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Thermo Scientific Thermolyne Furnace Large Tabletop Muffle/ Atmosphere Controlled Ashing Model Type: F30400

Installation and Operation Manual

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ThermoFisher
S C I E N T I F I C

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Release history:

For Research Use Only. Not for use in diagnostic procedures.

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Safety Information

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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 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 F30400 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:

Not be touched on the exterior or interior surfaces 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.

Warning

Please note the following WARNINGS:

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 1-800-438-4851.

1 Safety Information

Warning

Introduction

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| NOTE | When in the program RUN mode, the programmable controller serves to provide a programmed temperature profile as described earlier. When in the single setpoint automatic mode, the unit serves as an automatic temperature controller. |

Intended Use

The Type 30400 furnaces are general purpose laboratory and heat treating furnaces. For optimum element life, we recommend observing these temperature ranges: from 400°F (204°C) to 1800°F (982°C) for continuous use, or temperatures from 1800°F (982°C) to 2000°F (1093°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. an automatic proportioning digital set, digital read control with over-temperature protection and

3. a door interlock relay for user safety.

The Type 30400 Programmable furnace 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. Additional positive or negative going ramps are now initiated starting at the level at the end 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. See specific model number in proceeding chart for total number of program segments.

4. The Type 30400 Automatic furnace is designed as a single set point controller which reaches and maintains one temperature value.

General Usage

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

MODEL NUMBER	DIGITAL COMMUM.	TOTAL NUMBER OF PROGRAMMABLE SEGMENTS	NUMBER OF STORED PROGRAMS
F30420C-33-80	NO	8	
F30420-33-60-80	NO	8	
F30420C-60-80	NO	8	
F30420C-80	NO	8	
F30428C-60-80	NO	8	
F30428C-80	NO	8	

MODEL NUMBER	DIGITAL COMMUM.	TOTAL NUMBER OF PROGRAMMABLE SEGMENTS	NUMBER OF STORED PROGRAMS
F30430CM	YES	80	16 Segment Programs
F30430CM-33	YES	80	16 Segment Programs
F30430CM-33-60	YES	80	16 Segment Programs
F30430CM-60	YES	80	16 Segment Programs
F30438CM	YES	80	16 Segment Programs
F30438CM-60	YES	80	16 Segment Programs
F30420C	NO	0	
F30420C-33	NO	0	
F30428C	NO	0	

Principles of Operation

Furnace: The furnace chamber is heated by four electric resistance heaters which are embedded in a refractory material. The chamber is insulated with ceramic fiber insulation. The temperature is controlled by an automatic proportioning controller using a platinel thermocouple to feed back information. The control is located under the furnace chamber and is well insulated from the heat generated in the furnace chamber. The temperature is controlled by one of three types of controllers.

General Specification

Models		F30420C, (-33), (-33-60-80), (-33-80), (-60-80) & (-80) F30430CM, (-33), (-33-60) & (-60)	F30428C, (-60-80) & (-80) F30438CM & (-60)
Overall Dimensions IN. (CM)	**Width**	21 1/2 (55)	21 1/2 (55)
	Height	29 1/2 (75)	29 1/2 (75)
	Depth	25 1/2 (65)	25 1/2 (65)
Chamber Dimensions IN. (CM)	**Width**	14 (35)	14 (35)
	Height	14 (35)	14 (35)
	Depth	14 5/8 (37)	14 5/8 (37)
Weight	**Lbs. (KG)**	188 (86)	188 (86)
Electrical Ratings	**Volts**	240	208
	Amps	22.9	26.4
	Watts	5500	5500
	Freq.	50/60	50/60
	Phase	1	1
Temperature Ratings °F (°C)	**Cont.**	400°F-1800°F* (204°C)-(982°C)	400°F-1800°F* (204°C)-(982°C)
	Intermittent	1800°F-2000°F (982°C)-(1093°C)	1800°F-2000°F (982°C)-(1093°C)

* The maximum continuous temperature for ashing furnaces (-60 models) is 1787°F (975°C).

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; 10% to 85% relative humidity.
Voltage Tolerance	240VAC +/- 10%

Unpacking

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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⚠CAUTION	Be sure ambient temperature does not exceed 40°C (104°F). Ambient above this level may result in damage to the controller. The recommended ambient temperature is 17°C to 27°C (62.6°F to 80.6°F).
⚠CAUTION	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
⚠WARNING	To avoid electrical shock, this furnace must always use a properly grounded outlet of correct voltage and current handling capacity.

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.

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 Zmax= 0.0229 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.

Operation, All Models

Contents

⚠ WARNING	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.
⚠ WARNING	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	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.

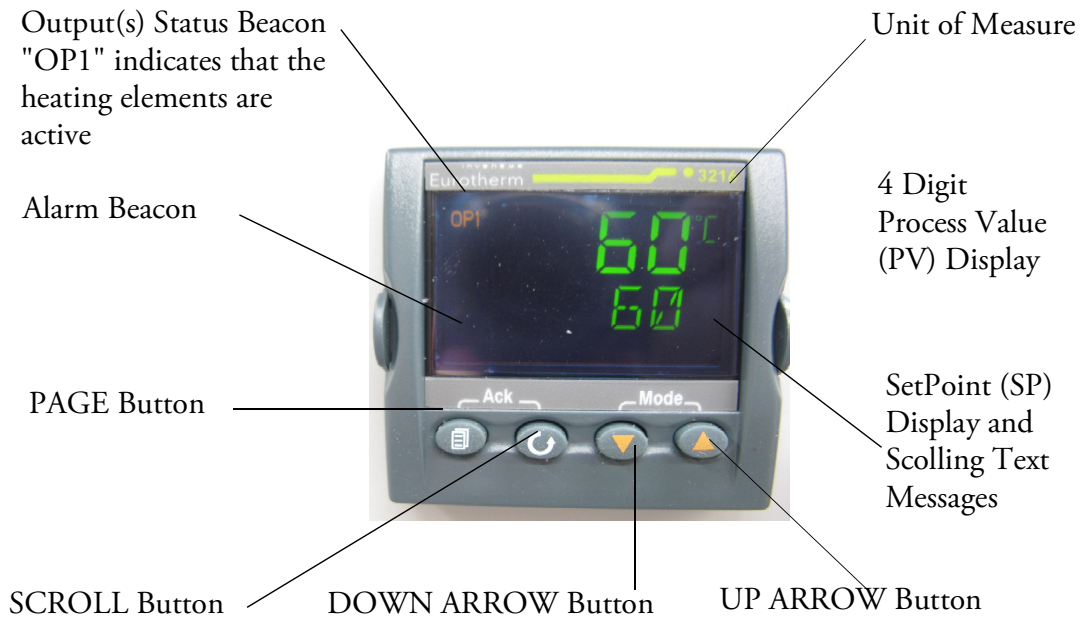# Single Setpoint Models w/OTP

Contents

Eurotherm 3216 Controller Operation

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.

Output(s) Status Beacon "OP1" indicates that the heating elements are active

Unit of Measure

Alarm Beacon

4 Digit Process Value (PV) Display

PAGE Button

SetPoint (SP) Display and Scolling Text Messages

SCROLL Button   DOWN ARROW Button   UP ARROW Button

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 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).
RAMPU: 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.

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.

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.rr" must be set to OFF or "tunE" will not initiate.

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

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.
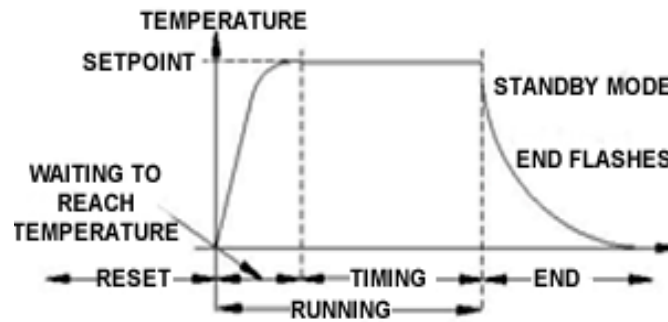
MODE 1 (OPT. 1)

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.
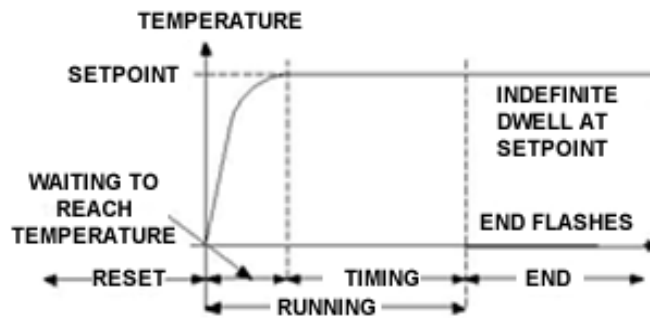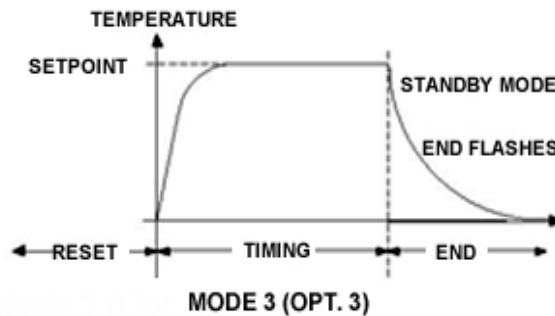

MODE 2 (OPT. 2)

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

3. **Mode 3 (SF.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.

MODE 3 (OPT. 3)

Program Overview

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

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.

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 & 5x16 Segment Programmable Models w/OTP

Contents

Eurotherm 3216 Controller

The Eurotherm 3216c and 3216p temperature controllers sense the furnace's chamber air temperature (the PV or process value) and provides the heat needed to reach the required set point.

There are two choices of controls used in the various furnaces models:

The 3216c controller is a basic single setpoint and Timer (1-program 8-segment or Dwell timer or Delay timer). The 3216p controller offers single setpoint and 5-program 16-segment, this controller can store up to 5-different programs and each program can contain up to 16 segments.

This chapter provides brief instructions on various controller operations which include:

- Setting target temperature

- Setting the ramp rate

- Changing display units

- Auto tuning the controller

- Setting over – temperature protection (OTP)

- Temperature offset procedure

- Timer operation (3216c controller only)

- 5x16 programmer operation (3216p controller only)

⚠️ **CAUTION**

Before operating the controller, read this chapter carefully. Wrong procedures can change the unit characteristics and design parameters, which can hamper performance and make the equipment dangerous to use.

The furnace temperature controller is configured and tuned at the factory to function well for most applications. Occasionally, it may be advisable to configure the temperature controller differently to suit a particular working environment or process.

Operator Interface & HOME Display

When the controller is turned ON, it will perform a brief self-test and then display the HOME Display page. The measured value (process value) is found in the upper display and the set point is found in the lower display.

