



Isotemp[®] Programmable Muffle Furnace 650-750 Series

Instruction Manual

Model 14

Catalog No.

10-650-14 & 14A, 10-750-14 & 14A
10-650-14C & 14AC, 10-750-14C & 14AC

Model 58

Catalog No.

10-650-58, 10-750-58
10-650-58C, 10-750-58C

Model 126

Catalog No.

10-650-126, 10-750-126
10-650-126C, 10-750-126C

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Safety Information

Alert Signals



Warning

Warnings alert you to a possibility of personal injury.



Caution

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



Note

Notes alert you to pertinent facts and conditions.



Hot Surface

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

Your Fisher Isotemp® Programmable Muffle Furnace 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.

When operating the furnace, always observe the following Safety Precautions:

- Wear insulating gloves.
- Use tongs.
- Use Safety goggles.
- Never stand in front of an open furnace.
- Use the supplied hearth plate on the chamber bottom

Introduction

Fisher Isotemp 650/750 Series Programmable Muffle Furnaces are available in three sizes: small (Model 14), medium (Model 58) and large (Model 126). All models provide PID microprocessor temperature control at operating temperatures from 50 to 1125 °C (90 to 2057 °F).

Furnace chambers are molded from alumina silicate ceramic fibers. Use of this material provides low thermal mass for fast heat-up and cool-down, as well as an unusually low exterior furnace temperature for safe operation. The furnace is heated by electric resistance elements embedded in easily removable side and base panels. The heating elements are designed to ensure extended service life, even in atmospheres characteristic of high-sulfur coal and coke samples.

Temperature readouts and control parameters are shown on two red 7-segment displays. Two LED's indicate when heater power is being applied or when an over-temperature error condition is encountered. Temperatures can be displayed in either °C or °F.

For operation with chamber atmospheres other than air (N₂, CO₂, etc), external gas supplies connect easily through a provided 3/8-inch port. An Injection Port Kit (10-550P) connected to the exhaust port allows convenient venting of the chamber.

Isotemp furnaces incorporate a variety of safety features. When the furnace door is opened, power is automatically cut to the chamber heating elements. The heater power is also cut out when the chamber temperature exceeds the set temperature by 25°C (45°F) or more. The alarm condition is indicated on the display while the alarm LED is lit. A ventilated base design prevents damage to the bench or countertop.

The system microprocessor permits the user to customize a heating program of up to 24 ramp and soak steps. The model 750 can store four 24 step programs, while the model 650 can store one 24 step program. If desired, a soak period of up to 23 hours, 59 minutes and 59 seconds may be interspersed between any two successive ramps.

Installation



Caution

Do not install closer than 6 inches to a wall of combustible material.

Selecting a Location

Choose a location for the furnace, which will provide an area of approximately four square feet (2 ft x 2 ft). The bench or table selected must be capable of supporting at least 60lbs for the Model 14, 90lbs for the Model 58 or 110lbs for the Model 126. Appropriate electrical power must be available. Locate the furnace within three feet of the power outlet so that no extension cord is required.

It is recommended that the site have facilities for venting an accessory Exhaust Tube Assembly (Cat. No.10-490-10) which is available for use with the furnace. Alternatively, the furnace may be located in a fumehood if samples are expected to produce toxic volatiles.

Unpacking

Fisher Isotemp Muffle Furnaces are shipped in a single carton. After unpacking, locate each item shown in the list below. Report any missing items, by name and part number, to your Fisher branch or representative. In the event of shipping damage, retain the carton and packing material and file a claim with the final carrier.

Item

Furnace Assembly

Model 14	120 V, 50/60 Hz
Model 14A	208/240V, 50/60 Hz
Model 58	208/240 V, 50/60 Hz
Model 126	208/240 V, 50/60 Hz

Hearth Plate

Shelf (Model 126 Only)

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Warranty Card



Warning

Isotemp Muffle Furnace chambers contain alumina silicate ceramic fibers. With continued use at temperatures above 1000°C (1832 °F), these materials slowly convert to crystalline silica (cristobalite). Long-term exposure to airborne cristobalite may result in severe respiratory diseases in humans. Tests with laboratory animals suggest that cristobalite is a possible carcinogen. Short-term effects may include irritation to skin, eyes and the respiratory tract. Please consult the Material Safety Data Sheet (MSDS) provided by Fisher Scientific for further information.



