Thermo Fisher Scientific

Lindberg/Blue M Vacuum Ovens
VO914 / VO1218 / VO1824

Installation and Operating Manual

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Table of Contents

1 Introduction. 1

1.1 Features and Benefits 1

1.2 Available Door Gaskets 1

1.3 Specifications 2

2 Safety Considerations 2

3 Installation. 4

3.1 Unpacking. 4

3.2 Location 4

3.3 Vacuum and Gas Connection. 4

3.3.1 Vent Tube Inlet – 1/4 in. O.D. 4

3.3.2 Gas Tube Inlet – 1/4 in. O.D. 4

3.3.3 Vacuum Tube Inlet – 3/8 in. O.D. 4

3.3.4 Vacuum Port – 1 in. NPT. 4

3.4 Wiring 4

3.5 Cleaning 4

3.6 Connections 4

4 Start Up 5

4.1 Oven Start Up. 5

5 Operation – UT150 Controller 5

5.1 Normal Controller Operation. 5

5.2 Setting the Temperature 6

5.3 Setting the Overtemperature Protection (OTP) Temperature. 6

5.4 Changing Between Celsius and Fahrenheit 6

5.5 Setting the Ramp to Setpoint Rate. 6

5.6 Auto Tuning the Controller 7

6 Operation – UP150 Controller ("P" Models only) 8

6.1 Normal Controller Operation 8

6.2 Single Setpoint Operation 9

6.2.1 Setting High Temperature Alarm Setpoint: 9

6.2.2 Accessing Local Mode 9

6.2.3 Exiting Local Mode 9

6.3 Programming Operation: Entering a Program 9

6.3.1 Entering Programming Mode 9

6.3.2 Entering Program Parameters 10

6.3.3 Running a Program 11

6.3.4 Ending a Program 11

6.3.5 Changing a Program 11

6.4 Auto Tuning the UP150 Controller 11

6.5 Temperature Offset Procedure 12

6.6 Changing Temperature Scale Between ºC and ºF 12

7 Maintenance 13

7.1 General Maintenance 13

7.2 Gasket Maintenance 13

7.3 Door Alignment 13

8 Troubleshooting 14

9 Replacement Parts 15

1 Introduction

The Lindberg/Blue M VO Series is a family of laboratory vacuum ovens designed for drying, curing, outgassing, process control, and applications which require elevated temperature in reduced atmospheres or vacuum/purge with non-flammable gases. Refer to Table 1 on page 2 for specifications.

1.1 Features and Benefits

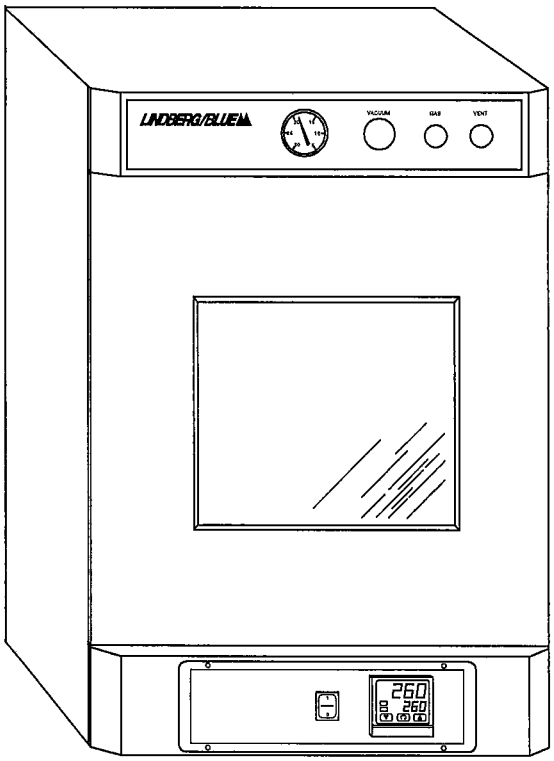
- Single setpoint digital electronic control (models with suffix P have programmable controls).
- Built-in overtemperature protection.
- Fully flexible vacuum/purge/release system.
- Vacuum system includes inert gas injection valve, fresh air inlets, vacuum port to exhaust vacuum atmosphere, and controllable vacuum release vent port.

1.2 Available Door Gaskets

In addition to the standard silicone gasket provided with the oven, the following gaskets are available from Lindberg/Blue M:

- Buna-N gasket for use with solvents up to 160°C.
- Viton-B gasket for applications involving acids.

Refer to Table 7 on page 15 for gasket ordering information.



1.3 Specifications

Table 1. Lindberg/Blue M VO Series Laboratory Vacuum Ovens

Model	Dimensions W x F-B x H in. (cm)			Voltage	Exterior	Heater Power (kw)	Shipping Weight lbs (kg)
	Chamber	Exterior	Shipping (Approximate)				
VO914(P)A	9 x 14 x 9 (22.9 x 35.6 x 22.9)	17.5 x 20 x 24.7 (44.5 x 50.8 x 62.7)	27.5 x 30 x 34.7 (69.8 x 76.2 x 88.1)	120 VAC, 50/60 Hz, Single Phase	Enameled Steel	1.05	150 (68)
VO914(P)C				240 VAC, 50/60 Hz, Single Phase			
VO1218(P)A	12 x 18 x 12 (30.5 x 45.7 x 30.5)	20.5 x 23 x 28.4 (52 x 58.4 x 72.1)	30.5 x 33 x 38.4 (77.5 x 84 x 98)	120 VAC, 50/60 Hz, Single Phase		1.55	250 (114)
VO1218(P)C				240 VAC, 50/60 Hz, Single Phase			
VO1824(P)A	18 x 24 x 18 (45.7 x 61 x 45.7)	26.3 x 30.4 x 34.3 (66.8 x 77.2 x 87.1)	36 x 41 x 45 (91.5 x 104.1 x 114.3)	120 VAC, 50/60 Hz, Single Phase		1.55	325 (148)
VO1824(P)C				240 VAC, 50/60 Hz, Single Phase			
VO914S(P)A	9 x 14 x 9 (22.9 x 35.6 x 22.9)	17.5 x 20 x 24.7 (44.5 x 50.8 x 62.7)	27.5 x 30 x 34.7 (69.8 x 76.2 x 88.1)	120 VAC, 50/60 Hz, Single Phase	Stainless Steel	1.05	150 (68)
VO914S(P)C				240 VAC, 50/60 Hz, Single Phase			
VO1218S(P)A	12 x 18 x 12 (30.5 x 45.7 x 30.5)	20.5 x 23 x 28.4 (52 x 58.4 x 72.1)	30.5 x 33 x 38.4 (77.5 x 84 x 98)	120 VAC, 50/60 Hz, Single Phase		1.55	250 (114)
VO1218S(P)C				240 VAC, 50/60 Hz, Single Phase			
VO1824S(P)A	18 x 24 x 18 (45.7 x 61 x 45.7)	26.3 x 30.4 x 34.3 (66.8 x 77.2 x 87.1)	27.5 x 30 x 34.7 (69.8 x 76.2 x 88.1)	120 VAC, 50/60 Hz, Single Phase		1.55	325 (148)
VO1824S(P)C				240 VAC, 50/60 Hz, Single Phase			

2 Safety Considerations

WARNING! Do not modify or change system components. Replacement parts must be O.E.M. exact replacement equipment. Modification or use of the equipment in a manner other than expressly intended may cause death or serious injury. This includes use of user-supplied components and materials not specifically designed for the oven. Reconfiguring the controller may cause death or serious injury.