The description of interface beacons and buttons are shown in "Beacon Display and Description" & "Operator Buttons" respectively.
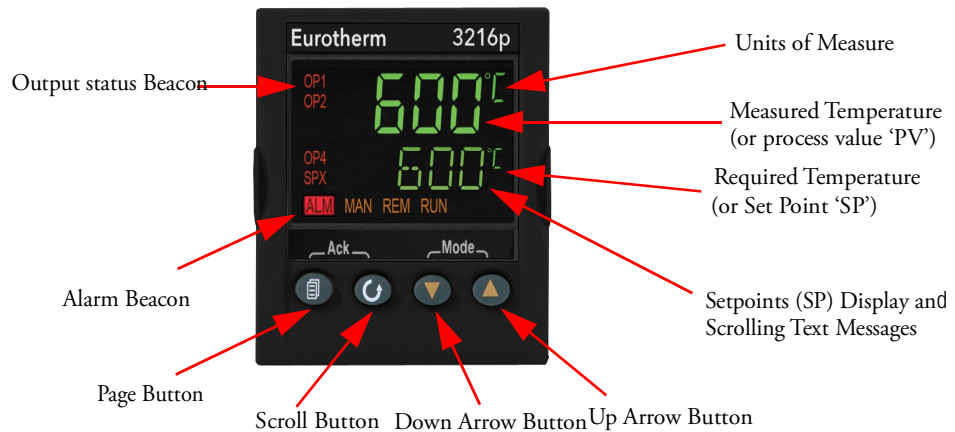
Beacon Display and Description

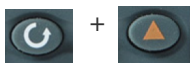|	
OP1 (Output 1)	Illuminates when the output to heater
OP4 (Output 4)	Illuminates when the output is ON (Over-temperature alarm).
SPX	Alternative set point in use (SP2)
ALM	Alarm active (Red)
REM	Remote set point or communication active
RUN	Timer running for 3216c or Program running for 3216p
RUN (flashing)	Timer hold for 3216c or Program hold for 3216p

Operator Buttons

|		
		Press to select a new list of parameters and from any display - press PAGE to return to the HOME Page
		Press to select new parameter from the page header. If held down it will continuously scroll through parameters.
+		Hold down SCROLL and press UP ARROW to scroll back parameters.
		Press to decrease or change the state of a value.
		Press to increase or change the state of a value.

Single Set Point Operation

3216 controller has capability to select set point-1 and set point-2. User can setup two different set points to select the desired set point, SP.SEL function can be used.

To set the desired temperature set point, complete the following steps:

1. Press the SCROLL ⟳ button until SP1 or SP2 is displayed.
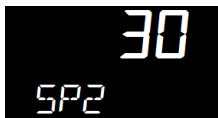
2. Press UP ▲ or DOWN ▼ button until the desired setpoint is displayed and then release the button. A few seconds after the button is released, the controller will accept the new value and is indicated by a brief flash of the display.

3. Press PAGE ▤ button to return to the HOME display.

Alternate Set Point Selection (SP2)

1. Press the SCROLL ⟳ button from HOME display until SP.SEL is displayed.

2. Press UP ▲ or DOWN ▼ button to select SP1 or SP2.
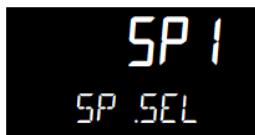
If SP2 is selected, then SPX beacon will appear on the HOME display indicating the action of alternate set point in use.

Set Point Ramp Rate

The ramp rate SP.RAT is designed to reduce the heating rate that the furnace normally exhibits. When SP.RAT is 'OFF', the furnace will operate at its maximum heating capability. But if ramp rate feature is used, then the chamber is heated at any rate slower than the maximum capability of the unit. To fine tune ramp rates, you may need to test the furnace using loads that you intend to use in furnace application or with loads having similar mass and thermal properties.

> NOTE If ramp rate exceed the capability of the furnace unit, it will run the max 100% output of heater capacity. If ramp rate value set less than 100%, furnace unit heater output is reduced and furnace unit chamber gets heated slowly.

Complete the following steps to set the ramp rate units:

1. The ramp rate units can be set in seconds, minutes or hours.

2. Press the SCROLL ⟳ button until RAMPU is displayed.

3. Press UP ▲ or DOWN ▼ button until the desired ramp rate unit is indicated on the display.

4. The new ramp rate unit is applied when the button is released and is indicated by a brief flash of the display.

5. Press PAGE ▤ button to return to HOME display.

Complete the following steps to change the ramp rate of SSP.

6. Press the SCROLL ⟳ button until SP.RAT is displayed.

```
 OFF
SP RAT
```

7. Press UP ⓐ or DOWN ⓥ button until the desired ramp rate is indicated on the display. The unit of ramp rate depends on the type of ramp unit RAMPU selected.

```
 10.0
SP RAT
```

8. The new ramp rate is applied when the button is released and is indicated by a brief flash of the display.

9. Press PAGE 🗐 button to return to HOME display.

View or Change the Display Units

To change the temperature scale in 3216 controller to operate on °F instead of the factory setting of °C, or to change from °F to °C, follow these steps.

1. Press the SCROLL ⟳ button until "UNITS" is shown in the lower display. The current unit is shown in the upper display.

```
 °C
UNITS
```
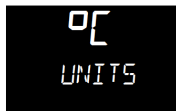
2. Press UP ⓐ or DOWN ⓥ button to change the display unit.

   a. (°C): Degrees Celsius

```
 °C
UNITS
```

   b. (°F): Degrees Fahrenheit

```
 °F
UNITS
```

   c. (°K): Kelvin

```
 °K
UNITS
```

d. (NONE): No units displayed

e. (PERC): Percent
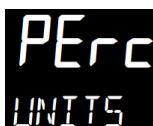
> NOTE Do not use nonE & PErc, they are used to measure other applications types other than temperature.

Auto Tuning

In Auto Tuning the characteristics (PID parameters) of the controller are matched to the characteristics of the product load in order to obtain good control.

Good control means:

- Stable control of the set point

- No overshoot or undershoot

- Quick response to deviations from the set point

- Removal of fluctuations

The 3216 controller uses a one-shot tuner which automatically sets the initial values of the parameters listed in Table Table 2, "Parameter Description and Accessibility in 3216c," on page 43 and Table Table 3, "Parameter Description and Accessibility in 3216p," on page 51.

Thermo Fisher recommends that you tune the furnace to your specific application to obtain the best results.

Steps to Auto Tune the Controller

1. Load the chamber with materials that have the same mass and thermal characteristics as a typical product load.

2. Set the temperature as per requirement; refer to section "Single Set Point Operation" on setting SP1 or SP2.

3. Press SCROLL ⟳ button to scroll through the list of parameters until A.TUNE is displayed.

4. To enable the auto-tune, set the A.TUNE parameter to ON by using DOWN ▼ or UP ▲ button.

5. Press the PAGE 🗐 button to return to the HOME display. The display will flash TUNE to indicate that tuning is in progress.

The auto tune is completed when the regular display of the measured temperature is shown and the process is allowed to control at the target set point using the new control terms.

> NOTE
> - If the process temperature or load changes significantly another auto tune session may be necessary to optimize the chamber performance.
> - If the controller is auto tuning and sensor break occurs, the auto tune will abort. Auto tune must be re-started when the sensor break condition is no longer present.
> - If an Auto tune cannot be performed an error message, Etun will be flashed in the display.
> - Auto tune will not work when controller is running program or Timer.

Parameter List

Parameters are available under different levels of security and are defined as Operator Level 1 (LEv1) & Operator Level 2 (LEv2). This section describes various parameters used in each operator levels.

Operator Level 1

Operator level 1 is designed for day to day operation of the controller and parameters are not protected by a security code. From HOME display, press SCROLL ⟳ button to scroll through the list of parameters in Level 1.

The parameter mnemonic and its scrolling description are shown in the lower display. The value of the parameter is shown in the upper display. After 5 seconds, a description of the parameter will scroll once along the display and then revert back to the mnemonic. The scrolling text can be interrupted at any time by a single press of any of the buttons, but will not scroll again until the parameter is returned to.

Operator Level 2

Operator Level 2 provides access to additional parameters and this access is protected by a security code. The Level 2 access should typically be granted to a specially trained person, since changing parameters can have major impact on the temperature performance of the furnace. After entering Level 2, press SCROLL (⟳) button to scroll through the list of parameters. Like Level 1, the mnemonic of the parameter is shown in the lower display, followed once by a scrolling help message showing a longer description of the parameter. The value of the parameter is shown in the upper display.

Press DOWN (▼) or UP (▲) button to adjust this value. If no button is pressed for about 30 seconds, the display returns to 'HOME Display'.

Back scroll is achieved when you are in the list by pressing UP (▲) button while holding DOWN (▼) and SCROLL (⟳) button.

To Enter Level 2

1. From any display press and hold PAGE (▤) button.

2. After a few seconds the display will show 'LEv 1 GOTO'.

3. Release SCROLL (⟳) button. (If no button is pressed for about 45 seconds the display returns to the HOME Display).

4. Press the UP (▲) or DOWN (▼) button to choose LEv2 (Level 2).

5. Press UP (▲) or DOWN (▼) button to enter the password. The default code is '25'.

If an incorrect code is entered the display reverts to Level 1.

To Return to Level 1

1. Press and hold PAGE 🔲 button to show the current operator level.

2. Press UP ⬆ or ⬇ DOWN button to select LEv 1.

```
LEu1
GOTO
```

When Level 1 is selected the display reverts to the HOME display. A passcode is not required when moving from a higher level to a lower level.

Offset Procedure

All ranges of the controller have been calibrated against traceable reference standards. This means that if the input type is changed it is not necessary to calibrate the controller. There may be occasions, however, when you wish to apply an offset to the standard calibration to take account of known errors within the process, for example, a known sensor error or a known error due to the positioning of the sensor. In these instances it is not advisable to change the reference (factory) calibration, but to apply a user defined offset.

PV Offset applies a single offset to the temperature or process value over the full display range of the controller and can be adjusted in Level 2. It has the effect of moving the curve up or down about a central point as shown in the example below:-
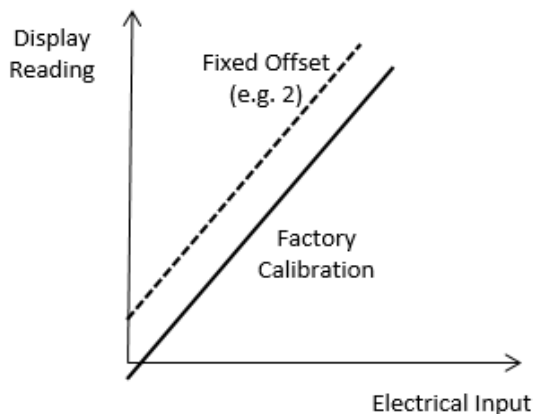
To Apply an Offset

Connect the input of the controller to the source device which you wish to calibrate to. Set the source to the desired calibration value. The controller will display the current measurement of the value. If the display is correct, the controller is correctly calibrated and no further action is necessary. If you wish to offset the reading:

1. Enter Level 2; refer to section "To Enter Level 2" for steps to enter Level 2.

2. Press SCROLL ⟳ button to scroll through the parameter list until 'PV.OFS' displayed.
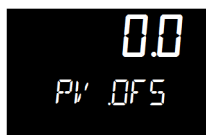
3. Press UP ▲ button or DOWN ▼ button to set the required offset value.

