MACHINE SOLUTIONS INC.

USER MANUAL

BEAHM DESIGNS SPLIT DIE THERMAL BONDER

MODEL 320-B

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WELCOME

Machine Solutions, Inc. (MSI) would like to take this opportunity to thank you for purchasing your new 320-B Split Die Thermal Bonder machine. 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

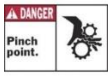
The Beahm Designs Inc. Model 320-B Split Die Thermal Bonder is a system for the purpose of thermal bonding or welding thermoplastic components to other materials by means of a pair of heated dies. The system features two die heads that remain at a constant process temperature vs. cycling the heat on 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 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:

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

INSTALLATION

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

SET UP AND CONFIGURATION

Proper sizing of the die heads 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.

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.
3. If using heat shrink, then pre-shrink the sleeve.
4. Measure the diameter at the bond area.
5. Subtract .002”-.003” from this measurement.
6. Bore this diameter through the die heads.

Refer to Appendix B for die head sizing.

Die Head Width - The die head width can vary greatly between applications and especially between butted (Butt) joints and overlap (Lap) joints. Since the 320-B is most used for 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.

Figure 1. Grip/Positioning nests

System Controls And Features

Located on the front and back panels of the Split Die Thermal Bonder are the following controls and/or displays and their functions:

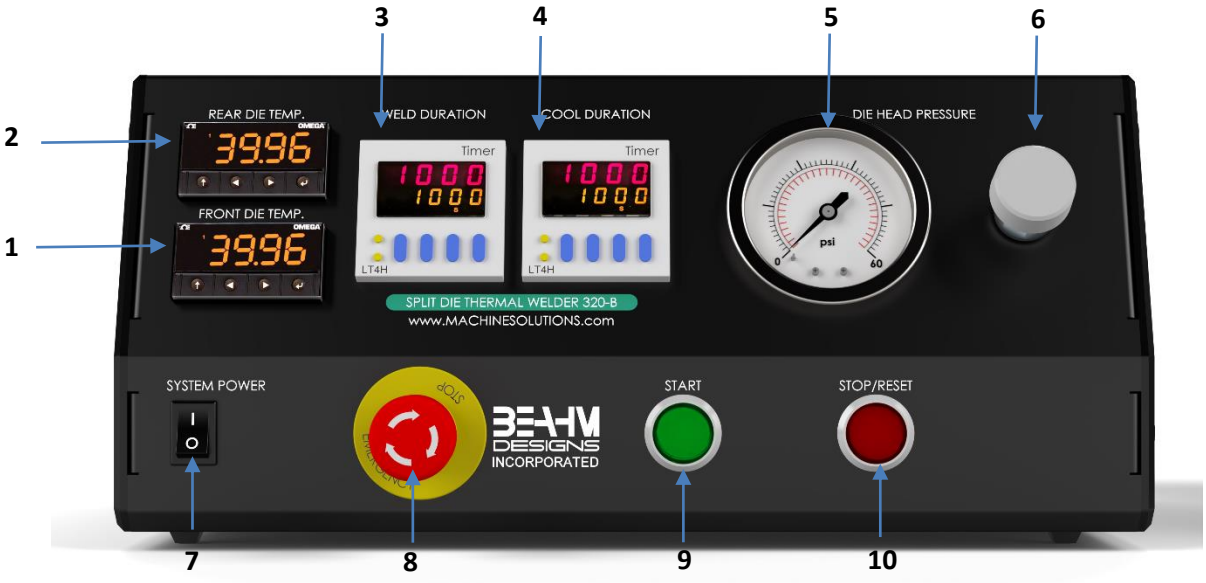


Figure 2. 320-B Split Die Thermal Bonder Front Panel

Table 1. Control and Display Functions (Front Panel)

	Description	Function
1	Front Die temperature controller	Controls the temperature of the front die head
2	Rear Die temperature controller	Controls the temperature of the rear die head
3	Heat Duration Timer	Controls the duration that the die heads are closed and/or in contact with product
4	Cool Duration Timer	Controls the duration the cooling air flow
5	Die head pressure gauge	Displays the pressure applied to the die head actuation cylinder
6	Die head pressure regulator	Regulates the pressure of the die head actuation cylinder
7	Main power switch	Toggles system power and air on and off
8	E-Stop	Interrupts all system power and air
9	Start switch	Initiates process sequence
10	Stop/Reset switch	Interrupts the process sequence and resets the system timer