Lindberg/Blue M shall not be liable for any damages, including incidental and/or consequential damages, regardless of the legal theory asserted, including negligence and/or strict liability.

Before using, user shall determine the suitability and integrity of the product for the intended use and that the unit has not been altered in any way. User assumes all risk and liability whatsoever therewith.

WARNING! Before maintaining this equipment, read the applicable MSDS (Material Safety Data Sheets) provided with your oven.

WARNING! This unit is not intended for use in processing hazardous work loads. Fatal injuries and property damage can result from processing combustible volatile fluids or materials which emit explosive vapors.

Do not use combustible gases in this oven.

Avoid combustible products which generate toxic or hazardous vapor or fumes. Work should only be done in a properly vented environment.

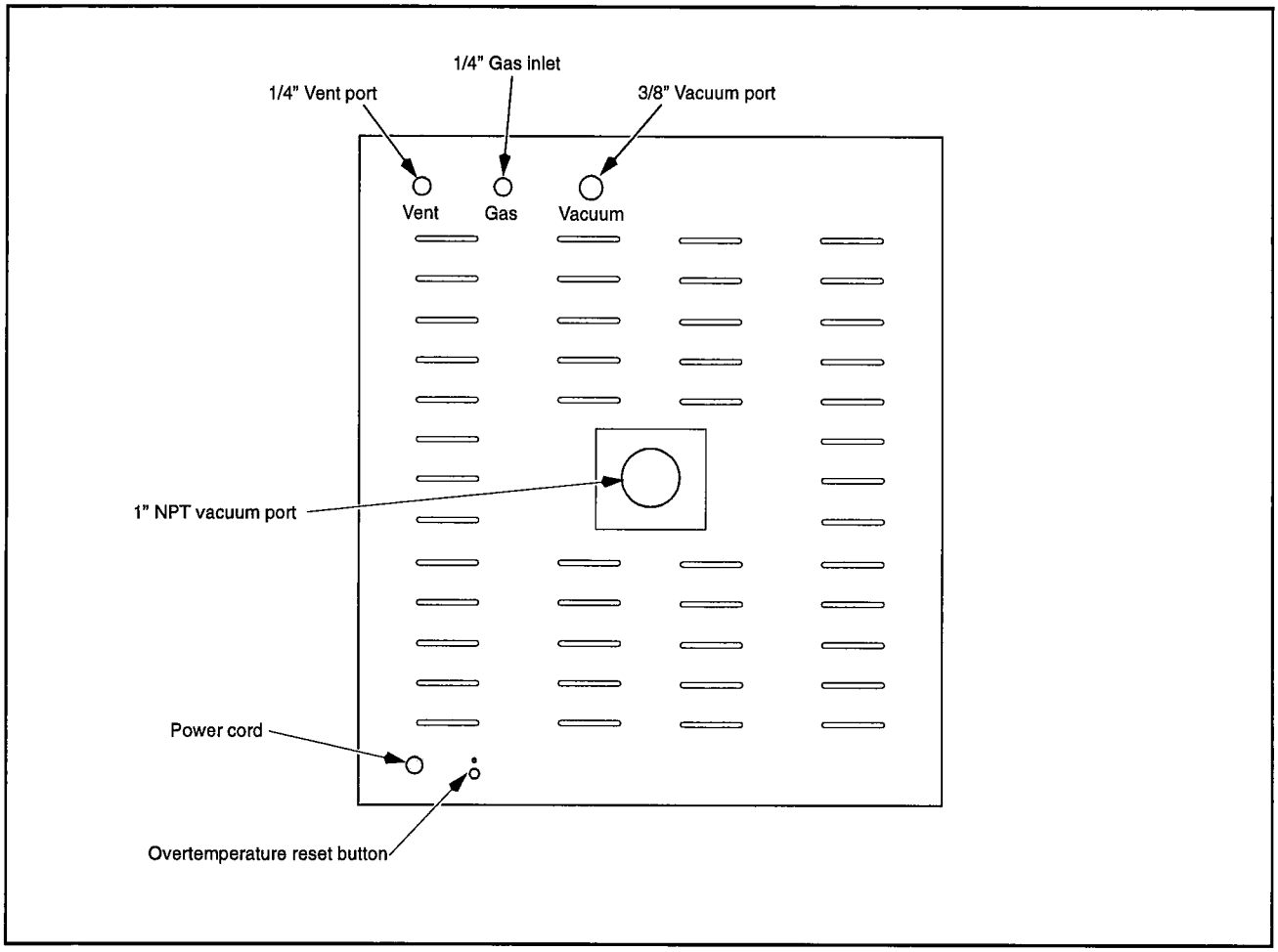


Figure 1. Vacuum and Gas Connections

CAUTION! This product contains fiberglass wool or other refractories which can result in the following:

- May be irritating to skin, eyes, and respiratory tract.
- May be harmful if inhaled.
- Possible cancer hazard based on tests with laboratory animals. Animal studies to date are inconclusive. No human exposure studies with this product have been reported.

WARNING! Before maintaining this equipment, read the applicable MSDS (Material Safety Data Sheets) at the back of this manual.

WARNING! When installing, maintaining, or removing the refractory insulation, the following precautions will minimize airborne dust and fiber:

- Keep personnel not involved in the installation out of the area.
- Use a good vacuum to clean area and equipment. Use a dust suppressant if sweeping is necessary. Do **not** use compressed air.
- Use disposable mask suitable for nuisance dust.
- Wear long sleeve clothing, gloves, hat, and eye protection to minimize skin and eye contact. Do not wear contact lenses.
- Thoroughly wash self after work is complete.
- Launder work clothing separate from other clothes and thoroughly clean laundering equipment after use. If clothing contains a large amount of dust and/or fiber, dispose of rather than clean.
- Promptly place used fiberglass parts and dust in plastic bags and dispose of properly.

3 Installation

Do not exceed the electrical and temperature ratings printed on the dataplate of the oven.

WARNING! Improper operation of the oven could result in dangerous conditions. To preclude hazard and minimize risk, follow all instructions and operate within design limits noted on the dataplate.

All standard Lindberg/Blue M Vacuum Ovens are shipped electrically complete. the only requirements for placing the oven into operation are positioning and connecting the electrical service and vacuum piping.

Note: Since the front panel display reads gauge pressure the value is relative to the local atmospheric pressure. Use in a location with reduced atmospheric pressure will result in the gauge displaying diminished vacuum levels.

3.1 Unpacking

Carefully unpack and inspect the unit and all accessories for damage. If you find any damage, keep the packing materials and immediately report the damage to the carrier. We will assist you with your claim, if requested. **Do not return goods to Lindberg/Blue M without written authorization.** ***When submitting a claim for shipping damage, request that the carrier inspect the shipping container and equipment.***

Remove all packing materials from inside the oven.

3.2 Location

Install the oven in a level area free from vibration with a minimum of three inches of space, for air flow, around the unit. Do not locate the oven in an area where extremely wide ambient temperature variations are likely to occur. This includes locations close to outside windows, entrances, and building heating and/or air conditioning vents.

3.3 Vacuum and Gas Connection

Figure 1 on page 3 shows the back of the oven where the vent tube inlet, gas tube inlet, vacuum tube inlet, vacuum port, power cord, and overtemperature reset pushbutton are located.

