Class "100" Clean Room Ovens

Operating Manual and Parts List LT1476X7 Rev. 0

Thermo
SCIENTIFIC

Models covered in this manual			
Models	**Size**	**Voltage**	**With HEPA Filter**
3490M (6879)	2.6 cu ft	120V	
3490M-1 (6880)	2.6 cu ft	240V	
3492M (6881)	2.6 cu ft	120V	
3492M-1 (6882)	2.6 cu ft	240V	
3494M-1 (6883)	2.6 cu ft	240V	
3495M-1 (6884)	3.6 cu ft	240V	
3496M-1 (6885)	2.8 cu ft	240V	X
3497M-1 (6886)	2.8 cu ft	240V	X
3498M-1 (6887)	4.6 cu ft	240V	
3499M-1 (6888)	4.6 cu ft	240V	

MANUAL NUMBER LT1476X7 (7006879)

0	--	6/4/10	Transfer to Marietta (was LT1476X7 5/30/08)	ccs
REV	**ECR/ECN**	**DATE**	**DESCRIPTION**	**By**

CAUTION
Contains Parts and Assemblies
Susceptible to Damage by
Electrostatic Discharge (ESD)

Important Read this instruction manual. Failure to read, understand and follow the instructions in this manual may result in damage to the unit, injury to operating personnel, and poor equipment performance. ▲

Caution All internal adjustments and maintenance must be performed by qualified service personnel. ▲

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Important operating and/or maintenance instructions. Read the accompanying text carefully.

Potential electrical hazards. Only qualified persons should perform procedures associated with this symbol.

Equipment being maintained or serviced must be turned off and locked off to prevent possible injury.

Hot surface(s) present which may cause burns to unprotected skin, or to materials which may be damaged by elevated temperatures.

Marking of electrical and electronic equipment, which applies to electrical and electronic equipment falling under the Directive 2002/96/EC (WEEE) and the equipment that has been put on the market after 13 August 2005.
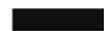
This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96/EC. It is marked with the WEEE symbol. Thermo Fisher Scientific has contracted with one or more recycling/disposal companies in each EU Member State European Country, and this product should be disposed of or recycled through them. Further information on Thermo's compliance with this directive, the recyclers in your country and information on Thermo products will be available at www.thermofisher.com.

✔ Always use the proper protective equipment (clothing, gloves, goggles, etc.)

✔ Always dissipate extreme cold or heat and wear protective clothing.

✔ Always follow good hygiene practices.

✔ Each individual is responsible for his or her own safety.

Do You Need Information or Assistance on
Thermo Scientific Products?

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1-740-373-4763	Direct
1-800-438-4851	Toll Free, U.S. and Canada
1-877-213-8051	FAX
http://www.thermoscientific.com	Internet Worldwide Web Home Page
service.led.marietta@thermofisher.com	Service E-Mail Address

Our **Sales Support** staff can provide information on pricing and give you quotations. We can take your order and provide delivery information on major equipment items or make arrangements to have your local sales representative contact you. Our products are listed on the Internet and we can be contacted through our Internet home page.

Our **Service Support** staff can supply technical information about proper setup, operation or troubleshooting of your equipment. We can fill your needs for spare or replacement parts or provide you with on-site service. We can also provide you with a quotation on our Extended Warranty for your Thermo Scientific products.

Whatever Thermo Scientific products you need or use, we will be happy to discuss your applications. If you are experiencing technical problems, working together, we will help you locate the problem and, chances are, correct it yourself...over the telephone without a service call.

When more extensive service is necessary, we will assist you with direct factory trained technicians or a qualified service organization for on-the-spot repair. If your service need is covered by the warranty, we will arrange for the unit to be repaired at our expense and to your satisfaction.

Regardless of your needs, our professional telephone technicians are available to assist you Monday through Friday from 8:00 a.m. to 6:00 p.m. Eastern Time. Please contact us by telephone or fax. If you wish to write, our mailing address is:

Thermo Fisher Scientific
401 Millcreek Road, Box 649
Marietta, OH 45750

International customers, please contact your local Thermo Scientific distributor.