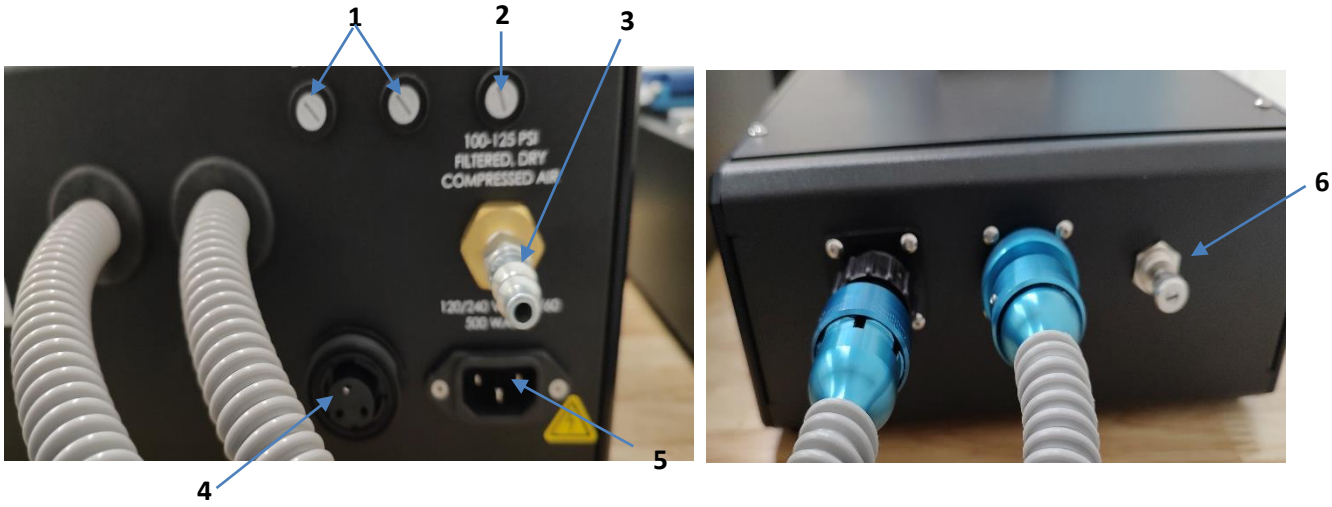


Figure 3. 320-B Split Die Thermal Bonder Back Panel

Table 2. Control and Display Functions (Back Panel)

	Description	Function
1	2 Amp Fuse Holders	Protects power distribution
2	10 Amp Fuse Holder	Protects power distribution
3	Industrial System Air Connection	Controls system air supply
4	Foot Switch	Allows connection to foot pedal
5	Power Entry Module	Connects to power cord
6	Cooling Air Regulator	Controls flow of cooling air

PARAMETER SETTINGS

Temperature Controller (Optional Eurotherm Temperature Controller)

- Depress and hold the up or down arrow key of the temperature controller to scroll to the desired temperature. After 2 seconds the new value will be accepted, and the temperature will ramp to the new set point.
- Set the die temperature on EACH temperature controller by pressing the UP/Down arrow key once to display the set temperature, then again to change it.

Setting Heat Duration

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

Adjusting Die Pressure

- Rotate the regulator knob clockwise or counterclockwise until the pressure gauge displays the desired 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 22 for resetting the temperature controller and all temperature control settings.

RUN PROCESS

1. Position the components to be processed between the die heads and in the tooling nests.
2. Lower the guide covers onto the product.
3. Depress the start button or foot switch to initiate the process sequence.
4. Upon completion of the cooling cycle, lift the guide covers and remove the assembly.

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: 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.

Preventative Maintenance

1. Check power cable for damage every 12 months and replace as needed.
2. Check setting of pre-regulator every 12 months.

Exchanging Die Heads

1. Remove upper heat shields.
2. Loosen the thermocouple set screw in each die head and slide the thermocouple out of each head.
3. Remove the fasteners at the base of each die head and remove the die heads.
4. Position the replacement die heads on the die bases with the thermocouple mounting holes facing away from each other.
5. Re-install the fasteners at the base of each die head, DO NOT tighten the fasteners.
6. Manually close the die heads and ensure that they are aligned left-to-right and, while holding the heads together, tighten the base fasteners.
7. Fully insert each thermocouple into each die head and lightly tighten each set screw.
8. Re-install each upper heat shield.

Exchanging Vee Guides

1. Raise the guide cover(s).
2. Remove the two fasteners in the guide/insert and remove the guide/insert.
3. Install the replacement guide/insert.
4. Re-install the mounting fasteners.

Aligning Tooling

Note: Alignment should be performed on a prepared product subassembly.