3.3.1 Vent Tube Inlet – 1/4 in. O.D.

This tube normally remains unconnected.

3.3.2 Gas Tube Inlet – 1/4 in. O.D.

If required by the material in process, connect this tube to an inert gas supply. The recommended inert gas supply pressure is 4 to 5 p.s.i.g. Do not exceed 10 p.s.i.g. supply pressure.

3.3.3 Vacuum Tube Inlet – 3/8 in. O.D.

This tube may be connected to house vacuum or an independent vacuum pump. If the 1 in. MPT vacuum port is used as the vacuum connection, this 3/8 in. tube may remain unconnected.

3.3.4 Vacuum Port – 1 in. NPT

This pipe may be used as the primary vacuum connection, or as an access port to the vacuum chamber. If the 3/8 in. O.D. vacuum tube inlet is used as the vacuum connection, this pipe should remain capped.

3.4 Wiring

For detailed wiring information, refer to the wiring diagrams at the end of this manual.

Do not exceed the electrical and temperature ratings printed on the dataplate of the oven. Fuse protection should not exceed 125% of the unit rating.

WARNING! Improper operation of the oven could result in dangerous conditions. To preclude hazard and minimize risk, follow all instructions and operate within design limits noted on the dataplate.

CAUTION! Connect the oven to the correct power source. Incorrect voltage can result in severe damage to the oven.

Plug the power cord into a grounded outlet. The voltage of the outlet should not vary more than 10% from the dataplate rating. A separate circuit should be used to prevent loss of product due to overloading or circuit failure. Lower voltage to the oven decreases power to the heating element. Always conform to national and local electrical codes.

WARNING! **Do not** connect the neutral side of the 120 volt line to the unit for grounding purposes. Do not connect the oven to overloaded power lines.

3.5 Cleaning

The oven is cleaned at the factory but we recommend cleaning the oven before initial operation. To clean the oven, complete the following steps:

1. Remove all interior parts, including the shelves and the shelf assembly.
2. Use acetone, alcohol, or ether to thoroughly clean the inside of the oven chamber, including all corners.

The oven should be cleaned periodically to prevent contamination.

3.6 Connections

Connect all vacuum lines and any accessories such as the foreline trap and the exhaust demister per the manufacturer's instructions.

4 Start Up

CAUTION! Observe the following precautions when operating the oven:
- Wear protective eyeware.
- Wear protective gloves.
- Use tongs to insert and remove oven load.
- Do not allow the load to touch the oven walls.

CAUTION! Do not attempt to operate the oven above the maximum rated temperature of 260°C. Operation above 260°C can cause damage to the oven.

4.1 Oven Start Up

To start the oven, complete the following steps:

1. Turn on main power switch. Wait until the controller runs initial diagnostics.
2. Verify the vacuum pump connection (see Section 3.3 on page 4).
3. Select the desired setpoints (refer to Section 5.3 on page 6 if you have a UT150 controller, Section 6 if you have a UP150 controller).

5 Operation – UT150 Controller

The oven 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.

CAUTION! Before reconfiguring the controller, read this chapter and the UT150 operation manual. Reconfiguring the controller can change the unit characteristics and design parameters, which can hamper performance and make the equipment dangerous to use.

This chapter provides brief instructions on how to perform the following configuration changes:

- Setting the temperature
- Setting the Overtemperature Protection Temperature
- Changing between celsius and fahrenheit
- Setting the ramp to setpoint time
- Autotuning the controller

Detailed instructions on configuring the temperature controller are found in the UT150 operation manual.

5.1 Normal Controller Operation

The Temperature Controller senses the chamber air temperature of the oven (the PV, or process value) and supplies the heat necessary to achieve the desired setpoint. The controller includes an LED display and a pushbutton keypad. Refer to Table 2 and Table 3 for lists of displayed parameters and keypad functions.

Table 2. UT150 Parameter Functions

Parameter Code	Description
Operating parameters (access by holding the SET/ENT key)	
A1	Alarm setpoint (ºC;)
CtL	Control mode
At	Auto tuning
P	Proportional band (ºC)
I	Integral time
d	Derivative time
Ct	Heat cycle time
FL	Sensor filter
bS	PV bias (offset)
LoC	Key lock
Setup parameters (access by setting LoC=-1)	
In	Input type (J thermocouple in ºC; ºF=35)
SPH	High setpoint limit ºC;
SPL	Low setpoint limit ºC; 2
Upr	Up ramp rate (degrees C or F / minute)
dnr	Down ramp rate (degrees C or F / minute)
AL 1	Alarm 1 type
AL 2	Alarm 2 type
HY 1	Alarm 1 hysteresis (ºF=1)
HY 2	Alarm 2 hysteresis
SC	Super Control
dr	Direct/reverse action

Table 3. Pushbutton Keypad

Button	Function
SET/ENT	Pressing and holding the SET/ENT for three seconds advances the display to the Operation Parameters Menu. While in the Operation Parameters Menu, use SET/ENT to move from one parameter to the next, and to register changes you have made in setpoint and parameter values. Holding SET/ENT for three seconds exits either the Operation or Setup Parameters menu.
△	Use the Up Arrow button to increase the temperature setpoint display and to change parameter values in the Operation and Setup Parameter menus. Whenever you change the value of a setpoint or parameter, the decimal point flashes to remind you to register the changed value with SET/ENT.
▽	Use the Down Arrow button to decrease the temperature setpoint display and to change parameter values in the Operation and Setup Parameter menus. Whenever you change the value of a setpoint or parameter, the decimal point flashes to remind you to register the changed value with SET/ENT.

5.2 Setting the Temperature

To set the temperature to the desired setpoint, complete the following steps:

1. Press △ or ▽ until the desired setpoint is indicated on the bottom line of the display.
2. Press **SET/ENT** to register the new setpoint.

5.3 Setting the Overtemperature Protection (OTP) Temperature

The high limit alarm system with the temperature controller disables the heater output. To set the alarm on the temperature controller (typically 5°C above the desired main temperature setpoint), complete the following steps:

1. Press and hold **SET/ENT** for 3 seconds, until **A1** is displayed on the upper line.
2. Press △ or ▽ until the desired overtemperature limit setpoint shows on the bottom line of the display.
3. Press **SET/ENT** to register the new overtemperature alarm setpoint.
4. Press and hold **SET/ENT** for 3 seconds to return to the normal display.

5.4 Changing Between Celsius and Fahrenheit

The controller is factory-set to operate with degrees Celsius. To change the display modes and parameter settings to the Fahrenheit scale, you will need to change the Input Type parameter **In** and also the values of various scale-dependent parameters. If during this procedure the buttons are inactive for more than two minutes, the controller will return to the standard display.