Warning

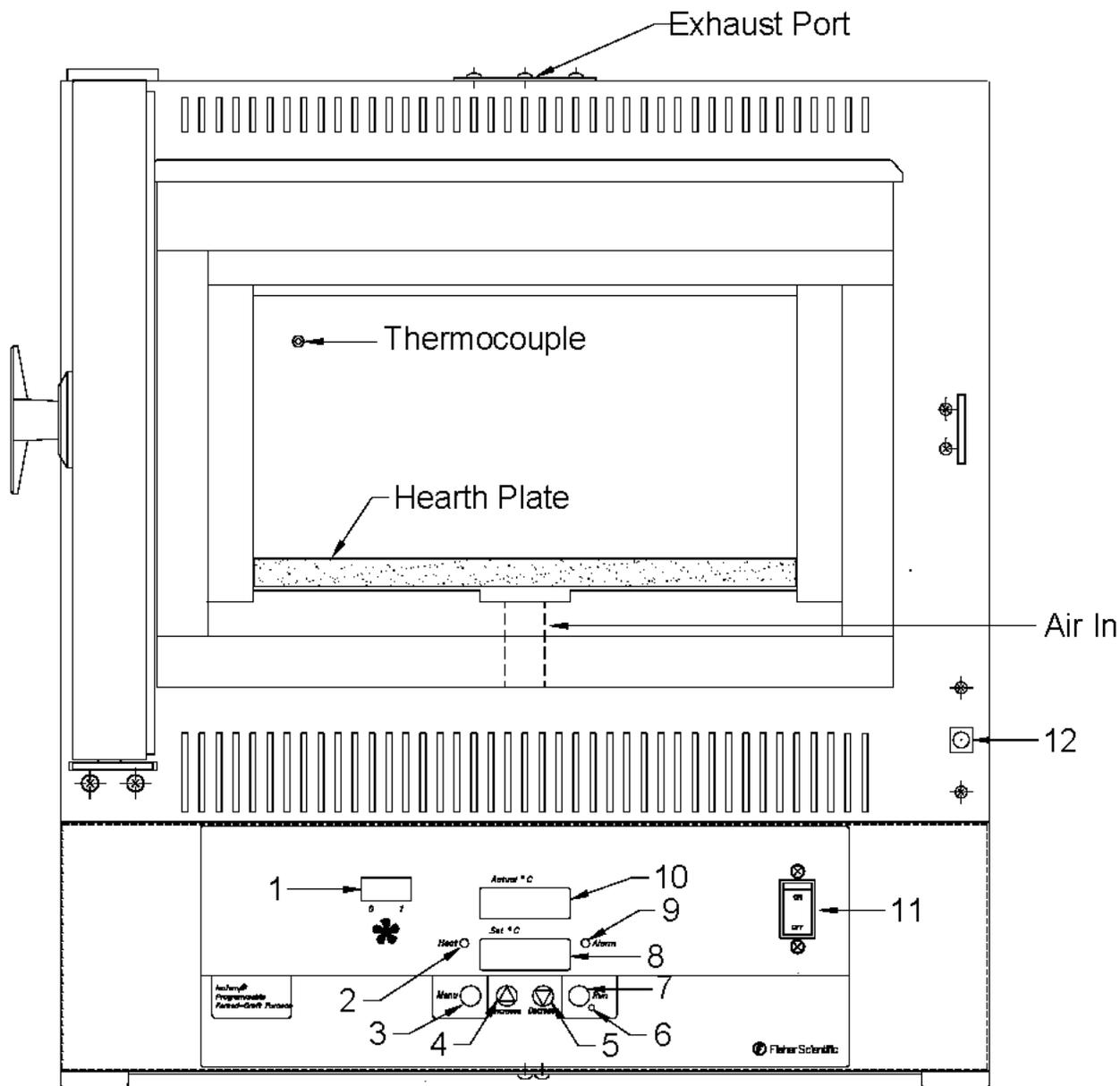
This unit is not explosion proof. Do not use in the presence of flammable or combustible materials; fire or explosion may result. Unit contains components that may ignite such materials.

Preparing the Furnace

To prepare the muffle furnace for operation, perform the following procedures:

1. Make certain all packing material is removed from furnace chamber.
2. Place hearth plate on the bottom of the chamber. Orient hearth plate such that smooth surface faces upward. See Fig. 1, Page 7.
3. *With the Model 126*, the supplied shelf may be used. If desired, install shelf by sliding it onto top of ledge protruding from each side of the inner chamber walls.
4. *If installing the accessory Exhaust Tube Assembly*, first locate exhaust port at top of furnace (see Fig 1). Use three screws to secure the port flange to the exhaust port. Attach tubing to port flange using a hose clamp (provided). Finally, route free end of tube to fumehood or other outside vent. If desired, exhaust tube may be cut to length using a hacksaw.

Figure 1 – Furnace Layout



- | | |
|--------------------------------------|------------------------|
| 1 Circulating Fan Switch (Model 750) | 7 Program Run Key |
| 2 Heater LED | 8 Set Temp Display |
| 3 Menu Key | 9 Alarm LED |
| 4 Increase Key | 10 Actual Temp Display |
| 5 Decrease Key | 11 Power Switch |
| 6 Program Run LED | 12 Door Switch |

NOTE: The air in port is closed for Model 650 Furnaces.
See the following pages for keypad/display descriptions.

Controls

The following sections briefly describe the locations and functions of various display fields and keypad controls. More detailed descriptions are provided, when required, in the operating sections of the manual.

Displays

The 650/750 Series controller features two bright, one-half inch LED numeric displays used in setting up the furnace program or reading out the furnace temperature. Two smaller LED's indicate, respectively, an alarm condition or when power is being applied to the furnace heaters. Each display field is discussed separately below.

Set Display

In the Control and Ramp and Soak modes, shows the furnace set temperature. During setup and programming, indicates control parameters to be set.

Actual Display

In the Control and Ramp and Soak modes, shows the actual furnace temperature. During setup and programming, indicates the numerical value assigned to the currently displayed control parameter.

Heat LED

Lights when controller is calling for heat.

Alarm LED

Lights if the actual furnace temperature exceeds the set temperature by 25°C (45°F).

Run LED

Lights when the furnace is running a ramp/soak program.

Keypads

The 650/750 Series incorporates a four-key, tactile keypad. The function of each key is discussed individually below. See Fig. 1 for keypad locations.

MENU During programming or setup, successively pressing the MENU key causes the controller display to sequentially step through menu selections.



In Control mode, pressing the UP Arrow key, increases the furnace set temperature, as indicated on the Set display. During programming or setup, used to step through menu options.



In Control mode, pressing Down Arrow key, decreases the furnace set temperature, as indicated on the Set display. During programming or setup, used to step through menu options.

RUN Pressing the RUN key alternates muffle furnace operation between the Control and Ramp and Soak modes.



Circulating Fan (Model 750 only)

Just above and to the left of the Actual Display is the power switch for the *Circulating Fan*. When turned on, outside air is circulated through the bottom of the furnace chamber under the hearth, where it is heated, and into the furnace chamber. Two to four air changes per min. can be expected with the fan on.

Operation

The 650/750 Muffle Furnaces feature two modes of operation:

- Control
- Ramp and Soak

Each is discussed separately in the following sections.

Control Mode

In Control mode, the muffle furnace maintains a set temperature until that set temperature is changed.

