LMF SERIES
BENCHTOP MUFFLE FURNACES
LMF-6525, 2525, M525

Operator's Manual

OMEGALUX™
An OMEGA Technologies Company

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SAFETY PRECAUTIONS and MSDS

Please read and follow the safety precautions listed below. These are intended for your safety and the safe operation of the equipment.

CAUTION

* NEVER OPERATE THE FURNACE WITH COMBUSTIBLE MATERIALS ABOVE, ON TOP OF, OR IN CLOSE PROXIMITY TO THE FURNACE.

* DO NOT USE TONGS OR OTHER TOOLS TO OPERATE THE CONTROLS.

* KEEP THE DOOR IN THE CLOSED POSITION WHILE NOT IN USE.

* DO NOT USE SOLVENTS OR LIQUID CLEANERS ON THE CONTROL PANEL.

* DO NOT PLACE HOT ITEMS REMOVED FROM THE FURNACE ON TOP OR IN FRONT OF THE FURNACE.

* DO NOT ATTEMPT TO SERVICE THE FURNACE UNTIL YOU HAVE READ AND UN-DERSTOOD THE SERVICE INSTRUCTIONS INCLUDED IN THIS MANUAL.

* ALWAYS TURN OFF THE POWER AND REMOVE THE LINE CORD FROM THE WALL OUTLET BEFORE SERVICING THE FURNACE.

* ALWAYS VERIFY THAT THE FURNACE CONTROL IS DISPLAYING "DOOR" BE-FORE ATTEMPTING TO LOAD, UNLOAD, OR REACH INTO THE FURNACE CHAM-BER WITH ANY TOOLS OR INSTRUMENTS.

* USE ONLY INERT GASES WITH THE AIR EXCHANGE FEATURE.

WARNING

This furnace is not designed for use in hazardous (Class I, II, or III) locations as defined by the National Electric Code.

For personal safety, this furnace must be grounded.

The furnace power cord is equipped with a three-prong (grounding) plug for use with wall receptacles to minimize the possibility of electric shock hazard from the fur-nace. The wall receptacles and circuit should be checked by a qualified electrician to make sure the receptacle is properly grounded.

Two- prong wall receptacles must be replaced with three- prong wall receptacles to ensure proper operation and safety. Two to three prong adaptors are not considered reliable, safe methods of electrical connection.

This furnace must be connected to a properly sized power circuit with the correct overcurrent protection for safe and reliable operation.

As a routine working precaution, always wear safety glasses and protective gloves when operating, loading and unloading the furnace. In addition, wear respiratory protection when cleaning or servicing the muffle chamber.

OSHA AND CALIFORNIA PROPOSITION 65 - MUFFLE DUST EXPOSURE

In keeping with the policy of OMEGALUX to build safe products, comply with all national and state statutes and keep you, the valued customer informed, the services of a Certified Industrial Hygienist firm were employed to test and evaluate the lab operator's exposure to respirable muffle dust in terms of any harmful results and the need for operation with special safety equipment.

The findings of this test revealed that there is no harmful exposure during the normal operation of this equipment as outlined in the operator's manual.

When it becomes necessary to replace the muffle, the person doing this work should wear a 3M Model 9900 mask to provide protection from possible inhalation of harmful dust.

Because this product and many similar products on the market today contain CRYSTALLINE SILICA, it is necessary under the statutes of California Proposition 65 that OMEGALUX include the following statement in this manual: "This product contains substances(s) known to the state of California to cause cancer, birth defects or other reproductive harm".

UNPACKING INFORMATION

The shipping carton contains the following:

- One furnace

- Ceramic floor tray - 8" (20 cm) Square

- Exhaust port - Top mount (Packed outside furnace during shipment)

- Two exhaust port ball plugs

- One operator/service manual

- One Electrical Plug for Auxiliary Output (6 Stage Only)

- One bottle of fiber-hardening agent

Remove the packing list and verify that all equipment has been received. If there are any questions about the shipment, please call OMEGA Customer Service Department at 1-800-622-2378 or (203) 359-1660.

Upon receipt of the shipment, inspect the container and equipment for any signs of damage. Take particular note of any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

NOTE: The carrier will not honor any claims unless all shipping material is saved for their examination. After examining and removing contents, save packing material and carton in the event reshipment is necessary.

MUFFLE
The muffle (heating chamber) is constructed in one piece. It is considered normal for cracks to appear on the surface, along edges and in the corners. This will not degrade or limit the performance or life of the muffle.

INSTALLATION

Remove all packing materials from inside and around the furnace. Select a benchtop location within five feet (1.5 meters) of the power receptacle. The furnace should be on a level surface at least 6 inches (16 cm) away from walls, other equipment, and heat sensitive materials. Do not mount under shelves or other structures that will restrict the flow of air. The furnace should be located under an exhaust hood if material or chemical reactions will be taking place inside the furnace.

The power receptacle should have a 15 Amp fuse or circuit breaker as overcurrent protection.

Firing trays are supplied with the furnace. Please place these in the muffle before the first firing. These will prevent molten materials from flowing into the muffle.

The exhaust port, with mounting screws, is packed in the top packing insert. Locate the port and install it on top of the furnace.

FEATURES

MANUAL CONTROLLER:
> Large Low Thermal Mass Fiber Muffle - Fast Heat and Cool Rates
> Percent Power Indicator Dial - Adjusts Temperature and Heating Rates

> High Temperature Range To 2012°F (1100°C)
> Type K Thermocouple

> Open Door Indicator
> Heating Indicator - Cycles With Heating Elements

> Top Exhaust Port with Plug

2 - STAGE CONTROLLER:
> Two Stages (Segments) Of Temperature Control
> Long Life Battery Backup Of Program Parameters (Lithium)

> Power Interruption Cycle Continuation (Power Outage Return)
> Digital PID (Proportional, Integral, Derivative) Temperature Control

> Delay Start Of Operation Timer
> High Temperature Range To 2012°F (1100°C)

> Hold Feature For Cycle Interruption Or Infinite Hold Capability
> Negative Rate (Ramp) Temperature Control

> 0.1 Degree Per Minute Rate (Ramp) Resolution
> Programmable High Limit Cutoff

> "LO" Battery Indicator
> Various Diagnostic Indications

> Type K Thermocouple
> Large Low Thermal Mass Fiber Muffle - Fast Heat and Cool Rates

FEATURES
6 - STAGE CONTROLLER:

> Six Stages (Segments) Of Temperature Control
> Four User Definable Stored Programs (Chainable Into 24 Stages Total)

> Programmable Auxiliary Output (3 Amp Max. Normally Open Switched Contact)
> Long Life Battery (Lithium) Backup Of Program Parameters

> Power Interruption Cycle Continuation (Power Outage Return)
> Digital PID (Proportional, Integral, Derivative) Temperature Control

> Delay Start Of Operation Timer
> High Temperature Range To 2012°F (1100°C)

> Hold Feature For Cycle Interruption Or Infinite Hold Capability
> Negative Rate (Ramp) Temperature Control

> 0.1 Degree Per Minute Rate (Ramp) Resolution
> Programmable High Limit Cutoff

> "LO" Battery Indicator
> Various Diagnostic Indications

> Type K Thermocouple
> Large Low Thermal Mass Fiber Muffle - Fast Heat and Cool Rates

SPECIFICATIONS

ELECTRICAL:

Power requirements in watts at nominal line voltage:	1500
Watts to maintain 1000 °C:	1100
Nominal current 50/60Hz in Amps at line voltage of	
120 Volts:	12.5
240 Volts:	6.3

MECHANICAL:

	2 and 6 STAGE	MANUAL
Furnace: Width: **Depth:** **Height:**	15.5in (39cm) 14.5in (37cm) 16.5in (42cm)	(same)
Muffle (Inside): Width: **Depth:** **Height:**	9in (23cm) 9in (23cm) 6.5in (17cm)	(same)
Furnace Weight:	35 lbs (16Kg)	27 lbs (13Kg)
Shipping Weight:	46 lbs (21Kg)	35 lbs (16Kg)
Maximum Muffle Load:	15 lbs (6.8Kg)	(same)

OPERATIONAL: 2 AND 6 STAGE

Temperature Control Range and Resolution:	212 °F to 2012 °F at 1 °F (100 °C to 1100 °C at 1 °C)
Temperature Control Accuracy:	+/- 9 °F (5 °C) in control range from 212°F to 2012°F (100°C to1100°C).
Amplitude at Setpoint:	Less than +/- 5.5 °F (3 °C)
* Settable Heat RATE Range:	0 °F(0°C) to 72 °F (40°C)/MIN in 0.2 °F (0.1°C) increments

* Note: See following graphs for actual expected heat rate performance.
72°F(40°C)/MIN is not possible at the maximum temperatures or with maximum loads.