To change from Celsius to Fahrenheit:

1. With the controller operating, access the Operating Parameters menu by pressing and holding **SET/ENT** for 3 seconds.
2. Press and release **SET/ENT** repeatedly until the upper display reads LoC.
3. Press ▽ until the displayed value of LoC is -1; then press **SET/ENT** to access the Setup Parameters menu (refer to Table 2 on page 5).
4. The first setup parameter displayed is Input Type (In). Press to change its value from 5 to 35. After making this adjustment (and all following parameter adjustments) be sure to press and release **SET/ENT** again to register the change.
5. Press and release **SET/ENT** to advance to the SPH parameter and change its value to 500.
6. Press and release **SET/ENT** to advance to the SPL parameter and change its value to 32.
7. Press and release **SET/ENT** to advance to the HY1 parameter and change its value to 1.
8. Press and hold **SET/ENT** for 3 seconds to exit the Setup Parameters Menu.
9. Press and hold **SET/ENT** for 3 seconds to enter the Operating Parameters Menu and display the A1 parameter.
10. Use the △ button to set the A1 parameter to the desired overtemperature limit in °F.
11. Press and release **SET/ENT** to advance to the P parameter and change its value to 16.2.
12. Press and hold **SET/ENT** for 3 seconds to exit the Operating Parameters Menu.
13. The new temperature units are now effective. Follow the instructions in Section 5.2 to reset the temperature setpoint in °F.
14. Apply the °F label over the °C label on the control panel.

5.5 Setting the Ramp to Setpoint Rate

The Ramp Rate feature allows the chamber to be heated or cooled at any rate slower than the maximum capability of the unit. To fine tune ramp rates, you may need to test using loads with similar mass and thermal properties to loads you intend to use in oven applications.

To set the ramp to setpoint time, complete the following steps. If during this procedure the buttons are inactive for more than two minutes, the controller will return to the standard display.

1. With the controller operating, press and hold **SET/ENT** for 3 seconds to enter the Operating Parameters menu.
2. Press and release **SET/ENT** until the LoC parameter is on the upper display.
3. Press the down arrow button to show '-1', and press **SET/ENT** once to enter the Setup Parameters menu.
4. Press and release **SET/ENT** until the Upr parameter is on the upper display.
5. Press the arrow buttons to select the new Up Ramp Rate value, in °C per minute or °F per minute, or 'oFF'. Press and release **SET/ENT** to register the value change.
6. Press and release **SET/ENT** until the dnr parameter is on the upper display.
7. Press the arrow buttons to select the new Down Ramp Rate value, in °C per minute or °F per minute, or 'oFF'. Press and release **SET/ENT** to register the value change.
8. Press and hold **SET/ENT** for three seconds to exit the Setup Parameters menu.
9. The new Ramp Rates are now effective.
10. Follow the instructions in Section 5.2 to reset the temperature setpoint.

Note: *The ramp rate begins when the SET/ENT button is pressed after the target setpoint is selected. The setpoint display on the controller will show the changing setpoint at the selected ramp rate.*

To view the target setpoint during the ramp rate, press and release an arrow button. The lower display will show the setpoint next to the selected target setpoint. Return to the ramping setpoint display by pressing and releasing the other arrow button.

5.6 Auto Tuning the Controller

Factory settings are provided for general purposes, but your process can be enhanced through the auto tune feature. For a given process temperature and product load, auto tuning maximizes the performance of the chamber by operating with the quickest response and minimal temperature overshoot.

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. Operate the chamber to the process temperature.
3. Press and hold **SET/ENT** for 3 seconds to display the A1 parameter of the Operating Parameter menu.
4. Press and release **SET/ENT** to show the At parameter.
5. Press and release the arrow buttons to show on in the lower display.
6. Press **SET/ENT** once to enter the auto tune mode and exit the Operating Parameters menu.

The controller will cycle three times through a heating and cooling pattern, measuring the characteristics of the load and chamber temperature controls. During the auto tuning, At will alternately flash with the measured temperature (PV) to indicate that the auto tuning is in progress. The length of time for the auto tune varies with the load, chamber size and temperature selected.

The auto tune is completed when the regular display of the measured temperature is shown. The chamber should now operate to the process temperature with the given product load, with the quickest response and minimal temperature overshoot.

If the process temperature or load changes significantly, another auto tune session may be necessary to optimize the chamber performance.

6 Operation – UP150 Controller ("P" Models only)

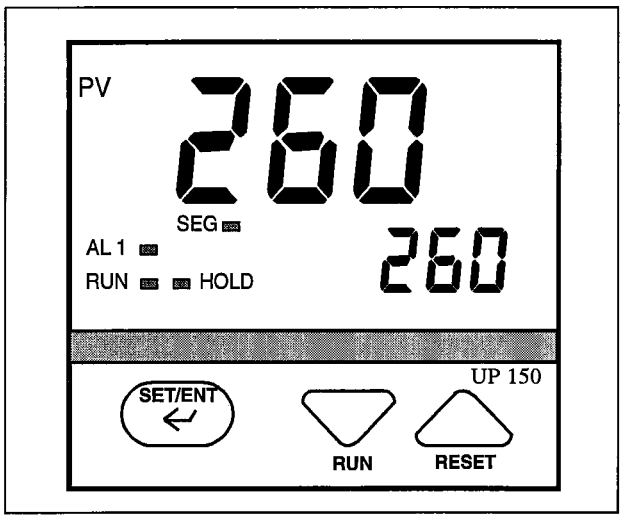


Figure 2. UP150 Control Panel

The oven 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.

⚠ **CAUTION!** Before reconfiguring the controller, read this chapter carefully. Reconfiguring the controller can change the unit characteristics and design parameters, which can hamper performance and make the equipment dangerous to use.

For more detailed instructions, refer to the Yokogawa UP150 manual.

6.1 Normal Controller Operation

The Temperature Controller senses the chamber air temperature of the oven (the PV, or process value) and supplies the heat necessary to achieve the desired setpoint. The controller includes an LED display and a pushbutton keypad. Refer to Table 2 and Table 3 for lists of displayed parameters and keypad functions.

The UP150 controller will accept a single program of up to 16 segments. This controller includes an automatic tuning feature and "Super" control to improve the performance. Refer to the UP150 manual for detailed information.

Table 4. UP150 Parameter Functions

Parameter Code	Factory Set Value	Description
Operating parameters (access by holding the SET/ENT key)		
HoLd	OFF	Program Hold
AdV	OFF	Segment Advance
CtL	Pid	Control mode
At	oFF	Auto tuning
P	32.4	Proportional band (ºC; ºF=11)
I	1384	Integral time
d	346	Derivative time
Ct	1	Heat cycle time
FL	OFF	Sensor filter
bS	0.0	PV bias (offset)
LoC	0	Key lock
Setup parameters (access by setting LoC=-1)		
In	5	Input type (J thermocouple in ºC; ºF=35)
SC	ON	Super function

Table 5. Pushbutton Keypad

Button	Function
SET/ENT	Pressing and holding the SET/ENT for three seconds advances the display to the Operation Parameters Menu. While in the Operation Parameters Menu, use SET/ENT to move from one parameter to the next, and to register changes you have made in setpoint and parameter values. Holding SET/ENT for three seconds exits either the Operation or Setup Parameters menu.
△	Use the Up Arrow button to increase the temperature setpoint display and to change parameter values in the Operation and Setup Parameter menus. Whenever you change the value of a setpoint or parameter, the decimal point flashes to remind you to register the changed value with SET/ENT. While in operating mode, pressing this key stops (resets) program operation.
▽	Use the Down Arrow button to decrease the temperature setpoint display and to change parameter values in the Operation and Setup Parameter menus. Whenever you change the value of a setpoint or parameter, the decimal point flashes to remind you to register the changed value with SET/ENT. While in operating mode, pressing this key starts (runs) a program

6.2 Single Setpoint Operation

The following sections describe how to operate the controller in single setpoint (local) mode. Use this mode when you only need to run the oven with a specific setpoint and do not require a programmed sequence of steps.