Alarms & Diagnostics

Alarms are used to alert an operator when a pre-set level has been exceeded. They are indicated by a scrolling message on the display and the red ALM beacon.

Alarm Indication & Acknowledgment

Alarm Indication & Acknowledgement should go before Sensor Break.

• If an alarm occurs the red ALM beacon will flash, a scrolling message will give the source of the alarm and the alarm (relay) output will operate. A typical default message will show the source of the alarm followed by the type of alarm. For example, 'ALARM 1 FULL SCALE HIGH'. If more than one alarm is present further messages are flashed in turn in the main display. The alarm indication will continue while the alarm condition is present and is not acknowledged.

• ALM beacon on continuously = alarm has been acknowledged.

• Press PAGE 🗐 button and SCROLL ⟳ button together to acknowledge an alarm. If the alarm is still present the ALM beacon lights continuously.

The action which takes place depends on the type of alarm configured:

Sensor Break & Loop Break Protection

Sensor Break Protection - The controller provides sensor break protection in the event the thermocouple opens. If an open thermocouple condition occurs, the digital display will blink "S.br", a red alarm beacon will be illuminated and the power to the heating element will be shut off.

Loop Break alarm is displayed as CONTROL LOOP BROKEN. This occurs if the controller does not detect a change in process value following a change in output demand after a suitable delay time. Since the time of response will vary from process to process the Loop Break Time parameter 'LBT' allows a time to be set before a loop break alarm is initiated. In these circumstances the output power will drive to high or low limit. For a PID controller, if the PV has not moved by 0.5 x Pb in the loop break time the loop is in break.

The loop break time is set by the AutoTune, a typical value is 12 x Td. The loop break alarm may be disabled by setting its time to Off.

Over-Temperature Protection (OTP)

The over-temperature protection will be in effect during any alarm condition when the temperature of the furnace has deviated beyond the limit. The Deviation High alarm is triggered when the measured temperature becomes higher than the set point by the amount of the threshold/deviation. Thermo Fisher recommends a value of 50°C above your working temperature to provide protection for your workload.

In certain units, full scale high alarm 'Hi' is also present. Full scale high alarm will be detected if the PV value exceeds the full alarm trip level.

To Configure Deviation High Alarm

1. Press SCROLL Ⓒ button until "A1.DHi" appears on the display.
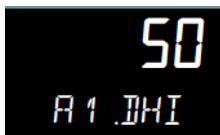
2. Press UP ▲ or DOWN ▼ button to select the OTP value you desire. We recommend a value of 50.

Program/Timer Segment Types

In program ON condition each segment consists of a controlled ramp rate to a target set point followed by a dwell at that set point. These values can be set by the user.
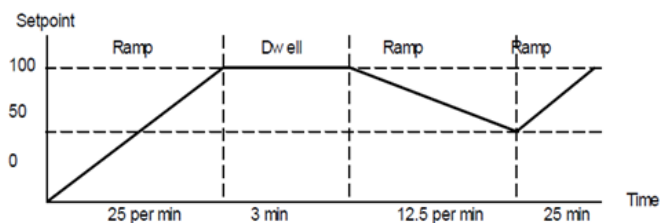
a. Target set point

Target set point will ramp from the current value of the measured temperature to the target set point value based on ramp rate.

b. Ramp Rate

A Ramp segment provides a controlled change of set point from an original to a target set point. The duration of the ramp is determined by the rate of change specified. The segment is specified by the target set point and the desired ramp rate. The ramp rate parameter is presented in engineering units (°C, °F, Eng.) per real time units (Seconds, Minutes or Hours). If the units are changed, all ramp rates are re-calculated to the new units.

c. Step

The set point changes instantaneously from its current value of the measured temperature to a new value at the beginning of a segment. Step can be achieved by turning off Ramp rate. A Step segment has a minimum duration of 1 second.

d. Dwell

The set point remains constant for a specified period at the specified target. The operating set point of a dwell is inherited from the previous segment.

Remaining Time

Time remaining before the dwell segment completes.

> NOTE For all modes except the setpoint programmer, the time remaining may be edited while the program is running, in this case the program duration is modified immediately. This is useful for extending or shortening the duration of a batch.

Elapsed Time

The time elapsed since the Program/Timer was activated.
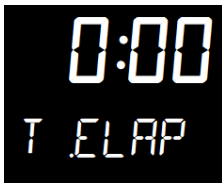
1-Program 8-Segment Controller Operation

An internal timer in 3216c controller can be configured to operate in four different modes:

- Dwell at temperature. This may be used in combination with the set point ramp limit to provide a simple ramp/dwell temperature sequence.

- Delayed switch on timer. This may be used to implement a switch on delay, and often eradicates the need for a separate timer device.

- Soft Start timer. Starts automatically on power up. It applies a power limit until the temperature reaches a threshold value or the timer times-out after the dwell period.

- 8-Segment programmable controller (4 ramps & 4 soaks).

The 8-segment programmable 3216c controller consists of microprocessor based three-mode PID (Proportional, Integral and Derivative) and appropriate output switching devices to control the furnace. The programmable controller can be used as a single set point controller or as a programmable controller. The 8-segment digital model enables eight segments of programming. 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.

Some of the commonly used parameters in operator Level 1 and Level 2 of 3216c controller are:

Table :1   Parameter Description and Accessibility in 3216c

No.	Parameter	Description	Level	Access	Values of CN71X315	Values of CN71X323
1	TIMER.Status	Timer Status	Level 1+2	Read/Write	END (3)	END (3)
2	TIMER.Remaining	Time Remaining	Level 2	Read Only	4s	4s
3	TIMER.ElapsedTime	Elapsed Time	Level 2	Read Only	0	0
4	ALARM.1.Threshold	Threshold	Level 1+2	Read/Write	50	50
5	ALARM.2.Threshold	Threshold	Level 2	Read Only	1118	1118
6	SP.SPSelect	Active Setpoint Select	Level 2	Read/Write	SP1 (0)	SP1 (0)
7	SP.SP1	Set point 1	Level 1 + 2	Read/Write	0	0
8	SP.SP2	Set point 2	Level 2	Read/Write	0	0
9	SP.RampUnits	Set point Ramp Units	Level 1 + 2	Read/Write	MIN (0)	MIN (0)
10	SP.RATE	Setpoint Rate Limit Value	Level 2	Read/Write	OFF (0)	OFF (0)
11	CTRL.Autotune Enable	AutoTune Enable	Level 1 + 2	Read/Write	OFF (0)	OFF (0)
12	INPUT.Units	Display Units	Level 1 + 2	Read/Write	°C (0)	°C (0)
13	TIMER.Type	Timer type configuration	Level 2	Read/Write	PROG (10)	PROG (10)
14	TIMER.SoftStartSetpoint	Soft Start Setpoint	Level 2	Read Only	-	-
15	TIMER.SoftStartPower	Soft Start Power Limit	Level 2	Read Only	-	-
16	TIMER.TimerThreshold	Timer Start threshold	Level 2	Read/Write	1	1
17	TIMER.Time	Requested Time Duration	Level 2	Read Only	-	-
18	TIMER.TimerEndType	Timer End Type	Level 1 + 2	Read/Write	OFF (0)	OFF (0)
19	TIMER.TimerRes	Timer Resolution	Level 2	Read/Write	MIN (1)	MIN (1)
20	TIMER.TimerSP1	Timer Target Setpoint 1	Level 2	Read/Write	0	0
21	TIMER.TimerRamp1	Timer Ramp Rate 1	Level 2	Read/Write	OFF (0)	OFF (0)
22	TIMER.TimerDwell1	Timer Dwell 1 Duration	Level 2	Read/Write	OFF (0)	OFF (0)
23	TIMER.TimerSP2	Timer Target Setpoint 2	Level 2	Read/Write	0	0
24	TIMER.TimerRamp2	Timer Ramp Rate 2	Level 2	Read/Write	OFF (0)	OFF (0)
25	TIMER.TimerDwell2	Timer Dwell 2 Duration	Level 2	Read/Write	OFF (0)	OFF (0)
26	TIMER.TimerSP3	Timer Target Setpoint 3	Level 2	Read/Write	0	0
27	TIMER.TimerRamp3	Timer Ramp Rate 3	Level 2	Read/Write	OFF (0)	OFF (0)
28	TIMER.TimerDwell3	Timer Dwell 3 Duration	Level 2	Read/Write	OFF (0)	OFF (0)
29	TIMER.TimerSP4	Timer Target Setpoint 4	Level 2	Read/Write	0	0
30	TIMER.TimerRamp4	Timer Ramp Rate 4	Level 2	Read/Write	OFF (0)	OFF (0)

No.	Parameter	Description	Level	Access	Values of CN71X315	Values of CN71X323
31	TIMER.TimerDwell4	Timer Dwell 4 Duration	Level 2	Read/Write	OFF (0)	OFF (0)
32	CTRL.ProportionalBand	Proportional Band	Level 2	Read/Write	NO (0)	NO (0)
33	CTRL.DerivativeTime	Intergral Time	Level 2	Read/Write	889	889
34	CTRL.LoopBreakTime	Derivative Time	Level 2	Read/Write	148	148
35	CTRL.LoopBreakTime	Loop Break Time	Level 2	Read/Write	OFF (0)	OFF (0)
36	INPUT.PVOffset	PV Offset	Level 2	Read/Write	0	0
37	COMMS.Address	Comms Address	Level 2	Read/Write	-	-
38	COMMS.Baud	Baud Rate	Level 2	Read/Write	-	-
39	INPUT.Type	Input Type	Level 2	Read Only	T028 (11)	T028 (11)
40	ACCESS.CustomerID	Customer ID	Level 1+2	Read Only	315	323

*Level 1+2 Read Only states that, Level 1 gives Read only access to user where as Level 2 gives Write access along with Read access.

**COMMS units only

Soft Start Timer

The timer is used to start a process at reduced power and/or reduced setpoint. It may be used where it is required to dry out a heater before applying full power, such as hot runner applications.

It is initiated by any one of the following:

- Switching on power;

- Pressing ▲ and ▼ together;

- Setting the parameter T.STAT to run;

- A command through serial communications;

- A logic input suitable configured.