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Section 1 Description

This advanced series of Ultra-Clean 100 ovens incorporates programmer-controller which can be conveniently and easily operated by the user from a front panel keyboard. Mnemonics in the display area of the programmer-controller keeps the user informed of the parameters which are being acted upon. An additional option allows the unit to be operated in either automatic or manual mode.

Mechanical air circulation provides optimum temperature uniformity and rapid recovery after door openings.

Two systems protect oven contents against overheating. An alarm setpoint programmed in the controller initiates a visual signal in the event the actual temperature exceeds the limit. In addition, a second system is an independent hydraulic thermostat set by the operator to a temperature slightly higher than the maximum operating temperature. This thermostat is a mechanical backup to protect contents in the unlikely event the programmer-controller experiences a failure. A red status lamp warns of the overtemperature condition.

Section 2 **Safety Information**

Your Thermo Scientific Class "100" Clean Room Oven has been designed with function, reliability, and safety in mind. It is your responsibility to install it in conformance with local electrical codes. It is most important that the user follow installation instructions exactly as written. Failure to do so is likely to lead to improper operation, erroneous calibrations and possible damage to the equipment. Do not attempt operation without this information.

Section 3 **Specifications**

Power Requirements

All models accept 50 Hz or 60 Hz current.

Model	Volts AC	Watts	Amps	Heaters
3490M, 3492M	120	1900	15.8	2
3490M-1, 3492M-1	220/240	1900	7.9	2
3494M-1, 3495M-1	220/240	3100	12.9	2
3496M-1, 3497M-1	220/240	3100	12.9	2
3498M-1, 3499M-1	220/240	3100	12.9	2

Temperature Range

Slightly above ambient to +250°C.

Temperature Control

Model	@100°C	@200°C
3490M, -1, 3492M-1	±0.1°C	±0.2°C
3494M-1, 3495M-1	±0.1°C	±0.2°C
3496M-1, 3497M-1	±0.2°C (@90°C)	
3498M-1, 3499M-1	±0.1°C	±0.2°C

Temperature Uniformity

Model	@100°C	@200°C
3490M, -1, 3492M-1	±1.0°C	±2.0°C
3494M-1, 3495M-1	±1.0°C	±2.0°C
3496M-1, 3497M-1	±1.5°C (@90°C)	
3498M-1, 3499M-1	±1.0°C	±2.0°C

Temperature Rise Times

3490M, -1, 3492M-1 . . . . .22.0 minutes

3494M-1, 3495M-1 . . . . .18.0 minutes

3496M-1, 3497M-1 .1.0 minutes (ambient to 90°C)

3498M-1, 3499M-1 . . . . .20.5 minutes

Temperature Recovery Time of Load

3490M, -1, 3492M-1 . . . . .8 minutes

3494M-1, 3495M-1 . . . . .4 minutes

3496M-1, 3497M-1 . . . . .11 minutes

   (@90°C: after 1 min., door opening of 90 degrees)

3498M-1, 3499M-1 . . . . .7 minutes

Method

Door open 90° for 1 minute. Oven loaded with 9, 4" wafer boats filled
with wafers and evenly distributed in the oven. A thermocouple measured
wafer temperature in the center wafer boat. Time recorded equals elapsed
time for wafer temperature to reach 90% of setpoint (150°C).

Note Performance measured under controlled laboratory conditions. Your
oven's performance may be slightly different, depending on application. ▲

Dimensions
3490M, -1, 3492M-1
Interior: 13"W x 18"D x 19-1/2"H (33 x 46 x 50 cm)
Exterior : 21-5/8"W x 24-1/4"D x 35"H (55 x 62 x 89 cm)
Capacity: 2.6 cubic feet
3494M-1, 3495M-1
Interior: 18"W x 18"D x 19-1/2"H (46 x 46 x 50 cm)
Exterior: 26-5/8"W x 24-1/4"D x 35"H (68 x 62 x 89 cm)
Capacity: 3.6 cubic feet

Dimensions (continued)

3496M-1, 3497M-1

Interior: 14"W x 18"D x 19-1/2"H (36 x 46 x 50 cm)

Exterior: 26-5/8"W x 24-1/4"D x 35"H (68 x 62 x 89 cm)

