



Thermo Scientific Thermolyne Furnace Premium Large Muffle/ Atmosphere Controlled Ashing Model Type: F6000

Installation and Operation Manual

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Release history:

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Type F6000 Furnace

OPERATION MANUAL AND PARTS LIST Series 1249

Single Setpoint Models	F6010, F6010CN, F6018
Single Setpoint Models with OTP	F6020C, F6020C-33, F6020C-33-60, F6020C-60, F6028C, F6028C-60
8 Segment Programmable Models with OTP	F6020C-33-60-80, F6020C-33-80, F6020C-60-80, F6020C-80, F6028C-60-80, F6028C-80
4 X 16 Segment Programmable Models with OTP & RS232 Communication	F6030CM, F6030CM-33, F6030CM-33-60, F6030CM-60, F6038CM, F6038CM-60
(-60 Models) - Ashing furnace	

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Safety Information

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- “Warnings” on page 6
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Alert Signals



Warnings alert you to a possibility of personal injury.



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



Notes alert you to pertinent facts and conditions.



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.

Important Information

Your Thermo Scientific Thermolyne Type F6000 Model Furnace has been designed with function, reliability and safety in mind. It is your responsibility to install it in conformance with local electrical codes. For safe operation, please pay attention to the alert signals throughout the manual.

This manual contains important operating and safety information.

You must carefully read and understand the contents of this manual prior to the use of this furnace. If the equipment is used in a manner not specified by the manufacturer, protection provided by the equipment may be impaired.

Warnings

To avoid electrical shock, this furnace must:

1. Use a properly grounded electrical outlet of correct voltage and current handling capacity.
2. Be disconnected from the power supply prior to maintenance and servicing.
3. Have the door switch operating properly.

To avoid burns, this furnace must:

Caution: Hot Surface - Avoid Contact. To avoid burns, do not touch the exterior or interior surfaces of this furnace during use or for a period of time after use.

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. Refer servicing to qualified personnel.

3. Always wear safety glasses or a safety shield and high temperature gloves when loading or unloading the furnace. Long sleeved, fire retardant clothing and a fire retardant apron is also recommended.

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 1-800-553-0039.

Introduction

Contents

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- “General Usage” on page 10
- “Principles of Operation” on page 10



Do not exceed operating temperatures shown in “[General Specification](#)” on [page 11](#).” Exceeding these limits will result in severely reduced element life.

Intended Use

The Type F6000 furnaces are general purpose laboratory and heat treating furnaces. For optimum element life, we recommend observing these temperature ranges: from 100°C (212°F) to 1093°C (2000°F) continuous use or from 1093°C (2000°F) to 1200°C (2192°F) for intermittent use. (-60) Ashing models continuous temperature range is 100°C (212°F) to 975°C (1787°F). Continuous use is operating the furnace for more than 3 hours and intermittent use is operating the furnace for less than 3 hours.

All furnaces consist of:

1. a vented heating chamber;
2. a temperature controller; and
3. a door safety switch for operator safety.

General Usage

Do not use this product for anything other than its intended usage.

Principles of Operation

The furnace chamber is heated by electric resistance elements and is insulated with ceramic fiber insulation. The controller is located under the furnace chamber and is well insulated from the heat generated in the furnace chamber. A door safety switch removes power to the heating elements whenever the furnace door is opened. The temperature is controlled by one of three types of controllers. The (-60) models operate the same as the other models except at a lower temperature and can inject gas into the chamber.

General Specification

For F6000 Furnace

Model #						
			F6020C	F6028C	F6010	F6018
			F6020C-33	F6028C-60	F6010CN	
			F6020C-33-60	F6028C-60-80		
			F6020C-33-60-80	F6038CM		
			F6020C-33-80	F6038CM-60		
			F6020C-60			
			F6020C-60-80			
			F6020C-80			
			F6030CM			
			F6030CM-33-60			
			F6030CM-60			
Dimensions in (cm)	Overall	Width	19.25(48.9)	19.25(48.9)	19.25(48.9)	19.25(48.9)
		Height	21 (53.3)	21 (53.3)	21 (53.3)	21 (53.3)
		Depth	20 (50.8)	20 (50.8)	20 (50.8)	20 (50.8)
	Chamber	Width	12.75 (32.4)	12.75 (32.4)	12.75 (32.4)	12.75 (32.4)
		Height	6.75 (17.1)	6.75 (17.1)	6.75 (17.1)	6.75 (17.1)
		Depth	10 (25.4)	10 (25.4)	10 (25.4)	10 (25.4)
	Weight	LBS. (9kg)		96 (43.5)	96 (43.5)	96 (43.5)
Electrical	Volts		220-240	208	220-240	208
Ratings	Amps		18.3	19.2	12.9	11.2
	Watts		4400	4000	3095	2325
	Freq.		50/60	50/60	50/60	50/60
	Phase		1	1	1	1

Model #					
Oper. Temp.Range	°F (°C)	212-2192°F	212-2192°F	212-2192°F	212-2192°F
		(100-1200°C)	(100-1200°C)	(100-1200°C)	(100-1200°C)
		*212-1787°F (*100-975°C)	*212-1787°F (*100-975°C)		

NOTE

The maximum ramp rates for this furnace for heat up are: 12°C (22°F) per min. from 25°C-537°C (75°F-1000°F), 10°C (18°F) per min. from 537°C-1093°C (1000°F-2000°F).

*(-60) coal-ashing furnaces.

Environmental Conditions

Operating:	17°C to 27°C; 20% to 80% relative humidity, non-condensing. Installation Category II (overvoltage) in accordance with IEC 664. Pollution degree 2 in accordance with IEC 664.
Altitude Limit:	2,000 meters.
Storage:	-25°C to 65°C; 20% to 85% relative humidity.

Declaration of Conformity

Thermo Scientific hereby declares under its sole responsibility that this product conforms with the technical requirements of the following standards: EMC(-33 Models Only):

Safety	EN 61326-1	Electrical equipment for measurement, control, and laboratory use; Part 1: General Requirements
	EN 61010-1	Safety requirements for electrical equipment for measurement, control, and laboratory use; Part 1: General Requirements
	EN 61010-2-010	Part II: Particular Requirements for Laboratory Equipment for the Heating of Materials
EMC	EN 61000-3-2	Limits for Harmonic Current Emissions
	EN 61000-3-3	Limits for Voltage Fluctuations and Flicker

per the provisions of the Electromagnetic Compatibility Directive 2014/30/EU and per the provisions of the Low Voltage Directive 2014/35/EU.

The authorized representative located within the European Community is:

Thermo Electron LED GmbH
Robert-Bosch-Str. 1
63505 Langenselbold
Germany

Copies of the Declaration of Conformity are available upon request.

4 Declaration of Conformity

Unpacking

NOTE

(-60) models are supplied with two stainless steel trays, handle and porcelain pegs.

NOTE

The Type 6000 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. (F6010 and F6018 are supplied with cord and plug).

1. Visually check for any physical damage to the shipping container.
2. Inspect the equipment surfaces that are adjacent to any damaged area.
3. Open the furnace door and remove the packing material from inside the furnace chamber.
4. Vacuum the chamber prior to use to remove the insulation dust due to shipment.
5. Retain the original packaging material if reshipment is foreseen or required.

Installation

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- “Site Selection” on page 18
- “Electrical Connections” on page 18
- “Electrical Conditions in the EU” on page 19



Be sure ambient temperature does not exceed 40°C (104°F). Ambient above this level may result in damage to the controller.



Allow at least six inches of space between the furnace, at least 40 inches above 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.



To avoid electrical shock, this furnace must be installed by a competent, qualified electrician who ensures compatibility among furnace specifications, power source and grounding code requirements. (Disregard Step 2 if you have Model F6010 or F6018).



For supply connections, use 10 AWG or larger wires suitable for at least 90°C. Failure to observe this caution could result in damage to furnace.



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.



Caution: Hot Surface. Avoid Contact.
To avoid burns, this furnace must not be touched on the exterior or interior surfaces during use or for a period of time after use.

Site Selection

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

Electrical Connections

1. The electrical ratings are located on the specification plate on the back of the furnace. Consult customer service if your electrical service is different than those listed on the specification plate. Be sure the front power switch is in the OFF position before connecting the furnace to your electrical supply. Your 6000 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.



Please observe the alert signals on the lefthand side of this page before operating your furnace.

Models F6010, F6010-33, F6018

Electrical Conditions in the EU

Electrical Conditions for operating the furnaces in the EU:

The furnaces are intended for use at a network supply with a maximum system impedance of $Z_{\max} = 0.0325 \text{ Ohm}$ at the point of connection, according to EN 61000-3-11 clause 6.2.2. The user has to ensure that the device is operated on a network supply that meets these requirements. If necessary, the system impedance can be confirmed by the energy supplier.

6 Installation

Electrical Conditions in the EU

Operation, All Models

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- “Power Switch” on page 22
- “Cycle Light shown on the display” on page 22
- “Door Safety Switch” on page 22



To avoid personal injury 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.



Caution: Avoid Contact. To avoid burns, this furnace must not be touched on the exterior or interior surfaces during use or for a period of time after use.



Always wear safety glasses or a safety shield and high temperature gloves when loading or unloading the furnace. Long sleeved, fire retardant clothing and a fire retardant apron is also recommended.



To avoid electrical shock, the door safety switch must be operating properly.

Power Switch

Both the ON/OFF power switch and the digital display will illuminate when power is switched ON. The furnace will begin to heat to its controller's current setpoint. (See the instructions for your type of controller for information on checking and setting the setpoint.)

Cycle Light shown on the display

The cycle light will illuminate whenever the power is being applied to the heating elements. The cycle light will turn on and off as the furnace reaches the setpoint.