When the timer status = run, the control output is limited to a reduced start up power until parameter SS.SP is exceeded. If the PV is already greater than SS.SP the reduced power limit is not applied and the timer times out.

When the timer status = reset, the control output is controlling at a level limited by the output high and low limits.

Soft Start Setpoint

A soft start timer is provided to control start-up of sensitive heaters. If these heaters are stressed by applying 100% power from cold they could be damaged. The soft start facility introduces a power limit until either the safe operating temperature (SS.SP) is reached or a time duration has elapsed (TIME).

The SS.SP is the threshold for the soft-start timer. If the PV is below this value at power up then the soft start timer is started.

Soft Start Power Limit

The soft start function limits the power delivered to the heater until it has warmed up. The SS.PWR is the power limit applied until the PV reaches the SS.SP or the timer has elapsed.
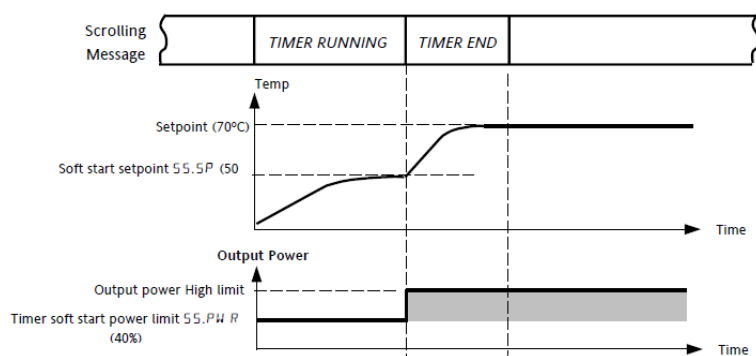
Delayed Switch On Timer

The timer is used to switch on the controller output power after a fixed length of time. It could be used to turn on a process at a particular time.

It is initiated by any of the following:

- Switching on power;

- Momentarily pressing ▲ and ▼ together;

- Setting the parameter T.STAT to run;

- A command through serial communications;

- A logic input suitably configured.

When the timer status = run, the control output is off.

When the timer status = reset, the control output is controlling.
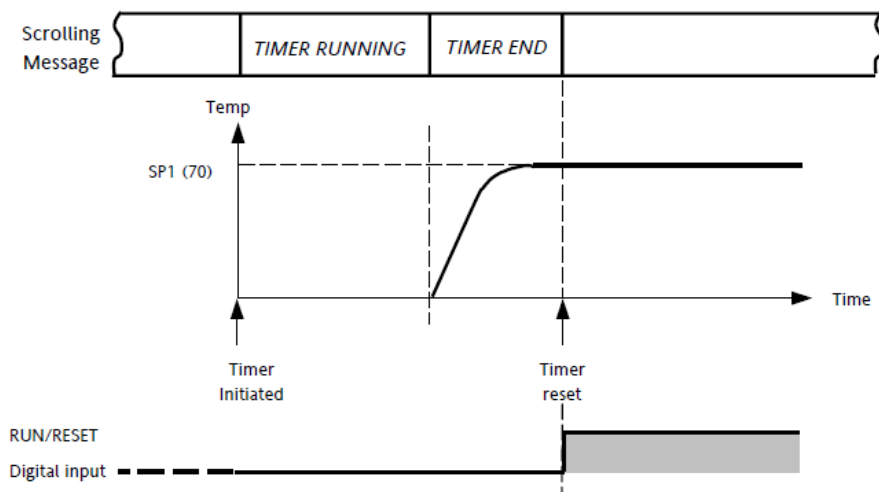
Timer Start Threshold

A single threshold value is available to provide a holdback on the entry to the dwell part of the ramp/dwell pair. It holds back the dwell until the PV has reached the band defined by +/- threshold around the PV. The timer starts timing when the temperature is within this threshold of the setpoint. This provides a guaranteed soak temperature. The threshold can be set to Off (0) in which the threshold is ignored and the timing starts immediately. Note that if a ramp rate is set, the ramp completes before timing starts.

To set the threshold value, press SCROLL ⟳ button until 'THRES' is displayed. ("THRES" can be accessed from Level 1 and Level 2). Press UP ▲ or DOWN ▼ button to adjust the value (In the example given below, the dwell periods will not start until the PV is within 5 units of the set point).
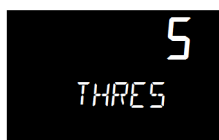
Timer as 8-Segment Programmer

A sample program profile of 3216c is shown in the diagram below. It is an 8 segment programmer consisting of four ramp/dwell pairs. Each ramp consists of a controlled rate of change of set point to a target level. Each ramp is followed by a dwell at that level. The ramp rate, target level and dwell time are set by the user.
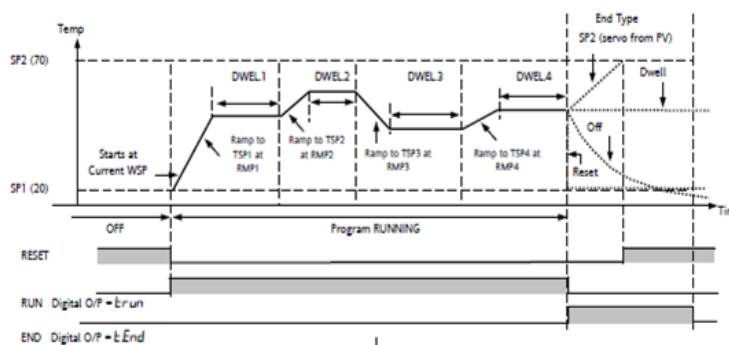
End Type parameter

The action which occurs at the end of program or in reset depends on the configuration of the **'END.T'** parameter. The **'END.T'** can be:

OFF : The heating is turned OFF.

dwEll : Controls at last program setpoint.

SP2 : Controls at setpoint 2 (When the timer completes the target setpoint will switch to setpoint 2. The setpoint 2 may be a lower or a higher temperature.).

rES : Reset on completion and reverts to SP1 or SP2, based on the setpoint selection.

SCROLL ⟳ through parameters in level 2 and set the required **'END.T'** by pressing ▲ or ▼.

To Configure the Programmer

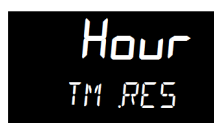1. Enter level 2 to configure the timer as a programmer. Press SCROLL ⟳ button to scroll through the list of parameters until **'TM.CFG'** is displayed. Now, press DOWN ▼ or UP ▲ button to select **'PROG'**.

2. To set the resolution, press SCROLL ⟳ button to select **'TM.RES'**. Press DOWN ▼ or UP ▲ button to set 'Hour or 'min' (In this example, the ramp rate and dwell period are set in hours).

3. Now set the threshold by pressing SCROLL ⟳ button to select **'THRES'**. Press UP ▲ or DOWN ▼ button to adjust the value (In this example, the dwell periods will not start until the PV is within 5 units of the set point).

```
     5
  THRES
```
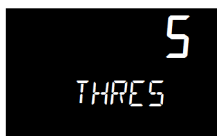
4. Now, set the action when the programmer times out. Press SCROLL ⟳ button to select **'END.T'** is displayed. Press UP ▲ or DOWN ▼ button to select 'Off or 'SP2' or 'Dwell' (This example uses 'dwEll' where the controller will continue to control indefinitely at the last set point. OFF will turn the output power off and SP2 will control at set point 2).

```
  dwEll
  END .T
```
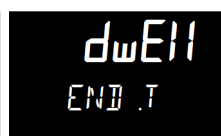
5. To set the first target set point, press SCROLL ⟳ button to select **'TSP.1'**. Press UP ▲ or DOWN ▼ button to adjust the value (In this example the set point will ramp from the current value of the PV to the first target 45°C).

```
    45
  TSP .1
```
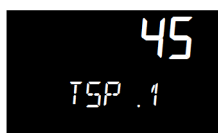
6. To set the first ramp rate, press SCROLL ⟳ button to select **'RMP.1'**. Press UP ▲ or DOWN ▼ button to adjust the value to 8. (In this example the set point will ramp to 45 at 8.0 units per hour).

```
   8.0
  RMP .1
```
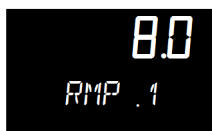
7. To set the first Dwell, press SCROLL ⟳ button to select **'DWEL.1'**. Press UP ▲ or DOWN ▼ button to adjust the value to 2:11. (In this example the set point will dwell at 45 for 2 hours 11 minutes).

```
  2:11
  DWEL .1
```
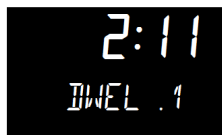
8. Now repeat the above three steps (5, 6 & 7) to set remaining all segments.

To Operate the Programmer

Operation	Action	Indication
To Run a program	Press and quickly release ▲ + ▼	Beacon RUN = On Scrolling display - TIMER RUNNING
To Hold a program	Press and quickly release ▲ + ▼	Beacon RUN = Flashing Scrolling display - TIMER HOLD
To Reset a program	Press and hold ▲ + ▼ for more than 1 second	Beacon RUN = Off If End Type = Off then OFF will be displayed at the end of the program
	Program ended	Beacon RUN = Off SPX On if End Type = SP2 Scrolling display – TIMER END

Programs can also be operated from the **'T.STAT'** parameter found in the level 1 parameter list.

hoLd
T.STAT
OR
rES
T.STAT
OR
run
T.STAT

NOTE

- The program ramp rate is designed to reduce the heating 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.

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

- When a step change is required, the ramp rate should be set to 'OFF'.

- Where ramp/dwell pairs are not required, the ramp rate should be set to 'OFF' and the target set point, TSP, the same as the preceding segment.

- TIMER END- when the end type is SP2, Timer END does not occur until the ramp is complete or SP2 is achieved. It is more usual to use a DWELL (default) or RESET end type.

- The program will start from the measured temperature. On recovery from power failure, the program will automatically run at the last ramp rate from the current measured temperature.

AUTO/MAN/OFF: (Auto/Manual/OFF Mode)

CAUTION : Thermo Fisher Scientific does not recommend to use controller in MANUAL mode or OFF mode, as Manual mode can damage the unit or cause over-heating without care or proper operation. If controller set as MANUAL mode operation, the end user must use a separate 'over-temperature' controller for safe operation of the unit.

Operation	Action	Indication
To change Auto to Manual model	Press and hold ▲ + ▼ for more than 3 seconds	Controller display Shows Auto mode as A-M.

Auto A-M OR **mAn** A-M MAN OR **OFF** A-M

1. AUTO: Ehen the controller is in the automatic mode the output automatically adjusts to keep the temperature or process value at the setpoint. Auto mode is also referred to as "closed loop" as the controller will use thermocouple temperature as feedback to control the furnace temperature.