Capacity: 2.8 cubic feet

3498M-1, 3499M-1

Interior: 23"W x 18"D x 19-1/2"H (58 x 46 x 50 cm)

Exterior: 31-5/8"W x 24-1/4"D x 35"H (80 x 62 x 89 cm)

Capacity: 4.6 cubic feet

Weight (net)

3490M, -1, 3492M-1: 180 lbs. (81.8 kg)

3494M-1, 3495M-1: 220 lbs. (100.0 kg)

3496M-1, 3497M-1: 202 lbs. (91.8 kg)

3498M-1, 3499M-1: 234 lbs. (106.4 kg)

Environmental Conditions

Pollution Degree: 2

Installation Category: II

Altitude: 2000 meters MSL (mean sea level)

Humidity: 80% maximum, non-condensing

Electrical supply: 120VAC or 240VAC

Voltage tolerance: ±10% of normal rated line

Temperature: 15°C to 40°C

Product usage: This product is intended for use indoors only.

Section 4 **Unpacking and Installation**

The shipping carton should be inspected upon delivery. When received, carefully examine for any shipping damage before unpacking. If damage is discovered, the delivering carrier should both specify and sign for the damage on your copy of the delivery receipt.

Open the carton carefully making certain that all parts are accounted for before packaging materials are discarded. After unpacking, if damage is found, promptly report it to the carrier and request a damage inspection promptly.

Important Failure to request an inspection of damage within a few days after receipt of shipment absolves the carrier from any liability for damage. Call for a damage inspection promptly.

BE ADVISED: Ovens must be cleaned and baked-out prior to use in clean rooms.

Note Disconnect unit from the power source when not in use. ▲

Location

Place the oven where it is to be operated, in an area away from drafts. Provide enough clearance to allow free air movement around the oven. Leave clearance at the rear for gas connection and adjustment of air vent. Position the unit with room for 90° of door opening to the right. The oven must not be placed on a combustible surface.

Stacking Units

Warning These ovens should not be placed one on top of the other because:

1) There is danger of the oven on top being accidentally knocked over with possibility of serious injury and property damage;
2) Heat from oven below can damage control panel components of oven above with possible resulting electrical short and fire.

To arrange ovens vertically, order optional space saver stacking rack (Model 3480-2). ▲

Leveling

The oven should be level, though its operation does not depend on this. Do not remove the oven's rubber feet - they are necessary for proper ventilation; removing the rubber feet may also cause erratic temperature control and damage to the electronic components.

Shelf Installation

Install shelf guides in desired locations along the inside sides of the oven. Make sure the pair of guides for each shelf are at the same level. Each guide has 2 sets of tabs. Insert the top tabs first, then the bottom tabs. Slide shelves into place.

Cleaning

The following procedure is based on test information and a survey of methods currently used by microchip manufacturers.

- The person cleaning the oven prior to clean room use should wear disposable polyethylene gloves to prevent skin oils from contaminating the oven surfaces.

- Use a lint-free soft paper manufactured for clean room maintenance.

- Remove shelves, floor and inside side walls from oven and clean thoroughly. Clean interior chamber, including heaters, blower wheel and, very gently, the sensor tube.

- Move the oven into the clean room and follow installation procedures, noting that it must be cleaned AGAIN before use.

Baking-Out the Oven

After installing the shelves, bake the empty oven with a steady air exchange until particle count is reduced to an acceptable level. For working temperatures about 200°C, bake 2 to 3 hours at 200°C.

Electrical Power

Turn the power switch (on the left side of the front panel) to OFF-the bottom half of the rocker pushed in. Plug the oven into an electrical outlet providing the power that is specified on the oven nameplate.

Gas Connection

Inert gas, such as nitrogen, can be injected into the chamber to flush out impurities. The gas inlet, on the back of the oven, is a 1/8-inch NPT pipe. Connect Tygon® R-3603 tubing to this pipe and to the dual regulator on the gas source. Leave the gas turned off until the oven is being operated.

If the oven is to be operated without gas, keep the inlet capped-DO NOT USE THE PLASTIC SHIPPING CAP.