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 an acoustic click of the switch during opening and closing of the door. If this condition is not true, consult the Troubleshooting section before proceeding. This check must be done when the furnace is heating and the cycle light on the display is illuminated.

Single Setpoint Models and Single Setpoint Models w/OTP

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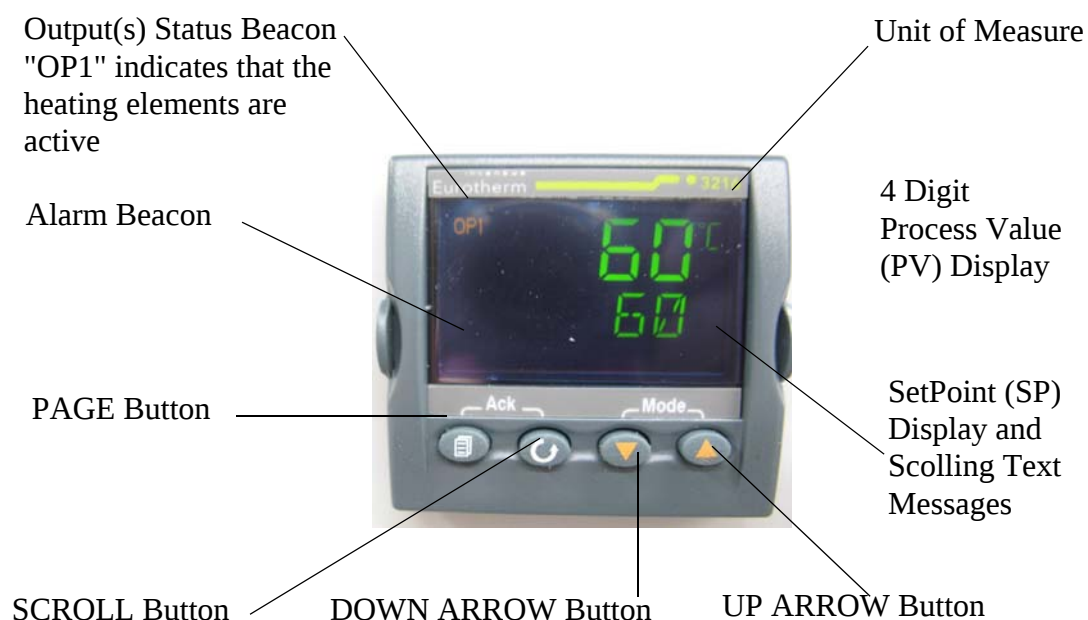
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- “Over – Temperature Protection (OTP)” on page 26
- “Tuning” on page 27

The single setpoint model w/OTP furnace controller is a single setpoint controller, which provides a single digital display to indicate the current chamber temperature or setpoint temperature.

This temperature controller features sensor break protection, self-tuning capability and over temperature protection (OTP) with an additional OTP relay device.

Basic Operation

When the controller is turned ON it will perform a short self-test and then display a default page. The measured value (process value) is found in the upper display and the setpoint is found in the lower display.



NOTE

If at any time you want to return to the HOME DISPLAY, press PAGE button.

Buttons and Indicators

OP1 (Output 1): Illuminates when the output is ON (normally heating). The cycle light on the display will turn on and off as the furnace reaches the setpoint.

OP2 (Output 2): Illuminates when the output is ON (normally cooling).

OP4 (Output 4): Illuminates when the AA relay output is ON (will go on during an alarm situation).

PAGE button: Allows you to select a new list of parameters.

SCROLL button: Allows you to select a parameter within a list of parameters.

DOWN button: Allows you to decrease a value.

UP button: Allows you to increase a value.

To View or change the Setpoint

If you want to change the setpoint, press the **SCROLL** button until “**SP1**” is displayed. Press the UP or DOWN button until the desired setpoint value is displayed and then release the button. A few seconds after the button is released, the controller will accept the new value and is indicated by a brief flash of the display. Press **PAGE** button to return to HOME DISPLAY.

To View the Display Units

Press **SCROLL** until “**UNITS**” is displayed. The temperature units are also shown on the HOME DISPLAY to the right of the measured value (process value).

Temperature Units can be changed by pressing up and down buttons. Choice of Celsius (°C), Fahrenheit (°F), Kelvin (°K), Percentage (%), or None (nonE).

Controller Parameters

Home Display

°C ,°F, °K, %, or None: Temperature units in Celsius (default), Fahrenheit, Kelvin, Percentage (PErc), or None (nonE).

A1.DHI: Deviation high alarm.

A2.HI: High Limit alarm. Read Only.

A3.LO: Low Limit alarm. Read Only.

A.TUNE (tune): One-shot autotune enable.

WRK.OP: Working Output power. Read Only.

PV.OFS: Process Value Offset. Read Only.

SP.RAT: Ramp Rate Setpoint (default units is minutes).

RAMP.U: Ramp Unit of measure (seconds, minutes and hours).

DWELL: Time for dwell or delay (default units is minutes).

T.STAT: Timer Status. Active only when timer is active.

TM.CFG: Timer configuration.
TM.RES: Timer Resolution (minutes and hours).
THRES: Timer start threshold (default is OFF).
END.T: Timer End Type (default is DWELL).

Pid List

Pb: Proportional band (in display units).
ti: Integral time in seconds.
td: Derivative time in seconds.
ACCESS List Code: Access code (Code needed to enter or change the other configuration parameters which are not normally accessible). Not accessible.

Alarms

The controller will flash an alarm message in the home display if an alarm condition is detected.

A2.HI: Measured value full scale high alarm.

A1.DHI: Measured value deviation high alarm.

S.br: Sensor break: check that sensor is connected correctly.

LBR: Loop break: check that the heating circuits are working properly.

Ld.F: Heater Circuit fault: indication of either an open or short solid state relay, a blown fuse, missing supply or open circuit heater.

NOTE

The following alarm messages are factory default settings and may vary if you have changed the configuration of your controller:

2FSH = 1225°C (All models except -60)

2FSH = 1000°C (-60 models)

Sensor Break Protection

This controller provides sensor break protection in the event the thermocouple opens. If an open thermocouple condition occurs, the digital display will blink “S.br” and the power to the heating element will be shut OFF (Cycle light on the display will extinguish).

Over – Temperature Protection (OTP)

The OTP will be in effect during any alarm condition when the temperature of the furnace has deviated beyond the limit. The “Deviation High” alarm is the only alarm value, which can be changed. To change it, press the SCROLL button until “1dHi” appears on the display. Press the UP or DOWN button to select the OTP value you desire. We recommend a value of 20° above your working temperature to provide protection for your workload.

In addition to over-temperature protection, units containing a single setpoint controller w/OTP feature a mechanical OTP relay device, which disconnects power from the elements in an alarm condition. (only in furnaces with OTP relay). See models listed on front page.

Tuning

This controller incorporates a self-tuning feature, which determines the optimum control parameters for the best temperature accuracy with your load and setpoint. Use this feature the first time you use your furnace and each time you change either your setpoint or the type of load you are heating. Thermo Fisher Scientific recommends you use this feature to provide the best temperature accuracy the controller can attain. To use the tuning feature:

1. Start tuning with the process at ambient temperature. This allows the tuner to calculate the low cutback and high cutback values more accurately.
2. Adjust the setpoint to your desired value.
3. Press the SCROLL button until display reads, "A.TUNE."
4. Press the UP or DOWN button to select, "on."
5. Press the PAGE button to return to the HOME DISPLAY. The display will alternately flash between "tunE" and the HOME DISPLAY while tuning is in progress.
6. The controller will then turn the heating on and off to induce an oscillation. When the measured value reaches the required setpoint the first cycle will end.
7. Tuning will be complete after two oscillation cycles and then the tuner will turn itself off.
8. Normal control function will resume after the controller calculates tuning parameters.

NOTE

Furnace must be at ambient temperature before starting a tune. ~~"Stat" and "Sp.r" must be set to OFF or "tunE" will not initiate.~~

NOTE

Tune has completed when "tunE" stops flashing on display.

Single Ramp & Dwell

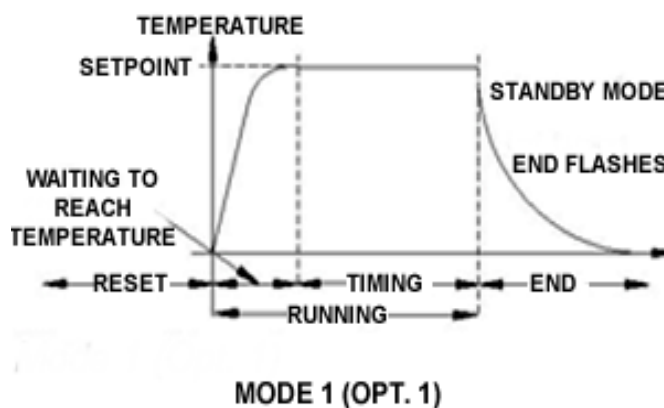
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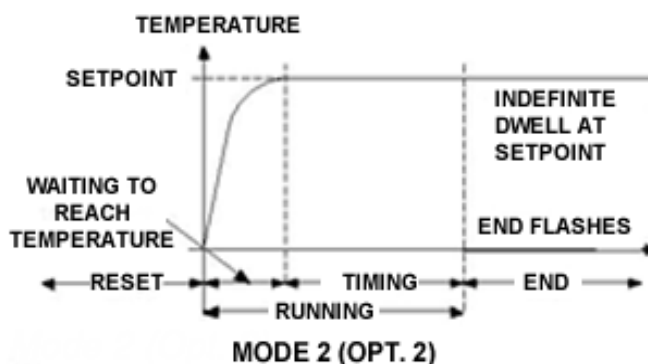
Functions

This type of controller has two step ramp and dwell programming capabilities. The Ramp and Dwell can be configured to three different modes.

