

Type F1500 Muffle Furnace

OPERATION MANUAL AND PARTS LIST

SERIES 327

Model #	Voltage	Control
FD1535M	120	Single Set Point
FD1538M	208	Single Set Point
FD1530M	240	Single Set Point
FD1530M-26	240	Single Point Set
FD1534M	100	Single Set Point
FD1545M	120	Programmable (2 Ramp & 2 Dwell)
FD1548M	208	Programmable (2 Ramp & 2 Dwell)
FD1540M	240	Programmable (2 Ramp & 2 Dwell)
FD1540M-26	240	Programmable (2 Ramp & 2 Dwell)
FD1544M	100	Programmable (2 Ramp & 2 Dwell)

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General Information

Alert Signals



Warning

Warnings alert you to a possibility of personal injury.



Caution

Cautions alert you to a possibility of damage to the equipment.



Note

Notes alert you to pertinent facts and conditions.



Hot Surface

Hot surfaces alert you to a possibility of personal injury if you come in contact with a surface during use or for a period of time after use.

Safety Information

Your Thermolyne Muffle Furnace has been designed with function, reliability, and safety in mind. It is the user's responsibility to install it in conformance with local electrical codes. For safe operation, please pay attention to the alert boxes throughout the manual.

Important Information

This manual contains important operating and safety information. The user must carefully read and understand the contents of this manual prior to the use of this equipment.

Warnings

To avoid electric shock, this furnace must:

1. Use a properly grounded electrical outlet of correct voltage and current handling capacity.
2. Disconnect from power supply before servicing.
3. Have the door switch operating properly.

To avoid personal injury:

1. Do not use in the presence of flammable or combustible materials ; fire or explosion may result. This device contains components which may ignite such material.
2. **Caution: Hot Surface - Avoid Contact.** To avoid burns, do not touch the interior or exterior surfaces of the furnace during use or for a period of time after use.
3. Refer servicing to qualified personnel.

Introduction

Intended Use

The type 1500 furnaces are general laboratory and heat treating furnaces. These furnaces are intended for applications requiring temperatures from 212°F (100°C) to 2192°F (1200°C). For maximum element life, it is recommended to operate the furnace at temperatures from 212°F (100°C) to 1950°F (1066°C) for continuous use or temperatures from 1950°F (1066°C) to 2192°F (1200°C) for intermittent use. Continuous use is operating the furnace for more than 3 hours and intermittent use is operating the furnace for less than 3 hours.

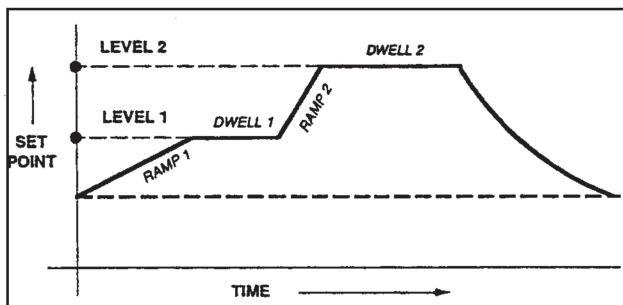
The unit consists of 1) a heating chamber, 2) a digital temperature control and, 3) a power switch. See Figure 1, page 29 for overall shape and general features of the unit.

Principles of Operation

The furnace chamber is heated by four electric resistance heaters which are embedded in a refractory material. The chamber is insulated with a ceramic fiber insulation. For safety, a door switch is incorporated to remove power from heating elements when door is opened. The furnace chamber is supported by the control section which also houses the electrical connections.

Two types of temperature controls are used:

- 1) **Single Set Point (Automatic)** This is an electronic control which enables the user to bring the furnace up to a preset point and hold that temperature.
- 2) **Programmable (2 ramp and 2 dwell)** This control is designed to control a programmed temperature profile. The profile is in the format of ramps and dwell segments. The first ramp, RAMP 1, starts at the initial measured Furnace temperature. This ramp is positive going at a programmed rate until the programmed level is reached. The setpoint will stay at this level for a period determined by the setting of DWELL 1. When the second ramp reaches the second programmed level, the setpoint stays at that level for the duration of the segment. Depending upon the model ordered, additional ramp and dwell segments may be added.



General Specifications for Furnaces

Model #			FD1540M & (26)° FD1530M & (26)°	FD1544M FD1534M	FD1545M FD1535M	FD1548M FD1538M
Dimensions in. (cm)	Chamber	Width	4 (10)	4 (10)	4 (10)	4 (10)
		Height	3-3/4 (9.5)	3-3/4 (9.5)	3-3/4 (9.5)	3-3/4 (9.5)
		Depth	9 (22.9)	9 (22.9)	9 (22.9)	9 (22.9)
	Overall	Width	11 (28)	11 (28)	11 (28)	11 (28)
		Height	16-1/2 (42)	16-1/2 (42)	16-1/2 (42)	16-1/2 (42)
		Depth	18 (46)	18 (46)	18 (46)	18 (46)
Weight	Lbs. Kg.	42 (19)	42 (19)	42 (19)	42 (19)	
Electrical Ratings	Volts		240	100	120	208
	Amps		9.3	20.7	18.6	10.7
	Watts		2230	2070	2230	2225
	Freq.		50/60	50/60	50/60	50/60
	Phase		1	1	1	1
Operating Temp. Range	Cont.		100°C - 1066°C	100°C - 1066°C	100°C - 1066°C	100°C - 1066°C
	Intermittent		1066°C - 1200°C	1066°C - 1200°C	1066°C - 1200°C	1066°C - 1200°C



Note

-26 models supplied with European type cord and plug. All other models **not** supplied with cord and plug.

Unpacking

Unpacking

Unpack furnace from box. The owners manual and door handle are included in the box. After unpacking the furnace, attach the door handle and remove packing material from inside furnace chamber. The furnace is supplied with one hearth plate. **The Type 1500 furnaces do not come with a power cord because current requirements are too great to be handled by ordinary power cords and standard wall supply.** (Exception: the -26 European models are supplied with a power cord.)