Warning Inject only an inert gas into the oven. The use of any other type gas may lead to fire or explosion and serious injury or death and property damage. ▲

Door Adjustment

During shipping, the oven door may have been knocked out of line. The following procedure will correct door-to-body and door-to-gasket misalignment.

1. Lay the unit on its back. If exhaust and purging ports are fitted, support the unit on 2' x 4's to protect these components.

2. Remove the pivot bolt and flat washer from the top door hinge.

3. Unlatch the door handle to release the door, then slide the door out and off the bottom hinge pivot bolt to gain access to hinge screws.

4. Slightly loosen hinge screws on top and bottom hinges, so hinges require firm hand pressure to reposition. DO NOT REMOVE HINGE SCREWS - complete removal of screws will make it extremely difficult to reassemble the hinge.

5. Replace the door on the bottom hinge pin and fit the door in place. Loosen the bottom hinge pivot bolt with an open-end wrench. Replace the top hinge pivot bolt and set it to be finger-tight.

6. Align the door to the body-top, bottom and sides.

7. Remove the top hinge pivot-bolt again, noting the position of properly aligned hinges. Remove the door carefully without moving the hinges out of position.

8. Tighten all hinge screws VERY securely.

9. Replace door on bottom hinge pivot bolt. Replace the top pivot bolt and washer. Tighten top and bottom hinge pivot bolts VERY securely to maintain proper alignment.

Latch Adjustment - Door Against Gasket

If the door does not fit snug against the gasket, follow the procedure below to adjust latch.

1. Open the door. Use a 5/64" Allen wrench to remove the Allen setscrew from the door strike assembly.

2. Rotate the catch mechanism clockwise to shorten length and thereby bring door closer to body of oven. The number of turns will have to be estimated.

3. Re-insert and tighten the Allen setscrew securely.

4. Repeat this procedure as necessary to achieve a tight seal.

Latch Adjustment - Door Hard to Open

If the door is too hard to open, follow the procedure below to adjust the latch.

1. Open the door. Use 5/64" Allen wrench to remove the Allen setscrew from the door strike assembly.

2. Rotate catch mechanism counterclockwise to increase length and, thereby, position door a little farther away from the body of the oven. The number of turns will have to be estimated. Reinsert and tighten Allen setscrew securely.

3. Repeat if necessary to achieve satisfactory operation.
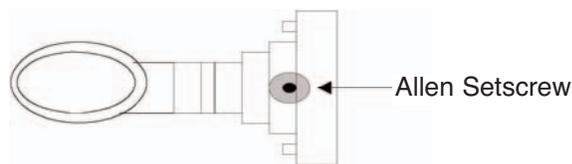
Figure 4-1. Door Strike Mechanism

Latch Adjustment - Heating Door Opens

If the door opens while oven is heating, follow the procedure below to adjust the latch. The door will have to be adjusted to close more easily to allow for the expansion occurring during heating.

1. Open the door. Use 5/64" Allen wrench to remove the Allen setscrew from the door strike assembly.

2. Rotate catch mechanism counterclockwise to increase length and, thereby, position door a little farther away from the body of the oven. The number of turns will have to be estimated. Re-insert and tighten Allen setscrew securely.

3. Repeat if necessary to achieve satisfactory operation.

Depending on operating temperature, the procedure may have to be repeated to ensure proper door operation.

Section 5 **Features**
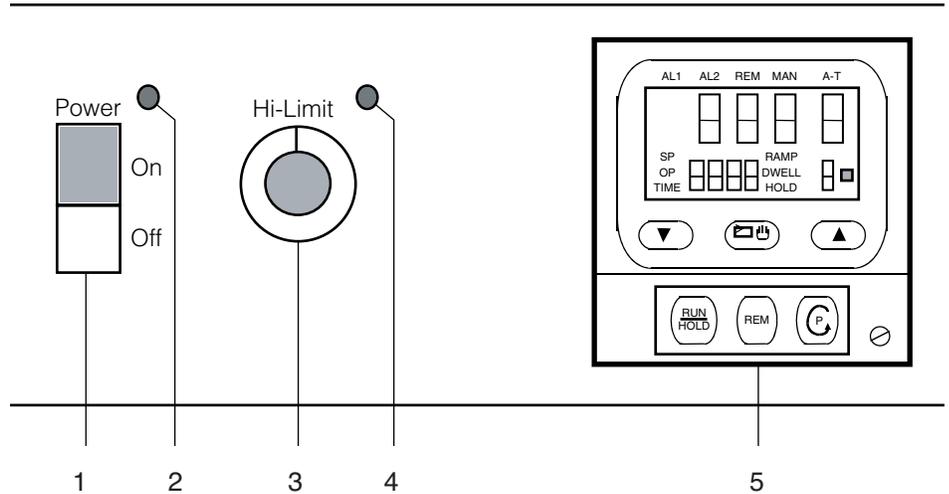
Figure 5-1. Control Panel