6.2.1 Setting High Temperature Alarm Setpoint:

1. Press and HOLD for three seconds the 'SET/ENT' button to display "modE rES".
2. Press and release the 'SET/ENT' button to display "PrG 0".
3. Press the 'UP/RESET' Button to show the lower display value of "1".
4. Press and release the 'SET/ENT' button to select this new value and advance to the "SSP 25" display.
5. Press and release the 'SET/ENT" button until the High Temperature Alarm Setpoint value is displayed as "A1".
6. Select an alarm setpoint 10°C above the target setpoint to be selected.
7. Press and release the 'SET/ENT' button to place this new value in the controller memory.
8. Press and HOLD for three seconds the 'SET/ENT' button to exit this menu.

6.2.2 Accessing Local Mode

1. Press and hold for three seconds the 'SET/ENT' button to display "modE rES".
2. Press and release the 'UP' button twice to select the display "modE LCL".
3. Press and release the 'SET/ENT' button once to select Local Mode. This selection causes the red indicator to illuminate beside "L" on the control panel.
4. Use the 'UP' and 'DOWN' buttons to select the desired operating temperature setpoint.
5. Press and release the 'SET/ENT' button once to register the setpoint value.
6. The display will then show measured temperature in the upper display, the present temperature setpoint in the lower display.
7. This display and the buttons will remain active as long power continues to the control module. Power interruptions will cause the controller to enter reset or standby mode in which no actions are made to operate the heating equipment.

You may use the arrow buttons to adjust the setpoint (lower) value to be adjusted in this display mode. The 'SET/ENT' button will register setpoint value changes, until these values are changed again.

6.2.3 Exiting Local Mode

To exit Single Setpoint or Local Mode and turn off the energy to the heaters:

1. Press and hold for three seconds the 'SET/ENT' button to display "modE LCL".
2. Press and release the 'DOWN' button twice to select the display "modE rES".
3. Press and release the 'SET/ENT' button once to select the Reset Mode.
   This selection causes the red indicator to extinguish beside the display label "L" that had indicated the Local Mode.
4. This will change the display showing the measured temperature in the upper display, with the lower display showing the Start Set Point (SSP) temperature setpoint of the program.

6.3 Programming Operation: Entering a Program

This section describes how to enter a simple program that is designed to:

- direct the controller to ramp to a higher temperature;
- stabilize;
- ramp to a lower-temperature;
- end with an indefinite dwell.

If you intend to use the program features of the controller, it is advisable to go through all the steps in this sample program to familiarize yourself with the elements of programming mode.

Note: If the controller buttons are NOT pushed for 2 minutes, the controller will return to the regular operator mode/menu.

6.3.1 Entering Programming Mode

To access the programming menu:

1. Make sure the indicators beside "RUN" and "L" on the controller face are off. If either indicator is on, press and hold the 'SET/ENT' button until the display shows 'modE'. Select 'rES' in the lower display with the 'arrow' buttons. Press and release the 'SET/ENT' button once.
2. Press the 'SET/ENT' button for 3 seconds to display "modE" in the upper display and "rES" (Reset) in the lower display.
3. Press and release 'SET/ENT' until "LoC" is displayed. Make sure the display below "LoC" is "0" (zero). If it is not "0", use 'DOWN ARROW' to select "0" and press and release "SET/ENT" button to register the change to "0".
4. Press and release the "SET/ENT' button until "PrG" is displayed.
5. At "PrG" display, press the 'UP ARROW' to make the lower display "1".
6. Press and release the 'SET/ENT' button once to enter the programming menu.

6.3.2 Entering Program Parameters

The first display is the Start Set Point parameter, shown as "SSP" in the upper display. The value assigned to SSP is usually the current room temperature, 25°C.

On the next page is an illustration of the program profile and a table of the parameters entered.

Basic Ramp and Dwell Parameters:

1. Use the arrow buttons to select "25" in the lower display, then press and release the 'SET/ENT' button twice to enter this new value and to advance to the "StC" display. If the value for "SSP" is correct and does not need to be changed, press and release the 'SET/ENT' button once to advance to the "StC" display.
2. Next is the Start Code parameter, shown as "StC" in the upper display. The value assigned to StC is usually "0". This will instruct the program to follow the Start Set Point. Press the SET/ENT button to advance to the next display.
3. The next parameter, "SP1", is the first setpoint value that is desired in the chamber and is normally a ramp segment. Select this target temperature setpoint value with the arrow buttons then press and release the 'SET/ENT' button twice to enter this value and to advance to the "tM1" display. If the value for "SP1" is correct and will not be changed, press and release the 'SET/ENT' button once to advance to the "tM1" display.
4. The next parameter, "tM1", represents the first time period for the unit to reach the target temperature setpoint selected in "SP1". This selection can be a value ranging from 0.00 to 99.59, which represents hours and minutes. Select this time value with the arrow buttons and enter it by pressing and releasing the 'SET/ENT' button twice.
5. Press and release the 'SET/ENT' button to advance to the next display of "SP2", this is normally the dwell segment. Select the same target setpoint temperature value as "SP1" with the arrow buttons. Press and release the 'SET/ENT' button twice to enter this value and to advance to the next display.
6. The next parameter, "tM2", represents the second time period used to maintain or dwell at the target setpoint selected in "SP2". This selection can be a value ranging from 0.00 to 99.59, which represents hours and minutes. Select this time value with the arrow buttons and enter it by pressing and releasing the 'SET/ENT' button twice.
7. Next, "SP3" is the third setpoint value desired in the chamber. Select this target temperature setpoint with the arrow buttons and press and release the 'SET/ENT' button twice to enter this value and to advance to the "tM3" display. If this value is correct and not changed, press and release the 'SET/ENT' button once to advance to the "tM3" display.
8. "tM3" represents the third time period for the unit to reach the target setpoint selected in "SP3". This selection can be a value ranging from 0.00 to 99.59, which represents hours and minutes. Select this value with the arrow buttons and enter it by pressing and releasing the 'SET/ENT' button.
9. The next parameter, "SP4" is normally the dwell segment. Select the same target temperature as "SP3" with the arrow buttons, then press and release the 'SET/ENT' button twice to enter this new value and to advance to the next display.

Additional Program Parameters"

10. The next parameter displayed is "tM4". Select a lower display value of "oFF" with the 'arrow' buttons, then press and release the 'SET/ENT' button twice to enter this value change and advance to the next display.
11. The next display shows "EV1" in the upper display. The lower value should always be "0" (zero). Press and release the 'SET/ENT' button once to go to the next display.
12. "AL1" should always have a lower value of "9". Press and release the 'SET/ENT' button once to advance to the next display.
13. The next parameter, "A1", is used to select the high temperature alarm trip setpoint. Use the 'arrow' buttons to select a value 10°C (or 20°F) HIGHER than the **highest** target setpoint to be used. Select the High Temperature Alarm value with the arrow buttons then press and release the 'SET/ENT' button twice to enter this new value and to advance to the "HY1" display. If the value for "A1" is correct and not changed, press and release the 'SET/ENT' button once to advance to the "HY1" display.
14. "HY1" is used to select the amount of temperature change below the high temperature alarm setpoint where the alarm relay will reset. This value is usually "1". Select "1" with the arrow buttons and press the 'SET/ENT' button six times to enter the correct value and advance to the "JC" display. Or if the value is correct, press the 'SET/ENT' button five times to advance to the "JC" display.
15. For the parameter displayed as "JC", select "1" with the arrow buttons, then press and release the 'SET/ENT' button twice to display "WTZ". Selecting the value of "1" will cause the program to hold the setpoint at this last segment. A value of "0" would cause the program to reset and stop running the program and stop the power to the heaters. A value of "2" will cause the program to repeat 'continuously'.
16. When the display shows "WTZ", select a lower display value of "oFF" with the 'arrow' buttons. Press and HOLD the 'SET/ENT' button for 3 seconds to return to the Reset or standby display.