1. **Mode 1 (DWELL)** The dwell time begins once the setpoint reaches the set threshold. The END TYPE action is executed when the dwell timer reaches the end.



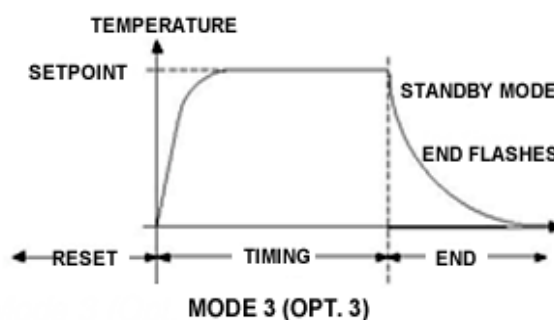
2. **Mode 2 (DELY)** The timer starts immediately upon instrument power-up or, when run is selected. The instrument remains in standby until the time has elapsed. After the time has elapsed, the instrument controls up to setpoint.



NOTE

These instructions are used with the Single Setpoint models with OTP only (See models listed on front page).

3. **Mode 3 (SE.ST)** Starts automatically on power up. This is a soft-start function. If the PV is below the Soft Start Threshold, then the power is limited to the Soft Start Limit until the threshold is met.



NOTE

Value of "None" deactivates the timer.

Program Overview

- A program mode can be set by changing the "TM.CFG" variable (in the 'Timer' menu) to "DWEL, DELY, or SE.ST.

NOTE

The program must be stopped and the controller must be displaying the actual temperature before beginning the Setup.

- A Ramp rate may be set by changing the "SP.RAT" variable (in the 'SP' menu) to a value. The Ramp rate units are set with the "RAMPU" variable (in the 'SP' menu). The selections are Hour / Min / Sec.
- The Dwell time can be set by changing the "DWELL" variable (in the 'Timer' menu) to the desired value. Dwell time units are set with the "TM.RES" variable (in the 'Timer' menu). The selections are Hour / Min.
- The program Status can be set by changing the "T.STAT" variable to "run", "hold", or "res." This variable will start, hold, or stop the program."
- The Timer End Type can be set by changing the "END.T" to one of the four options:
 - ▶ **OFF** - When the timer completes its dwell, the instrument will be put into Standby mode. The output power will be set to 0%, and the standard home display will display PV and OFF instead of setpoint.
 - ▶ **DWELL** - When the timer completes, the controller will continue to control at setpoint.
 - ▶ **SP2** - When the timer completes the target setpoint will switch to setpoint 2. The setpoint 2 may be a lower or a higher temperature.
 - ▶ **Reset (rES)** - The timer or program will reset on completion, reverting to the setpoint used at the point it was started.

NOTE

The above four options is to set what is expected of the unit to do once the program is complete.

For example, if it is desired for the controller to stop doing anything at all once the timer is finished, set End.T to OFF. If it is desired to revert back to the ambient temp setpoint at which the program started, set END.T to rES.

SetPoint Rate Limit Setup

1. Press the **SCROLL** button until the “**SP.RAT**” (Ramp Rate) is displayed.
2. Set the desired Ramp rate with the UP or DOWN buttons, if the ramp to setpoint feature is needed. **If the Ramp rate is not needed, then set to “OFF”** with the UP or DOWN buttons.
3. Press the **SCROLL** button until “**TM.CFG**” (Ramp & Dwell mode) will be displayed, select the desired mode with the UP or DOWN buttons. (DWEL, DELY, or SEST).
4. Press the **SCROLL** button until “**DWELL**” will be displayed set the desired Dwell time with the UP or DOWN buttons.
5. Press the **PAGE** button and **SCROLL** button together until the Actual temperature is displayed.

Running the Program

1. Press the **SCROLL** button until “**T.STAT**” is displayed, set to “**run**” with the UP or DOWN buttons; or from the HOME DISPLAY, press **UP** and **DOWN** arrows together.
2. Press the **PAGE** button to display Actual temperature.

Holding the Program

1. Press the **SCROLL** button until “**T.STAT**” is displayed, set to “hold” with the UP or DOWN buttons; or from the HOME DISPLAY, press **UP and DOWN** arrows together.
2. Press the **PAGE** button to display Actual temperature.

Stopping the Program

Press the **SCROLL** button until “**T.STAT**” is displayed, set to “**res**” with the UP or DOWN buttons.

Clearing the Flashing End

Press the PAGE and SCROLL buttons at the same time.

It can also be cleared by pressing and holding the UP and DOWN arrows simultaneously until A-M (Auto/Manual) is displayed. Then select “Auto” and unit will clear program and revert to normal operation.

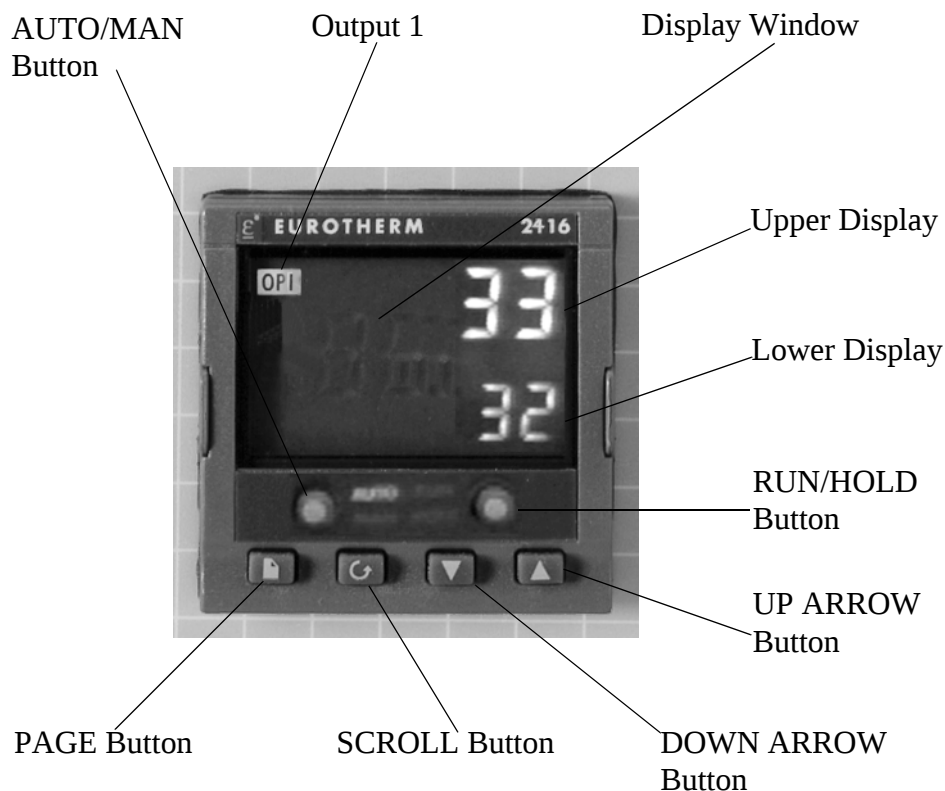
Verifying a Running Program

Press the SCROLL button until “T.SAT” is displayed. The display will show “run” if the program is running, “hold” if it is paused or “res” if it is not running. Press the PAGE button to display Actual temperature.

8 Segment & 4x16 Segment Programmable Models w/OTP

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4x16 & 8 Segment Programmable Models with OTP

The **8 segment programmable** controller consists of a microprocessor based three-mode PID (Proportional, Integral, and Derivative), programmable temperature controller with over-temperature protection and appropriate output switching devices to control the furnace. The digital readout continuously displays chamber (upper display) and setpoint (lower display) temperatures unless the SCROLL or PAGE button is depressed. The programmable controller can be used as a single setpoint controller or as a programmable controller. The 8 segment digital model enables eight segments of programming.

The **4x16 segment programmable** controller consists of a microprocessor based three-mode PID (Proportional, Integral, and Derivative), programmable temperature controller with over-temperature protection and appropriate output switching devices to control the furnace. The digital readout continuously displays chamber (upper display) and setpoint (lower display) temperatures unless the SCROLL or PAGE button is depressed. The programmable controller can be used as a single setpoint controller or as a programmable controller. The 4 program controller has four 16 segment programs.

NOTE

The controller will return to the HOME DISPLAY if left idle for more than a few seconds.

NOTE

Once the desired parameter has been selected, depressing either the UP or DOWN button will change the parameter value. In all cases, the value shown on the display is the current working value of that parameter.

Basic Operation

When the controller is turned ON, it will perform a short self-test and then change to the HOME DISPLAY. The HOME DISPLAY shows the measured temperature (process value) in the upper display and the desired value (setpoint) in the lower display.

To Change the Setpoint

If you want to change the setpoint, press the UP or DOWN button until the desired setpoint value is displayed in the lower display and then release the button.

To View Display Units

From the HOME DISPLAY press the SCROLL button. The display will briefly show the temperature units in °C/F/K and then return to the HOME DISPLAY. (If you require a different temperature unit call Customer Service.)

To View the % Output Power

From the HOME DISPLAY press the SCROLL button twice. This value is a read-only value and cannot be changed.

Buttons and Indicators

OP1 (Output 1): illuminates when the heating output of the temperature controller is on.

AUTO/MAN: (Auto/Manual Mode): when the controller is in the automatic mode the output automatically adjusts to keep the temperature or process value at the setpoint. The “AUTO” light will illuminate. The manual mode has been disabled through factory configuration. Call Customer Service for further information.