To set a temperature and initiate Control mode operation, perform the following:

1. Place the power switch in the ON position.
2. If the Run LED is lit or blinking, press Run key until the indicator remains off.
3. Observe the set temperature in the Set Display window.
4. To increase the set temperature, press the UP arrow key.
5. To decrease the set temperature, press the DOWN arrow key.
6. When the desired set temperature is shown, release the UP or DOWN arrow key. The muffle furnace automatically begins controlling to the set temperature.



Note

To rapidly increase or decrease the set temperature, **press and hold** the appropriate arrow key. To slowly increment or decrement the set temperature one degree at a time, press and immediately release the arrow key.

Ramp and Soak Mode

In Ramp and Soak mode of operation, the muffle furnace executes a sequence of program commands. During a ramp period, the muffle furnace temperature is controlled to increase (or decrease) at a linear rate set by the operator. During a soak period, the furnace maintains a constant temperature for a time interval selected by the operator.

Program Steps

A program consists of a sequence of operations or "steps" which the muffle furnace is set up to perform. The programmed operations are executed in the order entered: step 1, step 2, step 3, etc. A single program may have a maximum of 24 steps, or as few as two (one must be an End).

Program steps may be selected from among the four basic operations described below. The corresponding display for each operation is shown at the left:

A rectangular display box containing the letters "SP" in a stylized, blocky font.

A Set Point (SP) program step causes the furnace set temperature (shown in the Set Display) to be linearly increased or decreased ("ramped") at a selected rate. The Set Point operation begins at the current set temperature and finishes at the programmed Set Point temperature.

A rectangular display box containing the letters "Soak" in a stylized, blocky font.

Soak causes the final set temperature from the preceding step to be held for a time interval of up to 23 hours, 59 minutes and 59 seconds. This duration may be extended by adding further Soak steps or using a Jump Loop (see below).

A rectangular display box containing the letters "JL" in a stylized, blocky font.

A Jump Loop operation causes program execution to jump to another designated program step. *Each program step, up to the Jump Loop, is then sequentially repeated.* Use of a Jump Loop allows a programmed temperature cycle to be repeated up to 100 times. A Jump Loop cannot be used as the first step in a program.

A rectangular display box containing the letters "End" in a stylized, blocky font.

Program execution proceeds sequentially through each program step until an End is encountered, or until all 24 program steps have been completed. An End may be set up to cause the furnace to maintain the final set temperature indefinitely or simply to turn off heater power.

If no End is used, all 24 program steps will be completed, then the furnace will maintain the final programmed set temperature.



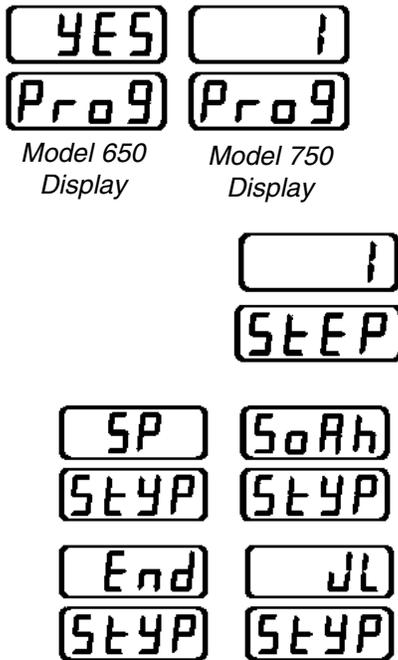
Note

During programming, the MODE key serves as an "enter" key to select a value shown on the Actual Display for a corresponding parameter shown on the Set Display.



Note

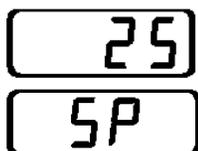
Model 750 will prompt for program number (1 to 4), while Model 650 prompts for single program entry (Yes/No).



Creating a Ramp and Soak Program

Creating a program consists of constructing a sequence of the four basic operations, Set Point (ramp), Soak, Jump Loop and End, to produce a desired temperature cycle. For each operation selected, several options also must be specified. To enter a ramp and soak program, perform the following procedures:

1. Verify the RUN LED is not lit. If it is, press the RUN key until it goes out.
2. Press the MENU key. The No Program display should appear (see left). If no key is pressed for one minute, the display automatically reverts to Control mode.
3. Press the UP-Arrow key once to present the program entry menu selection.
4. Use the UP or DOWN Arrow key to select the desired program number. Up to four programs can be entered (Model 750 only).
5. Press the MENU key to initiate entry of the first program number (Model 750 only), or when the Actual display indicates YES (Model 650).
6. Press the UP or DOWN Arrow key until the Actual Display shows the number of the step to program. Press the MENU key to enter the desired program step (1 to 24).
7. The Set Display then indicates 'StyP to signify that the step type must be selected from a menu of four operations being shown in the Actual Display. The four menu selections are Set Point (ramp), Soak, End or Jump Loop. These menus appear as shown on the left. Repeatedly press the UP or DOWN Arrow key until the desired step type appears. NOTE: For step 1 in a program, the jump loop option is not available.
8. *If the desired program step is a ramp to a Set Point, press the MENU key to select it when the Actual Display reads "SP". Otherwise, skip to step 11.*



9. If a ramp to a Set Point is selected, the Set Display first indicates "SP" to signify that the operator must select a final target temperature, or set point. Use the UP or DOWN Arrow key to adjust the Actual Display to indicate the desired final temperature for the ramp.

Press the MENU key to enter the selected set point temperature.



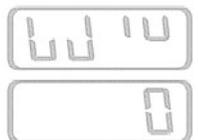
10. The Set Display then indicates "rAtE" to prompt the operator to select a desired heating or cooling rate in °C/min or °F/min. Press and hold the UP or DOWN Arrow key until the desired rate is shown in the Actual Display.

Press the MENU key to enter the selected rate. Proceed to step 21.



11. *If the desired program step is a Soak*, press the MENU key to select it when the Actual Display shows "SoAh.". Otherwise, skip to step 15.
12. If a Soak is selected, the Set Display first indicates "HOUr" to signify that the operator must select the number of hours for which the current set temperature will be maintained. Use the UP or DOWN Arrow keys to adjust the Actual Display to indicate the desired number of soak hours (maximum of 23 hours).