Note: Alignment MUST be performed with system power off and heads at ambient temperature. Alignment must be performed on a flat and reasonably level surface.

1. Remove the Y-Z axis covers of each vee guide/clamp assembly and the Z-axis cover of the die head assembly.
2. Prepare an assembly.
3. Position the assembly within the vee guide assemblies on either side of the die heads and with the bond area.
4. Leave guide covers open.
5. Carefully close the die heads while observing the alignment with the die head bore.
6. Adjust the Z-axis of the die head assembly as required such that the sub assembly is secured by the dies but slightly above the vee guides/inserts.
7. Adjust the Y-Z axis of each vee guide assembly until each guide comes into contact with the first feature of the subassembly on the corresponding side.
8. Close the guide covers.
9. Manually open and close the die heads and verify alignment.
10. Re-adjust each axis as required to obtain optimum alignment.

DIAGNOSTICS AND TROUBLESHOOTING

Table 3. Diagnostics and Troubleshooting

Issue	Possible Causes	Solution
Temperature not stable	• Thermal Nozzle replaced • Thermocouple loose	• Auto-tune (MSI recommends process auto-tune @ process temperature.) • Re-install thermocouple
"Open" flashing on temperature controller	• Break in thermocouple wire • Thermocouple failure	• Verify all connections from controller to remote TC jack • Replace thermocouple
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	• Verify installation

SPECIFICATIONS

Table 4. System Specifications

Description	Range	Resolution	Accuracy
Temperature	Ambient-500° F	0.1°F/°C temperature; 10 µV process	+/- 0.03% F.S.
Air Flow	0-60 psi	N/A	N/A

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 5. Critical Spare Parts

Part Number	Description	Quantity
120V – 1153590-001 220V – 1157788-001 1156762-001 1156762-003 1160217-001 1160217-003	HEATER, CARTRIDGE, 120VAC, 1.5IN, 100W HEATER, CARTRIDGE, 220VAC, 1.5IN, 100W HEATER, CARTRIDGE, .250 DIA, 2.5IN L, 250W, 120V HEATER, CARTRIDGE, .250 DIA, 2.5IN L, 250W, 240V HEATER, CART, .25 IN DIA, 3.5 IN L, 300W, 120V HEATER, CART, .25 IN DIA, 3.5 IN L, 300W, 220V	2
1143133-001	Thermocouple	2
3054593-101	Blank Die Heads (0.5”) (Pair)	1
1348043-001	Air Pressure Gauge	1
1161899-001	Temperature Controller	2
1143311-001	Solid State Relay	2
1143287-001	Relay, 24 VDC	2
1343250-001	Valve, 2 Way	2
1330445-003	Valve, 5-2	1

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

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 the 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

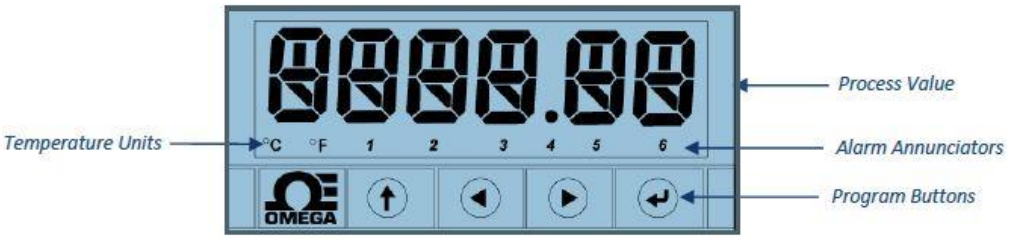

Figure A-1. Controller Layout

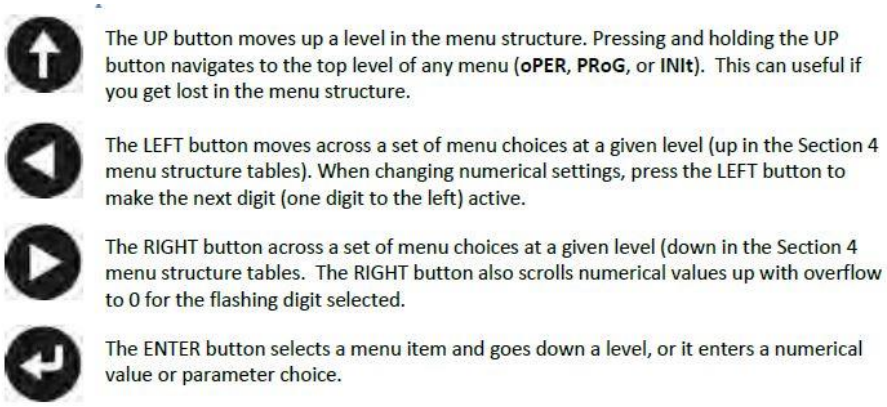

Figure A-2. Description of Button Actions

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
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.