Control Panel

1. Power Switch: Turns all power to the unit on or off.

2. Power Switch Status Lamp: When power is on, this green lamp is lit.

3. Hi-Limit Thermostat: This hydraulic type thermostat provides mechanical overtemperature back-up control if the temperature programmer-controller should fail.

4. Hi-Limit Thermostat Status Lamp: When lit, this red lamp signals that the temperature is exceeding the hi-limit setpoint established by the user.

5. Programmer-Controller: 4-button operation controller allows user to set and control operating temperature and program ramp-to-setpoint procedures (operating details follow in the upcoming OPERATION section).

Section 6 8 Segment & 4x16 Segment Programmable Models

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

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

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

Note Once the desired parameter has been selected, depressing either the UP or DOWN button will change the parameter value. In all cases, the value shown on display is the current working value of that parameter. ▲
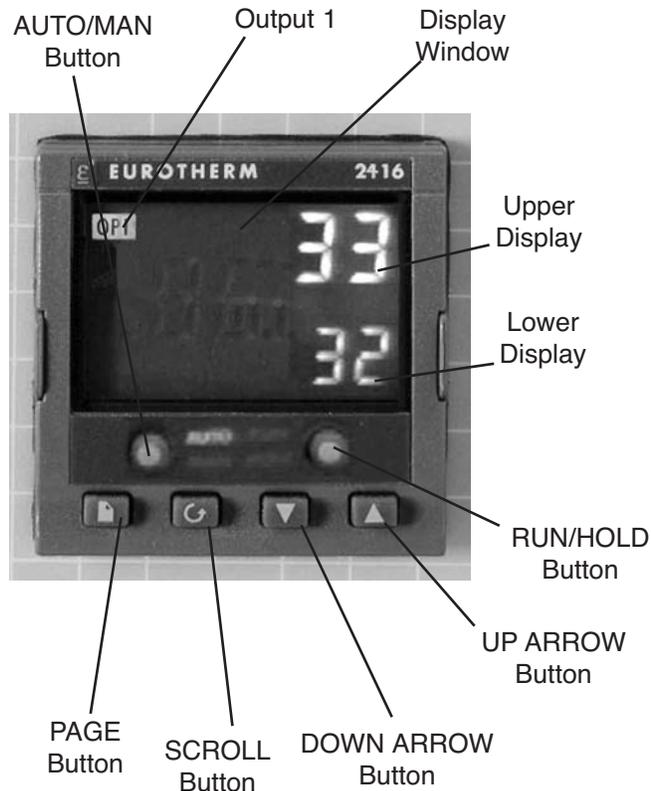
Figure 6-1. 4x16 & 8 Segment Programmable Models with OTP

Basic Operation

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

To Change the Setpoint

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

To View the Display Units

From the HOME DISPLAY, press the SCROLL button. The display will briefly show the temperature units in °C/F/K and then return to the HOME DISPLAY (if a different temperature unit is required, call Technical Services).

To View the % Output Power

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

Buttons and Indicators

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

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

RUN/HOLD (**Run/Hold button**):

- Starts a program when pressed once—RUN light illuminates.

- Holds a program when pressed again—HOLD light illuminates.

- Cancels hold and continues running when pressed again—HOLD light is off and RUN light illuminates.

- Exits a program when the button is held down for two seconds—RUN and HOLD lights are off.

- At the end of a program the RUN light will flash.

- During holdback the HOLD light will flash.