2. MAN: Manual mode means that the controller output power can be adjusted directly by the user. The input sensor is still connected and reading the PV but the control loop is 'open'. In manual mode the MAN beacon will be lit, Band and deviation alarm are masked, the auto-tuning timer and programmer functions are disabled. The power output can be continuously increased or decreased using the up or down buttons.

3. OFF: Off mode means that the heating and cooling outputs are turned off. The process alarm and analogue retransmission outputs will however, still be active while Band and deviation alarm will be OFF.

5-Program 16-Segment Controller Operation

The 3216p temperature process controller is a single loop PID based controller that can store up to 5 programs with 16 segments each. This controller consists of microprocessor based three-mode PID (Proportional, Integral and Derivative), programmable temperature controller and appropriate output switching devices to control the furnace. The programmable controller can be used as a single set point controller or as a programmable 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. This 16 segment digital model can enable 16 segments in each program.

Some of the commonly used parameters in operator Level 1 and Level 2 of 3216p controller are:

Table :2 Parameter Description and Accessibility in 3216p

No.	Parameter	Description	Level	Access	Values of CN71X317	Values of CN71X326
1	PROGRAMMER.Status	Program Status	Level 1 + 2	Read/Write	RES (0)	RES (0)
2	PROGRAMMER.Remaining	Time Remaining	Level 2	Read Only	-	-
3	PROGRAMMER.Elapsed-Time	Elapsed Time	Level 2	Read Only	0	0
4	ALARM. 1. Thershold	Threshold	Level 1 + 2	Read/Write	50	50
5	ALARM. 2. Thershold	Threshold	Level 2	Read Only	1000	1118
6	SP.SPSelect	Active Setpoint Select	Level 2	Read/Write	SP1 (0)	SP1 (0)
7	SP.SP1	Setpoint 1	Level 1 + 2	Read/Write	0	0
8	SP.SP2	Setpoint 2	Level 2	Read/Write	0	0
9	SP.RampUnits	Setpoint Ramp Units	Level 1 + 2	Read/Write	MIN (0)	MIN (0)
10	SP.Rate	Setpoint Rate Limit Value	Level 1 + 2	Read/Write	OFF (0)	OFF (0)
11	CTRL.AutotuneEnable	Autotune Enable	Level 1 + 2	Read/Write	OFF (0)	OFF (0)
12	INPUT.Units	Display Units	Level 1 + 2	Read/Write	°C (0)	°C (0)
13	PROGRAMMER.Program-Number	Program to Recall	Level 1 + 2	Read/Write	1 (1)	1 (1)
14	PROGRAMMER.EndType	Program End Type	Level 1 + 2	Read/Write	DWEL (1)	DWEL (1)
15	PROGRAMMER.Holdback	Program Holdback	Level 1 + 2	Read/Write	OFF (0)	OFF (0)
16	PROGRAMMER.DwellUnits	Dwell Units	Level 2	Read/Write	MIN (1)	MIN (1)
17	PROGRAMMER.SP1	Program Target Setpoint 1	Level 2	Read/Write	0	0
18	PROGRAMMER.Ramp1	Program Ramp Rate 1	Level 2	Read/Write	OFF (0)	OFF (0)
19	PROGRAMMER.Dwell1	Program Dwell 1 Duration	Level 2	Read/Write	OFF (0)	OFF (0)
20	PROGRAMMER.SP2	Program Target Setpoint 2	Level 2	Read/Write	0	0
21	PROGRAMMER.Ramp2	Program Ramp Rate 2	Level 2	Read/Write	OFF (0)	OFF (0)
22	PROGRAMMER.Dwell2	Program Dwell 2 Duration	Level 2	Read/Write	OFF (0)	OFF (0)
23	PROGRAMMER.SP3	Program Target Setpoint 3	Level 2	Read/Write	0	0
24	PROGRAMMER.Ramp3	Program Ramp Rate 3	Level 2	Read/Write	OFF (0)	OFF (0)
25	PROGRAMMER.Dwell3	Program Dwell 3 Duration	Level 2	Read/Write	OFF (0)	OFF (0)
26	PROGRAMMER.SP4	Program Target Setpoint 4	Level 2	Read/Write	0	0
27	PROGRAMMER.Ramp4	Program Ramp Rate 4	Level 2	Read/Write	OFF (0)	OFF (0)
28	PROGRAMMER.Dwell4	Program Dwell 4 Duration	Level 2	Read/Write	OFF (0)	OFF (0)
29	PROGRAMMER.SP5	Program Target Setpoint 5	Level 2	Read/Write	0	0
30	PROGRAMMER.Ramp5	Program Ramp Rate 5	Level 2	Read/Write	OFF (0)	OFF (0)

No.	Parameter	Description	Level	Access	Values of CN71X317	Values of CN71X326
31	PROGRAMMER.Dwell5	Program Dwell 5 Duration	Level 2	Read/Write	OFF (0)	OFF (0)
32	PROGRAMMER.SP6	Program Traget Setpoint 6	Level 2	Read/Write	0	0
33	PROGRAMMER.Ramp6	Program Ramp Rate 6	Level 2	Read/Write	OFF (0)	OFF (0)
34	PROGRAMMER.Dwell6	Program Dwell 6 Duration	Level 2	Read/Write	OFF (0)	OFF (0)
35	PROGRAMMER.SP7	Program Traget Setpoint 7	Level 2	Read/Write	0	0
36	PROGRAMMER.Ramp7	Program Ramp Rate 7	Level 2	Read/Write	OFF (0)	OFF (0)
37	PROGRAMMER.Dwell7	Program Dwell 7 Duration	Level 2	Read/Write	OFF (0)	OFF (0)
38	PROGRAMMER.SP8	Program Traget Setpoint 8	Level 2	Read/Write	0	0
39	PROGRAMMER.Ramp8	Program Ramp Rate 8	Level 2	Read/Write	OFF (0)	OFF (0)
40	PROGRAMMER.Dwell8	Program Dwell 8 Duration	Level 2	Read/Write	OFF (0)	OFF (0)
41	CTRL.ProportionalBand	Proportional Band	Level 1+2	Read/Write	9	9
42	CTRL.InternalTime	Integral Time	Level 1+2	Read/Write	889	889
43	CTRL.DerivativeTime	Derivative Time	Level 1+2	Read/Write	132	148
44	CTRL.LoopBreakTime	Loop Break Time	Level 2	Read/Write	OFF (0)	OFF (0)
45	INPUT.PVOffset	PV Offset	Level 2	Read/Write	0	0
46	COMMS.Address	Comms Address	Level 2	Read/Write	1	1
47	COMMS.Baud	Baud Rate	Level 2	Read/Write	9600 (0)	9600 (0)
48	INPUTS.Type	Input Type	Level 2	Read Only	T028 (11)	T028 (11)
49	Customer ID	Customer ID	Level 1+2	Read Only	317	326

*Level 1+2 Read Only states that, Level 1 gives Read only access to user where as Level 2 gives Write access along with Read access.

**COMMS units only

Holdback Function

The temperature ramp rate of the program is quicker than the furnace can achieve. the program will wait until the temperature of the furnace catches up. e.g. If a holdback value of 10 is set and the program is set to ramp to a set point of 600°C, the program will reach 600°C, then go into an hold state; the hold indicator will light until the furnace or oven temperature reaches 590°C, the program will then continue to control again.

The holdback will only apply once per Segment, therefore when control has been reestablished, the holdback will not apply again to that segment, even if the furnace or oven temperature go outside the holdback band. Each program can have its own Holdback value assigned to it.

H.BACK can be accessed from Level 1 or Level 2. To set the holdback value:

1. Press SROLL ⟳ button until display reads, **"H.back"**.

```
      3
H .BACK
```

2. Press the UP ▲ or DOWN ▼ button to set holdback value or to turn off holdback function.

Creating a New Program or Editing an Existing Program

3216p is a 16 segment programmer consisting of eight ramp/ dwell pairs. Each ramp consists of a controlled rate of change of set point to a target level. Each ramp is followed by a dwell at that level. The ramp rate, target level and dwell time are set by the user.

The same steps are used when creating a new program and editing an existing program. A currently active program cannot be altered. Go into reset mode before starting to create or modify a program. Follow the steps below to create or edit a program.

1. **'PROG'** can be accessed from level 1or Level 2.

2. Press the SCROLL ⟳ button until you reach the program parameter **'PROG'**

```
      1
PROG
```

3. Press the UP ▲ or DOWN ▼ button to select a number for a new program or to edit an existing program. The scrolling display shows "CURRENT PROGRAM NUMBER".

```
      3
PROG
```

End Type parameter

The action which occurs at the end of program or in reset depends on the configuration of the **'END.T'** parameter. The **'END.T'** can be:

dwEll : Controls at last program setpoint.

SP2 : Controls at setpoint 2 (When the programmer completes the target setpoint will switch to setpoint 2. The setpoint 2 may be a lower or a higher temperature).

rES : Reset on completion and reverts to SP1 or SP2, based on the Setpoint selection.

Scroll ⟳ through parameters in Level 2 and set the required **'END.T'** by pressing ▲ or ▼.

```
dwEll        SP2         rES
END .T  OR   END .T  OR  END .T
```
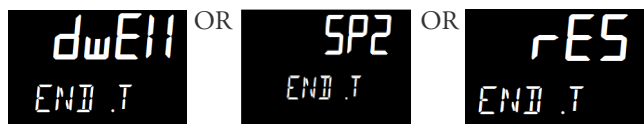
To Configure the Programmer

1. Enter level 2: refer to section "To Enter Level 2" for steps to enter Level 2.

2. To select the Programmer, press ⟳ as many times as necessary to view **'PROG'.**

```
   Hour
   TM.RES
```

3. To configure the first Program, press DOWN ▼ or UP ▲ to select program number **'1'.**

```
      1
   PROG
```
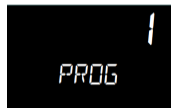
Similarly you can configure program (1, 2, 3, 4 or 5) for configuration.

4. To set the ramp unit, press SCROLL ⟳ button to select **'RAMP.U'** and then press DOWN ▼ or UP ▲ button to select **hour, min or sec** (In this example the ramp unit is set in min).

```
    min
   RAMP.U
```

5. To set the Dwell unit, press SCROLL ⟳ button to select **'DWEL.U'** and then Press ▼ or ▲ to select **hour or min** (In this example the dwell unit is set in min).

```
    min
   DWEL.U
```

6. To set the first Target Set point, press SCROLL ⟳ button to select **'TSP.1'**. Then Press DOWN ▼ or UP ▲ button to set the value.

```
     45
   TSP.1
```
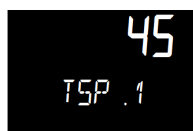
7. To set the first Ramp rate, press SCROLL ⟳ button to select **'RMP.1'**. Press DOWN ▼ or UP ▲ button to set the value.

```
    8.0
   RMP.1
```
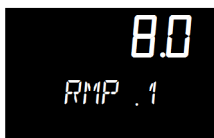
8. To set the first Dwell, press SCROLL ⟳ button to select **'DWEL.1'**. Press DOWN ▼ or UP ▲ button to set the value.

```
   2:11
   DWEL.1
```
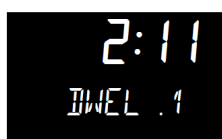
9. Now repeat the above three steps (6, 7 & 8) to set remaining all segments.