Programmable Parameter Ranges and Presets:

Parameter	Increment	Minimum	Maximum
DELAY START	1 Hour	0 Hour	99 Hours
RATE	0.1 deg/min	0°F/min (0°C/min)	72°F/min (40°C/min)
TIME	0.1 Hour	0.0 Hour	499.9 Hour
TEMP	1 deg	212°F (100°C)	2012°F (1100°C)
Programmable High Limit Cutoff	1 deg	932°F (500°C)	2012°F (1100°C)

End Of Cycle Operation: Factory Preset:
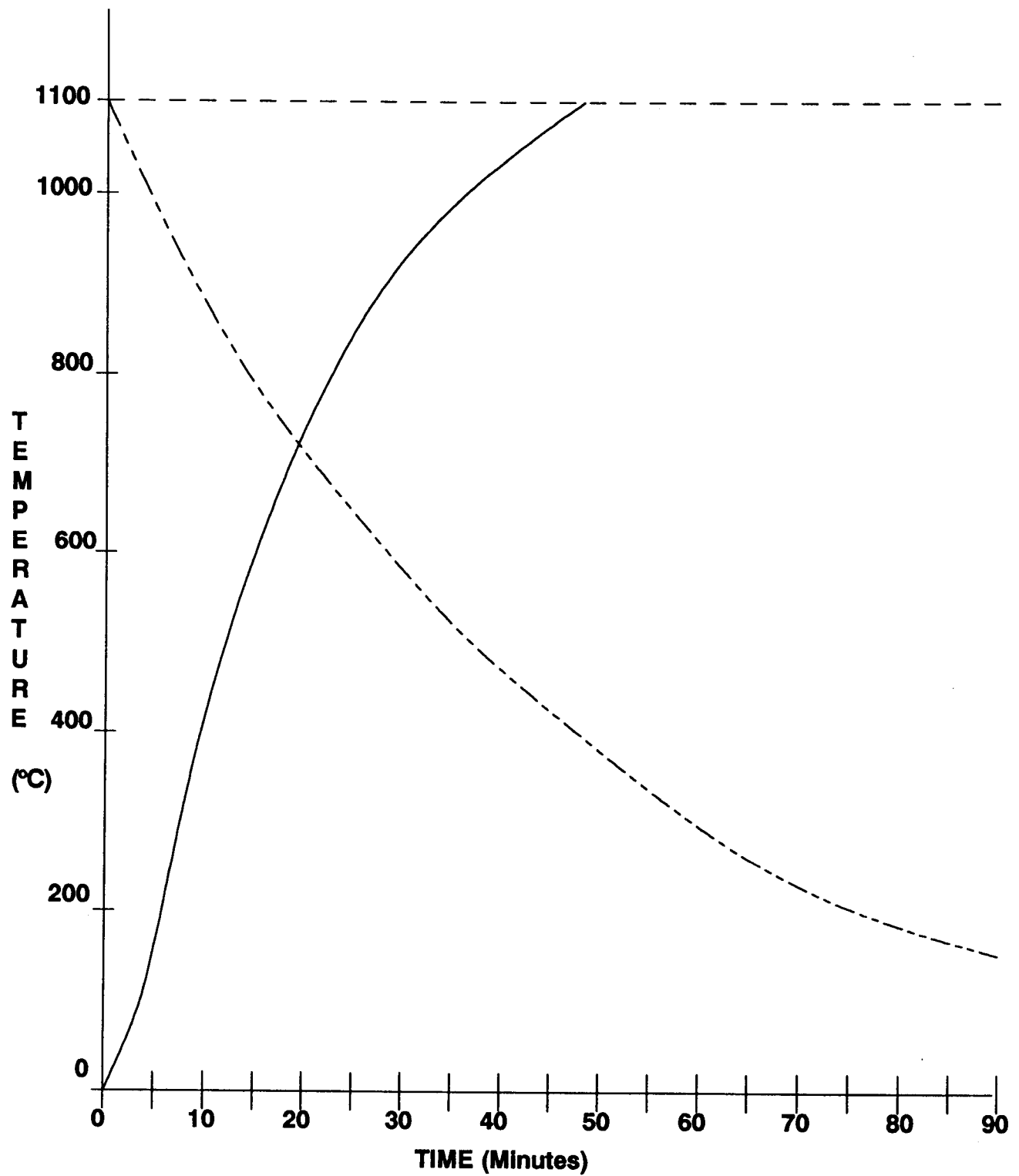(1) Hold last temperature and beep every 6 minutes.
Options:
(2) Hold last temperature, no beep
(3) Turn off after last TIME (muffle off)
(4) Repeat Cycle Continuously (6 Stage only)

HEATING and COOLING CURVES

TIME (Minutes)

TEST CONDITIONS: Nominal Line Voltage; No Load In Muffle; Full Power Applied To Muffle for heating. No power applied to muffle for cooling.

FURNACE DESCRIPTION AND OPERATION

EXHAUST

POWER
CORD

AUX 1
OUTPUT (6 Stage Only)

THERMOCOUPLE

MUFFLE

DOOR
INSULA-
TION
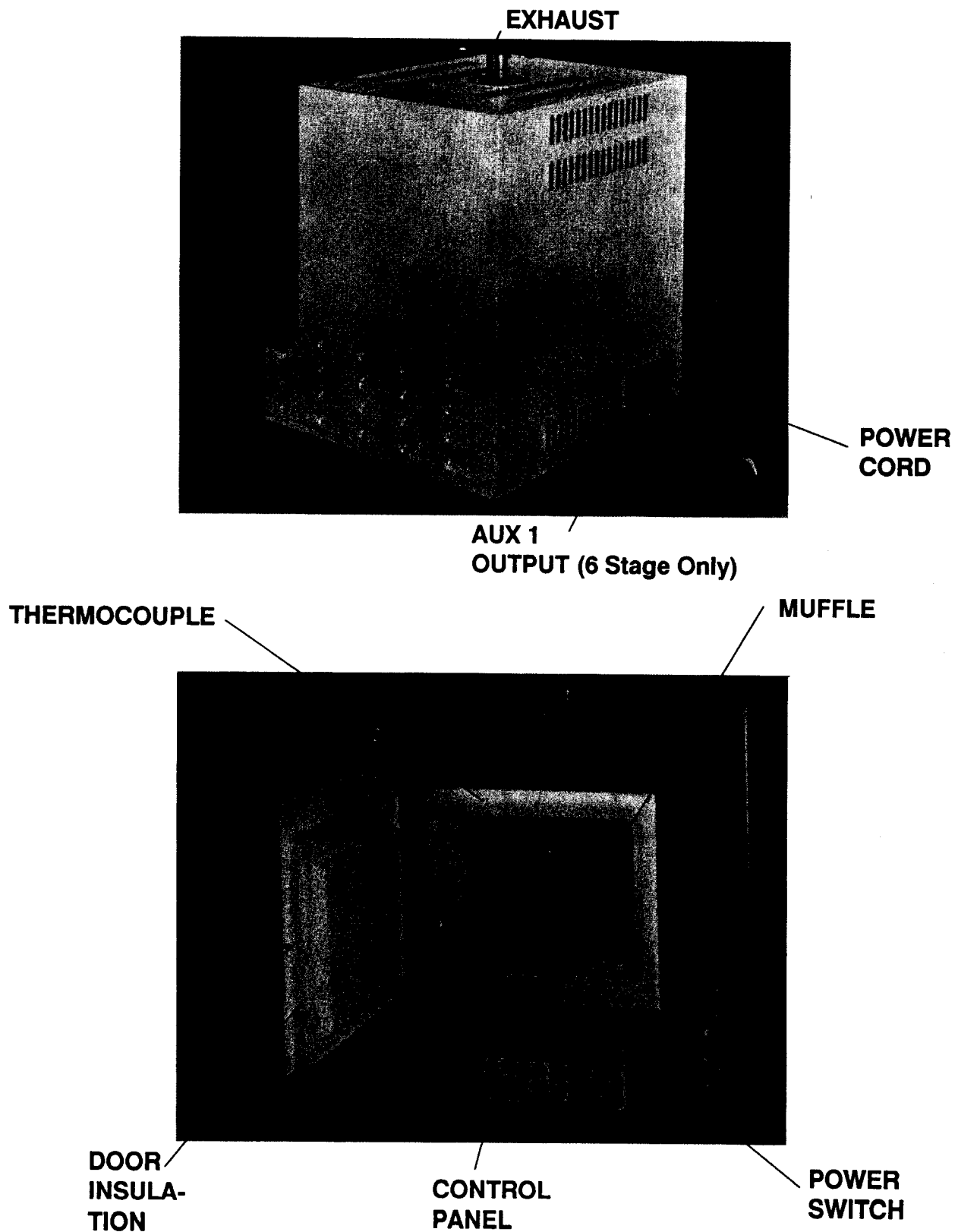
CONTROL
PANEL

POWER
SWITCH

1. Dual Scale
   Temperature Indicator   Indicates muffle temperature as sensed by the thermocouple. The indicator is scaled in Celsius and Fahrenheit with temperature graduations of 50 degrees.