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

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

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

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

Controller Parameters

Home Display

°C: measured temperature in Celsius. Temperature units can not be changed without entering the configuration. Contact Technical Services if a different temperature unit is required.

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

C.id: Controller identification number.

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

IdHi: Deviation High Alarm

tunE: One-shot autotune enable.

run LiSt (Program Run List)

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

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

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

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

ProG LiSt (Program Edit List)

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

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

Controller Parameters (continued)

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

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

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

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

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

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

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

AL LiSt (Alarm List)

IdHi: Deviation High Alarm.

Atun LiSt: (Autotune List)

tunE: One-shot autotune enable.

drA: Adaptive tune enable.

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

Controller Parameters (continued)

Pid LiSt

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

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

> **ti**: Integral time in seconds. (SEt 1)

> **td**: Derivative time in seconds. (SEt 1)

> **Pb2**: Proportional band. (SEt 2)

> **ti2**: Integral time in seconds. (SEt 2)

> **td2**: Derivative time in seconds. (SEt 2)

ACCS LiSt (Access List)

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

Alarms

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

Note The following alarm messages are factory default settings and may vary if you have changed the configuration of your controller:
> **IDHi: = 0°C**
> **2FSH = 250°C**

IdHi: PV deviation high alarm.

2FSH: PV full scale high alarm.

LCr: load current low alarm.

HCr: load current high alarm.

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

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

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

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

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

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 will extinguish).

Single Setpoint Controller Operation

1. Switch the circuit breaker to the "ON" position. The setpoint temperature presently set in the controller will appear in the lower display. The upper display indicates the actual chamber temperature.

2. To change the setpoint, press the UP or DOWN button until the desired setpoint value is displayed, then release the button.

3. The oven will begin to heat if the new setpoint temperature is higher than the present chamber temperature.

Programming the Controller

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

Creating a New or Editing an Existing Program

This procedure is for 4x16 Segment Programmable Models only.

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

Follow the steps below to create or edit a program.

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

2. Press the SCROLL button until display reads, "PrG.n."

3. Press the UP or DOWN button to select a number for a new program or to edit an existing program.

Hb: Holdback

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

OFF: holdback is disabled.

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

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

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

To set the holdback type:

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

2. Press the SCROLL button until display reads, "Hb."

3. Press the UP or DOWN button to toggle between "bAnd, Hi, Lo and OFF."

Hb U: Holdback Value

Note The value set in this parameter is always for the entire program. ▲

To set the holdback value:

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

2. Press the SCROLL button until display reads, "Hb.U."

3. Press the UP or DOWN button to enter a holdback value.

rmP.U: Setting Ramp Units

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

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

2. Press the SCROLL button until display reads, "rmP.U."

3. Press the UP or DOWN button to toggle between seconds, minutes and hours.

dwL.U: Setting Dwell Units

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

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

2. Press the SCROLL button until display reads, "dwL.U."

3. Press the UP or DOWN button to toggle between seconds, minutes and hours.

CYC.n: Setting the Number of Cycles

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

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

2. Press the SCROLL button until display reads,"CYC.n."

3. Press the UP or DOWN button to select the number of cycles you want to run or, press the DOWN button to select "cont." so the program will run continuously.

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

Setting the Segment Type

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

rmP.r (Ramp)

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

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

2. Press the SCROLL button until display reads,"tYPE."

3. Press the UP or DOWN button until display reads, "rmP.r."

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

Steps 4 and 5 are used in the 4 x16 segment program model only. If using an 8 segment program, skip to Step 6.

4. Press the SCROLL button until display reads "Hb."

5. Press the UP or DOWN button to toggle between "bAnd, Hi, Lo and OFF."

6. Press the SCROLL button until display reads, "tGt."

7. Press the UP or DOWN button to set a target setpoint.

8. Press the SCROLL button until display reads, "rAtE."

9. Press the UP or DOWN button to select a value in ramp units (seconds, minutes or hours; set in the "rmP.U" parameter).

rmP.t

To ramp to a specified temperature at a set time:

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

2. Press the SCROLL button until display reads, "tYPE."

3. Press the UP or DOWN button until display reads, "rmP.t."

Setting the Segment Type (continued)

