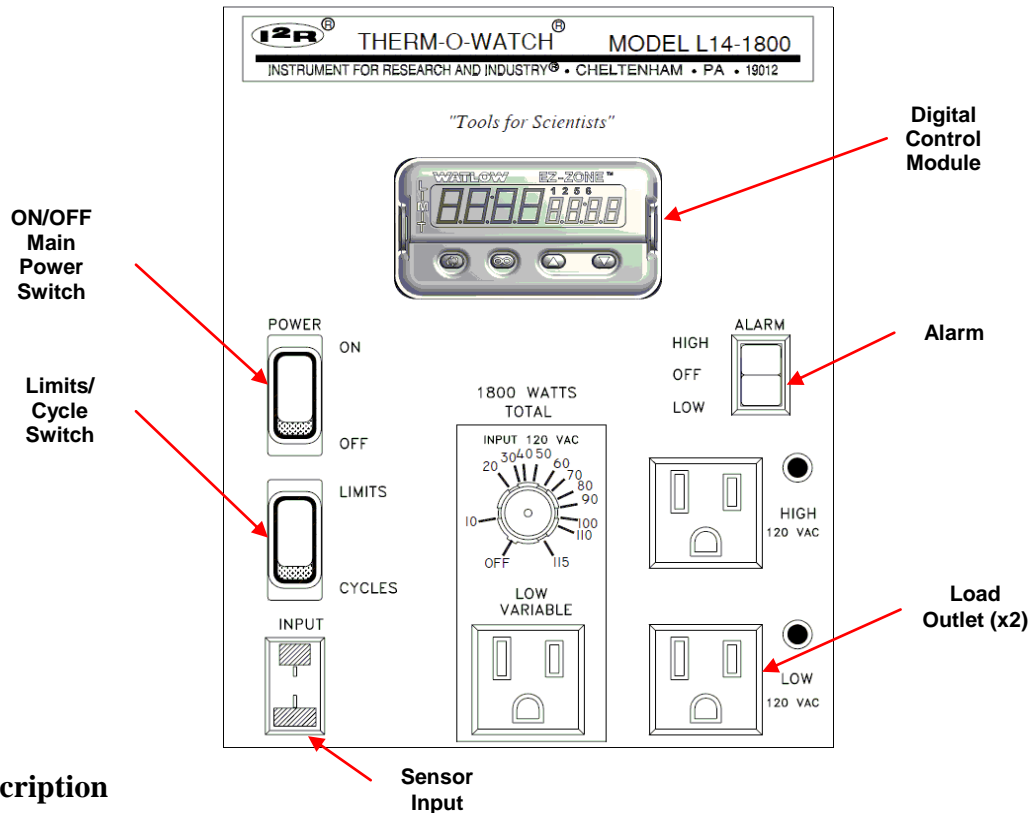


# Operation Manual

## Instruction Notes for 108A L14-1800



### General Description

This temperature control displays both the setpoint and process temperature and uses the most modern control technology for the best temperature stability. The Auto-tune feature minimizes setpoint overshoot and learns your process. Changing your setpoint is easily done with the interface keys. The controller can also perform ramp rate operations to allow the user to slowly raise the process temperature. There are several input types available. This unit comes with a 6' detachable power cord, grid support bracket, which is ideal for fume hood mounting to maximize bench space. This control is a microprocessor-based, digital indicating, automatic temperature control with a single input and a single variable output. It features an auto-tuning function that allows automatic setting of control parameters with a minimum of user input required. This family of control accepts a type "J", "K", "T" thermocouple depending on the model ordered.

The control automatically sets the PID parameters through a "learning" sequence in the auto-tuning mode. PID parameters include proportional band, reset/integral and rate/derivative. User-friendly features include automatic LED indicators to aid in monitoring and setup, as well as dual LED displays for process temperature and set point indication. This control automatically stores all information in a non-volatile memory.