2. Power Light   Illuminates when power is on.

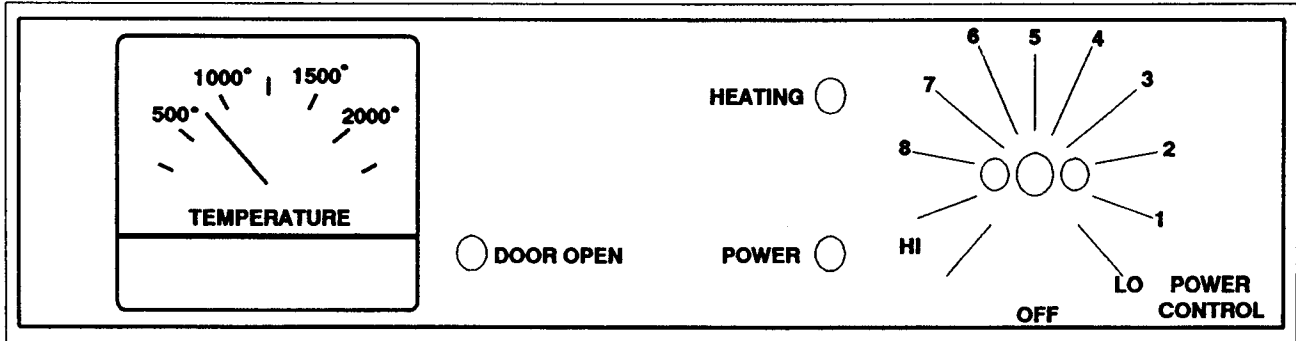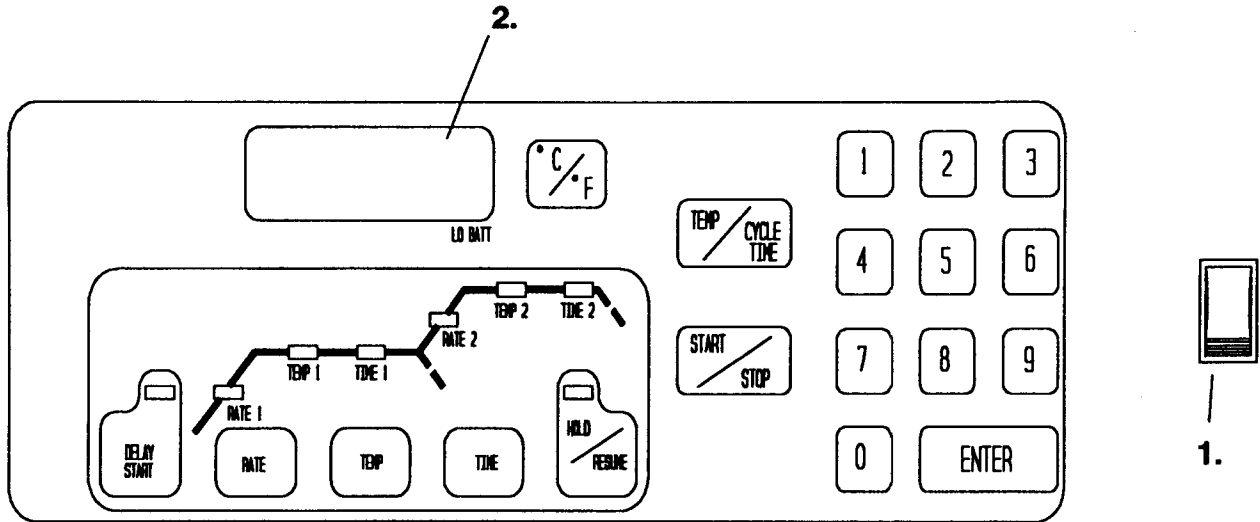3. Door Light   Illuminates when the door is open.

4. Power Controller   Serves as an "ON/OFF" switch and a proportional electrical power controller. It controls the power applied, not the muffle temperature. The muffle temperature is regulated by adjusting the power controller to the required power level necessary to achieve the desired temperature as indicated on the Temperature Indicator.

2 STAGE DESCRIPTION

2.

1. **POWER SWITCH**
Turns main power on and off to furnace. Does not start furnace operation.

2. **DIGITAL DISPLAY "LO BATT"**
Displays operating and programmed temperatures, times and status conditions. The right-most decimal point in the display is used to indicate a low battery condition.

3. **°C / °F**
Changes temperature display from degrees Celsius to degrees Fahrenheit. This key is only active when the current muffle temperature is being displayed. It is locked when displaying programmed parameters.

4. **DELAY START**
Turns the furnace on at a later time and runs the preselected cycle. Also gives operator access to program the amount of delay time desired. Pressing the DELAY START key causes the DELAY START LED to flash and the current value to be displayed. A new value can be programmed or the START/STOP key can be pressed to start a cycle after a delay.

5. **RATE**
Displays the currently programmed RATE and gives the operator access to program the desired value. The RATE LED's alternately flash each time the key is pressed. When the corresponding LED is flashing the indicated RATE can be reviewed and or programmed.

RATE refers to the desired temperature increase or decrease in tenths of a degree per minute (xx.x°/min). The decrease in temperature or cooling is limited by the natural cooling RATE of the furnace loaded. The control can force it to be slower but not faster. See the heating and cooling curves in Section 5.

Programming a RATE to zero prevents that stage from running. For example if RATE 2 is set to zero, only stage 1 will operate. If RATE 1 is set to zero, only stage 2 operates.

6. TEMP

Displays the currently programmed TEMP and gives the operator access to program the desired value. The TEMP LED's alternately flash each time the key is pressed. When the corresponding LED is flashing the indicated TEMP can be reviewed and or programmed.

7. TIME

Displays the currently programmed TIME and gives the operator access to program the desired value. The TIME LED's alternately flash each time the key is pressed. When the corresponding LED is flashing the indicated TIME can be reviewed and or programmed.

8. HOLD / RESUME

Pressing the HOLD/RESUME key when a cycle is operating holds the current temperature indefinitely. The HOLD/RESUME LED will light along with the LED for the portion of the cycle currently operating. Pressing the key a second time will resume the cycle from the hold point.

When a cycle is held with the HOLD/RESUME key, the program parameters can be changed. Resuming the cycle causes the control to use the newly programmed parameters.

9. TEMP / CYCLE TIME

Displays the current muffle temperature if parameters are being reviewed or the cycle time remaining in a TIME segment during operation.

10. START / STOP

Starts the furnace. The cycle will operate as programmed. Stops the cycle if the furnace is operating. Restarting a cycle that has been stopped with the START / STOP key will restart it from the beginning.

11. Digit or Numeric Keys

Used to enter temperatures, times, and heat rates. When entering a value, any incorrect entry can be changed by reentering the correct value. The incorrect value will disappear off the left side of the display.

12. ENTER

Confirms the Numeric Key entries and stores them in the control's memory.

13. Parameter LED's

LED's next to switches and in graphs are used to indicate control status.
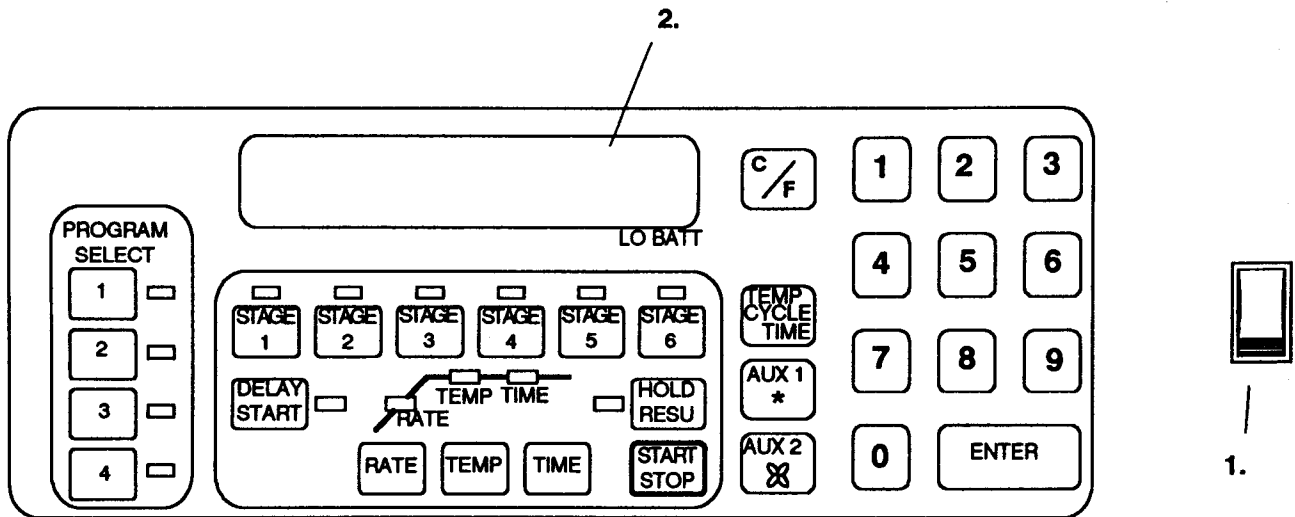
OTHER CONTROL INPUTS:
Door Switch (not shown)

Internal switch deactivated by door opening which causes the control to disconnect the muffle from both sides of the power line.

Thermocouple (not shown)

Type K thermocouple located in the upper rear left of the muffle to measure chamber temperature for the control.

6 STAGE DESCRIPTION

1. **POWER SWITCH** — Turns main power on and off to furnace. Does not start furnace operation.

2. **DIGITAL DISPLAY "LO BATT"** — Displays operating and programmed temperatures, times and status conditions. The right-most decimal point in the display is used to indicate a low battery condition.

3. **°C / °F** — Changes temperature display from degrees Celsius to degrees Fahrenheit. This key is only active when the current muffle temperature is being displayed. It is locked when displaying programmed parameters.

4. **DELAY START** — Turns the furnace on at a later time and runs the preselected cycle. Also gives operator access to program the amount of delay time desired. Pressing the DELAY START key causes the DELAY START LED to flash and the current value to be displayed. A new value can be programmed or the START/STOP key can be pressed to start a cycle after a delay.

5. **RATE** — Displays the currently programmed RATE for the selected program and stage. Gives the operator access to program the desired value.

   RATE refers to the desired temperature increase or decrease in tenths of a degree per minute ($xx.x°$/min). The decrease in temperature or cooling is limited by the natural cooling RATE of the furnace and its load. The control can force it to be slower but not faster. See the heating and cooling curves in Section 5.

   Programming a TEMP lower than the previous TEMP will cause a negative RATE. Similarly, starting the furnace with the muffle temperature higher than the first TEMP 1 will cause the control to cool at RATE 1 to TEMP 1.