Installation



Caution

Be sure ambient temperature does not exceed 104°F (40°C); ambients above this level may result in damage to the controller. Allow at least six inches of space between the furnace and any combustible surface. This permits the heat from the furnace case to escape so as not to create a possible fire hazard. For supply connections, use 14 AW or larger wires suitable for at least 392°F (200°C).



Note

(-26) models are supplied with a European cord set.



Warning

To avoid electrical shock, this furnace must be installed by a competent electrician who ensures compatibility among furnace specification, power source and ground code requirements.

Installation

Site Selection

Install furnace on a sturdy surface and allow space for ventilation.

The electrical specifications are located on the specification plate on the back of the furnace. Consult Barnstead/Thermolyne if your electrical service is different than those listed on the specification plate. Prior to connecting your Type 1500 furnace to your electrical supply, be sure the two position power switch is in the OFF position.

Your 1500 furnace may be wired either directly through a conduit system or by using a power cord and plug which conforms to the National Electrical Codes and electrical code requirements of your area. The terminal block to be used in wiring is located on the lower rear of the furnace. (See Figure 1, page 29 for wiring locations.)



Warning

Do not use in the presence of flammable or combustible chemicals. Fire or explosion may result; this device contains components which may ignite such materials.



Hot Surface

To avoid burns, do not touch the interior or exterior surfaces of the furnace during use or for a period of time after use.

Single Setpoint Temperature Control (Automatic Operation)



Note

The temperature control in these models is a single set-point device. By using the UP or DOWN buttons, a specific temperature can be chosen. The control will cause the furnace chamber to heat to the chosen temperature and hold it at this temperature until you turn off the power switch or select another temperature.



Warning

To avoid electrical shock, this furnace must have the door switch connected and operating properly. If the furnace power light does not go out while the door is open, consult the **Troubleshooting** section before proceeding.



Note

When performing the operations with the controller, remember that if more than eight to ten seconds elapse before the buttons are used again, the display screen will automatically switch back to displaying chamber temperature. If this happens, light up the front panel again and step through each parameter until you reach the point at which the interruption occurred. The parameter values you adjusted earlier will not be lost or altered. Holding down the SCROLL button allows longer viewing time.

Single Setpoint Temperature Control (Automatic) Operation (Models FD1530M, FD1530M-26, FD1534M, FD1535M, FD1538M)

Controls and Displays

Power Switch:

Turn power switch to the “ON” position. The CONTROLLER will illuminate when power is on.

Furnace Power Indicator:

The amber furnace power light will illuminate whenever the door is closed. This light will go out only when the door is open or when there is an over-temperature condition.

Door Safety Switch:

The door safety switch removes power from the heating elements when the door is opened. Open and close the door a few times, note that the amber furnace power light will go out while the door is open. If the furnace power light does not go out while the door is open, consult the Troubleshooting section before proceeding.

Control Buttons

To illuminate the “DOWN” button, “SCROLL” button, and “UP” button, touch anywhere on the front panel.

Digital Readout:

The Digital Readout continuously displays chamber (upper display) and setpoint (lower display) temperatures unless the “SCROLL” button is depressed.



Caution

Do not exceed limitations for continuous or intermittent operating temperature shown in the General Specifications. Exceeding these limits will result in severely reduced heating element life.



Note

If the power to furnace is turned off or interrupted while in “tuning” upon returning power to furnace, the controller display will indicate “LinE FAIL” because sampled data could be questionable. To restart tuning, refer to **Tuning** procedure. If the controller cannot maintain temperature set-point, “TunE FAIL” will appear on display. First, correct problem responsible for not maintaining the temperature setpoint, then restart the “tuning” procedure.

Start-up Display:

When the power switch is turned on, the controller will perform a self-test to make sure controller is operating properly. (If all four 1’s do not light up or fails to go to “8888” contact Thermolyne.)

Adjusting Furnace Setpoint

Temperature

To illuminate the “DOWN” button, “SCROLL” button, and “UP” button, touch anywhere on the front panel.

Push the “UP” button or the “DOWN” button to modify the temperature setpoint (lower digital display).

Tuning

This control incorporates a self tuning feature which determines the optimum control parameters for the best temperature accuracy. We recommend that you tune the furnace to your specific application to obtain the best results. Perform the following procedures when you first set up your furnace and each time you change your load type or operating temperature.

To tune your furnace

Load your furnace with a load characteristic of those you intend to heat in it.

Set the furnace’s setpoint to the temperature you intend to use for your application.

SINGLE SETPOINT TEMPERATURE CONTROL (AUTOMATIC OPERATION)

Push the “SCROLL” button until ‘TUNE’ appears. To start the tuning function, push the “UP” button.

When the tuning process is started, the lower display will flash ‘tunE’ along with the furnace temperature setpoint. During tuning, the temperature setpoint cannot be changed. To change temperature setpoint ‘tunE’ must be turned “OFF.” (To stop the tuning function, push the “DOWN” button.)

Changing Temperature Indication

Push “SCROLL” button once, “°C” will appear. This indicates temperature measurement. (Contact Thermolyne if control needs to be changed to °F.)



Note

The controller is fitted with a mechanical relay which is de-energized in the alm mode. This relay, when de-energized, removes power from the heating elements. If the primary control circuit fails, the OTP will control the furnace temperature at the preset value **you** have entered, **it does not shut off the furnace, but will maintain the chamber temperature at that value.**

Setting the High Alarm Temperature

(Over Temperature Protection OTP):

Push “SCROLL” button until “AL.SP” (Alarm Setpoint) appears. The lower display should indicate 1100°C.

Depress either the “UP” or “DOWN” button to select the OTP value you desire. Thermolyne recommends that you set the value either at the maximum operating temperature of the furnace or a value of 20 degrees above your working temperature if you desire to provide protection for your work load.