### Control Features

1. On/Off power switch.
2. High/Low alarm.
3. 15-amp output.
4. Circuit protection (fuses)
5. Audible alarm.
6. Variable voltage output for heating
7. Fixed voltage output for cooling

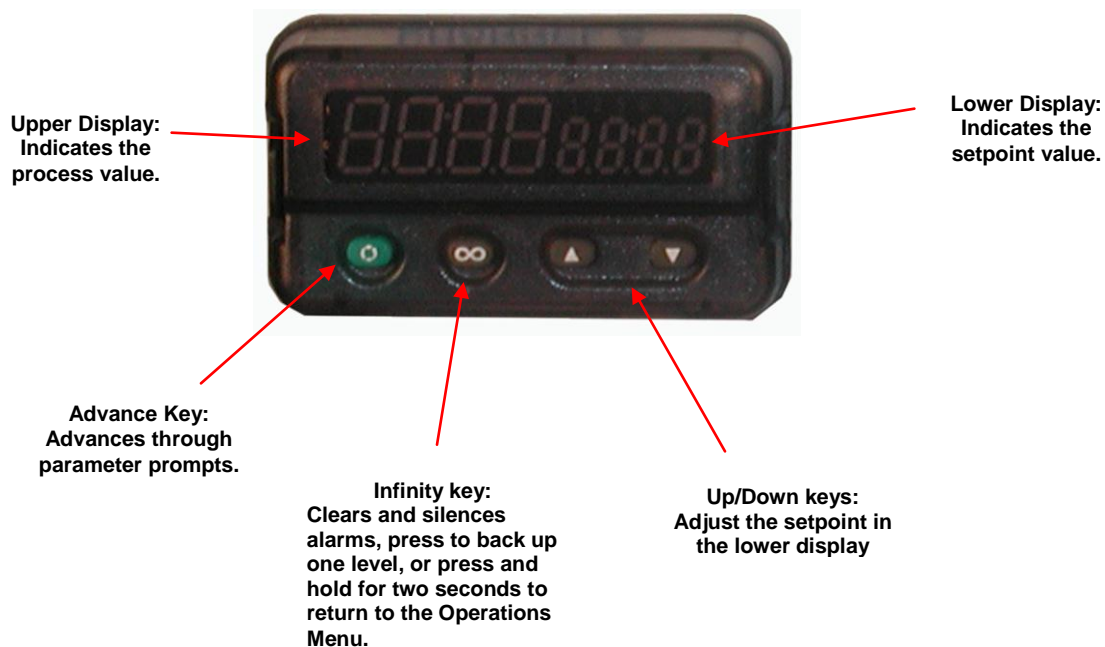


Figure 2. Digital Control Module Detail

### How to Setup and Operate

First, connect the heater load and the sensor to the load and sensor receptacles on the front panel. Next, plug the control line cord into an appropriate 3-wire grounded power receptacle. Push the power switch to the "ON" position. Wait five seconds for the control unit to energize.

The control is shipped from the factory with the display reading in degrees C. If a display in degrees F is desirable, press the **UP/DOWN** arrow keys simultaneously for three seconds to access the Setup Page. Press the **Advance** key until the Celsius\_Fahrenheit parameter [C-F] is shown in the lower display. Press the **UP** arrow key to change from C to F.

After changing the display, press the **Infinity** key to display the set point temperature and the process temperature (temperature at the sensor).

To begin the heating application, use the **Up/Down** arrow keys to enter the desired set point temperature. This is shown in the lower display. Press the **Advance** key to cycle through the Operations Page until the auto-tuning parameter [Aut] is shown in the lower display. Auto-tuning is recommended in most applications. Auto-tuning allows the control to set the parameters without those parameters being input by the user. It also minimizes the amount of temperature overshoot of the set point and decreases the time required for the process to stabilize.

After setting the auto-tuning parameter [Aut] to ON, press the **Infinity** key to display the set point and process temperatures. While the control is in the auto-tuning mode, the lower display alternately flashes the set point and the "Aut" prompt. When tuning is complete, the lower display indicates only the set point.

The auto-tuning function can be aborted by setting auto-tuning [Aut] to OFF or switching off power to the control.

It is recommended that auto-tuning be used each time a process is being run. If the process is being duplicated, the parameters learned in the initial setup are stored in the memory of the control and no repeat of auto-tuning is required.

Auto-tuning feature allows quick and simple automatic control for the majority of heating applications. This control is capable of performing other control functions and has a variety of features.