RUN/HOLD (Run/Hold button):

- Starts a program when pressed once—RUN light illuminates.
- Holds a program when pressed again— HOLD light illuminates.
- Cancels hold and continue running when pressed again—HOLD light is off and RUN light illuminates.
- Exits a program when the button is held down for two seconds—RUN and HOLD lights are off.
- At the end of a program the RUN light will flash.
- During holdback the HOLD light will flash.

PAGE button: allows you to choose a parameter from a list of parameters.

SCROLL button: allows you to choose a parameter within a list of parameters.

UP button: allows you to increase the value in the lower display.

DOWN button: allows you to decrease the value in the lower display.

Controller Parameters

Home Display

°C: measured temperature in Celsius.

Temperature units cannot be changed without entering the configuration. Contact Customer Service if a different temperature unit is required.

OP: % output power demand; displayed in lower display (cannot be changed).

C.id: Controller identification number.

PrG: Program number (displayed when a program is running; 4x16 programmable models only).

IdHi: Deviation High Alarm.

tunE: One-shot autotune enable.

run LiSt (Program Run List)

PrG: Currently running program (only used on 4x16 programmable models).

StAt: Displays the program status [OFF, run (running active program), hoLd (program on hold), HbAc (waiting for process to catch up), End (program completed)] in the lower display. The controller will default to “OFF.”

FASt: Fast run through program (no/YES). The controller will default to “no.”

SEG.d: Flash active segment type in the lower display of the home display (no/YES). The controller will default to “no.”

ProG LiSt (Program Edit List)

PrG.n: Press the UP or DOWN ARROW to select the program number (program number will be displayed in lower display on 4x16 programmable models only).

Hb: Press the UP or DOWN ARROW to select the holdback type [OFF (disables holdback), Lo (deviation low holdback), Hi (deviation high holdback) or bAnd (deviation band holdback)] for the entire program. The controller will default to “OFF.”

Hb.U: Press the UP or DOWN ARROW to select the holdback value (in display units).

rmP.U: Press the UP or DOWN ARROW to toggle between ramp units (Sec, min or Hour). Controller will default to “Sec.”

dwL.U: Press the UP or DOWN ARROW to toggle between dwell units (SEc, min or Hour). Controller will default to “SEc.”

Cyc.n: Press the UP or DOWN ARROW to set the number of program cycles (1 to 999 or cont). The controller will default to “cont.”

SEG.n: Press the UP or DOWN ARROW to select the segment number (1-8 in 8 segment models, 1-16 in 4x16 models).

tYPE: Press the UP or DOWN ARROW to select the segment type [End (end of program), rmP.r = ramp rate (ramp to a specified setpoint at a set rate), rmp.t = ramp time (ramp to a specified temperature in a set time), dwELL (to maintain a constant temperature for a set time), StEP (climb instantaneously from current to specified temperature), cALL (to call a program as a subroutine, available only on 4x16 programmable models)]. The controller will default to “End.” Other parameters used with tYPE include; tGt target setpoint), Rate (rate of temperature increase) and dur (time to target setpoint or time to dwell).

End.t: End segment type: dwELL (dwell continuous), rSEt (reset) and S OP (End Segment Output power level).

AL LiSt (Alarm List)

IdHi: Deviation High Alarm.

Atun LiSt: (Autotune List)

tunE: One-shot autotune enable.

drA: Adaptive tune enable.

drA.t: Adaptive tune trigger level in display units. Range = 1 9999.

Pid LiSt

G.SP (Gain Setpoint): Is the temperature at which the controller switches from the (SEt1) PID values to the (SEt 2) PID values.

Pb: Proportional band in display units (SEt 1).

ti: Integral time in seconds (SEt 1).

td: Derivative time in seconds (SEt 1).

Pb2: Proportional band (SEt 2).

ti2: Integral time in seconds (SEt 2).

td2: Derivative time in seconds (SEt 2).

ACCS LiSt (Access List)

Access Code (Code needed to enter or change the other configuration parameters which are not normally accessible.) Not accessible.

Alarms

The controller will flash an alarm message in the home display if an alarm condition is detected.

IdHi: PV deviation high alarm.

2FSH: PV full scale high alarm.

LCr: load current low alarm.

HCr: load current high alarm.

S.br: Sensor break: check that sensor is connected correctly.

L.br: Loop Break: Check that the heating circuits are working properly.

Ld.F: Heater Circuit Fault: indication of either an open or short solid state relay, a blown fuse, missing supply or open circuit heater.

SSr.F: Solid state relay failure indications in a solid state relay: indicates either an open or short circuit in the SSR.

Htr.F: Heater failure: Indication that there is a fault in the heating circuit: indicates either a blown fuse, missing supply or open circuit heater.

NOTE

The following alarm messages are factory default settings and may vary if you have changed the configuration of your controller:

IDHi: = 50°C

2FSH = 1225°C (All models except -60)

2FSH = 1000°C (-60 models)

Sensor Break Protection

This controller provides sensor break protection in the event the thermocouple opens. If an open thermocouple condition occurs, the digital display will Blink “S.br” and the power to the heating element will be shut OFF (Cycle light on the display will extinguish).

Over-Temperature Protection (OTP)

The OTP will be in effect during any alarm condition when the temperature of the furnace has deviated beyond the limit. The “Deviation High” alarm is the only alarm value which can be changed. To change it, press the SCROLL button until “idHi” appears on the display. Press the UP or DOWN button to select the OTP value you desire. We recommend a value of 20° above your working temperature to provide protection for your workload.

To Operate the Controller as a Single Setpoint Controller

1. Switch the circuit breaker to the “ON” position. The setpoint temperature presently set in the controller will appear in the lower display. (The upper display indicates the actual chamber temperature.)
2. To change the setpoint, press the UP or DOWN button until the desired setpoint value is displayed; then release the button.
3. The furnace will begin to heat if the new setpoint temperature is higher than the present chamber temperature.

Programming the Controller

The controller is capable of varying temperature or process value with time through programming. A program is stored as a series of segments and can be run once, repeated a set number of times or run continuously. To create a customized program using the controller parameters listed under “Controller Parameters” at the beginning of this section, follow the procedures outlined in the proceeding sections of this manual.

Creating a New Program or Editing an Existing Program (4x16 Segment Programmable Models Only)

The same steps are used when creating a new program and editing an existing program with the exception being that a new program starts with all its segments set to End in the tYPE parameter. Temporary changes can be made to these parameters when the program is in the hold state but permanent changes must be made in the reset state. Follow the steps below to create or edit a program.

1. Press the PAGE button until you reach the program list (ProG LiSt).
2. Press the SCROLL button until display reads, “PrG.n.”
3. Press the UP or DOWN button to select a number for a new program or to edit an existing program.

Hb: Holdback

Holdback consists of a value and a type. If the measured value lags behind the setpoint by an undesirable amount during a ramp or dwell, the holdback feature can be used to freeze the program at its current state (the HOLD light will flash). The program will resume when the error comes within the holdback value.

OFF: holdback is disabled.

Lo (Deviation Low Holdback): holds the program back when process variable deviates below the setpoint by more than the holdback value.

Hi (Deviation High Holdback): holds the program back when process variable deviates above the setpoint by more than the holdback value.

bAnd (Deviation Band Holdback): combines the features of the high and low deviation holdback in that it holds the program back when the process variable deviates above or below the setpoint by more than the holdback value.

To set the holdback type:

1. Press the PAGE button until you reach the program list (ProG LiSt).
2. Press the SCROLL button until display reads, “Hb.”

Press the UP or DOWN button to toggle between “bAnd, Hi, Lo and OFF. **Hb U: Holdback Value**

To set the holdback value:

1. Press the PAGE button until you reach the program list (ProG LiSt).

2. Press the SCROLL button until display reads, “Hb.U.”
3. Press the UP or DOWN button to enter a holdback value.

rmP.U: Setting Ramp Units

Ramp units are time units which are used in “rmP.r” segments (ramp to a setpoint at degrees per second, minute or hour) and “rmP.t” segments (ramp to setpoint in a specific amount of time). See “Setting the Segment Type” for an explanation on how to set a ramp segment.

1. Press the PAGE button until you reach the program list (ProG LiSt).
2. Press the SCROLL button until display reads, “rmP.U.”
3. Press the UP or DOWN button to toggle between seconds, minutes and hours.

dwL.U: Setting Dwell Units

Dwell units are time units which are used in “dwELL” segments (amount of time to remain at a specific temperature). See “Setting the Segment Type” for an explanation on how to set a dwell segment.

1. Press the PAGE button until you reach the program list (ProG LiSt).
2. Press the SCROLL button until display reads, “dwL.U.”
3. Press the UP or DOWN button to toggle between seconds, minutes and hours.

CYC.n: Setting the Number of Cycles

Set the number of times a group of segments or programs are to be repeated by following the steps listed below.

1. Press the PAGE button until you reach the program list (ProG LiSt).
2. Press the SCROLL button until display reads, “CYC.n.”
3. Press the UP or DOWN button to select the number of cycles you want to run or, press the DOWN button to select “cont.” so the program will run continuously.

Setting the Segment Type

NOTE

The program ramp rate is designed to reduce the heatup rate or cooling rate that the furnace normally exhibits. When not using this feature, the furnace will operate at its maximum heating and cooling capability.

NOTE

When the program ramp has ended or has been reset, the furnace will continue to maintain setpoint temperature. It will not cool to ambient temperature unless the setpoint is set to ambient temperature by the program or by the operator.