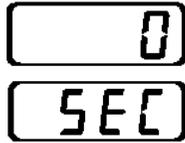
Press the MENU key to enter the selected number of soak hours.



13. The Set Display then shows "Min" to indicate that the operator must select the number of additional minutes for which the current set temperature will be held. Use the UP or DOWN Arrow keys to set the Actual Display to the desired number of soak minutes (maximum of 59).

Press MENU to enter the selected number of soak minutes.

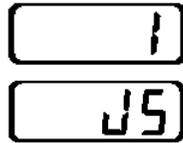
OPERATION



14. The Set Display then shows "SEC" to indicate that the operator must select the number of additional seconds for which the current set temperature will be held. Use the UP or DOWN Arrow key to adjust the Actual Display to indicate the desired number of soak seconds (maximum of 59).

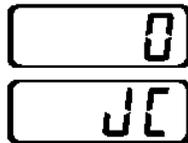
Press the MENU key to enter the selected number of soak seconds. Proceed to step 21.

15. *If the desired program step is a Jump Loop*, press the MENU key to select it when the Actual Display shows "JL." Otherwise, skip to step 18.



16. If a Jump Loop is selected, the Set Display first indicates "JS" to signify that the operator must select the step number destination for the jump. Use the UP or DOWN Arrow key to adjust the Actual Display to indicate the desired step number. **NOTE: The jump step number must be lower than the current step number. The jump cannot be to the current step or a higher step.**

Press the MENU key to enter the selected jump step.



17. The Set Display then shows "JC" to indicate that the operator must select the number of times the jump loop is to be repeated. Use the UP or DOWN Arrow key to adjust the Actual Display to select the number of times the loop is to be repeated.

Press the MENU key to enter the selected number of jump counts.

18. *If the desired program step is an End*, press the MENU key to select it. Otherwise, skip to step 11.



19. If End is selected, the Set Display shows "End" and the Actual Display shows one of the two options for an End step. To view each selection, repeatedly press either the UP or DOWN key. The options appear as shown on the left.

20. If the final temperature is to be held indefinitely at the end of the ramp and soak program, press the MENU key when "HoLd" is displayed on the Actual Display. If heater power is to be turned off at the end of the program, press the MENU key when the Actual Display indicates "OFF." Proceed to step 21.

no
rtn

21. Once a program step is entered, the display indicates "no rtn". *If further steps are to be programmed*, press the MENU key to continue programming. The next program step will be displayed. Return to step #6 of this procedure to add more program steps. Up to 24 can be entered per program. The Model 750 can accommodate four 24 step programs.

YES
rtn

22. *If no further program steps are required*, press the UP Arrow key. The displays indicate "YES rtn". Press the MENU key to return to control mode operation. To initiate the program, see *Running, Stopping or Resuming a Program*.

Running, Stopping or Resuming a Program

Prior to running the program in memory, first *make certain* that the current set temperature is the temperature from which the program is to start. For example, a program *intended* to ramp the furnace temperature from ambient to 600 °C, if started with the current set temperature at 1000 °C, will actually ramp the temperature **down** from 1000 °C to 600 °C. Use the UP/DOWN arrow keys to change the set temp if necessary.

To run the program currently in memory, perform the following steps:

1. Press the RUN key once. The Run indicator light begins to flash and the displays indicate the first program number (Model 750) or the first program step (Model 650). If running a program from a Model 650, skip to step 3.



Model 750 Display



2. If running a program from a Model 750, use the UP or DOWN arrow keys to cycle the Actual display to the desired program *number*, 1 through 4, or NO to cancel. Use the MENU key to select the desired program *number* to run.
3. The displays now indicate the first program step. Program execution will begin at the current program step. To change the program step use the UP or DOWN arrow key until the desired step is displayed. Press the RUN key to initiate the run, beginning at the program step number shown.

Observe that the Run indicator comes on full signifying that the furnace is in the ramp and soak mode with a program underway.

To stop a running program, press the RUN key. The RUN LED will turn off and furnace operation returns to the Control mode, with the set temperature at the last value achieved by the program.

To resume program execution after stopping a program, press the RUN key. The RUN LED will begin to blink. Press the MENU key. The displays indicate “x rESU”, where x is the last executed program step. Press the RUN key again. The program will continue executing at the point it was stopped.

Viewing Program Status

While a ramp and soak program is running, the status of the current program step may be viewed. With the Run LED lit to indicate the program is running, successively press the MENU key. Each control parameter associated with the current program step then is displayed sequentially. The parameter *type* is indicated in the Set Display, while the value for the parameter appears in the Actual Display. A final press of the MENU key returns the displays to tracking the actual and set temperatures.

The specific control parameters displayed in any instance depend upon whether the current step is a Set Point or a

Soak operation. The sequence of control parameters displayed in each case, and the corresponding Set Display messages (left), is as follows:

ENSP

RATE

EJC

STEP

HOUR

MIN

SEC

Set Point or Soak Step

End Set Point	Target final temperature at the completion of the ramp.
Rate	Rate of change of temperature, in °C/min, for the ramp.
Elapsed Jump Count	If a Jump Loop is in progress, indicates the number of times the loop has been executed.
Step	Current program step.
Hour	Hours remaining in the soak step.
Min	Minutes remaining in the soak step.
Sec	Seconds remaining in the soak step.

An Example Program

The ASTM method for Ash Analysis of Coal and Coke (D 3174-89)¹ specifies the following ramp and soak operations:

Step 1: Ramp from ambient to 500 °C at 8.0 °C/min (i.e., in 1 hour)

Step 2: Ramp from 500 °C to 750 °C at 4.2 °C/min (i.e., in 1 hour)

Step 3: Soak at 750 °C for two hours

Step 4: Turn off power to the heaters and allow to cool

¹American Society for Testing and Materials, *Gaseous Fuels: Coal and Coke, Vol.05.05, Section 5, pp.326-8*

To set up and run this program, perform the following procedures.

