired temperature is set, press the Enter button to return to home.
3. Pass end of tubing through the necking die and grasp at opposite side.
4. Draw tubing through die at a speed that produces the desired tubing OD.
5. To aid in obtaining tubing diameter, position the cooling air nozzle near the exit of the drawing die and switch cooling air "on" as tubing is drawn through the die.

Cooling Air ON Toggle

- Place toggle in the up position for cooling air On, and toggle down for cooling air Off.

Cooling Air Flow Adjust

- Rotate the Cooling Flow valve counterclockwise to increase the cooling air flow, and clockwise to decrease the cooling air flow.

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 the die heads are cooled to within 15°F 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. The machine should not be washed down.
2. Cleaning should be with a soft dry cloth only.

Die Head Replacement

Required Tools and Equipment

2 open end or similar wrenches
Allen Wrenches

1. Remove the 4 screws holding the heat shield.
2. Remove the heat shield.
3. Loosen the clamping nut and bolt located at the top and bottom of the heater housing.
4. Remove the existing die from the housing and replace it with alternate size die.
5. Tighten the clamping nut and bolt until the die is secure in the housing.
6. Reinstall the heat shield.

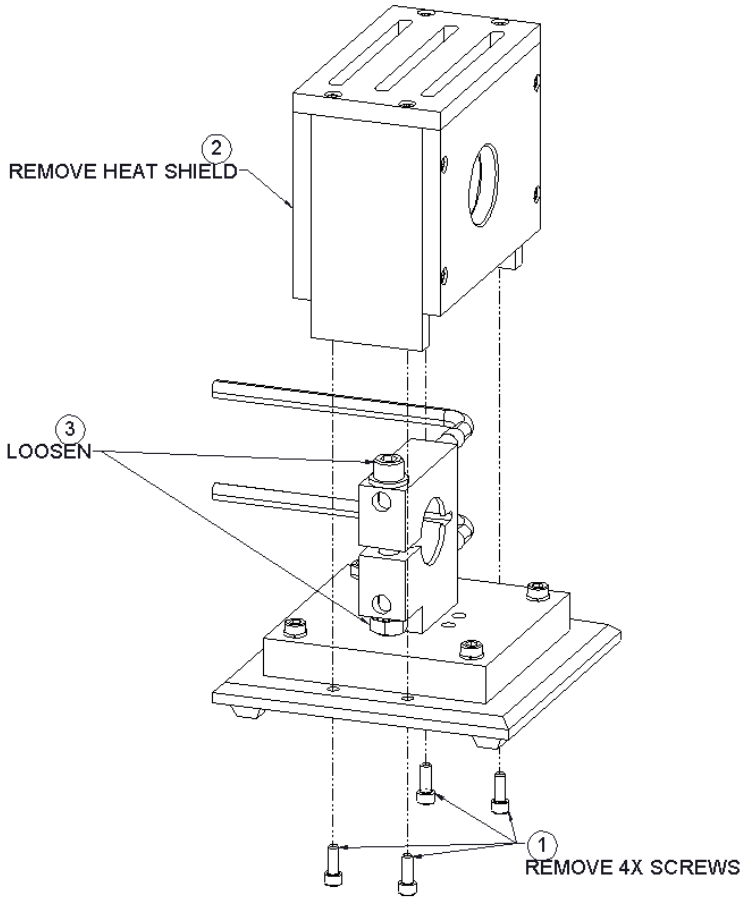

Figure 1. Die Head Replacement

Fuse Replacement

1. To replace a blown fuse, remove 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 2. Removing Fuse Insert

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

Figure 3. Fuse Replacement

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

Figure 4. Fuse Insert Replacement

DIAGNOSTICS AND TROUBLESHOOTING

Table 1. Troubleshooting

Issue	Possible Causes	Solution
Temperature not stable	• Thermocouple loose	• Auto-tune (MSI recommends auto-tune @ process temperature.) • Re-install thermocouple
"Open" flashing on temperature controller	• T.C sensor break	• Replace thermocouple • Verify complete T.C. path
No heat at Die	• 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 2. System Specifications

Description	Range	Resolution	Accuracy
Temperature	200-500°F	0.1°F/°C temperature; 10 µV process	+/- 0.03% F.S.

Facility Requirements

- Voltage: 120-240 VAC, 50/60 hz
- Wattage: 10 amps (500 watts)
- Compressed Air: 100-125 psi, clean dry compressed air

CRITICAL PARTS

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

Table 3. Critical Spare Parts

Part Number	Description	Quantity
120V – 1153590-001 220V – 1157788-001	HEATER CARTRIDGE	2 2
1143133-001	THERMOCOUPLE, K TYPE, 0.125 OD	1
1161899-001	TEMPERATURE CONTROLLER	1
1155195-001	SOLID STATE RELAY	1
1114668-005	24VDC POWER SUPPLY	1
110092-001	FUSE	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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WARRANTY AND LIMITATIONS

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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

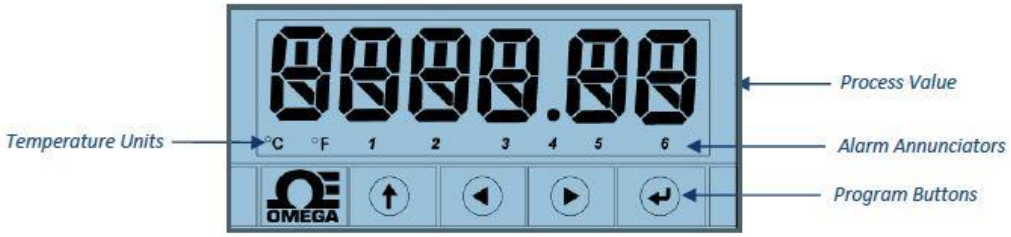

Figure A-1. Controller Layout

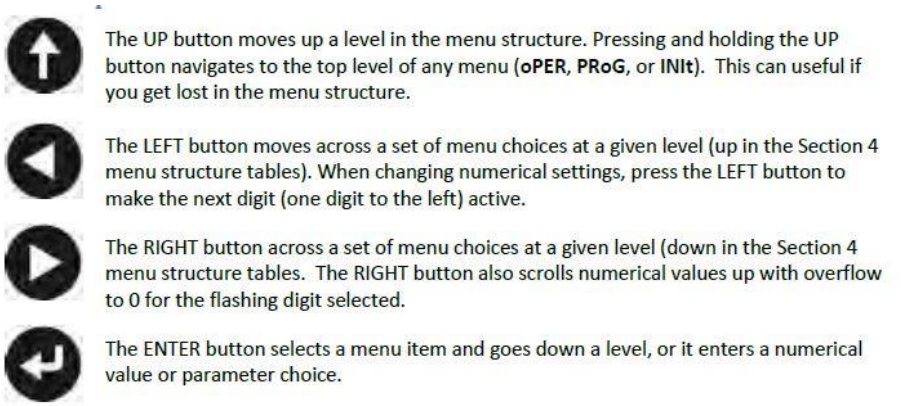

Figure A-2. Description of Button Actions

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
PId	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 **PId.** **Note: PId – Set the output to Proportional-Integral-Derivative (PID) Control Mode**
↵	Select **PId**.
◀▶	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.