4. Press the SCROLL button until display reads, "tGt."

5. Press the UP or DOWN button to set a target setpoint.

6. Press the SCROLL button until display reads, "dur."

7. Press the UP or DOWN button to select a time in ramp units (seconds, minutes or hours; set in the "rmP.U" parameter.

dwEll

To maintain a constant temperature for a specified time:

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

2. Press the SCROLL button until display reads, "tYPE."

3. Press the UP or DOWN button until display reads, "dwEll."

4. Press the SCROLL button until display reads, "dur."

5. Press the UP or DOWN button to select a time in dwell units (seconds, minutes or hours; set in the "dwL.U" parameter).

StEP

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

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

2. Press the SCROLL button until display reads, tYPE."

3. Press the UP or DOWN button until the display reads, "StEP."

4. Press the SCROLL button until display reads, "tGt."

5. Press the UP or DOWN button to set a target setpoint.

Setting the Segment Type (continued)

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

To call a program as a subroutine:

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

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

2. Press the SCROLL button until display reads, "tYPE."

3. Press the UP or DOWN button until display reads, "cALL."

4. Press the SCROLL button until display reads, "PrG.n."

5. Press the UP or DOWN button to select a program number to be linked.

6. Press the SCROLL button until display reads, "CYC.n."

7. Press the UP or DOWN button to select the number of cycles the linked program is to be run.

End

To end or repeat a program:

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

2. Press the SCROLL button until display reads, "tYPE."

3. Press the UP or DOWN button until display reads, "End."

4. Press the SCROLL button until display reads, "End.t."

5. Press the UP or DOWN button to toggle between "dwEll" (an indefinite dwell), "S OP" (End Segment Output Power) and "rSET" (reset).

Setting the Target Setpoint

This procedure is for 4x16 Segment Programmable Models only.

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

2. Press the SCROLL button until display reads, "tGt."

3. Press the UP or DOWN button to set the target setpoint temperature.

Running a Program

8 Segment Programmable Models only

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

4x16 Segment Programmable Models only

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

or:

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

2. Press the SCROLL button until display reads, "PrG."

3. Press the UP or DOWN button to select the program number you want to run.

4. Press the RUN/HOLD button once to start the program. (The RUN light will illuminate.)

Holding a Program

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

Cancelling a Program

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

Tuning Your Oven

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

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

Note Display will flash "tu.ER" if an error occurs during tuning. To clear the error and restart tuning, simultaneously press the PAGE and SCROLL buttons and follow the steps outlined in "Autotuning." ▲

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

Tuning Error

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

Gain Scheduling

G.SP: Gain Scheduling

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

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

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

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

Autotuning   The Autotune feature automatically sets up the PID values in the control parameters to suit new process conditions. To tune your oven using autotuning:

1. Load your oven with a load similar to your normal load and close the door.

2. Set the setpoint temperature.

3. Press the PAGE button until the display reads, "Atun LiSt."

4. Press the SCROLL button until "tunE OFF" is displayed.

5. Press the UP or DOWN button to select "on."

6. Simultaneously press the PAGE and SCROLL buttons to return to the HOME DISPLAY. The display will flash "tunE" while tuning is in progress.

Adaptive Tuning

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

To tune your oven using adaptive tuning:

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

2. Press the PAGE button until display reads, "Atun LiSt."

3. Press the SCROLL button until "drA OFF" is displayed.

4. Press the UP or DOWN button to select "on."

5. Press the SCROLL button until "drA.t" is displayed.

6. Press the UP or DOWN button until the desired trigger value is achieved.

Section 7 Maintenance

The Ultra-Clean Class 100 Oven should be cleaned with lint-free wipes and thoroughly vacuumed.

Caution Disconnect plug from electrical outlet before attempting any maintenance or repair of this unit.

Note Make no attempt to service or repair a Thermo Scientific product under warranty before consulting your Thermo Scientific dealer. After the warranty period, such consultation is still advised, especially when the repair may be technically sophisticated or difficult.

If assistance is needed beyond what the distributor can provide, call the Technical Services Department. No merchandise, however, should be returned directly to the manufacturer without prior approval.