There are five segment types. Proceed with the following steps according to the type of segment you have selected.

rmP.r (Ramp)

To ramp linearly at a set rate to a specified temperature:

1. Press the PAGE button until you reach the program list (ProG LiSt).
2. Press the SCROLL button until display reads, "tYPE."
3. Press the UP or DOWN button until display reads, "rmP.r."

Steps 4 and 5 are used in the 4 program model only. If you are using an 8 segment program, skip to step 6.

4. Press the SCROLL button until display reads "Hb."
5. Press the UP or DOWN button to toggle between "bAnd, Hi, Lo and OFF."
6. Press the SCROLL button until display reads, "tGt."
7. Press the UP or DOWN button to set a target setpoint.
8. Press the SCROLL button until display reads, "rAtE."
9. Press the UP or DOWN button to select a value in ramp units (seconds, minutes or hours; set in the "rmP.U" parameter).

rmP.t

To ramp to a specified temperature at a set time:

1. Press the PAGE button until you reach the program list (ProG LiSt).
2. Press the SCROLL button until display reads, "tYPE."
3. Press the UP or DOWN button until display reads, "rmP.t."
4. Press the SCROLL button until display reads, "tGt."
5. Press the UP or DOWN button to set a target setpoint.
6. Press the SCROLL button until display reads, "dur."
7. Press the UP or DOWN button to select a time in ramp units (seconds, minutes or hours; set in the "rmP.U" parameter).

dwEll

To maintain a constant temperature for a specified time:

1. Press the PAGE button until you reach the program list (ProG LiSt).
2. Press the SCROLL button until display reads, "tYPE."
3. Press the UP or DOWN button until display reads, "dwEll."
4. Press the SCROLL button until display reads, "dur."
5. Press the UP or DOWN button to select a time in dwell units (seconds, minutes or hours; set in the "dwL.U" parameter).

StEP

To climb instantaneously from the current temperature to a specified temperature.

1. Press the PAGE button until you reach the program list (ProG LiSt).
2. Press the SCROLL button until display reads, tYPE."
3. Press the UP or DOWN button until the display reads, "StEP."
4. Press the SCROLL button until display reads, "tGt."
5. Press the UP or DOWN button to set a target setpoint.

cALL (Running Multiple Programs; 4x16 Segment Programmable Models Only)

To call a program as a subroutine:

If you want to run multiple programs, you can program the controller to "call" or link one program to another. This makes it possible to run one program at any time during another program and also return to the original program if desired.

1. Press the PAGE button until you reach the program list (ProG LiSt).
2. Press the SCROLL button until display reads, "tYPE."
3. Press the UP or DOWN button until display reads, "cALL."
4. Press the SCROLL button until display reads, "PrG.n."
5. Press the UP or DOWN button to select a program number to be linked.
6. Press the SCROLL button until display reads, "CYC.n."
7. Press the UP or DOWN button to select the number of cycles the linked program is to be run.

End

To end or repeat a program:

1. Press the PAGE button until you reach the program list (ProG LiSt).
2. Press the SCROLL button until display reads, “tYPE.”
3. Press the UP or DOWN button until display reads, “End.”
4. Press the SCROLL button until display reads, “End.t.”
5. Press the UP or DOWN button to toggle between “dwell” (an indefinite dwell), “SOP” (End Segment Output Power) and “rSET” (reset).

Setting the Target Setpoint (4x16 Segment Programmable Models Only)

1. Press the PAGE button until you reach the program list (ProG LiSt).
2. Press the SCROLL button until display reads, “tGt.”
3. Press the UP or DOWN button to set the target setpoint temperature.

Running a Program (8 Segment Programmable Models)

To run a program, press the RUN/HOLD button. (The RUN light will illuminate.)

Running a Program (4x16 Segment Programmable Models)

To run a program, press the RUN/HOLD button.

(The RUN light will illuminate) or:

1. Press the PAGE button until you reach the run list (run LiSt).
2. Press the SCROLL button until display reads, “PrG.”
3. Press the UP or DOWN button to select the program number you want to run.
4. Press the RUN/HOLD button once to start the program. (The RUN light will illuminate.)

Holding a Program

To put a running program on hold, press the RUN/HOLD button. (The HOLD light will illuminate.)

Cancelling a Program

To cancel a program, hold the RUN/HOLD button down until the RUN and HOLD lights go off.

Tuning your Furnace

The purpose of tuning your furnace is to match the characteristics of your controller to the characteristics of the process being controlled. Good control is evidenced by: stable, straight-line control of the setpoint temperature with no fluctuations; No overshoot or undershoot of the setpoint temperature; rapid restoration of the setpoint temperature when external disturbances cause deviations from the setpoint.

This controller has automatic tuning features which install optimum tuning parameters to give the best temperature accuracy. No manual loading of tuning parameters is needed. We recommend that you tune the furnace to your specific application to obtain the best results. To provide the best temperature accuracy possible, use these features when you install your furnace and whenever you change your application or procedure.

Tuning Error

The display will flash “tu.ER” if an error occurs during tuning. To clear the error and restart tuning, simultaneously press the PAGE and SCROLL buttons and follow the steps outlined in “Autotuning.”

NOTE

The display will flash “tu.ER” if an error occurs during tuning. To clear the error and restart tuning, simultaneously press the PAGE and SCROLL buttons and follow the steps outlined in “Autotuning.”

NOTE

To stop the tuning function, simultaneously press the PAGE and SCROLL buttons.

Gain Scheduling

G.SP: Gain Scheduling

Gain scheduling is the automatic transfer of control between two sets of PID values. The 2416 controller does this at a presettable process value. Gain scheduling is used for difficult control processes which show large changes in their response time or sensitivity at high or low temperatures, or when heating or cooling.

The G.SP gain schedule setpoint is factory set at 700° C. The G.SP must be adjusted to 200°C from the desired setpoint temperature when tuning.

Setting the Transfer Point

If gain scheduling has been enabled, “G.SP will appear at the top of the PID list. This sets the value at which the transfer will occur. When the process value is below this level, PID1 will be active and when it is above, Pid2 will be active. Set a value between the control regions that show the greatest change to achieve the best point of transfer.

Tuning

The two sets of PID values can be manually set or automatically tuned. To tune automatically you must tune above and below the transfer point G.SP. If the process value is below the transfer point G.SP, the calculated values will automatically be inserted into the (SEt 1) set and if the process value is above G.SP, the calculated values will automatically be inserted into the (SEt 2).

Autotuning

The Autotune feature automatically sets up the PID values in the control parameters to suit new process conditions.

To tune your furnace using autotuning:

1. Load your furnace with a load similar to your normal load and close the door.
2. Set the setpoint temperature.
3. Press the PAGE button until the display reads, "Atun LiSt."
4. Press the SCROLL button until "tunE OFF" is displayed.
5. Press the UP or DOWN button to select "on."
6. Simultaneously press the PAGE and SCROLL buttons to return to the HOME DISPLAY. The display will flash "tunE" while tuning is in progress.

Adaptive Tuning

Adaptive tuning continuously evaluates tuning parameters. Adaptive tuning automatically installs new values if better accuracy is possible. Adaptive tuning should be used when the characteristics of a process change due to load or setpoint changes or, in a process that cannot handle the oscillation caused by a one-shot tune.

To tune your furnace using adaptive tuning:

1. Load your furnace with a load characteristic of those you intend to heat in it.
2. Press the PAGE button until display reads, "Atun LiSt."
3. Press the SCROLL button until "drA OFF" is displayed.
4. Press the UP or DOWN button to select "on."
5. Press the SCROLL button until "drA.t" is displayed.
6. Press the UP or DOWN button until the desired trigger value is achieved.

Installation and Operation of Air Control

Installation

Compressed Air Hook-Up

1. A 0.250 inch tube fitting is located at the rear of the furnace.
2. Using 0.250 inch I.D. rubber tubing, connect a piece of tubing from this input fitting to a corresponding 0.250 inch fitting located on the regulated side of a pressurized air service line.
3. Prior to making connections at the regulator, ensure that the regulator is completely closed (0 psi).
4. Turn flow control valve located at the bottom of the flow meter (front control panel) clockwise to closed positions.
5. Turn regulator to maximum output pressure of 20 psi. Check for any leaks at connection points of connecting tubing.
6. Open flow control valve slowly until ball in flow meter reads between 40-45 liters per minute flow rate.
7. Open furnace door and check that air is exhausting from the manifold located at the bottom rear of the chamber.
8. Turn flow control to off (clockwise).

Exhaust Tubing Hook-Up

Using accessory stainless steel tubing (part number AY408X1A) or equal quality 2.5 inch I.D. stainless steel tubing, connect flexible tubing from vent port at top of furnace case to an appropriate negative pressure exhaust system. This exhaust system must be capable of handling smoke and gases produced in an ashing procedure.

Furnace Programming

Refer to “Programmable Models” in this manual to program in the following values for performing ASTM specification D3174.

(Ramp 1) value is 8°C/minute

Target SP value is 500°C

(Dwell 1) value is 0 minute

(Ramp 2) value is 6°C/minute

Target SP value is 750°C
(Dwell 2) value is 120 minute
(Ramp 3) value is END (4 program models)
Cycles value is 1

Included with this furnace are two stainless steel trays which will hold crucibles of quartz jars. Use the appropriate side for the type of crucible you are using. A removable handle is also provided to use in loading and unloading the trays from the furnace.

Shelf Location

1. The side walls of the chamber contain twenty four holes (.250 inch dia.) which allow adjustment of the two perforated shelves at various heights within the chamber.
2. Using the eight, .250 inch diameter porcelain pegs, insert four pegs in the bottom row of holes.
3. Next insert the remaining four pegs in fourth row of holes and insert the two perforated shelves.
4. Check for proper fit at this point by inserting the crucible trays.