NOTE
- If not all the segments are used for a program, the Ramp & Dwell of each of the subsequent Segments should be set to OFF.

- A program will end in one of two ways, either revert to the control Set Point or dwell at the temperature set in the last segment used. When a program finishes on a dwell and the dwell time expires the temperature will revert to the control set point.

- Before running a program ensure that the control set point is set to Zero to avoid unexpected heating at the end of the program.

- When a Hold back is set, each segment used must have a Ramp Rate assigned to it, in order for it to be recognized by the program.

To Operate the Programmer

Operation	Action	Indication
To Run a program	Press and quickly release (▲) + (▼)	Beacon RUN = On Scrolling display - CURRENT PROGRAM STATE
To Hold a program	Press and quickly release (▲) + (▼)	Beacon RUN = Flashing Scrolling display - PROGRAM HOLD
To Reset a program	Press and hold (▲) + (▼) for more than 1 second	If program has ended then 'PROGRAM END' will be displayed at the end of the program

Programs can also be operated from the **'P.STAT'** parameter found in the level 1 parameter list.

hoLd
P .STAT   OR   rES
P .STAT   OR   run
P .STAT

NOTE

- The program ramp rate is designed to reduce the heating 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.

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

- When a step change is required, the ramp rate should be set to 'OFF'.

- Where ramp/dwell pairs are not required, the ramp rate should be set to 'OFF' and the target set point, TSP, the same as the preceding segment.

- END TYPE - when the end type is SP2, Timer END does not occur until the ramp is complete or SP2 is achieved. It is more usual to use a DWELL (default) or RESET end type.

Communication Option

The factory installed optional RS 485 Digital Communications Port allows controller to be connected to a PC for remote monitoring and control of the furnace. The equipment with communication option (COM) is equipped with two DB9 serial ports (1 Male port & 1 Female port). These ports are intended for connection to the PC or a Laptop & making a communication chain of furnace with communication option (COM) Capability. The RS 485 communication allows multiple devices (up to 30) to communicate at half-duplex on a single pair of wires, plus a ground wire..

NOTE The RS 485 pin should match with your DB9 to USB or 232 adapters for the communication option to work.

Furnace DB9-Pinout	RS 485 Output
Pin 2	A / D-
Pin 3	B / D+
Pin 5	Ground
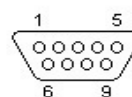
DB-9 Male   DB-9 Female
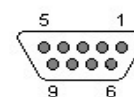
DB-9 Male   DB-9 Female

Adapters - RS 485 to RS 232/USB

The communication option requires an RS 485 to USB Adapter or RS 485 to RS 232 Adapter to for the furnace to communicate with the PC or Laptop. The RS 485 to USB or RS 485 to RS 232 adapter with terminal block is recommended for free wire connections. RS 485 adapter is suggested as pin connections vary with different adapter manufacturers and may not work properly if they don't match with the above DB9 pinout of the furnace.

NOTE Please ensure the adapter is compatible with the operating system of your PC/Laptop. Some adapter needs driver softwares & port access privileges on your PC/Laptop for proper functioning. Please contact your local IT for assistance.

RS 485 Pinout & Connections

The furnace is provided with a communication cable for connecting the furnace to the RS 485 adapter. The communication cable consists of DB9 connector at both ends. Use the accessory Cable # 7233 for serial communication.

> NOTE 7233
> Twenty five feet RS 485 cable and RS 232 converter for connection of furnace/control console RS 485 port to personal computer serial port.

Host Computer & Software

The host computer can communicate with furnaces with communication option (COM). A data logging & control software is required for data logging & control of the furnace using the RS 485 communication. Thermo Fisher Scientific does not provide any software - please refer to specialized software suppliers like SpecView or Eurotherm. These softwares can communicate with either a single Furnace or a network of severalFurnaces with the communication option.

3216c/p Controller Paremeters for Communication

Table :3   3216p Controller Parameters for Communication

Parameter	Value
Comms Module Identity	Comms (67)
Communications Protocol	Modbus
Communication Interface	RS 485
Baud Rate	9600_baud (0)
Parity	None
Comms Address	1

Troubleshooting Communications

If your connection is not working properly, check the following conditions:

a.   Verify complete and tight cable connections between the furnace and the PC.

b.   B. Verify that power has been supplied to the unit and temperature controller before starting the software program.

c.   Verify DB-9 pin connections as shown in wiring diagram, interchange 2 & 3 connections if communication is not working.

d.   Verify the configuration values in the controller, listed in the Table 4, "Controller Parameters for Communication".

Installation and Operation of Air Control

Models F30420-33-60-80, F30420C-60-80, F30428C-60-80, F30430CM-33-60, F30430CM- 60, F30438CM-60

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 for furnace temperatures less than 975°C, part number AY718X1 for furnace temperatures of 975°C or greater) 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.

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 40 psi is required.
NOTE	If the furnace is to be used regularly, the airline regulator may be left open to 30 psi.
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.

⚠ CAUTION — 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.

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.

- Use Hearth plate to elevate load when placing on bottom heating element. This prevents bottom heating element from overheating and burning out. (Part Numbers PHX1 & PHX2)

- 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.

Preventive Maintenance

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

⚠ **WARNING**	Refer servicing to qualified personnel.

⚠ **WARNING**	Replace fuses with same type and rating.

⚠ **WARNING**	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 preexisting 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).

⚠ **WARNING**	To avoid electrical shock, this furnace must always be disconnected from the power supply prior to maintenance and service. 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 screws and nuts on the terminals of the element to be replaced.

4. Open the door and pull the defective element out.

5. Slide the new element into place, threading the leads through the insulating porcelain bushing on the back of the furnace.

6. Cut off any excess lead wire. Be careful not to nick element lead wires. Reinstall terminal connections and tighten screws and nuts securely.

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 T/C lead wires).

3. Remove the screws on the thermocouple terminals and pull the thermocouple straight out.

4. Insert the new thermocouple into the furnace with colored beaded lead connected to the positive (+) marked terminal and other lead to negative (-) terminal.

5. Secure connections with screws removed earlier.

6. Replace the back terminal cover.

7. Reconnect the furnace to power supply.

8. Test operation of furnace.

To Replace Solid State Relay:

1. Disconnect furnace from power supply.

2. Remove the screws on the front dial and the screws on the lower back cover.

3. Remove the upper back cover.

4. Disconnect the element lead wires and one ground wire from back of furnace. Also, disconnect T/C lead wire from terminal block. (Note placement and connection of wires).

5. Slide control section forward and disconnect two wires from door switch. (Note placement and connection of wires).

6. Control section can now be removed from furnace housing.

7. Disconnect the wires from the relay and remove relay. (Note placement and connection of wires).

8. Install new relay.

9. Reverse steps 1-7 to reassemble furnace.

10. Test operation of furnace.

To Replace Door Switch (Microswitch)

1. Disconnect furnace from power supply.

2. Remove the screws on the front dial and the screws on the lower back cover.

3. Remove the upper back cover.

4. Disconnect the element lead wires and one ground wire from back of furnace. Also, disconnect the lead wire from terminal block (note placement and location of wires).

5. Slide the control section forward.

6. Disconnect the wires from the door switch. (Note connection and placement of wires to Microswitch).

7. Control section can now be removed from furnace housing.

8. Remove the two screws and nuts from the Microswitch.

9. Insert new Microswitch and secure with screws and nuts removed in Step 8.

10. Slide control section back and replace the wires on the door switch.

11. Reverse steps 2, 3, 4 and 5 to reassemble furnace.

12. Reconnect to power supply.

13. Test operation of door switch. (To realign door strike, see To Realign Door Strike).

To Realign Door Strike

1. Disconnect furnace from power supply.

2. Loosen the screws which retain the door strike on the bottom left side of the door.

3. Move the bracket closer to the furnace to make strike engage sooner. Move bracket further away to make strike engage later. (Lightly tighten screws between each adjustment to hold bracket while you test the strike.)

4. The door switch should click when the door is approximately 1" from being completely closed.

5. Tighten screws when bracket is positioned correctly.

6. Reconnect to power supply.

7. 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 Control Module

Gently pry the retaining tabs on both sides out, and then pull the control straight out of the sleeves. Install the new controller to the sleeve.

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 Causes	Corrective Action
Cycle light on the display 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.
	Door switch defective.	Realign door strike or replace door safety switch.
	Incorrect power source.	Check power source.
	Defective circuit breaker.	Replace circuit breaker.
The furnace does not heat.	No power.	Check power source and fuses or breakers.
	Defective electrical hookup.	Repair electrical hookup.
	Thermocouple has oxidized and opened the circuit.	Replace thermocouple.
	Controller malfunction.	Contact customer service.
	Two or more heating elements burned out.	Replace defective elements.
	Door switch malfunction.	Realign door strike or replace door safety switch.
	Defective safety relay.	Replace safety relay.
	Defective solid state relay (SSR).	Replace SSR.
Slow heatup.	Low line voltage.	Install line of sufficient size and proper voltage (Isolate furnace from other electrical loads).
	Heavy load in chamber.	Lighten load in chamber to allow heat to circulate.
	Wrong heating element.	Install proper element.
	One or more heating elements are burned out.	Replace burned out elements.
	Wired improperly.	Check wiring diagram for correct wiring of your furnace.

Door switch does not cut power to the furnace chamber.	Door switch is not functioning.	Realign door strike or replace door safety switch.
	Safety relay malfunction.	Replace safety relay.
Repeated element burnout.	Overheating furnace.	Do not exceed the maximum operating temperature of furnace or recommended continuous intermittent use values.
	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.
	Contamination present from previous burnout.	Clean and/or replace insulation material.
	Wired improperly.	Check wiring diagram for correct wiring of your furnace.
Inaccurate.	Oxidized or contaminated thermocouple.	Replace thermocouple.
	Poor thermocouple connections.	Tighten connections.
	Improper loading.	Use proper loading procedures.
	Poor ventilation of base.	Clear area around furnace base.
	Control out of calibration.	Contact customer service.

