5 Start Up

CAUTION! Observe the following precautions when operating the furnace:

- Never stand in front of an open furnace.
- Wear protective eyeware.
- Wear protective gloves.
- Use tongs to insert and remove furnace load.
- Do not allow the load to touch the furnace walls.
- Always use a process tube.

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

- Keep personnel not involved in the installation out of the area.
- Use a good vacuum to clean area and equipment. Do **not** use compressed air.
- Use NIOSH high efficiency respirator (3M #8710 or equivalent).
- 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 ceramic fiber, dispose of rather than clean.
- Promptly place used ceramic fiber parts and dust in plastic bags and dispose of properly.

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

5.1 Furnace Start Up

To start up, the furnace, turn it ON using the power switch on the front panel. Refer to Section 6 as you perform the following procedures:

1. Adjust the setpoint to 550°C, following the instructions in Section 6.
2. Run the furnace for two hours at 550°C.
3. Adjust the setpoint to 1000°C.
4. Run the furnace for two hours at 1000°C.
5. Adjust setpoint to room temperature.

6 Operation – UP150 Controller

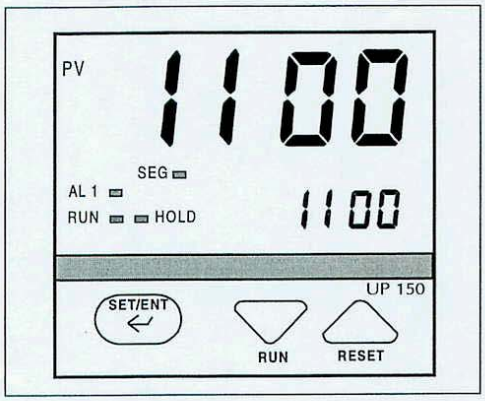

Figure 2. UP150 Control Panel

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

⚠ **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 (2nd edition).

6.1 Normal Controller Operation

The Temperature Controller senses the chamber air temperature of the furnace (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 1 and Table 2 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 on the "Super" feature and on autotuning.

Table 3. 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	34	Proportional band (°C; °F=93)
I	44	Integral time
d	11	Derivative time
Ct	1	Heat cycle time
FL	OFF	Sensor filter
bS	0.0	PV bias (offset)
LoC	1	Key lock
Setup parameters (access by setting LoC=-1)		
In	1	Input type (J thermocouple)
SC	ON	Super function

Table 4. 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 Basic Operation

To operate the UP150 controller, you must first enter a program. Once the program is entered into the controller, press the "arrow down" key to run it. Once the program is running, it can be placed in "hold mode" to maintain the current setpoint. Also, a "program advance" can be executed to step the program rapidly through program segments.

6.3 Entering Program Parameters

To access programming mode:

1. Press the SET/ENT key for 3 seconds. Make sure the RUN light is not lit at this time.
2. "PrG" will be displayed in the upper display with "0" in the lower display. Press the "arrow down" key once until "-1" is displayed with a flashing decimal.
3. Press the SET/ENT key once. Now the programming mode is accessed.

Prior to entering the actual program steps, you will be prompted for event type settings (EV1). This refers to how a relay will function, either as a "time event" or a "process variable (alarm) event".

To enter a program in program mode:

1. With "EV1" in the upper display and "0" in the lower display, press the SET/ENT key.
2. Next, "AL1" appears in the upper display. A value of "9" in the lower display configures the alarm as a high temperature alarm which is the factory setting. (For more information see "PV Event (alarm) Function List" in the UP150 Instruction Manual).
3. Press the SET/ENT key to advance to the Alarm 1 value (A1). This is the temperature at which the alarm will trip. This is typically set for 10° higher than the highest setpoint in the program.
4. Use the arrow up/down keys to enter the Alarm 1 value. Notice that the decimal point will flash indicating a change has been made. You must press the SET/ENT key to register a change.
5. Press the SET/ENT key to advance past the EV2 and AL2 settings to the SSP (starting setpoint) value and enter the appropriate setting.
6. From this point, you will be prompted for SP1 (setpoint 1), tM1 (time 1), SP2 – tM2, SP3 – tM3... etc. until all the program parameters have been entered. Note that Time is entered in hours and minutes, for example, 1.45 equals 1 hour and 45 minutes.
7. The controller will accept up to 16 setpoints and times. If fewer than 16 are required, enter "oFF" as a time value. This tells the controller you are finished. ***Do not enter a setpoint into your program beyond the maximum operating temperature of your unit.***
8. Next, you will be prompted for a Junction Code (JC). This determines how the controller will function at the end of the program. Three Junction Code values are available: "0" will cause the controller to shut-off its outputs at the end of the program. This is called the "reset" mode. "1" will place the controller in "Hold" mode. "2" will cause the program to repeat continuously.
9. Next you will be prompted for a Wait Zone (WTZ). This is similar to "guaranteed soak". The factory setting is "oFF" which means "not used". A wait zone causes the controller to stop the program clock if, at the transition from a ramp segment to a soak segment, the actual chamber temperature (PV) is not close enough to the setpoint. Assume the controller is programmed to ramp from 25°C to 100°C in 1 minute. Since the unit does not have the capability to heat up this quickly, the controller will change the setpoint from 25° to 100° in 1 minute and wait at beginning of the 100° segment for the unit to catch up with the setpoint before continuing the program. The program will continue when the unit temperature (PV) falls within the specified Wait Zone. The minimum value of the Wait Zone is 1% of the controller's span for a given input type. In this example, the span is from –200° to 1000° (1200° x 1% = 12°). This means, in the above example, the controller will continue the program when the unit temperature reaches 88° (100° - 12° = 88°).
10. The program is now complete and ready to run. Exit the program parameter setting mode by pressing and holding the SET/ENT key for 3 seconds.

6.4 Running the Program

To run the program, press the Run or "arrow down" key until the RUN light illuminates.

6.5 Using the Hold Function

To hold a running program:

1. Press and hold the SET/ENT key for 3 seconds."HoLd" will appear in the upper display.
2. Press the "arrow up" key so that "on" with flashing decimal appears in the lower display.
3. Press the SET/ENT key to accept.
4. Press and hold the SET/ENT key again to return to the normal display.

To exit the hold mode:

Press and hold the SET/ENT key for 3 seconds. "HoLd" will appear in the upper display. Press the "arrow down" key so that "oFF" with flashing decimal appears in the lower display. Press the SET/ENT key to accept. Press and hold the SET/ENT key again to return to the normal display.

6.6 Using the Advance Function

While the program is running, press and hold the SET/ENT key for 3 seconds. "HoLd" will appear in the upper display. Press the SET/ENT key again and "AdV" will appear in the upper display. "oFF" will appear in the lower display. Press the "arrow up" key so that "on" with flashing decimal appears in the lower display. Press the SET/ENT key to accept. The controller will automatically return to the normal display and the increment the program segment by one.