**Using the Alarm Switch:** When the alarm switch is set high, the alarm will sound when the process temperature is above the set point temperature. When the alarm switch is set low, the alarm will sound when the process temperature is below the set point temperature. To silence the alarm, switch the set switch to the middle of OFF position.

**Control Sensor:** Proper placement of the sensor can eliminate many problems in the total system. The probe should be placed so that it can detect any temperature change with little thermal lag. In a process that requires fairly constant heat output, the probe should be close to the heater. In processes where heat demand is variable, the probe should be close to the work area. Some experimenting with probe location can be tried to provide optimum results.

## Specifications

### Control Mode

- Microprocessor-based, single input, single output.
- PID parameters
  - Proportional band: 1 to 999 °F
  - Reset: 0.00 to 99.99 repeats per minute.
  - Integral: 0.00 to 99.99 minutes per repeat.
  - Rate or Derivative: 0.00 to 9.99 minutes.

### Operator Interface

- **Advance, Infinity, Up and Down** keys and ON/OFF switch.
- Dual, four digit LED displays.
- Thermocouple receptacle

### Input

- Type J, K, T thermocouple: input grounded or ungrounded.
- Automatic cold junction compensation and break protection for sensor.
- Degrees F or degrees C display; user selectable (preset for degrees C)

<b>Range Type J:</b>	<b>-200°C to 1200°C</b>
<b>Range Type K:</b>	<b>-200°C to 1370°C</b>
<b>Range Type T:</b>	<b>-200°C to 400°C</b>

### Primary Output (Heating or Cooling)

- 15 Amps, 120 Volts.

### Accuracy

- Calibration accuracy: 0.1% of span.
- Temperature stability: 0.2 °F / °F rise in ambient maximum.
- Voltage stability: 0.01% of span / % of rated line voltage.

### Power

- 50/60 Hz 5%
- Data retention upon power failure via nonvolatile memory.

Operating Environment: 32 to 149 °F / 0 to 65 °C; 0 to 90% RH, non-condensing.

**Variable output Voltage Control (VOVC):** This is a calibrated control that allows the user to adjust the outlet voltage below the precise temperature control. It has an off position that effectively cuts power to the load totally.

**Limits/Cycles Function Switch:** In the **Limits mode** the controller will apply power to the low and the variable low outlet as long as the monitored temperature is below the controller's set point. Once the set point has been reached the controller will switch states, turning the high outlet on and the low outlets off and remain in that state regardless of the monitored temperature until the power has been reset.

In the **Cycles mode** the controller will apply power to the low and the variable low outlet as long as the monitored temperature is below the controller's set point. Once the set point has been reached the controller will switch states, turning the high outlet on and the low outlets off. When the monitored temperature falls below the controller's set point the states will switch again.

**Variable Low Outlet:** This outlet will supply 10 to 115 VAC to your load (with 120 VAC supplied to the controller) up to 1800 watts.

**Thermocouple Jack:** L14 uses standard mini thermocouple jacks for sensor input. Your thermocouple type must match the type of jack on your instrument for proper operation.



**Main Control Module:** The main control module of the L14 indicates the monitored temperature as well as the set point temperature. This module also controls the functions of the outlet, states and provides the analog output for chart recorders. *Standard banana jacks on the rear of the unit provide an analog output for the chart recorders and other recording equipment. This output is calibrated for 10mV/C°*




**Alarm Switch:** The L14 has a simple HI/LO alarm that has an off position.

**High Power Outlet:** L14 employs ON/OFF control and can be used with cooling devices such as Jack-O-Matic and fans to assist in precision temperature regulation. This outlet is a 120 VAC switch outlet that is ON when the Low outlet is OFF.

**Low Power Outlet:** When the controller is calling for heat to reach the set point temperature this outlet is energized ON simultaneously with the Variable voltage outlet.





## Navigating the Operations Page

To go to the Operations Page from the Home Page, press both the Up  and Down  keys for three seconds. **RI** will appear in the upper display and **OPER** will appear in the lower display.

- Press the Up  or Down  key to view available menus. On the following pages top level menus are identified with a yellow background color.
- Press the Advance Key  to enter and view available prompts within a menu.

### Note:

Some of these menus and parameters may not appear, depending on the controller's options. See model number information in the Appendix for more information. If there is only one instance of a menu, no submenus will appear.