Eurotherm 3216p/c Controller Troubleshooting

Problem	Probable Causes	Corrective Action
Etun	Auto tune cannot be performed.	Check whether program or timer is running, If yes Turn off Programmer or Timer. Turn off Auto tune & Turn on again The error will be resolved, if still problem persist contact your supplier.
ECAL	Calibration error	Re-instate factory calibration.
E2.Er	EEPROM error	Return to factory for repair.
EE.Er	Non-vol memory error	Note the error and contact your supplier.
E.Lin	Invalid input type. This refers to custom linearization which may not have been applied correctly or may have been corrupted.	Return to factory for repair.
The controller displays do not illuminate.	The furnace is not connected to the power supply.	Check furnace connection to power source.
	Main switch is defective.	Replace power switch or controller.
	One of two circuit breakers is tripped.	If you find the breaker tripped first try to reset it by pressing the button in. If the breaker is not tripped and will not reset it should be replaced. Ensure both breakers are reset.

Replacement Parts List

Single Setpoint Models

F30420C, F30420C-33, F30428C

Part Number	Description	Quantity	Notes
CAX99	Line filter	1	All models
CA1249X1	Capacitor	1	All models
CN71X187	Controller	1	All models
EL412X1	Element (top)	1	208V model
EL412X2	Element (bottom)	'1	208V model
EL412X3	Element (side)	2	208V model
EL412X4	Element (top)	1	240 V model
EL412X5	Element (bottom)	1	240 V model
EL412X6	Element (side)	2	240 V model
FA1262X1	Fan	1	All models
PLX82	Pilot light	1	All models
RYX37	S.S. relay	1	All models
RYX62	Mechanical relay	1	All models
SWX103	Circuit breaker	1	All models
SWX143	Power switch	1	All models
SWX163	Door switch	1	All models
TC412X1A	Thermocouple	1	All models
TRX96	Terminal block	1	All models
TRX178	Terminal block	1	All models

8 Segment Programmable Models with OTP

F30420C-33-80, F30420-33-60-80, F30420C-60-80, F30420C-80, F30428C-60-80, F30428C-80

Part Number	Description	Quantity	Notes
CAX98	Line Filter	1	All models
CA1249X1	Capacitor	1	All models
CN71X323	Controller	1	F30420C-33-80, F30420C-80, F30428C-80
CN71X315	Controller	1	F30420-33-60-80, F30420C-60-80, F30428C-60-80
EL412X1	Element (top)	1	208V model
EL412X2	Element (bottom)	1	208V model
EL412X3	Element (side)	2	208V model
EL412X4	Element (top)	1	240V model
EL412X5	Element (bottom)	1	240V model
EL412X6	Element (side)	2	240V model
FA1262X1	fan	1	All models
SWX103	Circuit breaker	1	All models
PLX82	Pilot light	1	All models
RYX37	S.S. relay	1	All models
RYX62	Mechanical relay	1	All models
SWX143	Power switch	1	All models
SWX163	Door switch	1	All models
TC412X1A	Thermocouple	1	All models
TRX96	Terminal block	1	All models
TRX178	Terminal block	1	All models

5X16 Segment Programmable Models with OTP

F30430CM, F30430CM-33, F30430CM-33-60, F30430CM-60, F30438CM, F30438CM-60

Part Number	Description	Quantity	Notes
CAX99	Line Filter	1	All models
CA1249X1	Capacitor	1	All models
CN71X326	Controller	1	F30430CM,F30430CM-33, F30438CM
CN71X317	Controller	1	F30430CM-33-60, F30430CM-60, F30438CM-60
EL412X1	Element (top)	1	208V model
EL412X2	Element (bottom)	1	208V model
EL412X3	Element (side)	2	208V model
EL412X4	Element (top)	1	240V model
EL412X5	Element (bottom)	1	240V model
EL412X6	Element (side)	2	240V model
FA1262X1	fan	1	All models
SWX103	Circuit breaker	1	All models
PLX82	Pilot light	1	All models
RYX37	S.S. relay	1	All models
RYX62	Mechanical relay	1	All models
SWX143	Power switch	1	All models
SWX163	Door switch	1	All models
TC412X1A	Thermocouple	1	All models
TRX96	Terminal block	1	All models
TRX178	Terminal block	1	All models

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 800-438-4851.
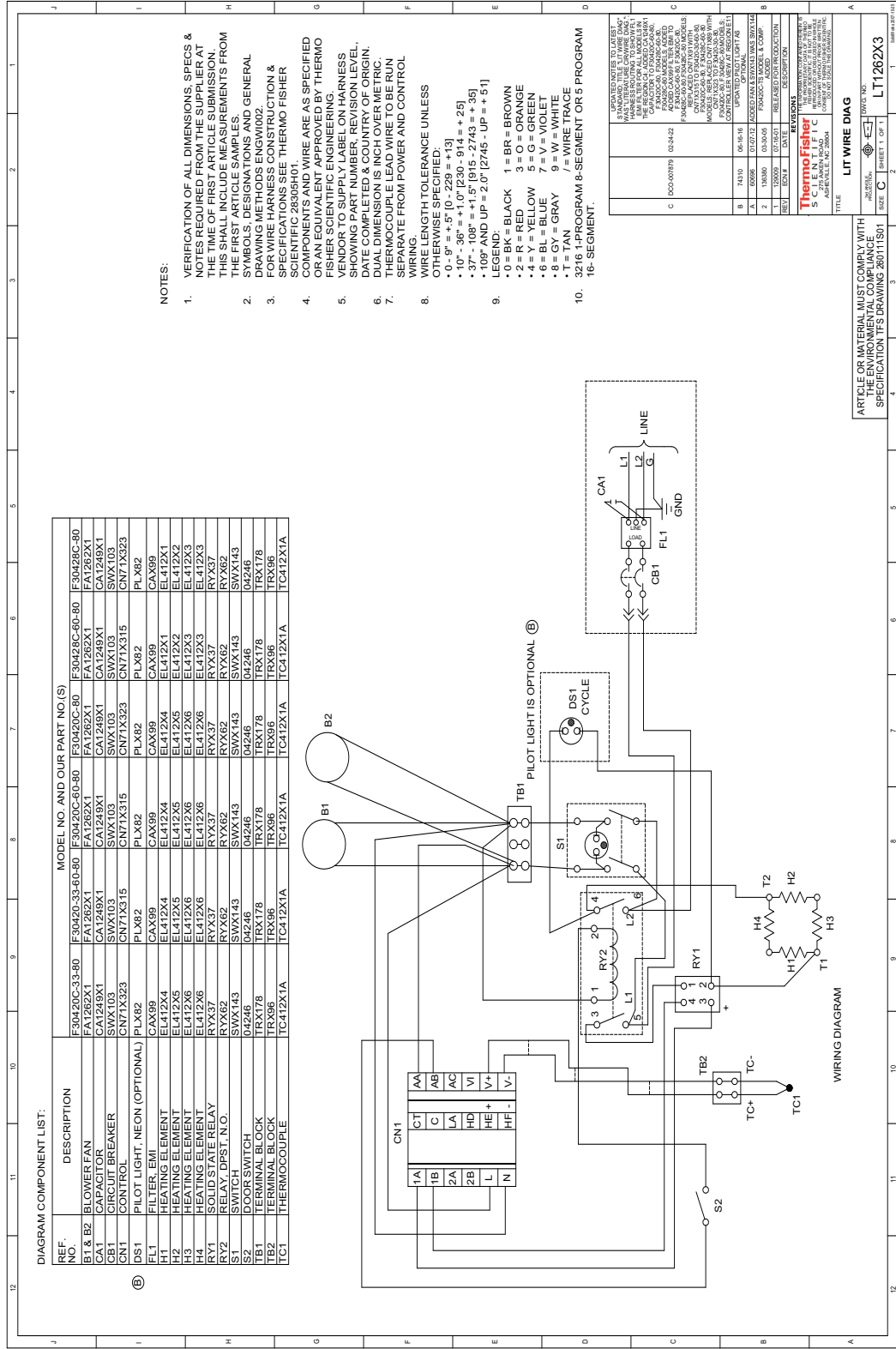
Prior to returning any materials, please contact our Customer Service Department for a "Return Materials Authorization" number (RMA). Material returned without an RMA number will be refused.
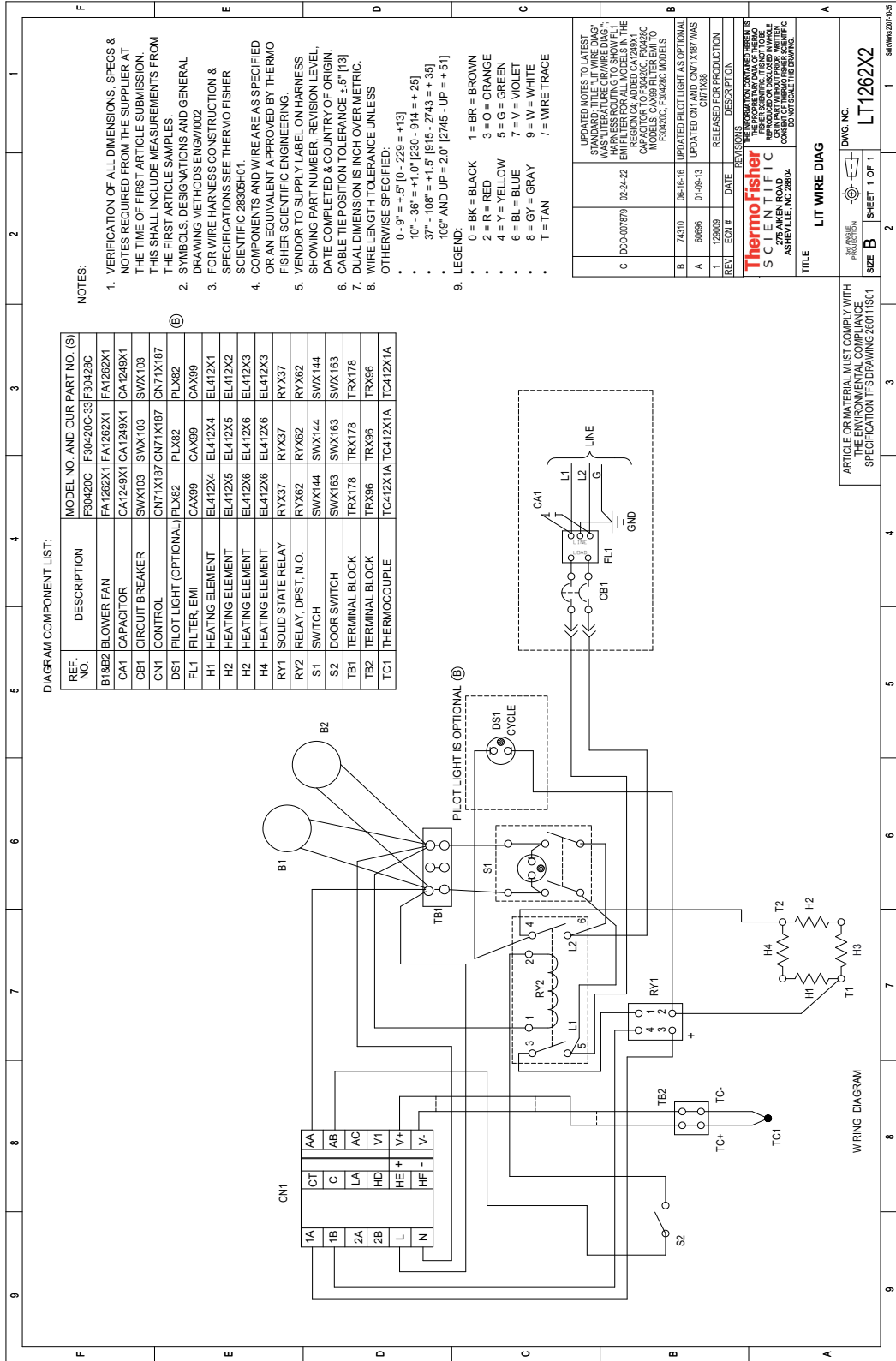
17