Operation

1. Insert crucible trays. One tray per shelf.
2. Close the furnace door.
3. Ensure the exhaust system is operating.
4. Set flow control valve so flow indicator reads between 40 and 45 liters per minute. (Check regulator to ensure 20 psi pressure).
5. Switch power switch to "ON".
6. Depress run button. The controller will automatically step the program through the various steps outlined earlier.
7. When the program has ended, the controller will maintain the chamber temperature at a value equal to the last programmed Target SP until the program is cancelled. It will not automatically cool to ambient unless last programmed Target SP is set at ambient. When a program is cancelled the controller will maintain the chamber temperature at a value equal to the main set point . To cancel a program depress and hold the run button until the "run" light extinguishes.

At the end of the program, turn the flow control valve fully clockwise to the closed position.

NOTE

Coal ashing furnaces -60 models contain a feature to provide air (or inert gas) flow within the furnace chamber.

NOTE

A pressurized air line with a minimum working pressure range of 0 to 20 psi is required.

NOTE

If the furnace is to be used regularly, the airline regulator may be left open to 20 psi.

NOTE

A flow rate of 40 to 45 liters per minute will provide three air exchanges of the chamber per minute.

NOTE

Appropriate exhaust must be provided to remove smoke and gases produced in an ashing procedure.

NOTE

Failure to connect the exhaust port to an appropriate exhaust system will result in smoke and gases filling the work area. Without the connection, gases and smoke will escape around the door seal and at the rear of the furnace.

Furnace Loading

For best results, use only the center two-thirds of the furnace chamber.



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

- If you are heating a number of small parts, spread them throughout the center of the furnace chamber.
- Keep objects away from thermocouple.
- Use insulated tongs and mittens when loading and unloading furnace.
- Always wear safety glasses.
- Use Thermolyne hearth plates if you place load on bottom of chamber. Part #PHX2 (three are required).

Preventive Maintenance



Disconnect from the power supply prior to maintenance and servicing.

This unit is equipped with a venting system on the top of the furnace. This is for the removal of fumes from the chamber of the unit. Contamination is a major cause of element failure, therefore, removes all fume forming material before heating. (e.g. clean cutting oil from tool steel). Housekeeping is vital to your electric furnace – KEEP IT CLEAN. Run your furnace up to 871°C (1600°F) empty occasionally to burn off the contamination that may exist on the insulation and elements. Maintain 871° (1600°F) for at least 4 hours to ensure complete ashing of foreign materials.

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 260°C (500°F). We highly recommend that you replace the thermocouple periodically (once every six months) to ensure temperature accuracy.

General Cleaning Instructions

Wipe exterior surfaces with lightly dampened cloth containing mild soap solution. The Troubleshooting section is intended to aid in defining and correcting possible service problems.

Maintenance and Servicing

Contents

- “To Replace a Heating Element” on page 58
- “To Replace a Platinel II Thermocouple” on page 58
- “To Replace a Chromel/Alumel Thermocouple” on page 58
- “To Replace Solid State Relay” on page 59
- “To Replace Door Switch” on page 59
- “To Realign Door Switch” on page 60
- “To Replace the Controller” on page 60

To Replace a Heating Element



Replace fuses with same type and rating.



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

1. Disconnect furnace from power supply.
2. Remove the back terminal cover of the furnace. (Note placement and connections of wires).
3. Loosen the nuts on the terminals of the element to be replaced.
4. Open the door and pull the defective element out. (It may be easiest to turn the furnace so that the element to be re- moved is on top).
5. Slide the new element into place, threading the leads through the insulating porcelain bushing on the back of the furnace.
6. Tighten the nuts securely. Cut off any excess lead wire.
7. Replace the back terminal cover.
8. Reconnect furnace to power supply.
9. Test operation of furnace.

To Replace a Platinel II Thermocouple

1. Disconnect furnace from power supply.
2. Remove the back terminal cover of the furnace. (Note placement and connection of wires).
3. Remove the screws on the thermocouple terminals and pull the thermocouple straight out.
4. Insert the new thermocouple into the furnace with yellow beaded lead connected to the positive (+) marked terminal and other lead to negative (-) terminal.
5. Secure connections with screws re- moved in step 3.
6. Replace the back terminal cover.
7. Reconnect the furnace to power supply.
8. Test operation of furnace.

To Replace a Chromel/Alumel Thermocouple

1. Disconnect furnace from power supply.
2. Remove both back covers. (Note placement and connection of wires).

3. Remove clip holding thermocouple in place (1 screw) and remove the two screws on the thermocouple terminals.
4. Remove the thermocouple. Pull thermocouple straight out of hole in the chamber first to avoid damage to the insulation.
5. Guide the looped ends of the new thermocouple through the plastic bushings with the red (-) lead to the right as you face the back of the furnace.
6. Insert the thermocouple straight through the hole in the chamber.
7. Secure the thermocouple with clip and screw. Connect the looped ends of the thermocouple to the terminals with + to+ (yellow wire). Chromel/Alumel thermocouples and lead wire are easily tested with a magnet. The nonmagnetic wire is positive (+) and the magnetic wire is negative (-).
8. Replace both back covers.
9. Reconnect to power supply. Test operation of furnace.

To Replace Solid State Relay

1. Disconnect furnace from power supply.
2. Remove back control cover. (Note connection and placement of wires to relay). Remove the front control panel screws to provide access to solid state relay. Slide control section forward.
3. Disconnect wires from terminals. Identify or mark wires.
4. Remove nuts, washers, and screws from relay, then remove relay.
5. Install new relay.
6. Reconnect the wires identified or marked in step 3.
7. Replace covers.
8. Reconnect furnace to power supply.
9. Test operation of furnace.

To Replace Door Switch

1. Disconnect furnace from power supply.
2. Remove the four top screws on the front dial and the four bottom screws on the back cover.
3. Slide the control section forward. (Do not pull excessively on the internal wires).
4. Disconnect the wires from the door switch. (Note connection and placement of wires to micro switch). Identify or mark wires.
5. Remove the two screws and nuts from the door switch(es).
6. Insert new door switch(es) and secure with screws and nuts removed in Step 5.
7. Reconnect wires identified or marked in Step 4 to new door switch(es).

8. To realign door switch see “To Realign Door Switch” section.
9. Slide control section back in and replace the screws described in Step 2.
10. Reconnect to power supply.
11. Test operation of door switch. (See “To Realign Door Switch” section.)

To Realign Door Switch

1. Disconnect furnace from power supply.
2. Remove the four top screws on the front dial and the four bottom screws on the back cover.
3. Slide the control section forward. (Do not pull excessively on the internal wires).
4. With the door closed loosen the screws on the microswitch and slide the switch downward, so that the screws are at the bottom of the slots in the mounting bracket.
5. Finger tighten both screws. While holding down the rear of the micro switch housing, gently push up on the front of switch until you hear a click.
6. Open and close the door; the switch should click approximately 1" to 1.5" before the door is closed.
7. Tighten the two screws to secure the micro switch. Check the operation of the switch as described in Step 6 after tightening the screws.
8. Slide control section back and replace the screws described in Step 2.
9. Reconnect to power supply.
10. To test the operation of the door switch: turn the power switch on, open and close the door a few times; Note an acoustic click of the switch during opening and closing of the door. This check must be done when the furnace is heating and the cycle light on the display is illuminated.

To Replace the Controller

The controller plugs into a panel mounting sleeve which should be left permanently installed in the furnace housing. To remove the controller, release the side clips and slide the controller out. Do not attempt to dismantle this unit further.on the display

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 cause's category and take necessary corrective action.

PROBLEM	PROBABLE CAUSE	CORRECTIVE ACTION
The power switch does not illuminate.	The furnace is not connected to power supply.	Check furnace connection to power source.
	ON and OFF power switch is defective.	Replace power switch.
	Fuses blown.	Replace fuses.
The furnace does not heat, cycle light on the display is illuminated.	Heating elements burned out or improper connections.	Replace heating elements or Repair connections.
	No power.	Check power source and fuses or breakers.
	Two or more heating elements in 208V or 240V furnaces are burned out.	Replace defective elements.
The furnace does not heat.	Thermocouple has oxidized and opened the circuit.	Replace thermocouple.
	Defective electrical hookup.	Repair electrical hookup.
	Door switch malfunction switch.	Re-align or replace door safety.
	Defective mechanical relay coil Or contacts.	Replace relay.
	Shorted thermocouple circuit.	Check thermocouple connection and/or replace thermocouple.
No temperature control.	Shorted solid state relay - over temperature protection may be activated.	Replace solid state relay.
	Defective control - error message on display may appear.	Return control for repair or replace.
	Thermocouple leads are reversed.	Connect leads correctly(see manual).

Slow heat-up.	One or two heating elements are burned out.	Replace burned out elements.
	Heavy load in chamber.	Lighten load in chamber to allow heat to circulate.
	Low line voltage.	Install line of sufficient size and proper voltage (isolate furnace from other electrical loads).
	Wrong heating elements.	Install proper elements.
Door switch does not cut power to the furnace chamber.	Door switch is not functioning.	Re-align or replace door safety switch.
	Mechanical relay contacts sticking.	Replace relay.
Repeated element burnout.	Chamber improperly loaded.	See loading procedures in start-up procedure.
	Heating harmful materials.	Enclose material in container. Clean up spills on chamber. Ventilate chamber by leaving door cracked slightly open when heating known harmful reagents.
	Overheating furnace.	Keep furnace under maximum temperature. Closer supervision Of control setting.
Wrong element.	Oxidized or contaminated thermocouple.	Replace thermocouple.
	Improper loading.	Use proper loading procedures. Refer to start-up procedure.
	Poor thermocouple connection.	Tighten connections.
	Solid state relay malfunction.	Replace solid state relay.
	Thermocouple connections	Reconnect thermocouple correctly.