Programming Step 1:

1. With the Run LED off, press the RUN key. Press the MENU key until the displays indicate “no Prog”.
2. Press the UP arrow key. The displays will now indicate “YES PrOg” (Model 650) or “1 PrOg” (Model 750). Press the MENU key again.
3. The displays now show “1 StEP”. Press the MENU key to begin programming at step #1.
4. Press the UP or DOWN arrow key until the displays indicate “SP StyP”. Press the MENU key to select the set point ramping command. Alarm
5. Use the UP or DOWN arrow keys to display the desired set point in the upper display (500°C). When the displays indicate “500 SP” (500 set point), press the MENU key to select the temperature.
6. The controller will next prompt for the ramping rate. Use the UP or DOWN arrow keys to enter the desired ramping rate in degrees/min (8.0°C/min). Press the MENU key to select the ramping rate.
7. The first step is now programmed. The controller will then display “no rEtn”. Press the MENU key to remain in the program editing mode. “2 StEP” is then displayed. Press the MENU key to continue.

Programming Step 2:

8. Press the UP or DOWN arrow key until the displays indicate “SP StyP”. Press the MENU key to select the second set point ramping command.
9. Use the UP or DOWN arrow keys to display the desired set point in the upper display (750°C). When the displays indicate “750 SP” (750 set point), press the MENU key to select the temperature.

10. The controller will next prompt for the ramping “rate”. Use the UP or DOWN arrow keys to enter the desired ramping rate in degrees/min (4.2°C/min). Press the MENU key to select the ramping rate.
11. The controller will then display “no rEtn”. Press the MENU key to remain in the program editing mode. “3 StEP” is then displayed. Press the MENU key to continue.

Programming Step 3

12. Press the UP or DOWN arrow key until the displays indicate “SoAh StyP”. Press the MENU key to select soak as the step type.
13. The displays will now show “0 Hour”. Use the UP or DOWN arrow keys to display the desired soak time in hours (2). Press the MENU key to select two hours of soaking.
14. The controller will next prompt for the desired minutes of soaking “0 Min”. Press the MENU key to select zero minutes.
15. The controller will next prompt for the desired seconds of soaking “0 Sec”. Press the MENU key to select zero seconds.
16. The total soak time is now programmed; 2 hrs, 0 minutes and 0 seconds. The controller will then display “no rEtn”. Press the MENU key to remain in the program editing mode. “4 StEP” is then displayed. Press the MENU key to continue.

Programming Step 4

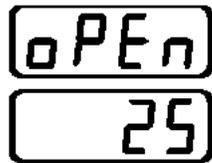
17. Press the UP or DOWN arrow key until the displays indicate End StyP. Press the MENU key to select the end command.
18. Press the Up arrow key until the displays show “oFF End”. Press the MENU key to select.
19. Once and End statement is programmed, the controller will prompt the user to save the current program, “SAVE”. Press the MENU key to save the program. The controller then returns to normal control mode.

Follow the procedures on page 15 to run the program.

High Temp Alarms

All Fisher Furnaces come equipped with high temperature alarms. When an alarm condition occurs, power to the heaters is removed while the Set display flashes between the current set temperature and "HI".

The high temperature alarm will activate when the actual temperature is greater than the set temperature by more than 25°C (45°F). The alarm condition will continue until the actual temperature falls within 5°C (9°F) of the set temperature.



Open Thermocouple

When the displays show "oPEn xx", where "xx" designates the last set temperature, an open thermocouple is being detected. Check the thermocouple connection and replace if necessary.



Caution

Use thermometers/thermocouples suited for operation at temperatures equal to or higher than the desired calibration temperature.

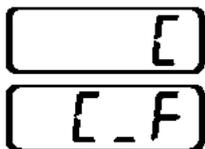


Calibration

To calibrate the furnace, place a reference thermometer or thermocouple lead inside the furnace chamber located as close to the geometric center of the chamber as possible. Set the furnace to the desired temperature and allow enough time for the temperature to stabilize.

Note the temperature as indicated by the reference thermometer. Compare it to the temperature in the Actual display. If the two readings do not agree, press the MENU key twice. The displays should show "0 CAL". Use the UP or DOWN arrow key to adjust the calibration (CAL) number to a value which will equal the temperature of the reference thermometer when added to the most recent temperature of the Actual display.

For Example: A furnace is set to 500°C and allowed to stabilize. The reference thermometer indicates 505°C. The furnace Actual display shows 500°C. The calibration (CAL) value is set to +5 in order for the Actual display to agree with the reference thermometer. Press the MENU key four more times until the displays show the temperatures with the Actual temperature corrected.



Units

The controller can be set up to display units in °C or °F. To change or verify the units being displayed simply press the MENU key until the displays show “C C_F”. The current units are displayed in the Actual display. To display temperatures in °C press the MENU key when the Actual display indicates “C”.

To display temperatures in °F, simply press the UP Arrow key until the Actual display shows “F” then press the MENU key to accept.

Power Failure

In the event a power failure occurs while operating in the ramp and soak mode, the controller can be set up to react in one of three ways; continue, hold or abort program execution. If a power failure occurs while operating in the control mode, the furnace will continue controlling at the last set temperature when power is restored.

The power failure options available in the ramp and soak mode are given below:

Cont

Pout

Hold

Pout

Abrt

Pout

Continue (Cont)-Continues program execution at the point the furnace lost power.

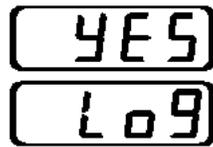
NOTE: The controller will continue a soak step to the nearest *minute* the program was interrupted.

Hold (HoLd)-Upon return of power, the program controls at the last set temperature attained by the running program. The displays will indicate “Pout xx”, where “xx” designates the last set temperature. The displays can be cleared by pressing the MENU key.