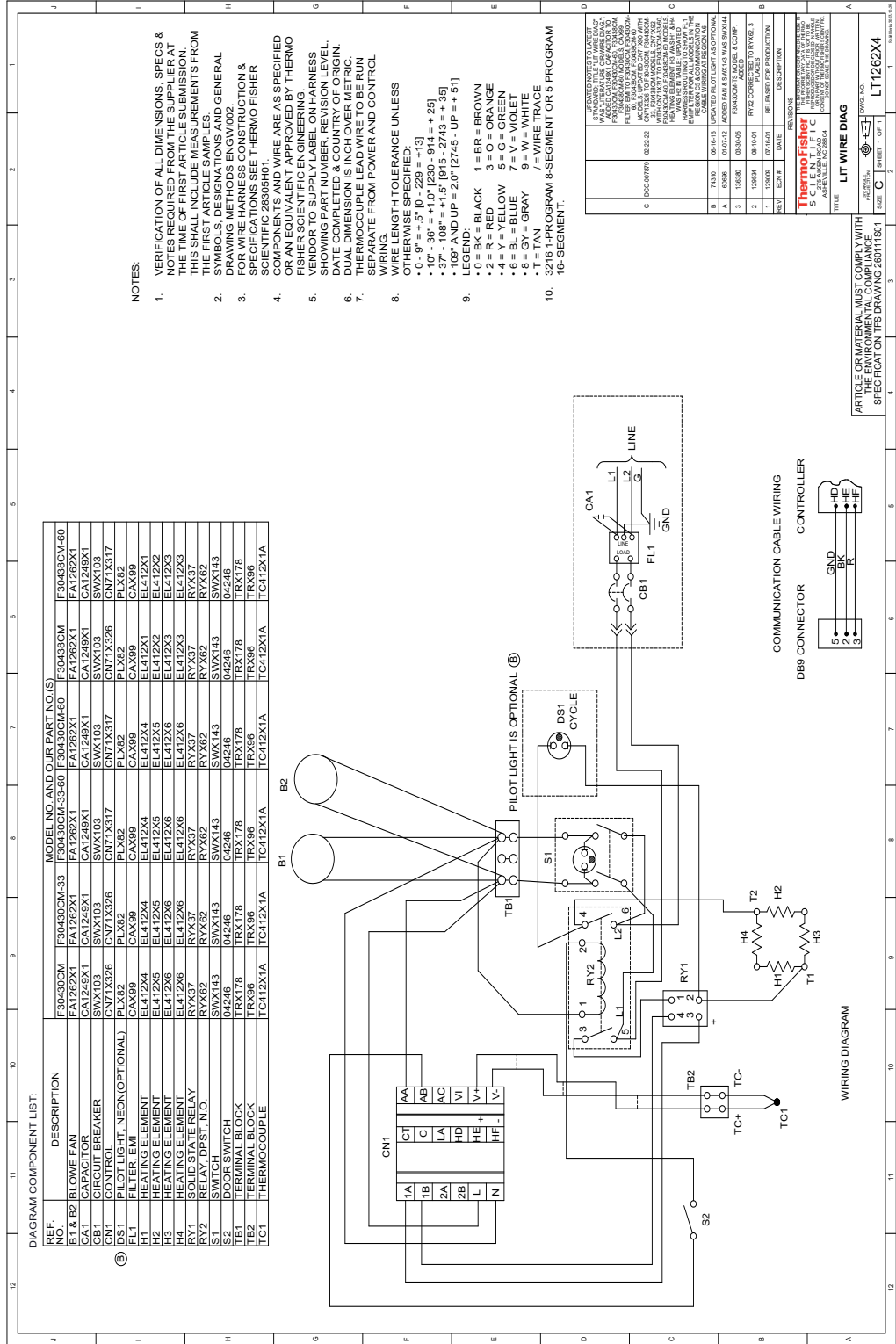# Wiring Diagrams

Contents

Single setpoint control

Segment programmable control

5X16 segment programmable control

Regulatory Compliance

Product Safety

This product family has been tested to all applicable US and Canadian product standards by CSA, a Nationally Recognized Test Laboratory (NRTL).

Electromagnetic Compatibility

FCC Statement (USA)

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Canadian ISED IC Notice

This ISM digital apparatus complies with Canadian ICES-001.

Cet appareil ISM est conforme á la norme NMB-001 du Canada

Evaluation of Chemicals - Regulations and Directives

Proposition 65

WARNING: This product can expose you to chemicals including refractory ceramic, refractory ceramic fiber or fiberglass insulation, and crystalline silica which are known to the State of California to cause cancer and/or silicosis. For more information go to www.P65Warnings.ca.gov.

Additional Regulations & Markings

European Union (-33)

The European voltages of this product meets all the applicable requirements of the European Directives and display the CE Marking. These Directives include thosecaptured in more detail in the sections below, as well as any listed in the EU Declarationof Conformity. The most current EU Declaration of Conformity may be obtained fromthe manufacturer.

EMC Directive - compliance with all applicable EMC standards has been completed and documented in the product technical file.

Low Voltage Directive - compliance with all applicable Product Safety standards has been completed and documented in the product technical file.

REACH - Europe

We are committed to meeting all compliance obligations to evaluate, communicate, and register any Substances of Very High Concern (SVHC), and finding alternates where appropriate.

RoHS - Europe

We are determined to reduce the impact we have on the environment, and so can declare that this product fully complies with the European Parliament's RoHS2 (Restriction of Hazardous Substances) Directive 2011/65/EU, with respect to all the following substances:

- Lead (0.1 %)
- Mercury (0.1 %)
- Cadmium (0.01 %)
- Hexavalent chromium (0.1 %)
- Polybrominated biphenyls (PBB) (0.1 %)
- Polybrominated diphenyl ethers (PBDE) (0.1 %)

2015/863 Annex II (RoHS3, In effect after July 22, 2019)

- Bis(2-ethylhexyl) phthalate (DEHP) (0.1 %)
- Butyl benzyl phthalate (BBP) (0.1 %)

- Dibutyl phthalate (DBP) (0.1 %)

- Diisobutyl phthalate (DIBP) (0.1 %)

Our compliance is witnessed by written declaration from our suppliers and/or component testing. This confirms that any potential trace contamination levels of the substances listed above are below the maximum level set by the latest regulations or are exempt due to their application.

WEEE Compliance

WEEE Compliance. This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2012/19/EU. It is marked with the following symbol. Thermo Fisher Scientific has contracted with one or more recycling/disposal companies in each EU Member State, and this product should be disposed of or recycled through them. Further information on our compliance with these Directives, the recyclers in your country, and information on Thermo Scientific products which may assist the detection of substances subject to the RoHS Directive are available at www.thermofisher.com/WEEERoHS.

WEEE Konformittät. Dieses Produkt muss die EU Waste Electrical & Electronic Equipment (WEEE) Richtlinie 2012/19/EU erfüllen. Das Produkt ist durch folgendes Symbol gekennzeichnet. Thermo Fisher Scientific hat Vereinbarungen getroffen mit Verwertungs-/Entsorgungsanlagen in allen EU-Mitgliederstaaten und dieses Produkt muss durch diese Firmen widerverwetet oder entsorgt werden. Mehr Informationen über die Einhaltung dieser Anweisungen durch Thermo Scientific, dieVerwerter und Hinweise die Ihnen nützlich sein können, die Thermo Fisher Scientific Produkte zu identizfizieren, die unter diese RoHS. Anweisungfallen, finden Sie unter www.thermofisher.com/WEEERoHS.

Conformità WEEE. Questo prodotto deve rispondere alla direttiva dell' Unione Europea 2012/19/EU in merito ai Rifiuti degli Apparecchi Elettrici ed Elettronici (WEEE). È marcato col seguente simbolo.Thermo Fischer Scientific ha stipulato contratti con una o diverse società di riciclaggio/smaltimento in ognuno degli Stati Membri Europei. Questo prodotto verrà smaltito o riciclato tramite queste medesime. Ulteriori informazioni sulla conformità di Thermo Fisher Scientific con queste Direttive, l'elenco delle ditte di riciclaggio nel Vostro paese e informazioni sui prodotti Thermo Scientific che possono essere utili alla rilevazione di sostanze soggette alla Direttiva RoHS sono disponibili sul sito www.thermofisher.com/WEEERoHS.

Conformité WEEE. Ce produit doit être conforme à la directive euro-péenne (2012/19/EU) des Déchets d'Equipements Electriques et Electroniques (DEEE). Il est marqué par le symbole suivant. Thermo Fisher Scientific s'est associé avec une ou plusieurs compagnies de recyclage dans chaque état membre de l'union européenne et ce produit devraitêtre collecté ou recyclé par celles-ci. Davantage d'informations sur laconformité de Thermo Fisher Scientific à ces directives, les recycleurs dans votre pays et les informations sur les produits Thermo Fisher Scientific qui peuvent aider le détection des substances sujettes à la directive RoHS sont disponibles sur www.thermofisher.com/WEEERoHS.
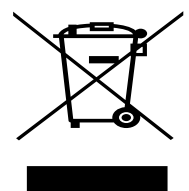
Great Britain
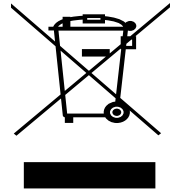
Deutschland

Italia

France

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

Thermo Fisher Scientific Inc.

275 Aiken Road
Asheville, NC 28804
United States

www.thermofisher.com

LT1262X1 Rev. J

thermoscientific

Contact Us
North America: 866-984-3766
Europe: France +33 2 2803 2180   Germany +49 9184 90 9640   UK/Ireland + 44 870 609 9203
Asia: China +86 21 6865 4588   India 1800 22 8374   Japan +81 45 453 9220