- Press the Up  or Down  key to move through available menu prompts.
- Press the Infinity Key  to move backwards through the levels: parameter to submenu; submenu to menu; menu to Home Page.
- Press and hold the Infinity Key  for two seconds to return to the Home Page.

## Operations Page

**RI**  
**OPER** Analog Input Menu  
**I**  
**RI** Analog Input  
**RIIn** Process Value  
**REr** Error Status  
**CR** Calibration Offset

**Lnc\***  
**OPER** Linearization Menu  
**I**  
**Lnc** Linearization  
**SwA** Source Value A  
**oFSE** Offset  
**ow** Output Value

**Pv\***  
**OPER** Process Value Menu  
**I**  
**Pv** Process Value  
**SwA** Source Value A  
**oFSE** Offset  
**ow** Output Value

**diO**  
**OPER** Digital Input/Output Menu  
**5** to **6**  
**diO** Digital Input/Output  
**doS** Output State  
**ES** Event State  
**diS** Input State



**Mon**  
**OPER** Monitor Menu  
**I**  
**Mon** Monitor  
**CR** Control Mode Active  
**hPr** Heat Power  
**CPc** Cool Power  
**CLSP** Closed Loop Working Set Point  
**PwA** Process Value Active

**Loop**  
**OPER** Loop Menu  
**I**  
**Loop** Loop  
**REN** Remote Enable  
**CR** Control Mode  
**RESp** Autotune Set Point  
**ARE** Autotune Request  
**CLSP** Closed Loop Set Point  
**IS** Idle Set Point  
**hPb** Heat Proportional Band  
**hHy** Heat Hysteresis  
**CPb** Cool Proportional Band  
**CHy** Cool Hysteresis  
**EI** Time Integral  
**Ed** Time Derivative  
**db** Dead Band  
**oSP** Open Loop Set Point



**ALM**  
**OPER** Alarm Menu  
**I** to **4**  
**ALM** Alarm 1  
**RLo** Low Set Point  
**Rhi** High Set Point

**PSE**  
**OPER** Profile Status Menu  
**I** to **4**  
**PSE** Profile Status  
**PSEr** Profile Start  
**PRC** Action Request  
**SEP** Active Step  
**SEYP** Active Step Type  
**ESp1** Target Set Point Loop 1  
**RLSP** Produced Set Point 1  
**SEI** Step Type Remaining  
**ENE1** Active Event Output 1  
**ENE2** Active Event Output 2  
**JL** Jump Count Remaining

## Navigating the Setup Page

To go to the Setup Page from the Home Page, press both the Up  and Down  keys for six seconds.

**A** will appear in the upper display and **SEE** will appear in the lower display.

- Press the Up  or Down  key to view available menus. On the following pages top level menus are identified with a yellow background color.
- Press the Advance Key  to enter and view available prompts within a menu.

### Note:

Some of these menus and parameters may not appear, depending on the controller's options. See model number information in the Appendix for more information. If there is only one instance of a menu, no submenus will appear.