Programming a RATE to zero prevents that stage and the following stages from running. For example if RATE 4 is set to zero only stages 1, 2 and 3 will operate and the program will end after stage 3.

6. TEMP

Displays the currently programmed temperature for the selected program and stage. Also gives the operator access to program the desired temperature value. When the corresponding LED is flashing, that TEMP is being reviewed and can be programmed.

7. TIME

Displays the currently programmed time for the selected program and stage. Also gives the operator access to program the desired time value. When the corresponding LED is flashing, that TIME is being reviewed and can be programmed.

8. HOLD / RESUME

Pressing the HOLD/RESUME key when a cycle is operating holds the current temperature indefinitely. The HOLD/RESUME LED will light, along with the LED for the portion of the cycle operating when the key was pressed. Pressing the key a second time will resume the cycle from the hold point.

When a cycle is held with the HOLD/RESUME key, the program parameters can be changed on any stage of the selected program. Resuming the cycle causes the control to use the newly programmed parameters.

9. TEMP / CYCLE TIME

Resets the display to the current muffle temperature if parameters are being reviewed or programmed. Displays the cycle time remaining in a TIME segment during operation.

10. START / STOP

Starts the furnace. The cycle will operate as programmed. Stops the cycle if the furnace is operating. Restarting a cycle that has been stopped with the START/STOP key will restart it from the beginning.

11. Digit or Numeric Keys

Used to enter temperatures, times, and heat rates. When entering a value, any incorrect entry can be changed by reentering the correct value. The incorrect value will disappear off the left side of the display.

12. ENTER

Confirms the Numeric Key entries and stores them in the control's memory.

13. Parameter LED's   LED's in the graph next to the switches are used to indicate control status.

14. PROGRAM SELECT 1-4

Selects PROGRAM to be reviewed, programmed, or run by the control. A new program can be selected whenever the control is not running the current program.

15. STAGE 1-6

Selects the STAGE (segment) of the selected program to be reviewed or programmed. The stages of the currently selected program can be reviewed at any time. The corresponding LED lights with each key and goes out in seven seconds if a parameter key (RATE, TEMP, TIME, AUX) is not pressed. Stage parameters can be reprogrammed only when the control is not running the current program or when the current program has been put on "HOLD".

All the STAGE LED's that are programmed light when the furnace is started. They go out in sequence as each STAGE is completed.

16. AUX 1 Normally open electrical contact output that can be programmed to turned on and off as the furnace runs the preprogrammed cycle. The AUX 1 output can be programmed to be on or off independently for each segment of a cycle. The IEC socket on the back of the furnace provides a 3 amp max. .fused contact closure when turned on.

17. AUX 2 (Not functional)

Door Switch (not shown) Internal switch deactivated by door opening which causes the control to disconnect the muffle from both sides of the power line.

Thermocouple Type K thermocouple located in the rear of the muffle to measure chamber temperature for the control.

Auxiliary Output Rear connection for AUX 1 described previously.

OPERATING THE FURNACE: MANUAL CONTROLLER

Set the Power Controller dial to the desired setting. After allowing the furnace to heat, observe the temperature indicator to determine if the furnace is at temperature. If the desired temperature is not indicated, turn the Power Controller clockwise for a lower temperature and counter-clockwise for a higher temperature.

WARNING: Setting the Power Controller to 8 or above without lowering it once the desired temperature is achieved, will significantly reduce muffle life. The Power Controller does not respond to temperature; it only adjusts the amount of power going into the furnace.

OPERATING THE FURNACE: 2 AND 6 STAGE CONTROLLERS

POWER ON:

Turning on the power switch activates the control. The control performs a self-test for approximately three seconds and displays the model number (ie. 525). At the end of the self-test the actual muffle temperature is displayed.

If an operating cycle is stopped with the START/STOP key, pressing the key a second time will restart the cycle from the beginning. If the muffle is at an elevated temperature, the control will use the programmed RATE 1 for the cooling or heating to TEMP 1.

If the model number is not displayed or the display sequences through all the model numbers listed on the front cover, see BATTERY REPLACEMENT and CONFIGURATION SETUP in Maintenance Section 7.

The furnace's operation can be changed in several ways by changing the "default settings". These are the preselected parameters the factory entered when the unit was tested. For more information about these see CONFIGURATION SETUP later in this section under programming.

REVIEWING THE PROGRAM:

The current stored programs can be reviewed by selecting a program, stage, and parameter keys to display the values. The first step is to press a PROGRAM key followed by a particular stage key for that program. Pressing the TEMP, RATE, TIME, or AUX keys displays the current value for that stage and program. The displayed parameter is replaced with the current muffle temperature by pressing the TEMP / CYCLE TIME key.

STARTING THE FURNACE WITHOUT A DELAY START:

The current program can be started by pressing the START/STOP key. The display continues to display the muffle temperature as the muffle heats up. The LED's in the programmed cycle are turned on when the key is pressed. They are individually turned off as each function is completed. Any one of the four furnace programs can be started in this way.

6 STAGE CONTROLLER (ONLY):

Programs can be chained together (run in groups) by pressing and holding the first program key in the chain. While this key is held down, press the additional programs to be chained to the first program. The LED for each program that is selected will light. Two, three, or four programs can be chained in their number sequence. (For example 1-2-3-4, 1-2, 3-4, 1-3-4, 2-4). Pressing the START/STOP key starts the first program in the chain. The other programs follow the first in sequence.

STARTING THE FURNACE WITH A DELAY START:

A value for the DELAY START must be programmed first (the default value is preprogrammed to zero). Press the DELAY START key followed by the digit keys of the desired amount of delay in hours. The DELAY START LED will flash and the programmed value will be displayed. Pressing the ENTER key will store this value and turn off the DELAY START LED. Pressing the DELAY START key again will activate the function, flash the LED, and display the delay value in hours. Pressing the START/STOP key will start the delay followed by the selected program. The DELAY START LED will be on during the delay.

FURNACE OPERATION:

During cycle operation all the indicating LED's (Program and Stage) for a cycle will initially light and go out as that portion of the cycle is completed. The RATE and TIME - TEMP LED's will

alternately come on. If a DELAY START has been selected, its LED will light first and when the delay is complete, the rest of the cycle LED's will light.

A flashing RATE LED indicates that the control is unable to maintain the programmed rate of change in temperature. The flashing is only an indication for the operator; the furnace will continue the cycle uninterrupted. This condition can be caused by programming the furnace with high programmed RATE, large loads, or low power line voltages. Refer to the heating and cooling curves in the SPECIFICATIONS section 5 for more information.

A power outage or turning off the power when the furnace is in the idle or off mode does not cause a loss of the programs. The furnace will resume a delay start cycle if a power interruption occurs during its operation. A power outage when the furnace is heating will result in the resumption of the cycle when power is reapplied, if the muffle temperature has dropped less than 90°F (50°C). If the muffle temperature has dropped more than 90°F (50°C), the furnace turns off. If power is interrupted or the power switch is turned off when the furnace is operating at less than 100°C, the furnace will turn on when power is reapplied.

STOPPING THE FURNACE:
Pressing the START / STOP key when the furnace is running will stop the cycle. The LED's will turn off and the muffle will cool to room temperature. The programmed cycle parameters will remain unchanged.

If an operating cycle is stopped with the START/STOP key, pressing the key a second time will restart the cycle from the beginning. If the muffle is at an elevated temperature, the control will use the programmed RATE 1 for the cooling or heating to TEMP 1.

HOLDING A TEMPERATURE:
The furnace can be stopped or held in the middle of a cycle indefinitely by pressing the HOLD/RESUME key. The muffle temperature, when the key is pressed, will be maintained with the associated HOLD LED, STAGE LED, and parameter LED on. Pressing the key a second time releases the control and it resumes the cycle that had been operating. The program parameters can be reprogrammed when the control is put in the HOLD mode.

END OF CYCLE:
The default "End Of Cycle" maintains the last programmed temperature, displays "HOLD" and beeps every six minutes. Other "End Of Cycle" operations available include maintaining the last programmed temperature without beeping, turning off the muffle at the end of the cycle while displaying "END", and continuously repeating the cycle. The end of cycle default setting can be changed by following the directions outlined later in this section under CONFIGURATION SETUP.

PROGRAMMING THE FURNACE:
The furnace control parameters can only be changed during idle mode (not running a cycle) or when put on hold during a cycle with the HOLD/RESUME key. If an out of range value is entered the control beeps and displays the maximum or minimum acceptable value. The previous stored value is retained.

DELAY START:
Pressing the DELAY START key displays the current programmed value and flashes the associated LED. When the LED is flashing, the DELAY START value can be reprogrammed by keying

in a new value followed by the ENTER key. If the value already stored for the delay start is acceptable, then either the ENTER key or the TEMP / CYCLE TIME key can be pressed to save the value. If an incorrect digit key is pressed while entering a parameter, the correct parameter should be reentered. The incorrect digit will shift off the display to the left. An alternate method to clear an incorrect entry is to press the DELAY START key a second time.

PROGRAMS: (6 STAGE ONLY)

Any one of the four programs can be selected for operation or programming independently. Pressing a PROGRAM key activates that program and the associated LED lights.

Programs can be chained together (run in groups) by pressing and holding the first program key in the chain. While this key is held down, press the additional programs to be chained to the first program. The LED for each program that is selected will light. The group selected in the chain is not stored in memory and must be assigned each time it is requested. Each individual program is stored and can be operated independently.