Operation of 2 Ramp and 2 Dwell Programmable Models



Note

In the event of a thermocouple break (open circuit), the numeric display increases rapidly upscale, then displays “Snb” (sensor break) and may alternately flash “HiAL” (high alarm) and/or dAL (deviation alarm) and the sensor break power value. A reversed thermocouple connection or incorrect thermocouple will cause the display to read “ur” (under-range) and the control will maintain the sensor break power output value selected.



Note

When performing operations with the controller, if you depress and release either the “PAR,” scroll “UP” or scroll “DOWN” buttons and more than six seconds elapse before the buttons are used again, the display will automatically switch to displaying chamber temperature. If this happens, you will have to step through each parameter until you reach the point at which the interruption occurred. The parameter Values adjusted earlier will not be lost or altered. Holding down on “PAR” allows longer viewing time.

Operation of 2 Ramp and 2

Dwell Programmable Models

(Models FD1540M, FD1540M-26, FD1545M, FD1544M, FD1548M)

Controls and Displays

Digital Readout:

The digital readout continuously displays chamber (upper display) and setpoint (lower display) temperatures unless the PAR (parameter) button is depressed.

If a program is in either run, Hb or Hold, pressing “PAR” once causes the lower display to indicate the current segment of the program (r1, d1, r2, d2, or Hb) along with °C or °F. If the program is currently in either d1 and d2, the value shown below these parameters (d1 and d2) reflects the time remaining in the segment.

While the program is in run, Hold, or Hb, the set point shown on the bottom display is the current working set point.

When the controller is in idle, depressing PAR shows each parameter and its current value in turn on the display. The parameter value can either be modified with the “up” or “down” push buttons or left unmodified.

See **Parameters** for a list of the controller parameters in order.

Power Switch:

Set power switch to the “ON” position. The CONTROLLER will illuminate when power is on.



Caution

Remember that whenever the power switch is turned “ON”, the furnace will begin to heat at the setpoint temperature that was previously set. This value will remain unchanged for up to a year without power being applied to the control.



Warning

To avoid electrical shock, this furnace must have the door switch connected and operating properly. If power light does not go out while the door is open, consult the **Troubleshooting** section before proceeding.



Note

Push button “A/M” and light “OP” are inactive and not used.



Note

The controller is filled with a mechanical relay which is de-energized in the alarm mode. This relay, when de-energized, removes power from the heating elements, If the primary control circuit fails, the OTP will control the furnace temperature at the preset value you entered. It does not shut off the furnace but will maintain the chamber temperature at that value.

Furnace Power Indicator:

The amber furnace power light will illuminate whenever the door is closed. This light will go out only when the door is open or when there is an over-temperature condition.

Door Safety Switch:

The door safety switch removes power from the heating elements when the door is opened. Open and close the door a few times, note that the amber furnace power light will go out while the door is open. If the furnace power light does not go out while the door is open, consult the Troubleshooting section before proceeding.

Parameters

PROG - program options . By pushing up or down buttons, three options can be chosen: run - to start program; idle - to end program; hold - to hold program until further action.

SP - set point temperature. When running a program, it is the last temperature value attained. Push up or down button to set.

TUNE - self-tuning feature. Push up or down button to set.

LC - loop count. The number of times the program is repeated. Push up or down button to set.

r1 - ramp rate #1. The rate of heat increase or decrease in °/minute. Push up or down button to set.

L1 - temp level #1. The temp level that r1 will attain. Push up or down button to set.

d1 - dwell (soak) time #1. The amount of time in minutes to hold L1 temp level #1. Push up or down button to set.

r2 - ramp rate #2. The rate of heat increase or decrease in °C/minute. Push up or down button to set.



Note

All temperature dependent parameters are automatically converted when the temperature unit (C or F) is changed.

L2 - temp level #2. The temperature level r2 will attain. Push up or down button to set.

d2 - dwell (soak) time #2. The amount of time in minutes to hold L2 temperature level #2. Push up or down button to set.

Hb - “holdback.” Automatically places the programmer into “HOLD” if the measured value deviates more than a specified amount from programmer setpoint. When measured value reenters the holdback band, the timing for the segment resumes. (Parameter is expressed in °C and only functions when running a program). Push up or down button to set.

HiAL - high alarm (over temperature protection). Push up or down button to set. Thermolyne recommends that you set the value either at the maximum operating temperature of the furnace or a value of 20 degrees above your working temperature if you desire to provide protection for your work load.

The next three parameters - Proportional Band, Integral and Derivatives - are the three control parameters of a P.I.D. control system. These parameters will be set when you tune your furnace. (See **Tuning.**)

Proportional Band (Prop)

Integral Time (In.T)

Derivative Time (dEr.T)

HPI - High Power Limit (%) This parameter limits the average maximum power that is applied to the heating elements. Remember that this parameter does not reduce the voltage to the elements. It reduces the average power to the elements by cycling power on and off.

C/F - Centigrade/Fahrenheit. Choose the desired temperature unit by depressing the “UP” or “DOWN” push-button.

Tuning Your Controller

This programmable control has an automatic tuning feature which installs optimum tuning parameters to give the best temperature accuracy. No manual loading of tuning parameters is needed. We **highly** recommend using this feature to provide the best temperature accuracy the controller can attain. Perform the following procedures when you first set up your furnace and each time you change your load type, operating temperature, or program.

To initiate the self tune feature

Load your furnace with a load characteristic of those you intend to heat in it.

If you will be using the controller as a single Setpoint Controller, set the furnace's setpoint to the temperature you intend to use for your application.

If you will be running a multistep program, set the furnace's setpoint to the value of **L1 (temp level #1)**.

Push "PAR" button until TUNE is displayed, then push "UP" or "DOWN" button to turn tune "ON."

During the operation, TUNE flashes in the lower display. Do not make any adjustments to the controller parameters during this period. The self tuning is finished when TUNE no longer flashes in the lower display.

Self tuning will calculate values for:

Proportional band (prop)

Integral time (Int.t)

Derivative time (der.t)

- Self tuning cannot be initiated while running a program.
- A power failure will cause the TUNE parameter to revert back to NO. (Reset tune parameter to YES).
- If there are alarm conditions during self tuning, they flash alternately with TUNE.