Replacement Parts List

Listed below is the common replacement parts for all models of the 6000 furnace. The far left column contains the letter designation found on the circuit diagrams. Be sure to identify the correct part number with respect to the exact model number found on your furnace.

REPLACEMENT PART	DESCRIPTION	MODELS USED ON
CN71X185	Controller	F6010, F6010CN, F6018
CN71X188	Controller	F6020C, (-33), F6028C
CN71X188	Controller	F6020C-33-60, F6020C-60, F6028C-60
CN71X83	Controller	F6020C-33-80, F6020C-80, F6028C-80
CN71X86	Controller	F6020C-60-80, F6020C-33-60-80, F6028C-60-80
CN71X84	Controller	F6030CM, F6030CM-33, F6038CM
CN71X87	Controller	F6030CM-33-60, F6030CM-60, F6038CM-60
PLX82 (Optional)	Pilot Light	All models
EL408X1	Heating Element, Top	F6020C , (-33), (-33-60), (-33-80), (-33-60-80), (-60), (-60-80) & (-80), F6030CM, (-33), (-33-60) & (-60)
EL408X10	Heating Element, Top	F6010, F6010CN, F6018
EL408X2	Heating Element, Top	F6028C, (-60), (-60-80) & (-80), F6038CM & (-60)
EL408X5	Heating Element, bottom	F6020C , (-33), (-33-60), (-33-80), (-33-60-80), (-60), (-60-80) & (-80), F6030CM, (-33), (-33-60) & (-60)
EL408X4	Heating Element, bottom	F6028C, (-60), (-60-80) & (-80), F6038CM & (-60)
EL408X9	Heating Element, bottom	F6010, F6010CN, F6018
EL205X6	Heating Element, side	F6020C , (-33), (-33-60), (-33-80), (-33-60-80), (-60), (-60-80) & (-80), F6030CM, (-33), (-33-60) & (-60)

REPLACEMENT PART	DESCRIPTION	MODELS USED ON
EL408X3	Heating Element, side	F6028C, (-60), (-60-80) & (-80), F6038CM & (-60)
EL408X11	Heating Element, side	F6010, F6010CN, F6010-33, F6018
RYX57	Relay	All models except F6010, F6010CN, F6010-33, F6018
RYX34	Solid State Relay	All models
SWX144	Power Switch	All models
SW1172X1	Micro Switch	All models except F6010, F6010CN, F6018
SWX163	Micro Switch (2)	F6010, F6010CN, F6018
TC1249X1	Thermocouple, Type K	F6010, F6010CN, F6018
TC327X1	Thermocouple, Platinel	All models except F6010, F6010CN, F6018
CAX99	Filter, EMI	-33 models
LT1249X5	Fuse Holder	F6010, F6010CN, F6018 only
2-58147	Fuse	F6010, F6010CN, F6018 only

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 Thermo Scientific 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 563-556-2241 or 800-553-0039.

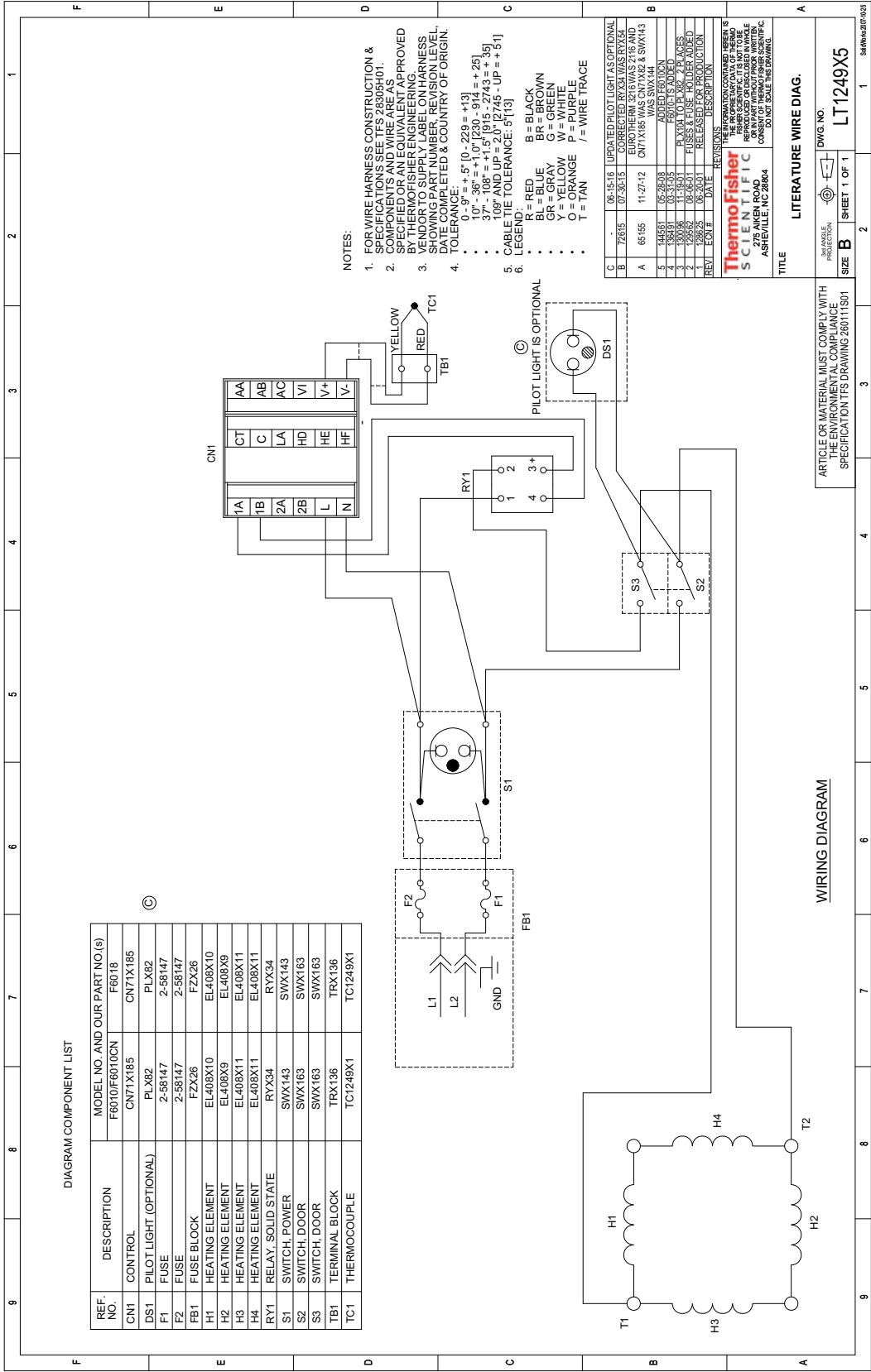
Prior to returning any materials, please contact our Customer Service Department for a “Return Materials Authorization” number (RMA). Material returned without an RMA number will be refused.