STAGES: (6 STAGE ONLY)

Once a program has been selected the individual stage RATE's, TEMP's, TIME's, and AUX's can be programmed. A STAGE key has to be pressed before the various parameters can be programmed. After the key is pressed, the STAGE LED will remain on for 7 seconds if no other keys are pressed. If one of the parameter keys is pressed, it will remain on until the ENTER or TIME/TEMP key is pressed. If the LED goes out, the STAGE key must be pressed again.

RATES:

The RATE key sets heat rate or temperature increase rate. Pressing the RATE key displays the current value for the program and stage selected. The corresponding RATE LED also flashes.

While the RATE LED is flashing, a new RATE can be entered on the keyboard. If an incorrect digit key is pressed while entering a parameter, the correct parameter should be reentered. The incorrect digit will shift off the display to the left. Once the correct value is displayed, save it by pressing the ENTER key. If the ENTER key is not pressed, the original value will be retained and the new value will be lost. After the ENTER key is pressed, the display returns to the current muffle temperature.

Entering a 0 for any RATE (2 through 6) causes the cycle to end after the previous stage. (Example: RATE 4 = 0; Program ends after STAGE 3). Programming RATE 1 to 0 causes the program to start with STAGE 2.

TEMPERATURES:

The TEMP key sets the muffle temperature. Pressing the TEMP key displays the current value for the program and stage selected. The corresponding TEMP LED also flashes.

While the TEMP 1 LED is flashing, a new temperature can be entered on the keyboard. If an incorrect digit key is pressed while entering a parameter, the correct parameter should be reentered. The incorrect digit will shift off the display to the left. Once the correct value is displayed, save it by pressing the ENTER key. If the ENTER key is not pressed, the original value will be retained and the new value will be lost. After the ENTER key is pressed, the display returns to the current muffle temperature.

TIMES:

The TIME key sets the length of the hold time at the programmed temperature. Pressing the TIME key displays the current value for the program and stage selected. The corresponding TIME LED also flashes.

While the TIME LED is flashing, a new time can be entered for the selected STAGE on the keyboard. If an incorrect digit key is pressed while entering a parameter, the correct parameter should be reentered. The incorrect digit will shift off the display to the left. Once the correct value is displayed, save it by pressing the ENTER key. If the ENTER key is not pressed, the original value will be retained and the new value will be lost. After the ENTER key is pressed, the display returns to the current muffle temperature.

Setting the last TIME to 0 causes the control to end the cycle and shut off. The muffle temperature is not held. The last TIME can be TIME 6 or the TIME immediately before a RATE set equal to zero.

AUXILIARY OUTPUT #1: (6 STAGE ONLY)

The AUX 1 output is a normally open electrical contact accessible to the user in the rear of the furnace close to the power cord. A n adaptor plug is supplied in the accessory kit to make the connections. The socket for AUX 1 is fused at 3 amps with the fuses mounted in the socket.

The AUX 1 contacts can be independently closed (ON) or opened (OFF) for each STAGE of each PROGRAM. The AUX 1 is programmed to be ON (contacts closed) by selecting a STAGE key of a program followed by the AUX 1 key. "AUX1 ON *" will be displayed if it was previously programmed to be off. Pressing the AUX 1 key a second time turns it off. "AUX1 OFF" is displayed. "*" is displayed in the far right character of the display when AUX 1 is on and the cycle is running.

AUXILIARY OUTPUT #2:

Not applicable to these models.

CONFIGURATION SETUP

The furnace has other features or operations that are only accessible when power is applied (power up). These features are programmed by pressing the ENTER key during the 3 seconds after power up when the furnace displays the model number. "SELECT" will appear on the display to indicate configuration setup.

The following selections are available for programming.

END OF CYCLE:
  (1) Pressing the "1" key followed by the ENTER key will cause the control to continuously hold the last TEMP and beep every 6 minutes. "HOLD TEMP" is displayed. (This is the factory preset.)

  (2) Pressing the "2 "key followed by the ENTER key will cause the control to continuously hold the last TEMP without beeping. "HOLD TEMP" is displayed.

  (3) Pressing the "3" key followed by the ENTER key will cause the control to end the cycle and shut off the muffle after the last TIME. "END" is displayed and the control beeps three times.

  (4) Pressing the "4" key followed by the ENTER key will cause the control to continuously repeat the cycle that has been started. (6 STAGE ONLY)

HIGH LIMIT CUTOFF:
  (5) Pressing the "5 "key followed by the ENTER key will cause the current High Limit Cutoff temperature to be displayed (1100°C is the factory preset value). To select a different temperature enter the new value using the digit keys followed by the ENTER key. CAUTION: Previously programmed values for TEMP's must be lower than High Limit Cutoff.

  The furnace will now shut down and display "Err3" if the muffle temperature goes above the programmed High Limit Cutoff. The error is cleared by turning off the furnace. Attempting to program a temperature higher than the High Limit Cutoff will cause the control to beep and display the maximum temperature.

SYSTEM RESET: CAUTION!!
  (7) Pressing the "7 "key followed by the ENTER key will cause the control to reset all the parameters and settings in the control. "Reset" will be displayed. This is for diagnostics and system checking.

  Refer to Configuration Setup in the maintenance section 7 for further directions.

To end the configuration setup routine, press the "9 "key followed by the ENTER key. The control will go into normal operation displaying the current muffle temperature. The selections made above (except for system reset "7") will be retained in memory and will require reprogramming only when the battery goes dead.

2-STAGE EXAMPLE:

SITUATION:
You wish to do a two -stage drying process with the furnace being heated slowly (5.0°C/min) to 500°C and held there for one hour. It will then be heated to 950°C at 20°C/min and held for at least 2.5 hours before cooling down.

ASSUMPTIONS: 1. Furnace is turned off.
                      2. The muffle is cool.
                      3. The load is inside the muffle on a ceramic tray.

END OF CYCLE SELECTION: (Programs furnace to turn off at the end of
program rather than holding the last temperature.)

STEP	ACTION
1	Turn on power switch.
2	Press the ENTER key during the first three seconds while the furnace model number is being displayed.
3	Press the "3" digit key followed by the "ENTER" key - "END" is displayed
4	Press the "9" digit key followed by the "ENTER" key.

PROGRAMMING STEPS:

STEP	PRESS KEY	ACTION
1.	RATE	Press key until the RATE 1 LED flashes.
2.	5 - 0	
3.	ENTER	RATE 1 is now programmed.
4.	TEMP	Press key until the TEMP 1 LED flashes.
5.	5 - 0 - 0	
6.	ENTER	TEMP 1 is now programmed
7.	TIME	Press key until the TIME 1 LED flashes.
8.	1 - 0	
9.	ENTER	TIME 1 is now programmed.
10.	RATE	Press key until the RATE 2 LED flashes.
11.	2 - 0	
12.	ENTER	RATE 2 is now programmed.
13.	TEMP	Press key until the TEMP 2 LED flashes.
14.	9 - 5 - 0	
15.	ENTER	TEMP 2 is now programmed
16.	TIME	Press key until the TIME 2 LED flashes.
17.	2 - 5	
18.	ENTER	TIME 2 is now programmed.
19.	START/STOP	Starts the cycle, all the LED's are on in the cycle profile, the furnace beeps twice.

6-STAGE EXAMPLE:

SITUATION:
You wish to do a six -stage temperature profile. The following heating rates, temperatures and holding times are desired.

1.	RATE=45°F/min	TEMP=500°F	TIME=.3 Hour
2.	RATE=10°F/min	TEMP=760°F	TIME=.5 Hour
3.	RATE=5°F/min	TEMP=1200°F	TIME=1.7 Hours
4.	RATE=10°F/min	TEMP=1760°F	TIME=3 Hours
5.	RATE=-.5°F/min	TEMP=1510°F	TIME=.1 Hours
6.	RATE=-10°F/min	TEMP=1000°F	TIME=30 Hours

ASSUMPTIONS:
1. Furnace is turned on.
2. The muffle is cool.
3. The muffle temperature is being displayed in degrees Fahrenheit. Press °C/°F key, if current display is in °C.
4. The load is inside the muffle on a ceramic tray.
5. Program will be stored in PROGRAM 1. Press PROGRAM 1 key, if PROGRAM 1 LED is not on.

PROGRAMMING STEPS:

STEP	PRESS KEY	ACTION
1.	RATE	RATE 1 LED flashes.
2.	4 - 5 - 0	45.0 °F/min
3.	ENTER	RATE 1 is now programmed.
4.	TEMP	TEMP 1 LED flashes.
5.	5 - 0 - 0	500°F
6.	ENTER	TEMP 1 is now programmed
7.	TIME	TIME 1 LED flashes.
8.	3	0.3 Hour
9.	ENTER	TIME 1 is now programmed.

STAGE 1 IS NOW PROGRAMMED.

10.	RATE	RATE 2 LED flashes.
11.	1 - 0 - 0	10.0 °F/min
12.	ENTER	RATE 2 is now programmed.
13.	TEMP	TEMP 2 LED flashes.
14.	7 - 6 - 0	760°F
15.	ENTER	TEMP 2 is now programmed
16.	TIME	TIME 2 LED flashes.
17.	5	0.5 Hour
18.	ENTER	TIME 2 is now programmed.

STAGE 2 IS NOW PROGRAMMED.

19.	RATE	RATE 3 LED flashes.
20.	5 - 0	5.0 °F/min
21.	ENTER	RATE 3 is now programmed.
22.	TEMP	TEMP 3 LED flashes.
23.	1 - 2 - 0 - 0	1200°F
24.	ENTER	TEMP 3 is now programmed
25.	TIME	TIME 3 LED flashes.
26.	1 - 7	1.7 Hours
27.	ENTER	TIME 3 is now programmed.