Abort (Abrt)-Upon return of power, program execution is terminated. The heaters are turned off and the displays indicate “Pout 0”.

To view/change a power failure procedure, press the MENU key until the displays show “Cont Pout”. To *continue* program execution after a power failure, simply press

the MENU key. To change the power failure option, press the UP Arrow key to change the actual display to one of the above options. Press the MENU key to select the desired option.



Data Logging

The final menu display is for setting up logging parameters used for serial communications. See the Serial Communications section for instructions on serial communication. To access the data logging parameters, press the MENU key until the displays show “no Log”.

Press the UP arrow key. The displays will now indicate “Yes Log”. Press the MENU key a second time. The following communication options can be selected:

- BAud: Use the UP or DOWN arrow key to select the baud rate. Press the MENU key to enter.
- int: Use the UP or DOWN arrow key to select the logging interval in minutes. Use the MENU key to enter the value.

Serial Communication

Fisher offers a line of furnaces equipped with a serial communications option. The units listed on the following page are designed to log data to an adaptable device (PC) which uses RS232 serial communication protocol.

The furnace will log data to the interfacing device only. That is, it will not read from the interfacing device.

To begin communicating to the furnace controller follow the procedures given below:

1. A 9-pin connector is located on the right side of the furnace, in the center of the ventilation screen. Plug a communications cable between the furnace connector and the interfacing computer.
2. The port settings on the interfacing device



Note

It is recommended that the communications link be established by a person experienced in data communications.

should be set for 8 data bits, non-parity, and 1200, 2400, 4800 or 9600 baud rate.

3. Set the furnace baud rate to match the port settings of the interfacing device, as described under Data Logging.
4. The furnace should immediately begin logging data to the interfacing device. The data will be logged in the format shown below.

Actual Temperature, Set Temperature, Units, Alarm State

Furnaces Equipped with Serial Communication Interface

10-650-14C	10-750-14C
10-650-14AC	10-750-14AC
10-650-58C	10-750-58C
10-650-126C	10-750-126C

Troubleshooting

This table is intended to assist in resolving user-correctable furnace problems by relating symptoms to their likely causes. If service beyond the scope of this table is required, contact your nearest Fisher Scientific Service Office.

Symptom	Probable Cause	Action
Furnace temperature erratically high.	Defective control thermocouple.	Replace control thermocouple.
Heaters turn off only when alarm is activated.	Defective solid state relay.	Check solid state relay. Replace if necessary.
Failure to heat	Set temp is less than actual temp.	Refer to operation.
	Door switch is not activating safety relay.	Check door switch (S2). Replace if necessary.
	Magnetic relay not closing.	Check magnetic relay, replace if necessary.
	Solid state relay is not turning on.	Replace solid state relay.
	Defective heater element.	Check heater resistance. Replace if necessary.
	Defective controller.	Contact Fisher Services.

Fisher Scientific Customer Service: 1-800-766-7000
Fisher Technical Assistance: 1-800-943-2006

Service



Caution

Only qualified personnel should conduct service to the furnace.



Warning

Always disconnect power cord from power supply before servicing instrument.



Caution

Allow furnace to cool to ambient temperature before attempting repair.



Caution

The heater panel material is fragile. Exercise care when inserting replacement panels into the furnace chamber. Likewise, bend or flex the heater leads gently if necessary.

All Fisher Isotemp Furnaces are built to provide years of reliable service. Should the furnace malfunction, the following procedures provide a guide to replacing some of the major components.

Replacing a Heater

To replace a defective heater, proceed as follows:

1. Open the chamber door. Allow the door to remain open throughout the heater replacement procedure.
2. Remove the screws that secure the perforated metal back panel of the furnace to the main chassis. Remove the panel and set it aside.
3. Remove the two heater terminal screws located on the terminal barrier strip. Straighten the lead wires.
4. *Carefully* withdraw the defective heater from the furnace chamber. Ceramic wool insulation surrounding the heater wires will fall into the furnace chamber. Remove it and set it aside for later use.
5. *Carefully* install the replacement heater by reversing the procedure in step 4 above.
6. *Carefully* re-attach the heater terminals by reversing step 4. Then re-fill the holes around the heater leads with ceramic wool preserved from step 5.
7. Re-install the perforated metal back panel of the furnace.
8. When the above steps are complete, return the power cord to the electrical outlet.

Replacing the Control Thermocouple

To replace a defective thermocouple, perform the following steps:

1. Remove all contents from inside the furnace including shelf or hearth plate.
2. Perform steps 1 and 2 in Replacing a Heater noting all cautions.
3. Gently slide the thermocouple lead out through the back of the furnace wall.
4. Carefully lay the unit on its side to expose the bottom screen.
5. Remove the four rubber bumpers and the four phillips head screws that fasten the bottom screen to the base. Set the screen aside.
6. Unplug the thermocouple from the control board by pressing in on the thermocouple connector. Pull both leads out from the connector while the clamps are depressed.
7. Route the new thermocouple from the back of the chamber to the controller.
8. Insert the sensing end into back of the chamber through the existing hole until the tip protrudes approximately 3 inches into the chamber. Replace any ceramic wool previously removed.
9. Connect the stripped ends to the control board thermocouple connector. Verify the orange lead of the thermocouple is clamped under the positive (+) terminal and the red lead is clamped under the negative (-) terminal.
10. Replace the bottom and back screen.