APPENDIX B

Die Head Sizing

Description:	This procedure describes the process of sizing the Thermal Die Head tooling used on Beahm Bonders (model #'s 220B, 320B, 420B, 520B & 620B)
Scope:	This document applies to Part # 3054593-001, and 3052819-001 (only applies to 520B and 620B) Thermal Die Heads
Tools and Equipment:	Caliper or micrometer
Reference:	Figure B-1. Die Head Sizing

Procedure:

1. Assemble components to be bonded over mandrel(s) (Refer to Figure B-1, 1-2).
2. Measure bond length, tubing overlap, and balloon sleeve length (Refer to Figure B-1, Steps 1-3).
3. Position protective sleeves (fitted PTFE, PET heat shrink, or Polyolefin heat shrink) over bond location Refer to Figure B-1, Steps 1-4).
4. For heat shrink sleeves (PET, Polyolefin etc.), shrink the sleeve onto the bond location.
5. Measure O.D. of protective sleeve at bond location (Refer to Figure B-1, Steps 1-5).
6. Machine the die heads to width based on value in Step 2.
7. Bore hole through heads .003" less than the diameter value in Step 4.
8. For Balloon Shield bore size, add .005" to the product OD (without sleeve).

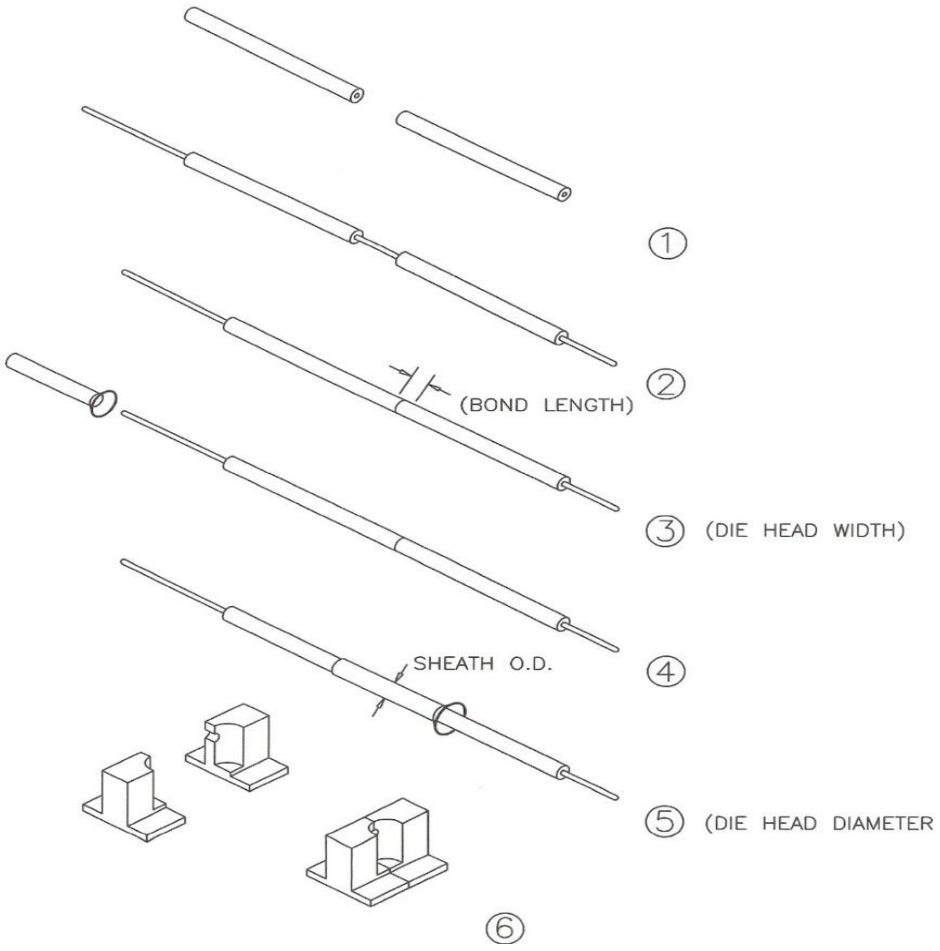

Figure B-1. Die Head Sizing