STAGE 3 IS NOW PROGRAMMED.

28.	RATE	RATE 4 LED flashes.
29.	1 - 0 - 0	10.0°F/min
30.	ENTER	RATE 4 is now programmed.
31.	TEMP	TEMP 4 LED flashes.
32.	1 - 7 - 6 - 0	1760°F
33.	ENTER	TEMP 4 is now programmed.
34.	TIME	TIME 4 LED flashes.
35.	3 - 0	3.0 Hours
36.	ENTER	TIME 4 is now programmed.

STAGE 4 IS NOW PROGRAMMED.

37.	RATE	RATE 5 LED flashes.
38.	5	0.5 °F/min
39.	ENTER	RATE 5 is now programmed.
40.	TEMP	TEMP 5 LED flashes.
41.	1 - 5 - 1 - 0	1510°F
42.	ENTER	TEMP 5 is now programmed.
43.	TIME	TIME 5 LED flashes.
44.	1	0.1 Hour
45.	ENTER	TIME 5 is now programmed.

STAGE 5 IS NOW PROGRAMMED.

46.	RATE	RATE 6 LED flashes.
47.	1 - 0 - 0	10.0°F/min
48.	ENTER	RATE 6 is now programmed.
49.	TEMP	TEMP 6 LED flashes.
50.	1 - 0 - 0 - 0	1000°F
51.	ENTER	TEMP 6 is now programmed.
52.	TIME	TIME 6 LED flashes.
53.	3 - 0 - 0	30.0 Hours
54.	ENTER	TIME 6 is now programmed.

STAGE 6 IS NOW PROGRAMMED.

After TIME 6 the control will continue to hold the last temperature (TEMP 6) until turned off, while beeping every 6 minutes.

MAINTENANCE

CLEANING:
>Vacuum (rather than blow) any muffle dust found in and around the furnace. This will minimize the airborne dust.

SEE SECTION 1: SAFETY PRECAUTIONS and MSDS

>Clean the control panel with a soft dry cloth. Do not use water, liquids or spray cleaners on the panel or on the cloth. These cleaners can enter the switch panel and cause damage.

>Clean the furnace cabinet with any household non-abrasive cleaner and a soft cloth.

CALIBRATION: (2 and 6 STAGE ONLY)
>Under normal use the furnace will not require calibration. Situations where calibration may be required include thermocouple damage and replacement, and control/power pc board assembly replacement.

>An electronic temperature meter, if available, should be used to calibrate the furnace. If one is not available ,then the boards and themocouples should be used as supplied. They have been precalibrated at the factory and will be more accurate than other methods of calibration.

>If an electronic temperature meter is used, its thermocouple sensor should be placed in the center of the muffle half way between the top and bottom. Program the furnace to heat to 960°C at a rate of 20°C /min and start the control. After the furnace reaches 960°C, wait 30 minutes for the muffle temperature to stabilize. Record the temperature measured by the electronic temperature meter as the difference between 960 and its reading. For example ,if the meter reads 980, then the difference is +20°C. If the meter reads 950, then the difference is -10°C.

>Once a measurement has been recorded ,turn off the furnace and unplug its power cord. Allow the furnace to cool to room temperature. Remove the control panel by following the directions under "Control Panel Removal" in section 8. The following directions apply once the control panel is opened.

>The trimmer/potentiometer labeled R12 "SPAN ADJ" on the computer/power printed circuit board assembly (horizontally mounted pcb) will be adjusted to correct the calibration. If the muffle temperature measures higher (positive difference in example above) than the furnace indicates, turn the trimmer/potentiometer labeled R12 "SPAN ADJ" clockwise (CW) to reduce the display temperature. The potentiometer should be turned one complete turn for every 10°C of difference. If the temperature measures lower (negative difference), adjust the pot counter clockwise (CCW) using the same ratio.

BATTERY REPLACEMENT: (2 and 6 STAGE ONLY)
>If the program contents are lost when the furnace power is turned on and off, then the battery is dead. In addition, if the "Low Batt" indicator flashes, the battery should be replaced.

>Refer to the CONTROL PANEL REMOVAL section 8 for instructions on your furnace. Once the control panel has been pulled out of the front of the furnace 6 inches (30 to 40 cm), the old battery can be removed. The battery is located near the front center of the computer/power pc board. Remove the tape, then using a small screw driver, remove the old battery. Replace it with a new battery with the positive "+" side to the top.

The battery bracket should be opened only a small amount so that it is not deformed. Replace the control panel and reapply power. The battery replacement will cause the control to lose complete memory. Go to configuration setup below.

CONFIGURATION SETUP: (2 and 6 STAGE ONLY)

When powered up for the first time after battery replacement, the control will display a series of furnace model numbers (ie. 525). Press the ENTER key when the 525 number appears. A pattern similar to "oooo" for the 2 STAGE or "SELECT" for the 6 STAGE will appear to indicate configuration setup. Pressing the "9" key followed by the ENTER key will place the control in the normal operating mode. See the CONFIGURATION SETUP in the programming section 6 for details on possible operating mode changes.

MUFFLE REPAIR:

The furnace muffle is constructed of a lightweight fiber insulation. Exercise caution to prevent punctures or tears in the muffle when loading and unloading the furnace. Punctures exposing the heating elements embedded in the insulation may significantly shorten muffle life. The accessory ceramic trays provided with the furnace should be used to protect the muffle floor.

Damage to the fiber insulation in the muffle or the door can be repaired. A bottle of "Fiber Hardening Agent" has been included with your furnace shipment. The "Fiber Hardening Agent" is a binding solution with the viscosity of water. It will harden the surface which was damaged. Directions for using this material are listed below:

1. Unplug the furnace and allow to cool.
2. Apply liquid hardening agent generously to the damaged area with a small brush or swab.
3. Plug in the furnace and heat to 500°F (250°C) for approximately two hours or until the agent
   is dry or solid. Allow the furnace to run longer if the material is not dry.
4. After the agent is solidified, the furnace is ready for normal use.

SERVICE

This section is provided as assistance to qualified service personnel. If you are qualified to service the furnace, please read the entire manual before you attempt any servicing.

IF YOU ARE NOT QUALIFIED TO SERVICE THE FURNACE, PLEASE READ THE PARAGRAPH BELOW, AND FOLLOW THE DIRECTIONS SPECIFIED.

If the unit requires service, review pages 8-2 and 8-3 before contacting the OMEGA Customer Service Department at 1-800-622-2378. Describe the particular problem and give the model and serial numbers of the furnace. This information is located on the data plate attached to the back of the furnace.

When the unit is returned for repair:
1. The furnace muffle interior should be emptied of all trays and work pieces.
2. The exhaust tube should be removed and stored for use upon the return of the furnace.

TROUBLESHOOTING and ERROR CODES (2 and 6 STAGE ONLY)

Review the following list of questions and suggestions before calling OMEGA Customer Service.

Problem:
No operation - Display does not light up , LED's do not come on, and muffle does not heat.
1. Does the power receptacle have power? Test with another load (ie. lamp or radio.)
2. Does furnace beep when power is turned on? If yes, go to next step. If no, call OMEGA Customer Service Department.
3. Do any of the LED's on the control/power board light? Look into rear back vents of furnace. If yes, check pc board to pc board connections.

Problem:
No Heat - Display and LED's operate.
1. Does the display show "ERR 2"? See Error Codes below.
2. Does the neon light on the control/power board light when the power switch is turned on? If not, check muffle continuity with ohmmeter. If the muffle does not have continuity, replace it. If the muffle has continuity, check wiring and terminals between muffle, triac, and control/power pc board.
3. Does the neon light flash off and on when the start key is pressed? Does LED DS1 (upper lefthand corner of control/power pc board) flash opposite the neon light (on to off)? If not, contact OMEGA Customer Service.

Problem:
Furnace operates, but not correctly.
1. Does RATE LED flash slowly when program is operating?
The RATE parameter is programmed faster than furnace can heat or cool. Unit will con tinue to operate but with a slower rate than programmed. See Heating Curves, Section 5.
2. Control lost all preprogrammed parameters when turned off. Programming not saved when power is turned off. Did "LO BATT" indicator flash? Battery dead or not seated properly.

Problem:
Error Codes on Display.
1. Lower Right Decimal Point Flashes In Display: "LO BATT" Battery is low or dead, replace battery. See MAINTENANCE SECTION 7.

2. ERR 1 is displayed: The muffle temperature is above 2012°F (1100°C) or overtemperature. Possible problems include: shorted output triac, shorted optotriac (U7) on control/power pc board, wiring shorted, thermocouple pushed back out of muffle, thermocouple shorted outside of muffle, or the control is out of calibration. Verify the calibration of the furnace.

3. ERR 2 is displayed: The control thermocouple is open or disconnected. Possible problems include: thermocouple disconnected at control/power pc board, thermocouple weld inside muffle open or damaged.

4. ERR 3 is displayed: The control is attempting to go above the Programmable High Limit Cutoff. Review the section on programming the Cutoff in the programming section 6.

5. "DOOR" remains on display when door is closed. Check door switch continuity. Check door switch actuator tab by listening for switch click as door closes.