Wiring Diagrams

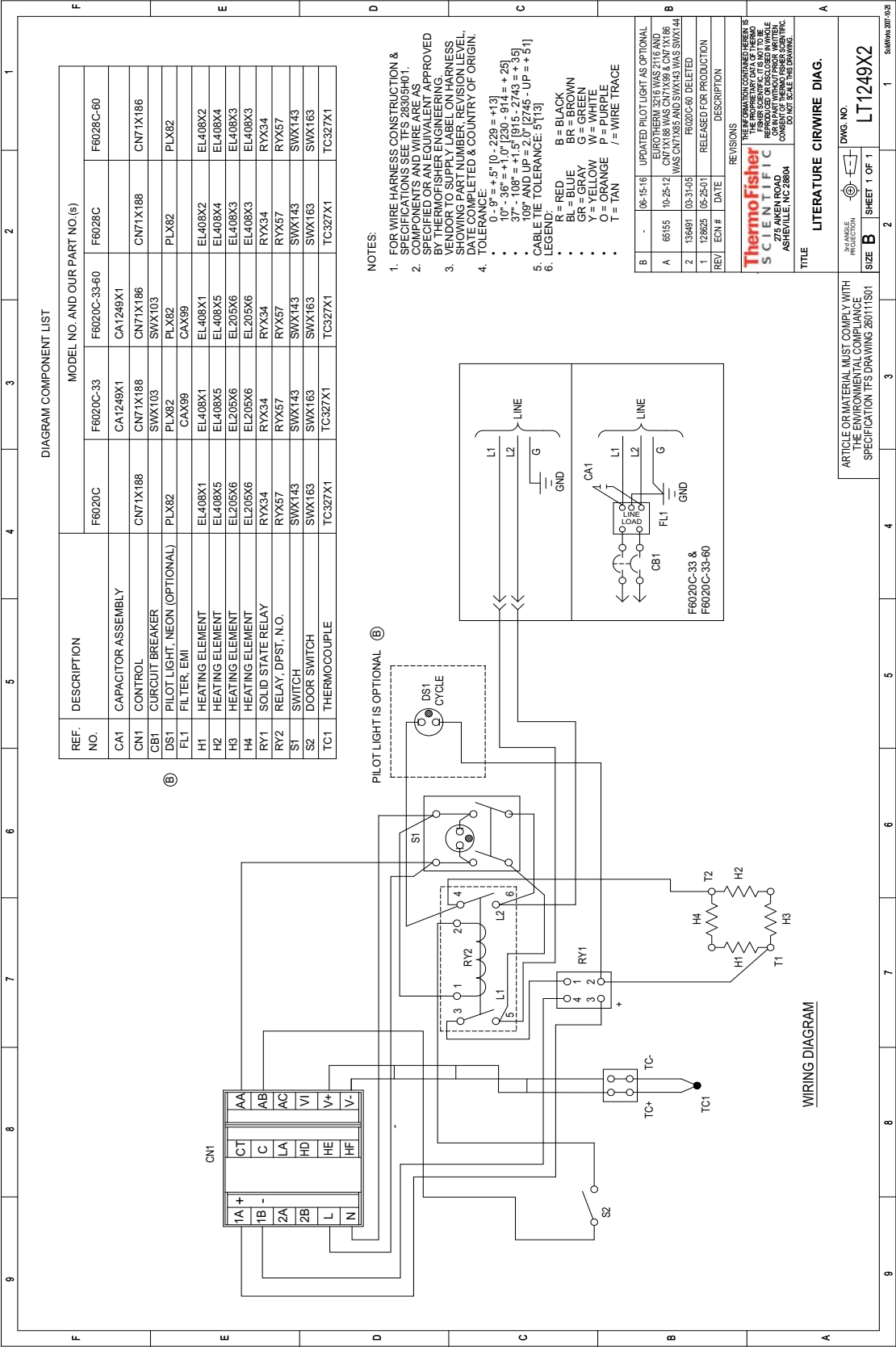
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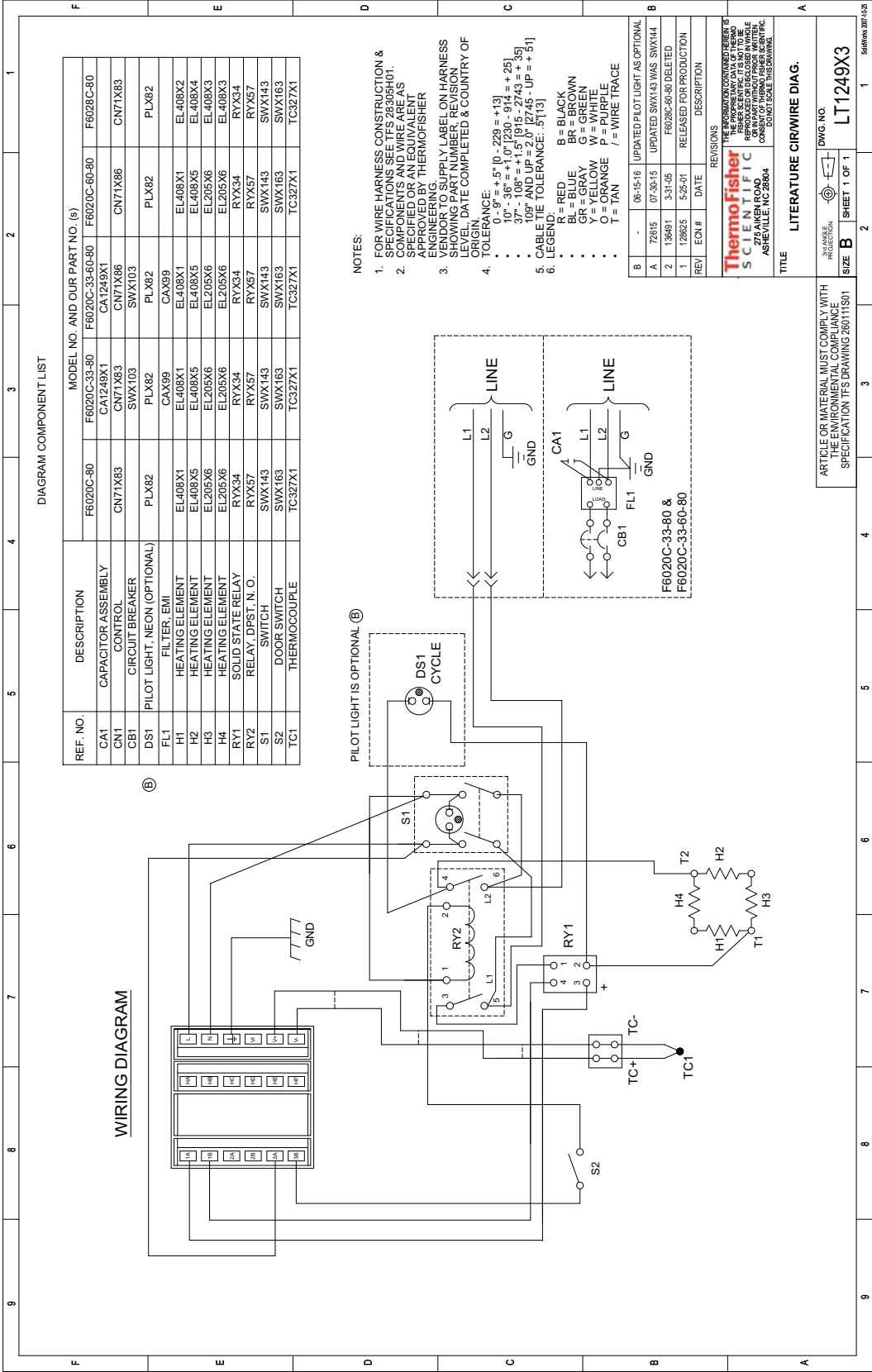
Single Setpoint Control w/OTP



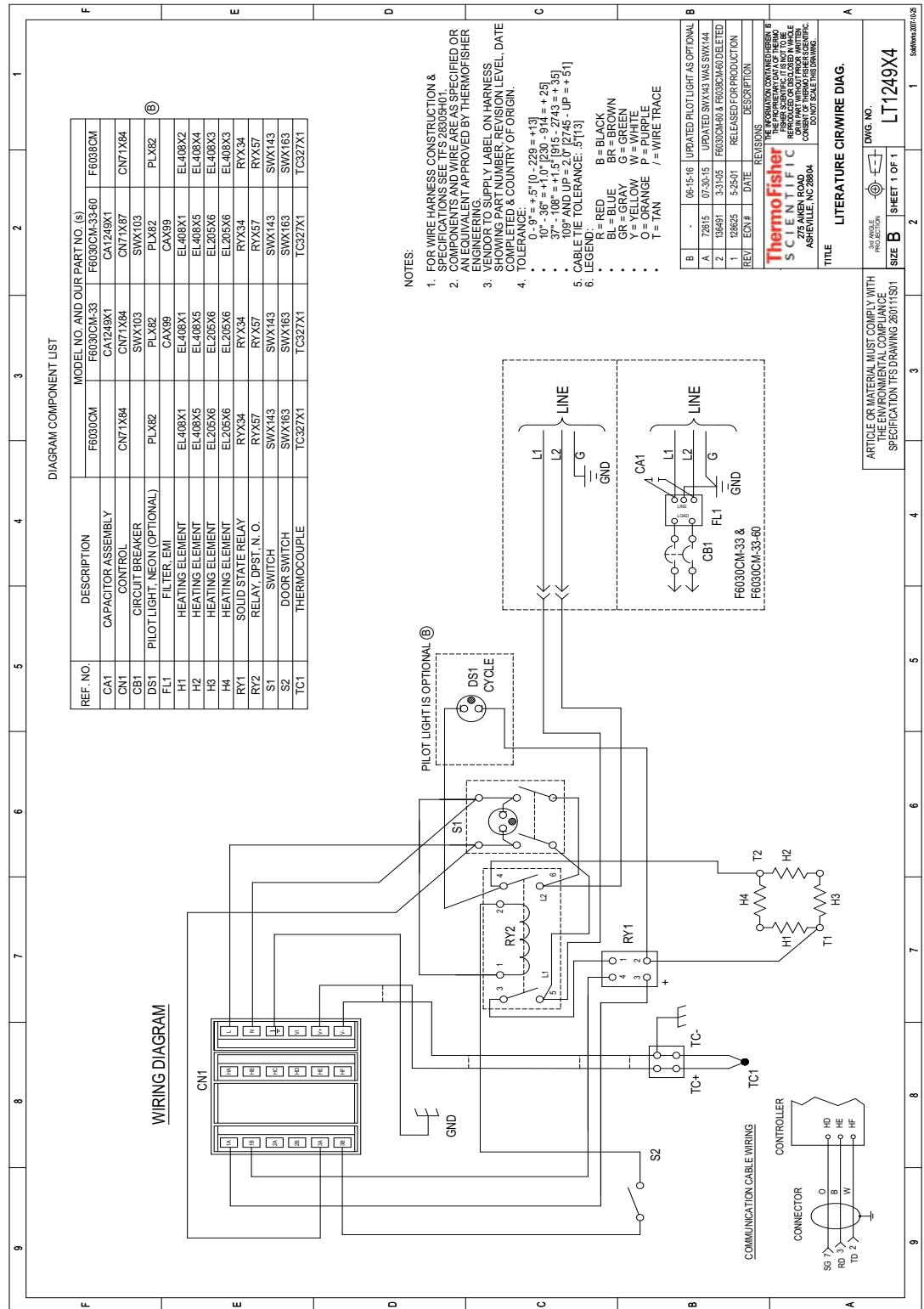
Single Setpoint Control w/OTP



8 Segment Programmable Control



4 X 16 Segment Programmable Control



Important

For your future reference and when contacting the factory, please have the following information readily available:

Model Number: _____

Serial Number: _____

Date Purchased: _____

The above information can be found on the dataplate attached to the equipment. If available, please provide the date purchased, the source of purchase (manufacturer or specific agent/rep organization), and purchase order number.

IF YOU NEED ASSISTANCE:

LABORATORY PARTS and SERVICE

Phone: 800/438-4851

FAX: 828/658-2576

TECHNICAL SUPPORT

Phone: 800/438-4851

LT1249X1 Rev. F

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