Caution

Do not exceed limitations for continuous or intermittent operating temperature shown in the **General Specifications (in furnace manual)**. Exceeding these limits will result in severely reduced heating element life.

Operating the Controller

Single Set Point Operation

The programmable control can be used as a single setpoint control or as a programmable control. To use as a single set point control simply push up or down buttons to choose a specific temperature. The control will cause the furnace chamber to heat to the chosen temperature and hold this temperature until the power switch is set to OFF or another temperature is selected.

- a. The setpoint temperature presently set in the control will be read out on the lower display.
- b. To change this set point, depress the “UP” or “DOWN” push button until the desired setpoint value is displayed then release the button.
- c. At this point the furnace will begin to heat if the new set point temperature you have chosen is higher than the present chamber temperature.

Programming Controller

To run a program, first determine your ramp rate, dwell times, and program levels. It is helpful to graph your program out for ease of loading the program into controller.

A maximum of 2 ramp and 2 dwell segment combinations are available, thus enabling 2 different set point levels to be achieved. Each ramp is programmed by specifying the temperature level (L1) and the required ramp rate (r1). The programmer then automatically calculates the time that is required to attain the temperature level (L1) based on the desired ramp rate (r1). Dwell segments (d1) then can be attached to each temperature level (L1) to hold that temperature for a specified amount of time.

Make sure the PROG parameter is set to idle (to stop program) when entering program values. (See **Parameters.**)

Push "PAR" until "r1" is displayed. Push "UP" or "DOWN" buttons and set ramp rate "r1" (heat increase or decrease) in °C/minute.

Push "PAR" until "L1" is displayed. Push "UP" or "DOWN" buttons and set temperature level "L1." This is the target temperature for the first ramp.

Push "PAR" until "d1" is displayed. Push "UP" or "DOWN" buttons and set dwell (soak) time "d1" in minutes.

Push "PAR" until "r2" is displayed. Push "UP" or "DOWN" buttons and set ramp rate "r2" in C/minutes.

Push "PAR" until "L2" is displayed. Push "UP" or "DOWN" buttons and set temperature level "L2." This is the target temperature for the second ramp.

Push 'PAR' until "d2" is displayed. Push "UP" or "DOWN" buttons and set dwell (soak) time "d2" in minutes.

Push "PAR" until "SP" is displayed. Push "UP" or "DOWN" buttons and modify set point temperature. After "d2" dwell time has expired, thus ending the program, the last temperature level to be attained will be equal to "SP" temperature. For example, if after your program has been completed, you want the furnace to cool to ambient, set "SP" to 20. This will be the last temperature level attained.

Push "PAR" until "LC" is displayed. Push "UP" or "DOWN" buttons and set "LC" (loop count - number of times program is repeated).

Skipping Segments

If you desire to skip a ramp or dwell segment, follow this procedure:

- for a dwell segment, enter a setting of "0" minutes.
- for a ramp segment, enter a high value such as 100°/min. This will cause controller to skip to next segment as fast as the furnace is capable.

Setting the Holdback Feature

This controller features a holdback (Hb) function to ensure programmed parameter values are adhered to. Holdback is set in display units (degrees C or F) and represents the allowable excursion of measured value away from the current set point, either above or below, before the program is forced into hold (clock stops).

The program will remain in hold until the measured value comes within holdback band (clock starts). This feature is active the whole time that the program is running. (Holdback functions only while running a program).

Push PAR until "Hb" is displayed. Select desired holdback setting - a setting of 20° is recommended.

If a running program is forced into holdback, the illuminated dot below the "R" symbol on controller will flash and the PROG parameter will indicate "Hb." When the program is in "holdback," it effectively lengthens the time of the program - if the holdback band "Hb" is set too low, the program will never escape the holdback band, thus the program will never be completed. If you do not want to use the holdback function, set "Hb" to an extremely large value.

Implementing Programs

Implementing Programs

When you have finished programming and are ready to run your program, push “PAR” until PROG is displayed. Pushing the “UP” or “DOWN” buttons, you have three options: “Run” (to start program), “idle” (to stop program), “hold” (to hold program) - parameter values can be changed when hold is chosen.



Note

Parameter values r1, L1, D1, r2, L2, r2, D2 and Lc cannot be adjusted while running a program.

Program Execution

When “run” is selected, the program will start from the actual furnace temperature at that point in time. Also, the dot under “R” on the control will illuminate to indicate the program is running.

Program Hold

To adjust parameters while running a program, you must put control into “Hold.” Push “PAR” until “prog” is displayed. Push “UP” or “DOWN” buttons until Hold is displayed. When the dot underneath “R” on controller flashes and “Hold” is indicated at the “prog” parameter, the controller is in Hold. Now you are able to adjust all parameters. To restart the program, set “prog” to “run” again.

Program Idle

To stop program, push “PAR” button until “prog” is displayed. Push “UP” or “DOWN” buttons until “idle” is displayed. This will terminate program.

Furnace Loading



Caution

Do not overload your furnace chamber. If the load is to be heated uniformly, it should not occupy more than two-thirds of any dimension of the chamber. Failure to observe this caution could result in damage to furnace components.

Furnace Loading

For best results of furnace loading, use less than two-thirds of any dimension of the chamber. If you are heating a number of small parts, spread them throughout the middle two-thirds of the chamber.

- Keep objects away from thermocouple.
- Block up load with small pieces of ceramic, or use the supplied hearth plate.
- Use insulated tongs and mittens when loading and unloading furnace.
- Always wear safety glasses.

Use hearth plated supplied with furnace (Cat. No. PHX2) to protect bottom heating element.

Preventative Maintenance



Warning

To avoid electrical shock, this furnace must always be disconnected from the power supply prior to maintenance and servicing. Refer servicing to qualified personnel.

Preventative Maintenance

Contamination is a major cause of element failure, therefore, when possible, remove the fume forming material before heating. (e.g., cleaning cutting oil from tool steel).