Door Gasket Repair

Remove oven from clean-room area.

If the door gasket is nicked or has a small tear, the gasket may be repaired with RTV Sealant 3145 (part #120-053-00). Form the sealant to the proper shape in the case of a nick. Use the sealant to reattach a small torn piece to the rest of the gasket. Allow 12 hours for the sealant to dry fully. Bake the gasket for several hours until the RTV has hardened completely. Then return oven to the clean-room area.

Complete Gasket Replacement

1. Unplug oven from outlet before servicing.

2. Remove shelves, floor and side walls.

3. Lay the oven on its back side. Be sure to support the oven back above the surface to protect the vent port. Loosen all the Phillips screws from the trim strips holding the gasket.

4. Pull the gasket out from under the trim strips.

5. Starting at the seam on the hinge side, slide the double lip under the trim strip and work the gasket around the door opening. Smooth out any bows in the gasket and trim off any excess.

6. Tighten screws holding trim strips.

7. Clean oven's inner body; replace floor, side walls and shelves.

Filter Replacement

1. Disconnect unit from electrical outlet.

2. In the event unit has been in use, be certain that it has cooled before doing any work in the interior.

3. Filter cover is on the right hand side of interior of cabinet.

4. Remove shelves.

5. Locate and remove 2 screws on front of filter cover - one at top and the other at the bottom.

6. Note flange of filter cover which is secured to back wall by nuts. Remove nuts and washers.

7. Remove filter cover assembly from cabinet.

8. Replace existing filter with new one.

9. Reverse procedure to reassemble.

Parts Replacement/General

In the event that access is required to replace heaters, RTD sensor or safety thermostat, extreme care is necessary when removing Teflon bladder.

After completing repairs, it is recommended that bladder and sealant (Dow Corning Sealant #736) be replaced.

Section 8 Replacement Parts

DESCRIPTION	PART NUMBER
Bladder, Teflon®:	720-457-00
Blower Wheel:	160-125-01
Fuse, 1 Amp:	FZX8
Cordsets	
3490M	CR1476X2
3490M-1, 3495M-1, 3499M-1, 3497M-1	CR1476X1
Door Handle	600-002-00
Fan Blade, Heat Relief	160-124-00
Fan Motor, 120 V	MT1476X4
Fan Motor, 240V	MT1476X3
Fan Motor Blower	370-264-00
Filter, HEPA (3497M-1)	525-036-00
Filter, Inline (3497M-1)	525-034-00
Fuses	
3490M-1:	330-298-00
All Other Models:	330-299-00
Fuse Holder	330-297-00
Gasket (order length by model number)	530-180-00
Heaters:	
3490M, 3490M-1	340-244-00
3495M-1, 3497M-1, 3499M-1	340-231-00
Rubber Feet (4)	790-078-00
Sealant (Dow Corning 736)	120-080-00
Sensor Assembly	014-186-00
Shelves*	
3490M -1	587-843-00
3495M-1	587-844-00
3497M-1	588-806-00
3499M-1	587-845-00
Shelf Support Bracket	171-346-00
Solid State Relay	400-233-00

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DESCRIPTION	PART NUMBER
Status Lamps	
Green	360-238-00
Red	360-234-00
Status Lamp Base, Power (Green)	PL1476X1
Status Lamp Base, Hi-Limit (Red)	PL1448X1
Switch, Power	440-226-00
Temperature Controller, 8 segment	CN71X146
Temperature Controller, 4 program	CN71X145
Thermostat, Hi-Limit	CNX175
Thermostat Knob	560-225-00
*Shelves for 3490M units can be ordered with brackets as	3490M-8
*Shelves for 3495M units can be ordered with brackets as	3495M-8
*Shelves for 3499M units can be ordered with brackets as	3499M-8
*Shelves for 3497M units can be ordered with brackets as	3497M-8

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, check first with your dealer. If the dealer cannot process your request, then contact our Technical Services Department.

Prior to returning any materials, please contact our Technical Services Department for a "Return Materials Authorization" number (RMA). Material returned without an RMA number will be refused.

Thermo Fisher Scientific
401 Millcreek Road
Marietta, Ohio 45750
United States

www.thermofisher.com

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