Replacing the Solid State Relay

The solid state relay is located in the base of the furnace. It cycles power to the heaters as directed by the furnace controller. To replace the solid state relay, follow the procedures below:

1. Unplug the furnace and allow it enough time to cool to ambient temperature.
2. Remove all contents from the furnace chamber including the shelf and hearth plate.
3. Gently set the furnace on its side so that the bottom screen is exposed.
4. Remove four rubber bumpers on the furnace base. Also remove the four phillips-head screws holding the screen to the base. Set the screen aside.
5. If removing the relay from a small furnace (Models 65014/14A or 750-14/14A) remove two additional screws that fasten the relay heat sink to the base. Turn the heat sink over to expose the relay.
6. Remove the wires connected to the relay, observing their locations. Use the wiring diagram at the end of the manual for reference.
7. Noting the orientation of the relay, remove the two phillips-head screws and washers that hold it to the heat sink.
8. Set the replacement relay on the heat sink in the proper orientation. Fasten the replacement relay to the heat sink using the two phillips-head screws previously removed.
9. Connect the four wires as shown in the wiring diagram noting AC and DC terminals.
10. Mount the heat sink to the base (Model 650-14/14A or 750-14/14A only).
11. Replace the base screen and the rubber bumpers. Plug the unit back into the wall outlet and operate as usual.

Replacing the Magnetic (Safety) Relay

The magnetic relay is used to disconnect heater power during alarm conditions or when the door is opened. To replace a faulty magnetic relay, follow these instructions:

1. Perform steps 1 through 4 in Replacing the Solid State Relay.
2. Disconnect the wire terminals from the relay, observing their locations on the relay (see wiring diagram).
3. Using a nut driver, remove two 6-32 nuts that fasten the relay to the furnace base.
4. Mount the new relay using the nuts removed in step 3.
5. Following the wiring diagram on page 26, connect the wire terminals to the new relay.
6. Replace the base screen and the rubber bumpers. Plug the unit back into the wall outlet and operate as usual.

Replacement Parts

Replacements for muffle furnace parts serviceable by the user may be ordered, by part number, from Fisher Scientific Co.

<u>Item</u>	<u>Part Number</u>
Line Cord and Plug	
Models 650-14, 750-14	SPN102802
Models 650-14A/58, 75014A/58	SPN95774
Models 650-126, 750-126	SPN83910
Temperature Controller	
10-650-14/14A/58/126	SPN103472
10-750-14/14A/58/126	SPN103756
Cooling Fan	
120VAC	SPN83915
240VAC	SPN83916
Thermocouple Assembly	SPN103058
Solid State Relay (SSR)	SPN83917
Safety Relay (SR)	SPN102260
Rocker Switch (ON/OFF), Circuit Breaker	
120V	SPN95499
208V/240V	SPN83914
Door Switch	SPN83926
Shelf (Model 650/750-126 Only)	
For Loads < 3 lbs (supplied)	10-750S
For Loads > 3 lbs (accessory)	SPN83893
Hearth Plate	
Model 650-14	SPN83890
Model 750-14	SPN83892
Model 650-58/126	SPN83891
Model 750-58/126	SPN83893
Side Heaters	
Model 650-14, 750-14 (two required)	SPN83634
Model 650-58, 750-58 (two required)	SPN83633
Model 650-126, 750-126 (four required)	SPN83633
Base Heaters	
Model 650-14, 750-14	SPN83637
Model 650-58/126, 750-58/126	SPN83638
Ceramic Wool (1 inch wide strip)	SPN40885
Ledge (Model 126 Only)	SPN83985

Accessories and Supplies

A variety of accessories and supplies suitable for use with the Isotemp Muffle Furnaces are available from Fisher. Catalog numbers of commonly used items are listed below for convenience.

<u>Item</u>	<u>Catalog Number</u>
Crucibles, Fused Quartz w/lid (set of 4)	10-490-4
Crucible, Porcelain, 10 ml	07-965C
Crucible, Porcelain, 15ml	07-965D
Exhaust Tube Assembly	10-490-10
Gloves	19-062-844
Grinding Mill	08-415
High Temperature Markers	13-382-16
Jumbo Crucible Tongs, Stainless	15-207
Crucible Rack Handle	10-490-17
Free Standing Shelf	10-651S
Crucible Racks (for Fused Quartz Crucibles)	
Model 650-14, 750-14	10-490-6
Model 650-58, 750-58	10-497-5
Model 650-126, 750-126	10-497-5
Crucible Racks (for Porcelain Crucibles)	
Model 650-14, 750-14	10-490-5
Model 650-58, 750-58	10-497-10
Model 650-126, 750-126	10-497-10
Injection Port Kit	10-550P

Performance Characteristics/Specifications

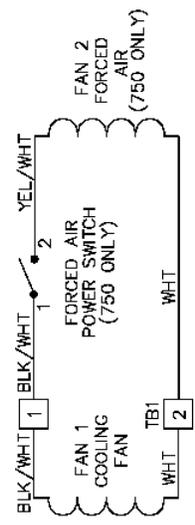
Operating Range	50°C to 1125°C (90°F to 2025°F)	Electrical Requirements	10-650-14/14C, 10-750-14/14C 120VAC, 50/60 Hz 10-650-14A/14AC, 10-750-14A/14C 208/240VAC, 50/60 Hz
Average Temperature Uniformity	±5°C (±9°F)		10-650-58/58C, 10-750-58/58C 208/240VAC, 50/60 Hz 10-650-126/126C, 10-750-126/126C 208/240VAC, 50/60 Hz
Average Temperature Stability	±1°C (±2°F)	Power Requirements	
Set Point Repeatability	±1°C (±2°F)	Model 14	1700 Watts
Set Point Accuracy (Offset = 0.0)	±3°C (±5.5°F)	Model 58	3000 Watts
		Model 126	4600 Watts
Rise Time²		Chamber Volumes	
Models 650-14, 750-14	25 minutes	Model 14	0.14 Ft ³
Models 650-58, 650-126	35 minutes	Model 58	0.58 Ft ³
Models 750-58, 750-126	25 minutes	Model 126	1.26 Ft ³
Recovery Time @ 500°C³	6 minutes	Chamber Dimensions	
Cool Down Time (Door opened) (1125°C to 200C)	25 minutes	Model 14	6 x 10 x 4 inches
		Model 58	12 x 14 x 6 inches
		Model 126	12 x 14 x 13 inches
Air Changes/Minute			
Model 750-14	4/min		
Model 750-58	3/min		
Model 750-126	2/min		
Typical Maximum Ramp Rates			
@ 200°C	+50°C/Min.		
@ 500°C	+24°C/Min.		
@ 700°C	+14°C/Min.		