Housekeeping is vital to your electric furnace—**KEEP IT CLEAN!** Run your furnace up to 1600°F (870°C) empty occasionally to burn off the contamination that may exist on the insulation and elements. Run for approximately two hours **with the door slightly open.**

Element life is reduced somewhat by repeated heating and cooling. If the furnace is to be used again within a few hours, it is best to keep it at the operating temperature or at a reduced level such as 500°F (260°C).

During normal use the thermocouple in your furnace can become oxidized and cause inaccurate control; therefore, we suggest that if you regularly use your furnace you should **check your thermocouple once every six months** to assure the accuracy of your control.

Troubleshooting



Warning

Disconnect from power supply before servicing.

Troubleshooting

The Troubleshooting section is intended to aid in defining and correcting possible service problems. When using the chart, select the problem category that resembles the malfunction. Then proceed to the possible causes category and take necessary corrective action.

Problem	Possible Causes	Corrective Action
The power light does not illuminate.	The furnace is not connected to the power supply.	Check furnace connection to power supply.
	ON and OFF power switch defective.	Replace power switch.

Problem	Possible Causes	Corrective Action
Inaccurate temperature readout.	Oxidized or contaminated thermocouple.	Replace thermocouple.
	Poor thermocouple connection.	Tighten connections.
	Improper loading procedures.	Use proper loading procedures.
	Poor ventilation of base.	Clear area around furnace base.
	Thermocouple connections reversed.	Reconnect thermocouple correctly.
	Control out of calibration.	Contact Barnstead/Thermolyne.
	P.I.D. values invalid.	Re-tune control.
	Control malfunction. "EE FAIL" will be displayed. (Single Set Point Control)	Verify and correct all parameter and configuration values. If "EE FAIL" persists, replace control.

TROUBLESHOOTING

Problem	Possible Causes	Corrective Action
The furnace does not heat.	<p>No power</p> <p>Thermocouple is open or thermocouple leads reversed. "SnSr FAIL" will be displayed.</p> <p>Single Set Point Controller malfunction. "EE FAIL" will be displayed.</p> <p>Element burned out. "LP.Br" will be displayed. (Single Set Point Control)</p> <p>Solid state relay defective.</p> <p>Door switch malfunction.</p>	<p>Check power source and fuses or breakers.</p> <p>Replace thermocouple or check thermocouple connections.</p> <p>Verify and correct all parameters and configuration values. If "EE FAIL" persists, replace control.</p> <p>Replace muffle (element).</p> <p>Replace solid state relay.</p> <p>Realign or replace door safety switch.</p>
Slow heat up.	<p>Low line voltage.</p> <p>Heavy load in chamber.</p> <p>Wrong heating in element.</p> <p>Low ramp rate setting.</p>	<p>Install line of sufficient size and proper voltage. (Isolate furnace from other electrical loads.)</p> <p>Lighten load in chamber to allow heat to circulate.</p> <p>Install proper element.</p> <p>Increase setting.</p>
Repeated element burnout.	<p>Heating harmful materials.</p> <p>Control unit malfunction.</p> <p>Incorrect element.</p> <p>Oxidized thermocouple leading to inaccurate reading.</p> <p>Wired improperly.</p>	<p>Clean up spills in chamber. Ventilate chamber by leaving door cracked slightly open when heating known harmful regents.</p> <p>Replace control unit.</p> <p>Install proper element.</p> <p>Replace thermocouple.</p> <p>Check wiring diagram for correct wiring of your furnace.</p>

Maintenance and Servicing



Note

Perform only maintenance described in this manual. Contact an authorized dealer or our factory for parts and assistance.

Maintenance and Servicing

To Replace A Heating Element:

- a) Disconnect furnace from power supply.
- b) Remove back terminal cover (See Figure 2, page 29.)
- c) Loosen the nuts on the terminals of the element to be replaced.
- d) Straighten the leads of the old element.
- e) Open the door and pull the defective element out. (It may be easiest to turn the furnace so that the element to be removed is on top.)
- f) Slide the new element into place, threading the leads through the insulating porcelain bushing in the back of the furnace.
- g) Bend the elements across the “U” shaped terminal clamp washer. Replace the adjacent element lead across the washer. Put the round terminal clamp washer over the element leads and tighten the nut securely. Cut off any excess lead wire.
- h) Replace the back terminal cover.
- i) Reconnect furnace to power supply.

To Replace The Platinel II Thermocouple:

- a) Disconnect furnace from power supply.
- b) Remove the back terminal cover (See Figure 2, page 29.)
- c) Remove old thermocouple by removing T/C bracket and the washer and nuts on the terminal posts. (Make sure small bracket between the two metal pieces does not fall out.)
- d) Reassemble the bracket and plates removed in step c to the new thermocouple and secure to furnace back plate.
- e) Insert the new thermocouple into the furnace until tip extends approximately 1" into the chamber. **Make sure the T/C lead wire with the colored beads is connected to the terminal marked positive.** (See Figure 2, page 29.)
- f) Secure thermocouple extension wires to terminals (yellow to +).
- g) Replace the back terminal cover.
- h) Reconnect furnace to power supply.

To Replace Door Switch (Micro Switch):

- a) Disconnect furnace from power supply.
- b) Turn furnace upside down and remove bottom plate.
- c) Disconnect the wires from door switch. **Identify or mark wires disconnected to insure proper placement and connection when reinstalling.**

- d) Remove two screws from door switch and slide switch from the wire rod.
- e) Insert new door switch while sliding it over the wire rod. Secure door switch to furnace.
- f) Reconnect wires identified or marked in Step (c) to new door switch.
- g) Replace bottom cover.
- h) Turn furnace upright and reconnect to power supply.
- i) Test operation of door switch.

To Realign Door Switch:

- a) Disconnect furnace from power supply.
- b) Loosen set screw on cam and adjust it so that the power is removed when approximately a 15° movement is made with the door handle. (When opening the door.)
- c) Tighten set screw on adjusting cam.
- d) Reconnect furnace to power supply.
- e) Test operation of door switch.