This concludes the steps required to enter a typical ramp-and dwell program.

6.3.3 Running a Program

To run a program such as the one outlined above, press and hold the 'DOWN/RUN' button making the 'RUN' indicator illuminate. At the end of this program the 'HLD' (hold) indicator is illuminated to indicate this program is in the indefinite dwell at the last target temperature. This hold indicator is caused by the "JC" selection of "1", while the "JC" selections of "0" or "2" will not illuminate the 'HLD' (hold) indicator.

6.3.4 Ending a Program

To end a program while in the 'RUN' or 'HLD" (hold) mode, press and hold the 'UP/RESET' button to turn off the current program and extinguish the 'RUN' or 'HLD' indicator.

Turning off the unit's power will also stop the program. When power is restored, the controller is in the Reset or standby mode with no power to the heaters.

Note: The programmer/controller will not operate the unit's heaters (to change or maintain a temperature) unless there is a program running or a single setpoint value is selected in the Local Mode.

6.3.5 Changing a Program

To make changes ONLY to the target temperature and segment length times for simple program operation, follow these steps:

1. Make sure the indicators beside "RUN" and "L" on the controller face are off. If either indicator is on, press and hold the 'SET/ENT' button until the display shows 'modE'. Select 'rES' in the lower display with the 'arrow' buttons. Press and release the 'SET/ENT' button once.
2. Press the 'SET/ENT' button for 3 seconds to display "modE" in the upper display and "rES" in the lower display. Press and release 'SET/ENT' repeatedly to display "LoC". Make sure the value below "LoC" is "0" (zero). If it is not "0", use 'DOWN' arrow to select "0" and press and release "SET/ENT" button to register the change to "0".
3. Press and release the 'SET/ENT' button once to show "PrG" on the upper display.
4. Press the 'UP' arrow to make the lower value "1".
5. Press and release 'SET/ENT' button twice to display "SP1". Using the arrow buttons to revise the target setpoint.
6. Press and release 'SET/ENT' button twice to display "tm1". Using the arrow buttons to revise the segment time length needed to get to the target setpoint 'SP1'.
7. Press and release 'SET/ENT' button to display other setpoints and segment time lengths. Use the arrow buttons to change the temperature setpoints and time lengths. Press and release the 'SET/ENT' button to register any new values.
8. Press and HOLD the 'SET/ENT' button for 3 seconds to exit the program menu and return to the reset or standby display.

6.4 Auto Tuning the UP150 Controller

Auto tuning maximizes the performance of the chamber at a selected temperature with the product load's characteristics, by operating with the quickest response and minimal temperature overshoot.

Factory settings are for general purposes, but your process can be enhanced through the auto tune feature. To obtain this maximum performance, follow these steps to auto tune the controller.

1. Load the chamber with materials that have the same mass and thermal characteristics as an actual product load.
2. Operate the chamber to the process temperature.
3. Start the Auto Tune: Press and hold the 'SET/ENT' button for three seconds to display the "modE" parameter of the Operating Parameter menu.
4. Press and release the 'SET/ENT' button five times to advance to the "At" parameter.
5. Press and release the 'UP' arrow button to show "on" in the lower display.
6. Press the 'SET/ENT' button once to enter the auto tune mode and exit the Operating Parameters menu.
7. The controller will cycle three times through a heating and cooling pattern, measuring the characteristics of the load and chamber temperature controls. During the auto tuning, 'At' will alternately flash with the measured temperature (PV) display to indicate that the auto tuning is in progress. The length of time for the auto tune varies with the load, chamber size and temperature selected.
8. The auto tune is completed when the regular display of the measured temperature is shown without the "At" value flashing. The chamber should now operate to the process temperature with the given product load, with the quickest response and minimal temperature overshoot.
9. If the process temperature or load changes significantly, another auto tune session may be necessary to optimize the chamber performance.

To interrupt the auto tune before it is completed, simply turn off the power to the controller and unit. When the power is restored the auto tune will not be operating.

6.5 Temperature Offset Procedure

The purpose of this procedure is to create an offset in the displayed temperature measurement for the Yokogawa model UP150 temperature controller.

1. Operate the oven chamber to your normal stable temperature setpoint, with an independent temperature measurement device located in the center of the chamber. The controller will be 'running' the program or operating in the local mode to maintain the temperature.
2. Note any difference in the controller's measured temperature (upper value) and the independent measurement. If a difference of greater than 1°C is noted proceed with the following steps.
3. Press and hold the "SET/ENT" button for 3 seconds to display "modE".
4. Verify the button lockout parameter will give access to make this display offset. Press and release the "SET/ENT" button twelve times to display "LoC". The value 0 (zero) displayed will give full access and is necessary to make the display offset changes desired. If the value displayed is 1 or 2, use the "down arrow" button to make 0 (zero) and press and release the "SET/ENT" button to register this change.
5. Press and release the "SET/ENT" button twelve times to display "bS" and the current offset value.
6. Select the offset value with the arrow buttons that is needed to make this controller display correctly.
   For example, if the independent measurement is 253°C, the controller Temperature measurement display shows 250°C, and the current controller offset (bS) is –2, then make the controller display offset "+1"
   [(+3 needed offset) + (-2 current offset) = (+1 new offset)].
7. Press and release the "SET/ENT" button once to register this new offset value. Press and hold the "SET/ENT" button for 3 seconds to exit this controller menu.
8. Operate the controller to the same temperature to stabilize the chamber to check for any further variations between the controller and the independent measurement. Repeat steps 2 – 7 as necessary.
9. This completes the display offset procedure for the Yokogawa model UP150 temperature controller. If the button lockout parameter "LoC" was originally on a value of 1 or 2, repeat steps 3 & 4 to return to this original value.

Contact Technical Service at 1-800-438-4851 if you have any questions.

6.6 Changing Temperature Scale Between ºC and ºF

To change the temperature scale in the UP150 controller to operate on °F instead of the factory setting of °C, or from °F to °C, follow these steps.

These changes will alter the controller input type and associated scale-dependant parameters, ***AND ERASE the stored program to default values***. Please document the stored program in the controller BEFORE proceeding.

If during this procedure the buttons are inactive for more than two minutes, the controller will return to the standard display.