TROUBLESHOOTING - Manual Controller

Problem:

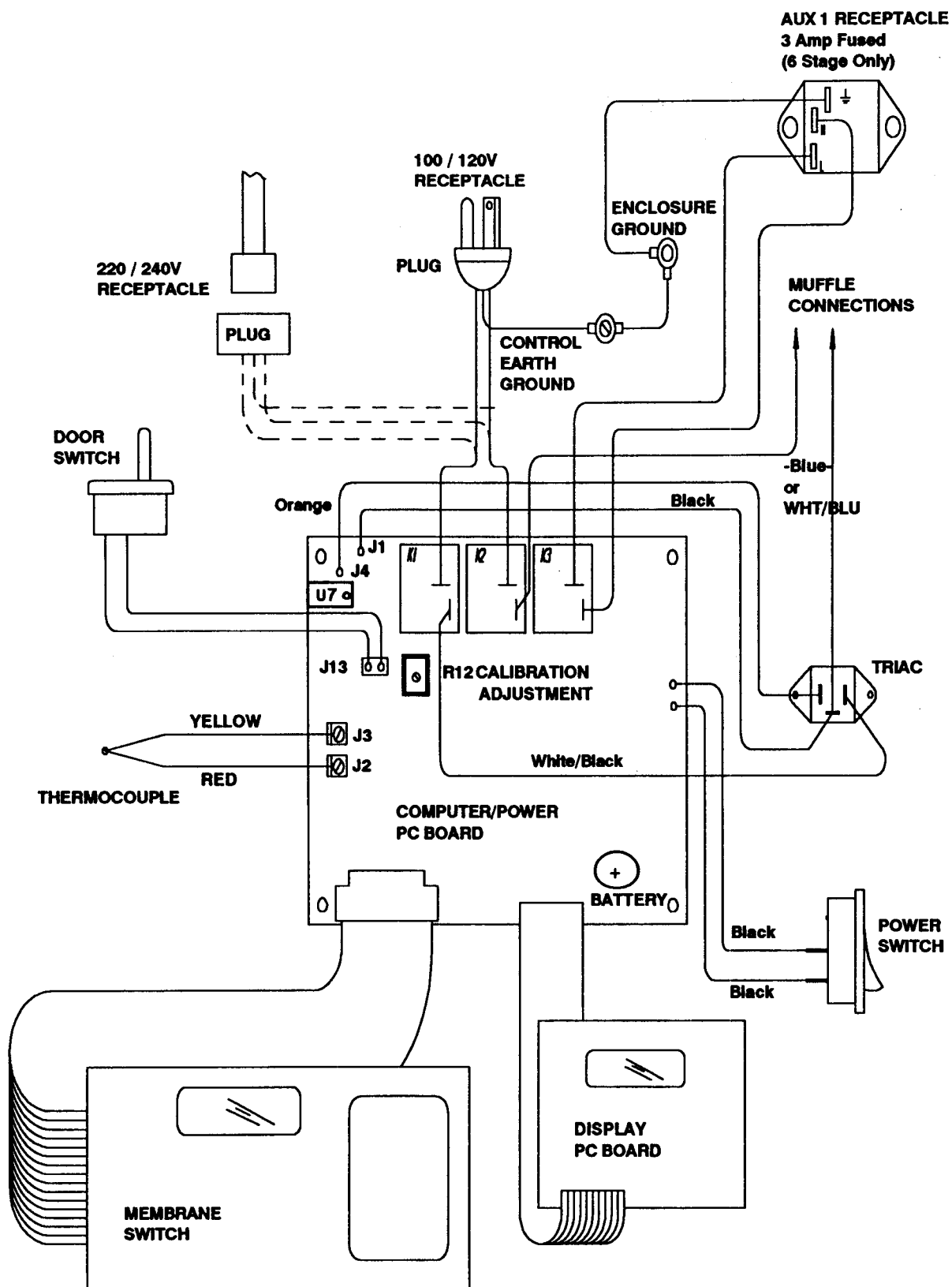No operation - lights do not come on, and muffle does not heat.

1. Does the power receptacle have power? Test with another load (ie. lamp or radio.)
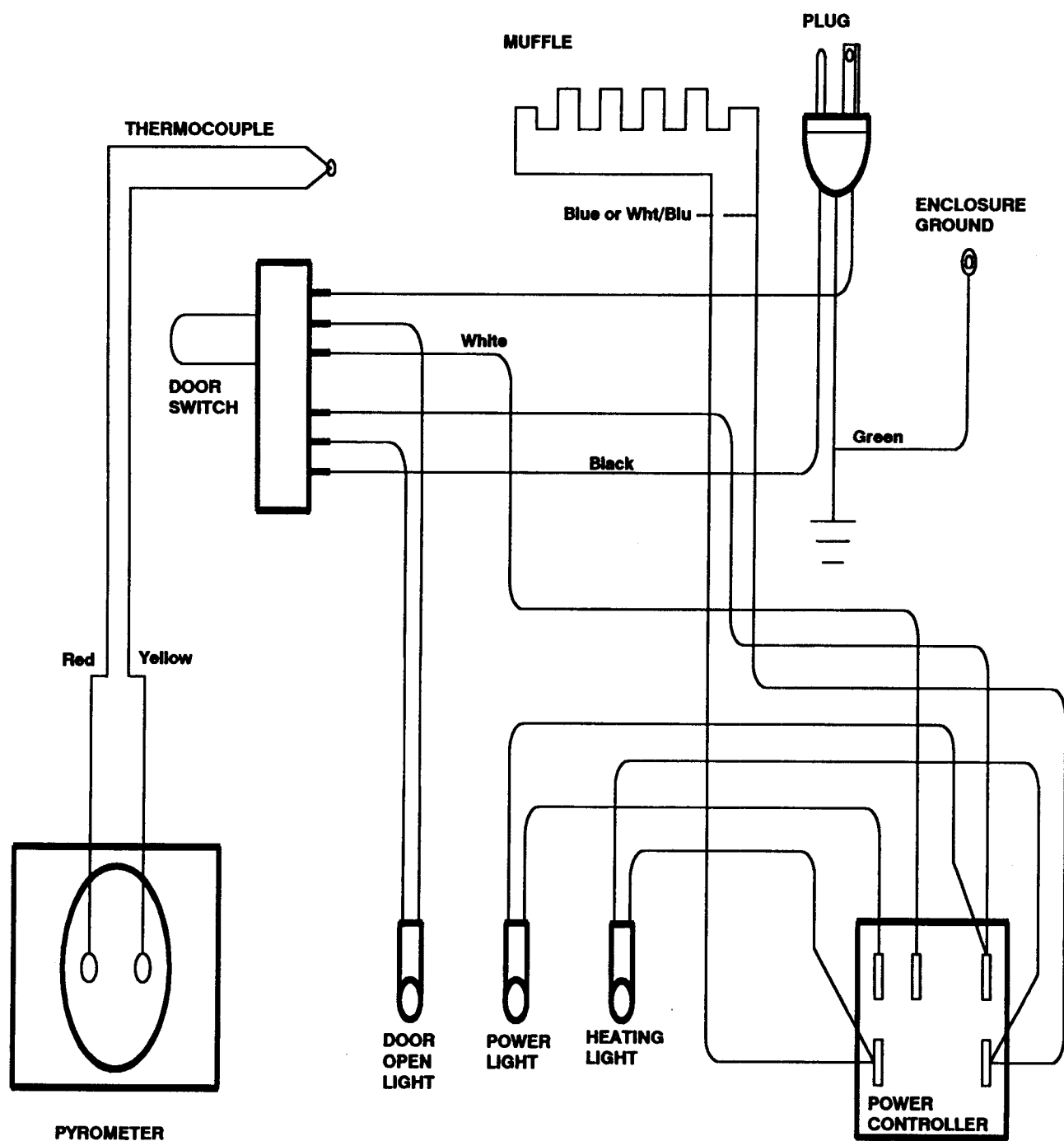2. Do any of the lights on the controller light? If yes, check wiring connections.

Problem:

No heat.

1. Is DOOR OPEN light on? Check door switch operation.
2. Does HEATING light come on when controller is turned on? Check power controller.

2 and 6 STAGE SCHEMATIC

AUX 1 RECEPTACLE
3 Amp Fused
(6 Stage Only)

100 / 120V
RECEPTACLE

PLUG

ENCLOSURE
GROUND

MUFFLE
CONNECTIONS

220 / 240V
RECEPTACLE

PLUG

CONTROL
EARTH
GROUND

-Blue-
or
WHT/BLU

DOOR
SWITCH

Orange

Black

J1
J4

U7

K1 K2 K3

TRIAC

J13

R12 CALIBRATION
ADJUSTMENT

YELLOW

J3

RED

J2

White/Black

THERMOCOUPLE

COMPUTER/POWER
PC BOARD

BATTERY

Black

POWER
SWITCH

Black

DISPLAY
PC BOARD

MEMBRANE
SWITCH

MANUAL CONTROLLER SCHEMATIC

THERMOCOUPLE

MUFFLE

PLUG

Blue or Wht/Blu

ENCLOSURE
GROUND

DOOR
SWITCH

White

Black

Green

Red   Yellow

DOOR
OPEN
LIGHT

POWER
LIGHT

HEATING
LIGHT

POWER
CONTROLLER

PYROMETER

DISASSEMBLY INSTRUCTIONS

READ THE CAUTIONS ON PAGES 1-1 AND 1-2 BEFORE PROCEEDING!

DISCONNECT THE FURNACE LINE CORD FROM THE WALL RECEPTACLE/OUTLET BEFORE PROCEEDING! Refer to the schematics and the exploded view drawings for the appropriate furnace during servicing.

Respiratory, eye, and hand protection should be worn during the following procedures.