To Replace Temperature Control:

- a) (Single Set Point Models) Simply grasp control at top and bottom and pull straight out.

- b) (Programmable 2 Ramp & 2 Dwell Control) Turn out retaining screw located on right side of control and pull control straight out.

Figures

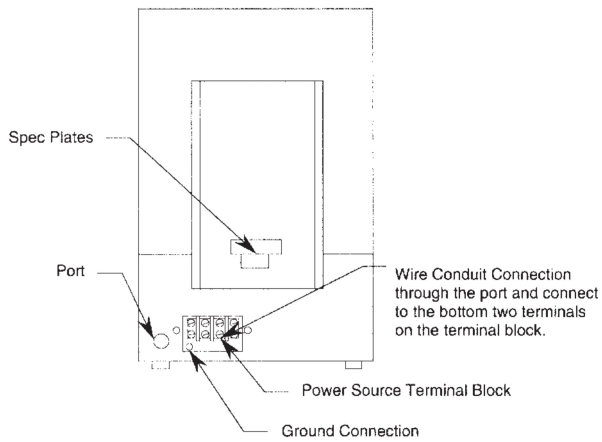
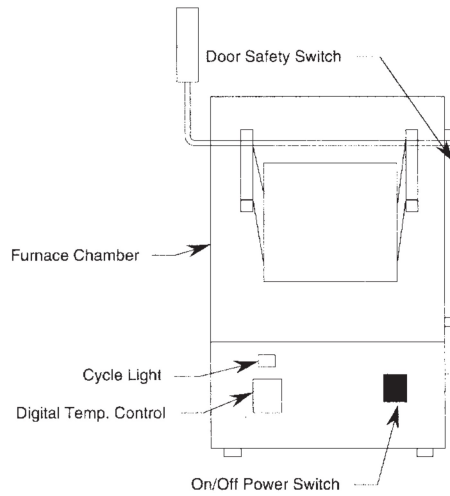
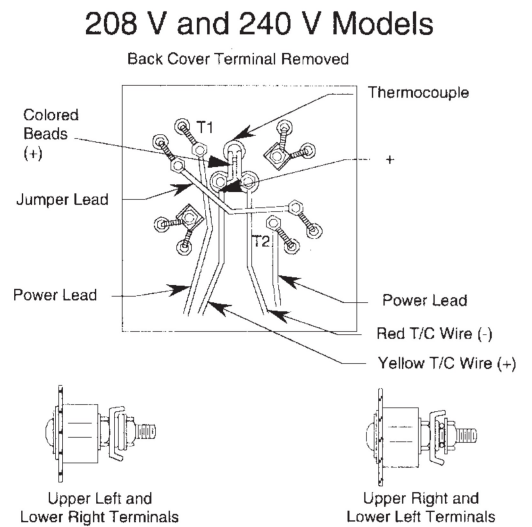
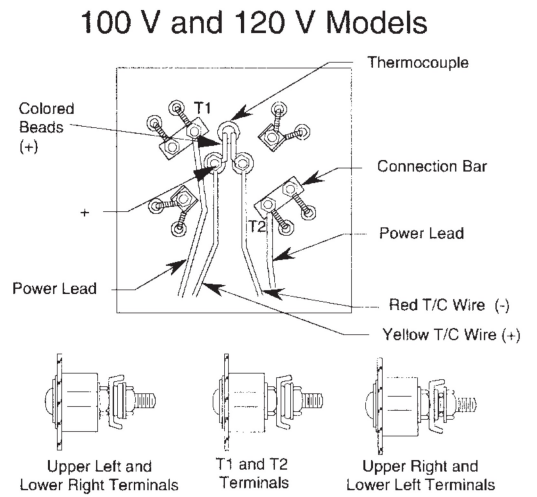