² Rise time is defined as the time required to achieve 63% of the maximum operating temperature of 1125°C with a set temperature of 1125°C.

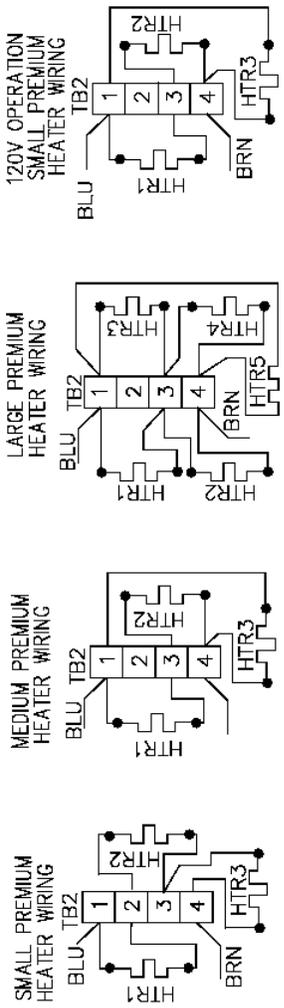
³ Door opened for 1 minute.

Wiring Diagram

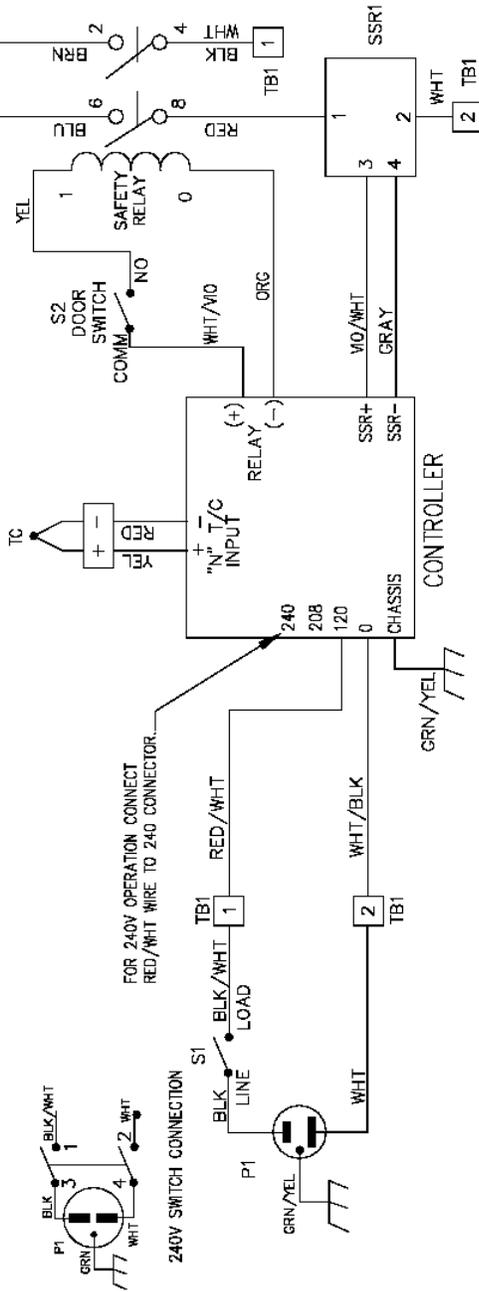
HEATER RESISTANCE					
	HTR1	HTR2	HTR3	HTR4	HTR5
SMALL 120V	8 Ω	8 Ω	18 Ω	—	—
SMALL 240V	8 Ω	8 Ω	18 Ω	—	—
MEDIUM 240V	18 Ω	18 Ω	41.1 Ω	—	—
LARGE 240V	18 Ω	18 Ω	18 Ω	18 Ω	41.1 Ω



HEATER CONNECTIONS



NOTE:
ALARM CIRCUIT IS +12VDC DURING
NORMAL OPERATION, 0 VDC DURING
ALARM CONDITION.



Warranty

Laboratory instruments and equipment manufactured by Fisher Scientific Company L.L.C. – Laboratory Equipment Division (hereinafter called “the Company”) are warranted only as stated below.

Subject to the exceptions and upon the conditions specified below, the Company agrees, at its election, to correct by repair, by replacement, or by credit to the purchaser, any defect of materials or workmanship which develops within one year (13 months for refrigerator and freezer products) from the date of purchase by the original purchaser by the Company or by an authorized dealer of the Company provided that investigation or factory inspection by the Company discloses that such defect developed under normal and proper use

The exceptions and conditions mentioned above are the following:

- a. The Company makes no warranty concerning components or accessories not manufactured by it, such as tubes, batteries, etc. However, in the event of the failure of any component or accessory not manufactured by the Company, the Company will give reasonable assistance to the purchaser in obtaining from the respective manufacturer whatever adjustment is reasonable in the light of the manufacturer’s own warranty.
- b. The Company shall be released from all obligations under its warranty in the event repairs or modifications are made by persons other than its own service personnel or authorized dealer personnel unless such repairs by others are made with the written consent of the Company.
- c. **THE COMPANY MAKES NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED, EITHER IN FACT OF BY OPERATION OF LAW,...STATUTORY OR OTHERWISE.**
- d. The above warranty and the above obligations to repair, replace, or credit are complete and exclusive and the Company expressly disclaims liability for lost profits or for special, indirect, incidental, consequential, or exemplary damages of any nature whether attributable to contract, warranty, negligence, strict liability, or otherwise even if the Company has been advised of the possibility of such damages.
- e. Representations and warranties made by any person, including dealers and representatives of the Company, which are inconsistent or in conflict with the foregoing warranty shall not be binding upon the Company unless reduced to writing and signed by an officer of the Company.



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