<b>A</b>	<b>oPB</b> Output Point 8	<b>P788</b> Manual Power	<b>RLR</b> Latching
<b>SEE</b> Analog Input Menu	<b>iP9</b> Input Point 9	<b>LdE</b> Open Loop Detect Enable	<b>RbL</b> Blocking
<b>I</b>	<b>oP9</b> Output Point 9	<b>LdE</b> Open Loop Detect Time	<b>RS</b> Silencing
<b>A</b> Analog Input	<b>iP10</b> Input Point 10	<b>LdD</b> Open Loop Detect Deviation	<b>RdSP</b> Display
<b>SEn</b> Sensor Type	<b>oP10</b> Output Point 10	<b>rP</b> Ramp Action	<b>RdL</b> Delay
<b>LIn</b> Linearization	<b>Pu*</b>	<b>rSL</b> Ramp Scale	
<b>rEL</b> RTD Leads	<b>SEE</b> Process Value	<b>rRE</b> Ramp Rate	<b>FUn</b>
<b>Un,E</b> Units	<b>I</b>	<b>LSP</b> Low Set Point	<b>SEE</b> Function Key Menu
<b>SLo</b> Scale Low	<b>Pu</b> Process Value	<b>hSP</b> High Set Point	<b>I</b> to <b>I</b>
<b>Sh</b> Scale High	<b>Fn</b> Function	<b>SPLo</b> Set Point Open Limit Low	<b>FUn</b> Function Key
<b>rLo</b> Range Low	<b>PUnE</b> Pressure Units	<b>SPHi</b> Set Point Open Limit High	<b>LEu</b> Level
<b>rHi</b> Range High	<b>RUnE</b> Altitude Units		<b>Fn</b> Digital Input Function
<b>PEE</b> Process Error Enable	<b>F,L</b> Filter		<b>F</b> Instance
<b>PEL</b> Process Error Low		<b>oEPE</b>	
<b>EL</b> Thermistor Curve	<b>dIo</b>	<b>SEE</b> Output Menu	
<b>rR</b> Resistance Range	<b>SEE</b> Digital Input/Output Menu	<b>I</b> to <b>I</b>	
<b>FIL</b> Filter	<b>S</b> to <b>S</b>	<b>oEPE</b> Output	<b>GLbL</b>
<b>EL</b> Error Latching	<b>dIo</b> Digital Input/Output	<b>Fn</b> Function	<b>SEE</b> Global Menu
<b>dEL</b> Display Precision	<b>d,r</b> Direction	<b>F</b> Function Instance	<b>I</b>
	<b>Fn</b> Function	<b>oLE</b> Control	<b>GLbL</b> Global
<b>Lnc*</b>	<b>F</b> Function Instance	<b>atb</b> Time Base	<b>C-F</b> Display Units
<b>SEE</b> Linearization Menu	<b>oLE</b> Control	<b>oLo</b> Low Power Scale	<b>RLFF</b> AC Line Frequency
<b>I</b>	<b>atb</b> Time Base	<b>ah</b> High Power Scale	<b>rEYP</b> Ramping Type
<b>Lnc</b> Linearization	<b>oLo</b> Low Power Scale	<b>oEPE</b> Output 1 process	<b>PEYP</b> Profile type
<b>Fn</b> Function	<b>ah</b> High Power Scale	<b>oEY</b> Type	<b>gSE</b> Guaranteed Soak Enable
<b>Un,E</b> Units		<b>Fn</b> Function	<b>gSd1</b> Guaranteed Soak Deviation 1
<b>iP1</b> Input Point 1	<b>LooP</b> Control Loop	<b>F</b> Function Instance	<b>gSd2</b> Guaranteed Soak Deviation 2
<b>oP1</b> Output Point 1	<b>hRg</b> Heat Algorithm	<b>SLo</b> Scale Low	<b>SrA</b> Source instance A
<b>iP2</b> Input Point 2	<b>LRg</b> Cool Algorithm	<b>Sh</b> Scale High	<b>SrB</b> Source instance B
<b>oP2</b> Output Point 2	<b>LLC</b> Cool Output Curve	<b>rLo</b> Range Low	<b>PaE</b> Power Out Time
<b>iP3</b> Input Point 3	<b>EEUn</b> Tru-Tune+™ Enable	<b>rHi</b> Range High	<b>LEd</b> Communications LED Action
<b>oP3</b> Output Point 3	<b>ebnd</b> Tru-Tune+™ Band	<b>oLR</b> Calibration Offset	<b>Zone</b> Zone Action
<b>iP4</b> Input Point 4	<b>EgN</b> Tru-Tune+™ Gain		<b>ChAn</b> Channel Action
<b>oP4</b> Output Point 4	<b>ERgR</b> Autotune Aggressiveness	<b>RLP*</b> Alarm Menu	<b>dPrS</b> Display Pairs
<b>iP5</b> Input Point 5	<b>PdL</b> Peltier Delay	<b>I</b> to <b>I</b>	<b>dE</b> Menu Display Timer
<b>oP5</b> Output Point 5	<b>rEn</b> Remote Set Point Enable	<b>RLP*</b> Alarm	
<b>iP6</b> Input Point 6	<b>rEY</b> Remote Set Point Type	<b>REY</b> Type	
<b>oP6</b> Output Point 6	<b>UFR</b> User Failure Action	<b>SrA</b> Source Function A	
<b>iP7</b> Input Point 7	<b>FRIL</b> Input Error Failure	<b>SrB</b> Source Instance A	
<b>oP7</b> Output Point 7		<b>RHy</b> Hysteresis	
<b>iP8</b> Input Point 8		<b>RLg</b> Logic	
		<b>RSd</b> Sides	
			<b>CP*</b>
			<b>SEE</b> Communications Menu
			<b>I</b>
			<b>CP*</b> Communications
			<b>PCAL</b> Protocol
			<b>RdS</b> Standard Bus Address
			<b>RdP*</b> Modbus Address
			<b>bRd</b> Baud Rate
			<b>PRr</b> Parity
			<b>P7hL</b> Modbus Word Order
			<b>P78P</b> Data Map
			<b>nuS</b> Non-volatile Save
			<b>rEL*</b>
			<b>SEE</b> Real Time Clock
			<b>hour</b> Hour
			<b>P7in</b> Minute
			<b>dod</b> Day of Week