Figure 1

Figure 2



FIGURES

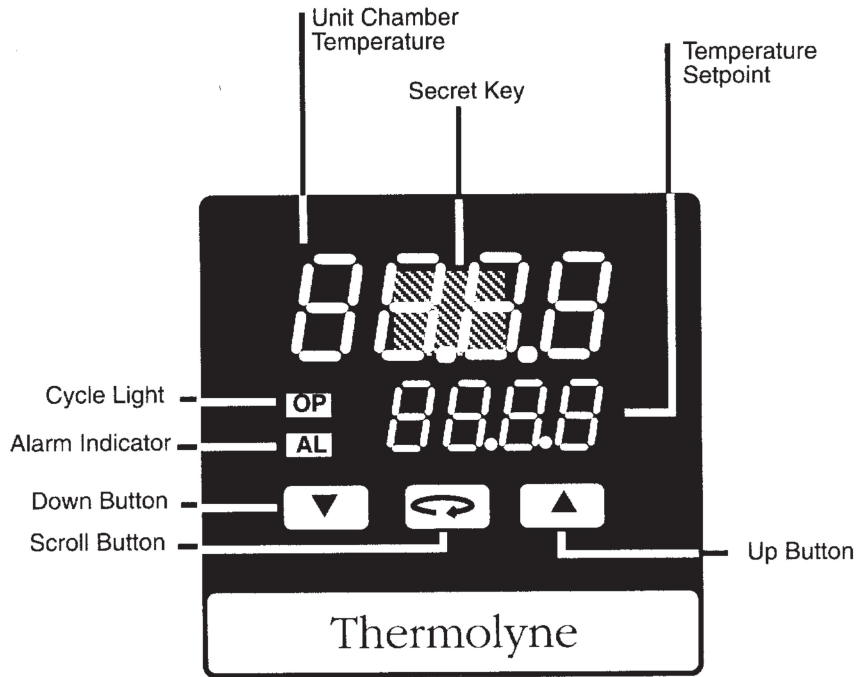


Figure 3
Single Set Point Controller

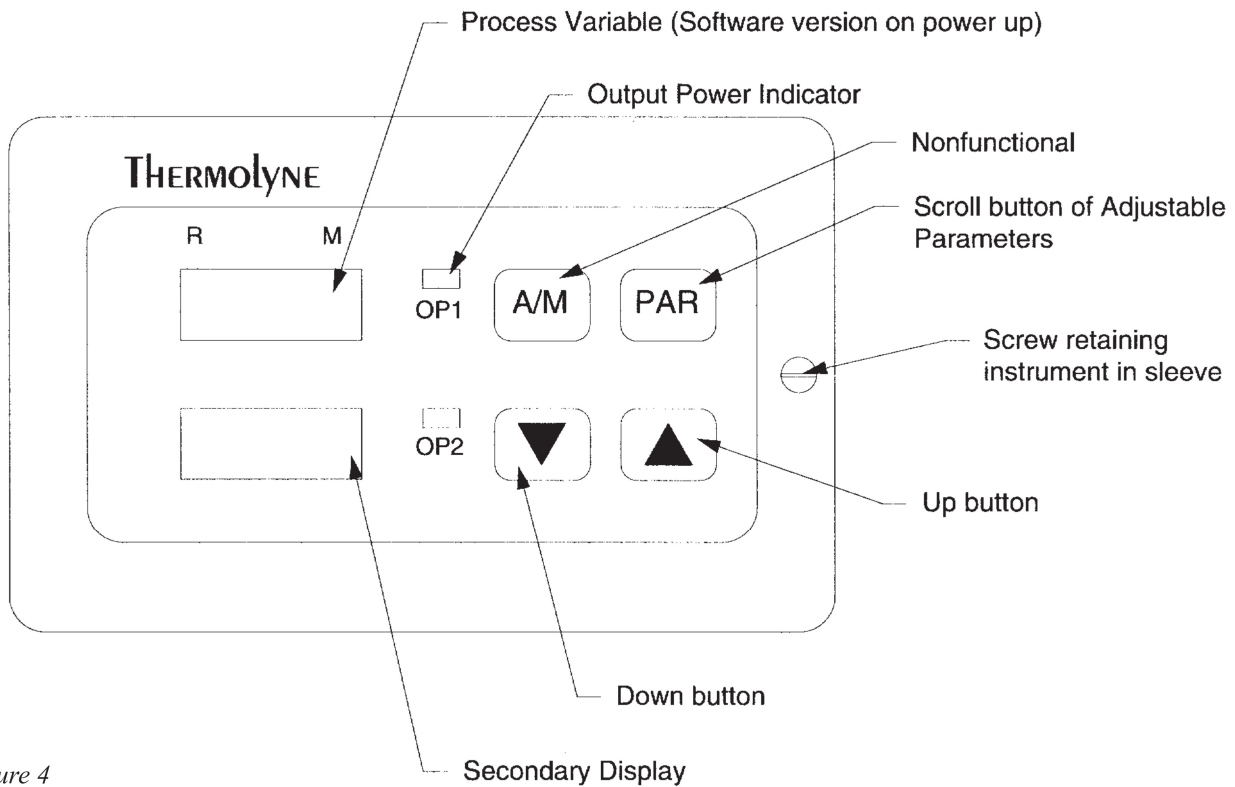


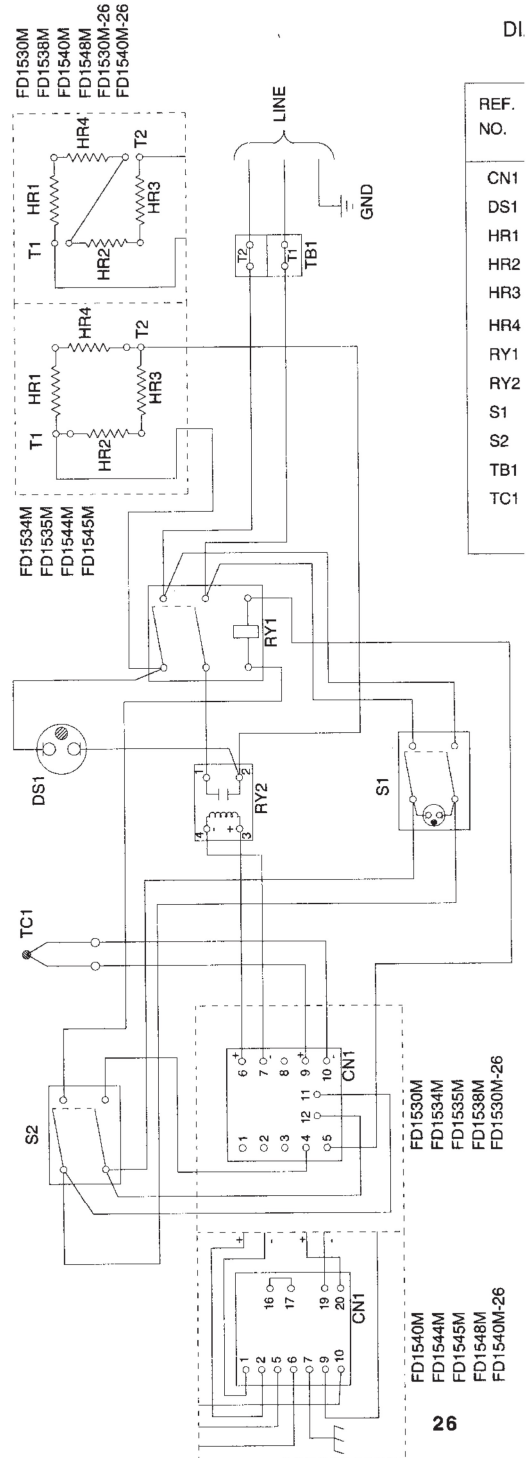
Figure 4
Programmable Control (2 ramp & 2 dwell)