1. Make sure the indicators beside "RUN" and "L" on the controller face are off. If they are on, press and hold the 'UP/RESET' button until the RUN or L indicators are off.
2. To access the Operating Parameters menu, press and HOLD the 'SET/ENT' button for at least 3 seconds to display "modE".
3. Press and release the 'SET/ENT' button until the display shows "LOC" in the upper display. Make sure the value below "LoC" is "0" (zero). If it is not "0" use 'down arrow' to make "0" and press and release "SET/ENT" button to register change to "0".
4. At "LoC" display, press the 'down arrow' to make the lower value "-1".
5. Press and release the "SET/ENT" button to enter the Setup Parameters menu and show "In" on the upper display and a numerical value in the lower display.
6. See table below for the STANDARD values for this parameter and the others needed in the following steps.
7. Select the appropriate value for the "In" parameter. Press the 'UP' or 'DOWN' arrow buttons to make the lower display to the new value, then press and release the 'SET/ENT' button TWICE to register the new value and advance to the next parameter.
8. "SPH" is the next parameter displayed. Select and enter the new value, then press and release the 'SET/ENT' button TWICE.
9. "SPL" is the next parameter displayed. Select and enter the new value, then press and release the 'SET/ENT' button ONCE.
10. Press and HOLD the 'SET/ENT' button for at least 3 seconds to exit.
11. Press and HOLD the 'SET/ENT' button for at least 3 seconds to enter the Operating Parameter menu and show "modE" in the upper display.
12. Press and release the 'SET/ENT' button until the upper display shows "P". Select the value in the table and adjust the lower display accordingly. Press and release the 'SET/ENT' button TWICE.
13. "I" is the next parameter displayed. Select and enter the new value, then press and release the 'SET/ENT' button TWICE.
14. "d" is the next parameter displayed. Select and enter the new value, then press and release the 'SET/ENT' button ONCE.
15. Press and HOLD the 'SET/ENT' button for at least 3 seconds to exit.
16. Reenter or create a program using the new temperature scale.

The P, I and D parameters may be altered through auto tuning (refer to Section 6.4 on page 11).

7 Maintenance

CAUTION! Maintenance should only be performed by trained personnel.

WARNING! Disconnect oven from main power before attempting any maintenance to oven or its controls.

CAUTION! This product contains fiberglass wool or other refractories which can result in the following:

- May be irritating to skin, eyes, and respiratory tract.
- May be harmful if inhaled.
- Possible cancer hazard based on tests with laboratory animals. Animal studies to date are inconclusive. No human exposure studies with this product have been reported.

WARNING! Before maintaining this equipment, read the applicable MSDS (Material Safety Data Sheets) provided with this unit.

WARNING! When installing, maintaining, or removing the refractory insulation, the following precautions will minimize airborne dust and fiber:

- Keep personnel not involved in the installation out of the area.
- Use a good vacuum to clean area and equipment. Use a dust suppressant if sweeping is necessary. Do **not** use compressed air.
- Use disposable mask suitable for nuisance dust.
- Wear long sleeve clothing, gloves, hat, and eye protection to minimize skin and eye contact. Do not wear contact lenses.
- Thoroughly wash self after work is complete.
- Launder work clothing separate from other clothes and thoroughly clean laundering equipment after use. If clothing contains a large amount of dust and/or fiber, dispose of rather than clean.
- Promptly place used fiberglass parts and dust in plastic bags and dispose of properly.

7.1 General Maintenance

WARNING! Disconnect oven from main power before attempting any maintenance to oven or its controls.

Regular maintenance is required to keep the oven running at optimum levels.

1. Clean the oven interior as necessary with acetone, alcohol, or ether.

WARNING! When using cleaning materials, follow all precautions listed on the cleaning containers. Always use cleaning materials in well ventilated areas as inadequate ventilation can be fatal.

Note: *Frequency of cleaning depends on the oven workload. If the oven becomes contaminated, the ultimate vacuum level will not be attained.*

2. Check hose connections for leaks weekly.
3. Check the vacuum pump oil level.
4. Check the condition of the vacuum pump oil. Replace the oil if it is contaminated.

7.2 Gasket Maintenance

WARNING! Disconnect oven from main power before attempting any maintenance to oven or its controls.

The door gasket is designed for easy removal and installation. This gasket may come off when the door is opened after high temperature operation or processing of workloads containing resin. To prolong gasket usage, clean the oven to remove any resin.

7.3 Door Alignment

WARNING! Disconnect oven from main power before attempting any maintenance to oven or its controls.

The oven may not pump down properly if the door is out of alignment. To realign the oven door, complete the following steps:

1. Lay the oven on its back.
2. Loosen top and bottom hinges.
3. Square the door. Check that the glass comes in contact with the gasket.
4. Place a small amount of pressure (approximately one pound) on the hinges.

Note: *This pressure is required so that the door seals when closed. The glass floats on springs to achieve a complete seal.*

5. Tighten the hinges.
6. Pump the oven down.

8 Troubleshooting

WARNING! Troubleshooting procedures involve working with high voltages which can cause injury or death. Troubleshooting should only be performed by trained personnel.

This section is a guide to troubleshooting oven problems. Refer to Table 6 for troubleshooting procedures.

Table 6. Troubleshooting

Problem	Probable Causes	Solution
Oven shelves warp and discolor.	Oven temperature is above 260°C.	Do not operate the oven above 260°C.
Door gasket comes off.	Gasket is damaged from high temperature operation or from resin damage.	Do not operate the oven above 260°C. Clean oven to remove resin.
System ultimate pressure is high.	Oven is contaminated with high vapor pressure material.	Clean the oven. Refer to Section 7.1 on page 13.
	Pump oil is contaminated.	Change the oil. Use inlet vapor trap and/or gas ballast.
	Leaks in vacuum piping or ports.	Check for leaks in vacuum line, oven port, door.
	Vacuum pump seal is worn.	Replace shaft seal.
	Discharge valve is worn.	Replace valve.
	Internal parts are worn.	Install new vanes.
	Vacuum vent valve is opened.	Close vent valve.
	Oven does not pump down properly due to misaligned door.	Realign the door. Refer to Section 7.3 on page 13 for realignment information.
No vacuum in oven.	Power to pump is off.	Check the power switch and outlet.
	Use of extension cord results in insufficient amperage.	Move the oven closer to power source and do not use extension cord.
	Pump is damaged.	Return the pump to the factory for repair.
Pump stalls.	The discharge line is blocked.	Change the demister and clear the blockage.
	No pump oil or lost viscosity (overheating).	Change the oil.
Long drying time.	The piping is too narrow.	Install piping the same size as the pump inlet.
	The distance between the pump and the oven is too large.	Move the pump closer to the oven or use a larger pump.