### How to Tune and Operate

Manual operation provides direct (time proportioned % time) control from -100% to 100%. A negative value is allowed only when Ot 1=Cool. Automatic operation provides sensory feedback ON/OFF or PID control. When the operation transfers from automatic to manual operation, the power level from automatic operation is retained and restored to the previous set point.

The % LED indicates manual operation. The LED is on when in Manual operation and off when in AUTO operation. When the LED is flashing, press the **Infinity** key again within 5 seconds to complete the change in operation. If the sensor is open and LOC=0, 1 or 2, the control switches to Manual operation if the output was stable before the break occurred.

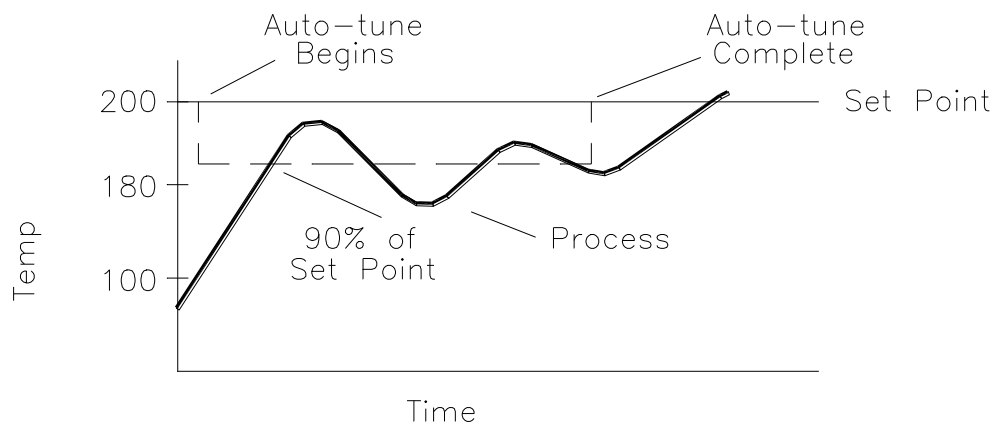
### **Tuning-Automatic**

Auto-tuning: This control can automatically tune the PID parameters to fit the characteristics of your particular thermal system.

Auto-tune can only be used when Output 1 is hEAt. Once the auto-tune sequence has begun, the lower display flashes between AUt and the set point. The displayed set point remains unchanged.

Once the control finished "learning" the system, it returns to standard PID control with the values automatically set. Auto-tuning is complete within 80 minutes. Any change of the set point, while in auto-tune, re-initiates the auto-tune procedure.

In order for the control to successfully complete auto-tune, the process must cross set point four times within 80 minutes after auto-tune has started. If this does not happen within the 80 minute time limit, Pb1 remains at 0 and the control functions in an ON/OFF mode.



To start auto-tuning:

1. Press the **Advance** key until the Aut prompt appears in the lower display.
2. Change the parameter to YES.
3. Press the **Infinity** key to display the set point and sensor temperatures. While the control is in the tuning mode, the lower display alternately displays set point and the "Aut" prompt.
4. When tuning is complete, the lower display indicates setpoint only and Aut reverts to OFF. The control installs appropriate PID tuning parameters and saves them in the non-volatile memory.