The following tools are required for disassembly/reassembly work described in this section.
* Small blade screwdriver   * Medium Phillips screwdriver
* Needle-nose pliers   * Regular pliers

CONTROL PANEL REMOVAL:
(Access to power controller, pc boards, triac, power switch, door switch, thermocouple and muffle wiring connections)

1. Turn off the power to the furnace and remove the line cord from the wall receptacle/outlet. Allow the furnace to cool to room temperature before starting service.
2. Remove 9 screws from around the top, sides, and bottom of the control panel. Hanging the front of the furnace off of the counter by 2 inches (50mm) will aid in removing the bottom screws.
3. The control panel can now be removed by pulling it out the front of the furnace while raising the panel up slightly. The control panel will slide out approximately 6 inches (150mm).
4. With the control panel pulled out, various connections can be accessed.
   (2 and 6 STAGE) The pc boards can be replaced along with the membrane switch panel on its mounting plate with the drawer out. The neon light and LED's on the control/power pc board can be examined at this point. Battery replacement and temperature calibration can also be done with the control drawer in this position.
   (MANUAL CONTROLLER) The power controller, pyrometer, and wiring can be checked and replaced.
5. If the control panel is to be completely removed, the wiring connections should all be noted, labeled, or verified with the schematic included in this manual.
6. Reverse the steps above for reinstallation making sure that all electrical connections are tight.

THERMOCOUPLE REMOVAL:
1. Turn off the power to the furnace and remove the line cord from the wall receptacle/outlet. Allow the furnace to cool to room temperature before starting service.
2. Remove Control Panel by following the instructions above.
3. (2 and 6 STAGE) Disconnect thermocouple red and yellow wires from the left-hand side of the control/power pc board. Disconnect the blue or white/blue muffle wires from control/power pc board and triac. (Refer to the appropriate schematic prior to this section.)
   (MANUAL CONTROLLER) Disconnect thermocouple red and yellow wires from the rear of the pyrometer. Disconnect the blue or white/blue muffle wires from the back of the power controller.
4. Remove the exhaust port by removing the 3 retaining screws.
5. Remove Front Panel from enclosure by removing 7 screws from top and sides.
6. The Front Panel with the muffle attached pulls out of the front of the enclosure. Support the Front Panel assembly on the muffle, taking care not to bend the door switch actuator (located on the bottom).

7. The thermocouple can now be removed from the back of the muffle by pulling it out. (Note: When installing the new thermocouple, keep aluminum foil insulation away from the exposed thermocouple wire.)
8. Route the thermocouple through the bushing in the rear of the heatshield and behind the door switch bracket.
9. Reverse steps 1-6 for reinstallation. (Note: The screws holding the front panel to the cabinet must be installed prior to installing the control panel.)
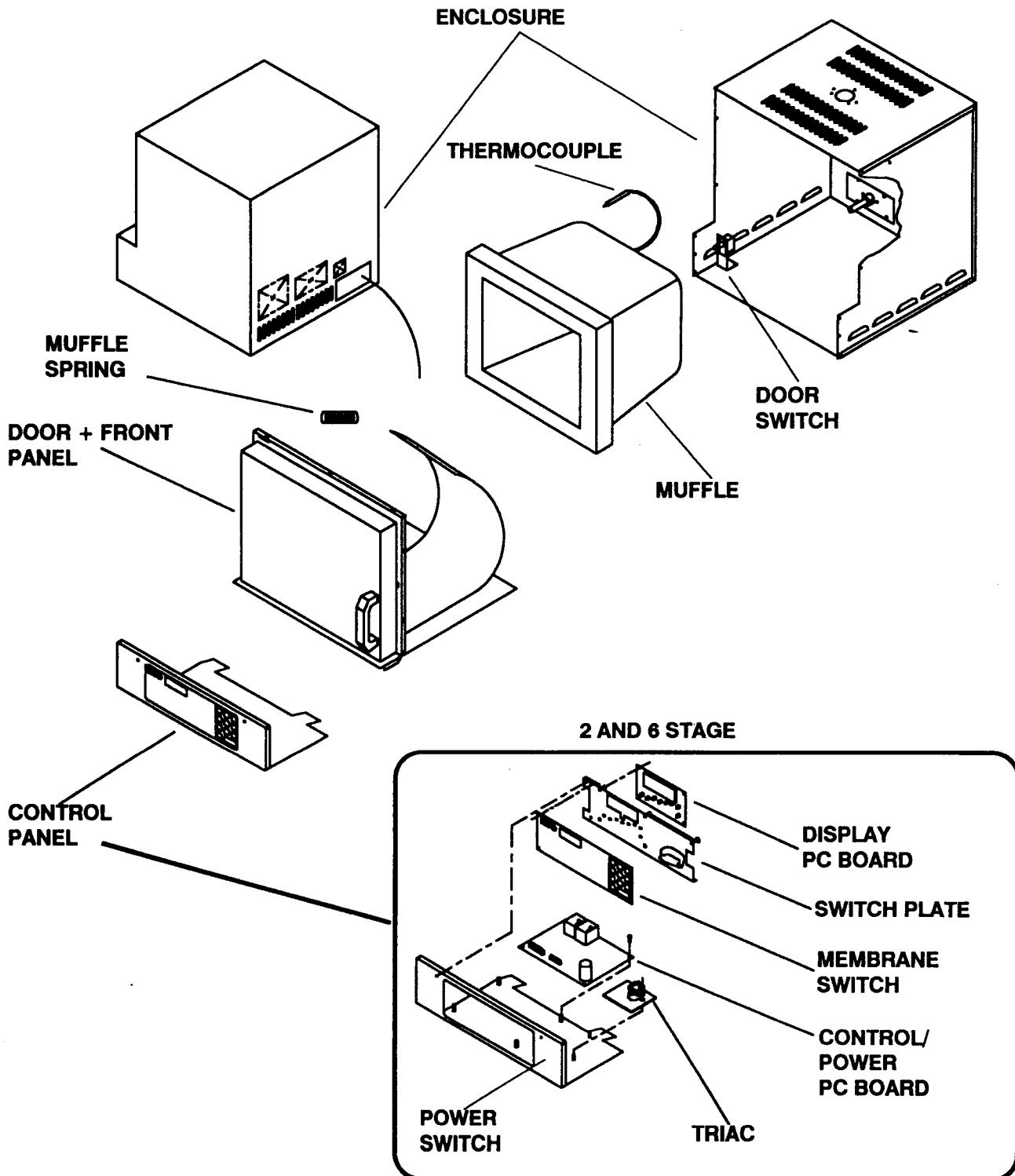
MUFFLE REMOVAL:
1. Turn off the power to the furnace and remove the line cord from the wall receptacle/outlet. Allow the furnace to cool to room temperature before starting service.
2. Remove Control Panel by following the instructions above.
3. Remove the exhaust port by removing the three retaining screws.
4. Disconnect the blue or white/blue muffle leads from the triac and the power board at relay K2.
5. Remove the thermocouple by pulling it out of the muffle. Follow the instructions above if thermocouple is to be replaced.
6. The muffle can now be removed by releasing the two springs that hold it in position. USE CAUTION WHEN RELEASING OR INSTALLING THE SPRINGS! Using pliers, release spring on end farthest from you. This will prevent it from flying at you if your grip should slip.
7. When installing the muffle, make sure that the muffle is pressed tightly against the front panel. The muffle wires must be fed through the two bushings in the front of the heatshield.
8. Reverse steps 1-6 for reinstallation. Gloves and protective eyewear should be worn when in stalling the springs.

REPAIR PARTS

The furnace and its internal components and assemblies are delicate and need to be packed properly for return shipment. Pack all parts or assemblies in a bag with foam and seal them in suitable boxes. Use original packaging when it is available.

DESCRIPTION	VOLTAGE	
	120V	240V
Muffle	LMF-MUFFLE/120	LMF-MUFFLE/240
Thermocouple	LMF-TC	
Triac	-----R9303015-----	
Power Switch	-----R9306021-----	
Door Switch (2 and 6 Stage)	-----R9492666-----	
Door Switch (Manual)	-----R9306031-----	
Power/Control PC Board		
Assembly: 2 Stage	---R9492570---	---R9492571---
6 Stage	---R9492572---	---R9492573---
Display PC Board		
Assembly: 2 Stage	--R9492702--	
6 Stage	--R9492703--	
Membrane Switch and		
Plate: 2 Stage	---R9492636---	
6 Stage	---R9492659---	
Battery, Lithium		
Panasonic # BR2032	Obtain Locally	
Radio Shack # CR2032		
Fuse, 1 Amp, 250V,	Obtain Locally	
5mm x 20mm		
Dual Scale Temp		
Indicator (Manual)	R9390451	
Power Controller		
(Manual)	----R9390019----	----R9390143----

EXPLODED VIEW , 2 AND 6 STAGE UNITS

ENCLOSURE

THERMOCOUPLE

MUFFLE
SPRING

DOOR + FRONT
PANEL

DOOR
SWITCH

MUFFLE

CONTROL
PANEL

2 AND 6 STAGE

DISPLAY
PC BOARD

SWITCH PLATE

MEMBRANE
SWITCH

CONTROL/
POWER
PC BOARD

POWER
SWITCH

TRIAC

ENCLOSURE

THERMOCOUPLE

MUFFLE
SPRING

POWER
CORD

DOOR & FRONT
PANEL

DOOR
SWITCH

MUFFLE

MUFFLE
STRAP

CONTROL
PANEL

PYROMETER

POWER CON-
TROLLER