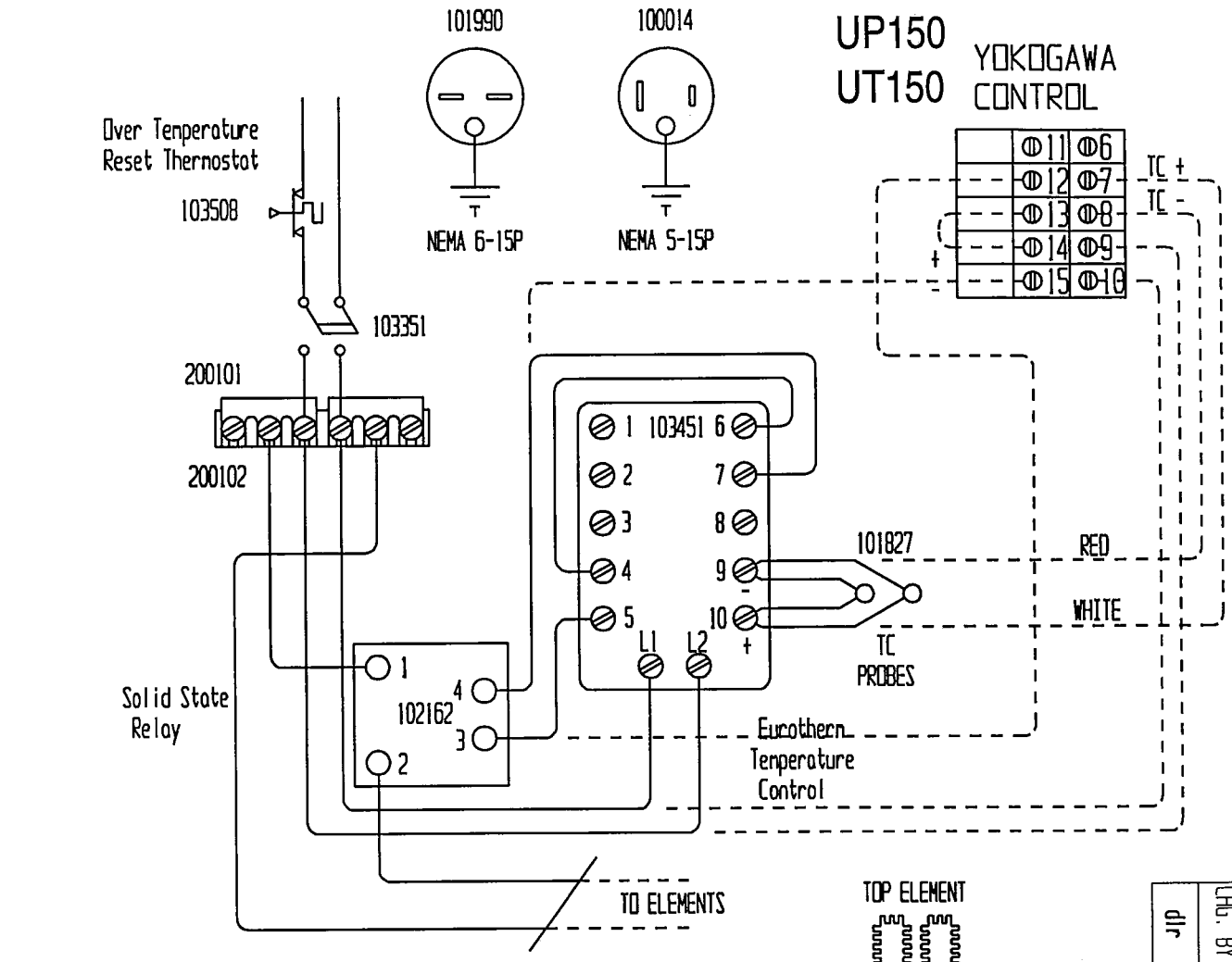
9 Replacement Parts

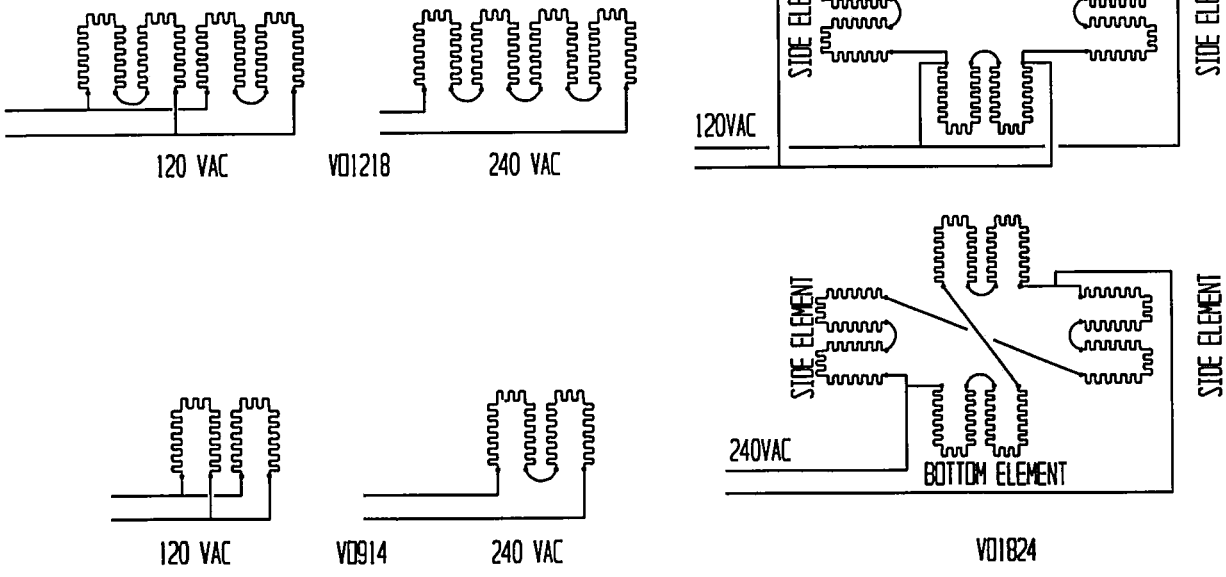
All quantities are one each unless noted.

Table 7. Replacement Parts

Oven Model Series	VO914	VO1218	VO1824
Line Cord (120 V Models)	118971	34732H01	34732H01
Line Cord (240 V Models)	34731H01	34731H01	34731H01
Needle Valve (1/4 in.)	(2) 118970	(2) 118970	(2) 118970
Type J Shielded Thermocouple	(2) 118965	(2) 118965	(2) 118965
Solid State Relay	118966	118966	118966
Switch (Green)	118967	118967	118967
Vacuum Gauge	118972	118972	118972
Temperature Controller - UT150	303115H03	303115H03	303115H03
Temperature Controller - UP150	303115H19	303115H19	303115H19
Safety Thermostat	118964	118964	118964
Element	(3) 118968	(3) 118968	(4) 34635H01
Needle Valve (3/8 in.)	118969	118969	118969
Silicone Gasket	118975	38027H01	34636H01
Door Pull Handle, SA and SC Units	38023H01	38023H01	38023H01
Pull Handle, A and C Units	38024H01	38024H01	38024H01
Door Magnet Catch	38025H01	38025H01	38025H01
Levelling Feet	(4) 38026H01	(4) 38026H01	(4) 38026H01
Aluminum Full Shelf	38028H01	(2) 38028H02	(3) 38028H03
Aluminum Half Shelf	38028H04	38028H05	—
Optional Gaskets			
Buna-N Gasket	118974 (9 x 9)	118977 (12 X 12)	34637H01 (18 x 18)
Viton Gasket	118973 (9 x 9)	118976 (12 X 12)	34638H01 (18 x 18)

DWG BY: dlr	DATE 5/18/99		SCALE NOT TO SCALE	NOTE BEND RADIUS .032" UNLESS OTHERWISE NOTED
TOLERANCE UNLESS OTHERWISE SPECIFIED		VD914 - 1218 - 1824 all	PART # 9850881	REVISION A
.X = ± .063	ANGULAR ± 1°		MATERIAL Reference	
.XX = ± .032	HOLE DIA.			
.XXX = ± .015	± .005			





CHG. BY	CHG. #	REV.	DATE	DESCRIPTION
dlr	JinNye	A	6/10/02	add safety loop to Yokogawa

PAGE 1 OF 1

9850881

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Great Britain

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Italia

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Important

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

Model Number: _____

Serial Number: _____

Date Purchased: _____

The above information can be found on the data plate 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:

SALES DIVISION

Phone: 1-866-984-3766

1-866-9-THERMO

LABORATORY PARTS and SERVICE

Phone: 1-800-438-4851

TECHNICAL SUPPORT

Phone: 1-800-438-4851

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