\*To abort auto-tuning, the operator must reset Aut to NO. Auto-tuning may also be aborted by cycling power off and on. In all cases, aborting auto-tuning restores all original values.

### **Error Code Definitions and Actions:**

Er.In - An open or reversed polarity sensor is the most likely cause. Check the sensor; if the connection is good and functions properly, call the factory. Make sure the input parameter [SEn] is set to the correct type thermocouple.

Er.Ab – Ambient temperature may be too hot or too cold. Make sure that the temperature surrounding the control is –18 to 65C.

Er.CS – Checksum Error. Settings may have changed unexpectedly. Press the **Infinity** key to clear the error. Verify settings. If error message persists, contact the factory.

To clear a corrected error, cycle power to the control.

### **GLOSSARY**

Automatic prompts: Data entry points where a microprocessor-based control "prompts" or asks the operator for information input.

Auto-tune: Automatically tunes the parameters to fit the characteristics of your particular thermal system.

Cold junction compensation: Electronic means to compensate for the effect temperature at the cold junction.

Cycle time: The time necessary to complete a full On-through-Off period in a time proportioning control system.

Derivative/Rate: Anticipatory action that senses the rate of change of the process, and compensates to minimize overshoot and undershoot.

Default parameters: The parameters (programmed instructions) permanently stored in microprocessor software to provide the data base.

Droop: Difference in temperature between set point and stabilized process temperature.

Hysteresis: In On/Off control, the temperature change necessary to change the output from On to full Off.

Input (sensor): Process variable information being supplied to the instrument.

Integral/Reset: Control action that automatically eliminates offset, or "droop", between set point and actual process temperature.

Offset: Adjustment to actual input temperature and to the temperature valves the control uses for display and control.

ON/OFF control: Control of temperature about a set point by turning the output full On below set point and full Off above set point.

Output: Action in response to difference between set point and process variable.

Overshoot: Condition where temperature exceeds stepping due to initial power up or process changes.

Parameter: a physical property whose value determines the response of a electronic control to given inputs.

PID: Proportioning control with auto-reset and rate.

Process variable: Thermal system element to be regulated, such as time, temperature, relative humidity, etc.

Proportional band: Span of temperature about the set point where time proportional control action takes place.



Set point: Intended value of the process variable.

Thermal system: A regulated environment consisting of a heat source, heat transfer medium, sensing device and a process variable control.

Thermocouple: Temperature sensing device that is constructed of two dissimilar metals wherein a measurable, predicated voltage is generated corresponding to temperature.

Thermocouple break protection: Fail-safe operation that assures output shutdown upon an open thermocouple condition.

Time Proportioning Control: Action which varies the amount of ON and OFF time when "close" to the set point (within the proportional band). This variance is proportional to the difference between the set point and the actual process temperature.

### **Maintenance**

Simple preventative maintenance steps include keeping the controller clean. Protect it from overload, excessive dirt, oil and corrosion.

### **Limited Warranty**

Glas-Col warrants products of its manufacture to be free from defects in material and workmanship for one year and agrees to repair or replace without charge any products found defective upon examination at the factory. With proper care and operation, Glas-Col products will give long and efficient service. Chemical spillage, overloading and general misuse will greatly reduce the service life. Glas-Col is not responsible for damage to apparatus due to improper installation or through attempts to operate the apparatus beyond its rated capacity, intentional or otherwise.

### **Limitations of Warranties**

APART FROM SUCH WRITTEN STATEMENT OF WARRANTY, THERE ARE NO WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY, WHICH EXTEND BEYOND THE DESCRIPTION OF THE PRODUCTS ON THE FACE HEREOF.

Glas-Col products are intended only for legal and legitimate purposes in commercial laboratory and industrial settings.

Glas-Col reserves the right to make product refinements without prior notice.

### **Returns**

Call or fax Customer Service for a Return Goods Authorization (RGA) number before returning a heating mantle.

Reference the RGA number on the shipping box and on a written description of the problem.

A 20% restocking charge of the net price is charged for all standard products returned to stock.

Glas-Col products are intended only for legal and legitimate purposes in commercial laboratory and industrial settings.

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