Replacement Parts List

Part Number	Description	Model Number
EL11X11	Heating Element, Top or Bottom	FD1530M, FD1535M, FD1530M-26, FD1540M, FD1545M, FD1540-26
EL11X12	Heating Element, Sides	FD1530M, FD1535M, FD1530M-26, FD1540M, FD1545M, FD1540M-26
EL11X15	Heating Element, Top or Bottom	FD1538M, FD1534M, FD1548M, FD1544M
EL11X16	Heating Element, Sides	FD1538M, FD1534M, FD1548M, FD1544M
TC408X1A	Platinel II Thermocouple	All Models
RYX34	Solid State Relay	All Models
RYX56	Mechanical Relay (120V)	FD1534,FD1535M, FD1544M, FD1545M
RYX57	Mechanical Relay (240 volt)	FD1538M, FD1530M, FD1530M-26, FD1540M, FD1548M, FD1540M-26
SWX78	Door Switch	All Models
CN71X51	Temperature Control, Single Set Point	FD1530M, FD1535M, FD1538M, FD1534M, FD1530M-26
CN71X52	Temperature Control, Programmable (2 ramp & 2 dwell)	FD1540M, FD1545M, FD1540M-26, FD1548M, FD1544M
CR327X1	Cord Set	FD1530M-26, FD1540M-26
SRX16	Strain Relief	FD1530M-26, FD1540M-26
SWX137	Power Switch (100-120 volt)	FD1534M, FD1535M, FD1544M, FD1545M
SWX138	Power Switch (208-240 volt)	FD1538M, FD1530M, FD1530M-26, FD1540M, FD1548M, FD1540M-26
PLX76	Cycle Light (100-120 volt)	FD1534M, FD1535M, FD1544M, FD1545M
PLX82	Cycle Light (208-240 volt)	FD1538M, FD1530M, FD1530M-26, FD1540M, FD1548M, FD1540M-26
DR327X3A	Door Only (Insulated)	All Models
PHX2	Hearth Plate	All Models
DR327X4A	Door Assembly (includes handle and hinge.)	All Models
PT327X4A	Terminal Plate w/ Insulators	All Models

Wiring Diagram

Ref. No.	Description
CN1	Controller
DS1	Cycle Light
HR1	Heating Element
HR2	Heating Element
HR3	Heating Element
HR4	Heating Element
RY1	Relay, Mechanical
RY2	Relay, Solid State
S1	Switch, Power
S2	Switch, Door
TB1	Terminal Block
TC1	Thermocouple



Ordering Procedures

Please refer to the Specification Plate for the complete model number, serial number, and series number when requesting service, replacement parts or in any correspondence concerning this unit.

All parts listed herein may be ordered from the **Barnstead Thermolyne** dealer from whom you purchased this unit or can be obtained promptly from the factory. When service or replacement parts are needed we ask that you check first with your dealer. If the dealer cannot handle your request, then contact our Customer Service Department at 319-556-2241 or 800-553-0039.

Prior to returning any materials to **Barnstead Thermolyne Corp.**, please contact our Customer Service Department for a "Return Goods Authorization" number (RGA). Material Returned without an RGA number will be returned.







Warning

Please note the following WARNINGS:

WARNING

This warning is presented for compliance with California Proposition 65 and other regulatory agencies and only applies to the insulation in this product. This product contains refractory ceramic, refractory ceramic fiber or fiberglass insulation, which can produce respirable dust or fibers during disassembly. Dust or fibers can cause irritation and can aggravate pre-existing respiratory diseases. Refractory ceramic and refractory ceramic fibers (after reaching 1000°C) contain crystalline silica, which can cause lung damage (silicosis). The International Agency for Research on Cancer (IARC) has classified refractory ceramic fiber and fiberglass as possibly carcinogenic (Group 2B), and crystalline silica as carcinogenic to humans (Group 1).

The insulating materials can be located in the door, the hearth collar, in the chamber of the product or under the hot plate top. Tests performed by the manufacturer indicate that there is no risk of exposure to dust or respirable fibers resulting from operation of this product under normal conditions. However, there may be a risk of exposure to respirable dust or fibers when repairing or maintaining the insulating materials, or when otherwise disturbing them in a manner which causes release of dust or fibers. By using proper handling procedures and protective equipment you can work safely with these insulating materials and minimize any exposure. Refer to the appropriate Material Safety Data Sheets (MSDS) for information regarding proper handling and recommended protective equipment. For additional MSDS copies, or additional information concerning the handling of refractory ceramic products, please contact the Customer Service Department at Barnstead|Thermolyne Corporation at 1-800-553-0039.

One Year Limited Warranty

Barnstead|Thermolyne Corporation warrants that if a product manufactured by **Barnstead|Thermolyne** and sold by it within the continental United States or Canada proves to be defective in material or construction, it will provide you, without charge, for a period of ninety (90) days, the labor, and a period of one (1) year, the parts, necessary to remedy any such defect. Outside the continental United States and Canada, the warranty provides, for one (1) year, the parts necessary to remedy any such defect. The warranty period shall commence either six (6) months following the date the product is sold by **Barnstead|Thermolyne** or on the date it is purchased by the original retail consumer, whichever date occurs first.

All warranty inspections and repairs must be performed by and parts obtained from an authorized **Barnstead|Thermolyne** dealer or **Barnstead|Thermolyne**. Heating elements, however, because of their susceptibility to overheating and contamination, must be returned to our factory, and if, upon inspection, it is concluded that failure is not due to excessive high temperature or contamination, warranty replacement will be provided by **Barnstead|Thermolyne**. The name of the authorized **Barnstead|Thermolyne** dealer nearest you may be obtained by calling 1-800-446-6060 or writing to:

Barnstead|Thermolyne
P.O. Box 797
2555 Kerper Boulevard
Dubuque, IA 52004-0797
USA
FAX: (319) 556-0695

Barnstead|Thermolyne's sole obligation with respect to its product shall be to repair or (at its own discretion) replace the product. Under no circumstances shall it be liable for incidental or consequential damage.

THE WARRANTY STATED HEREIN IS THE SOLE WARRANTY APPLICABLE TO **Barnstead|Thermolyne** PRODUCTS. **Barnstead|Thermolyne** EXPRESSLY DISCLAIMS ANY AND ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR USE.

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