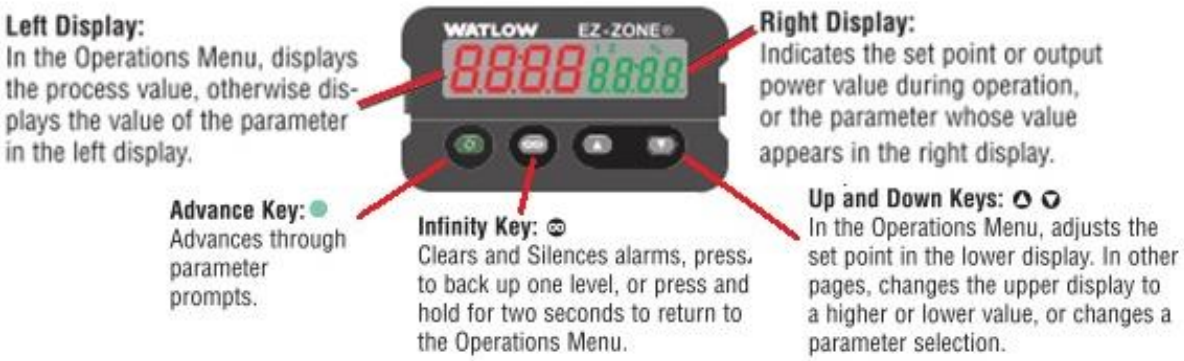
user instructions

711 HULMAN STREET
PO BOX 2128
TERRE HAUTE, IN 47802
812-235-6167
FAX 812-234-6975

OPERATING AND SAFETY INSTRUCTIONS
for
DIGITAL TEMPERATURE CONTROLS (PLSM SERIES)

Models: **104A PLSM112; 104A PLSM112K; 104A PLSM112T15A; 120V, 50/60 Hz.**
104A PLSM212; 104A PLSM212K; 104A PLSM212T15A; 120V, 50/60 Hz.
104A PLSM312; 104A PLSM312K; 104A PLSM312T15A; 120V, 50/60 Hz.
104A PLSM124; 104A PLSM124K; 104A PLSM124T10A; 240V, 50/60 Hz.
104A PLSM224; 104A PLSM224K; 104A PLSM224T10A; 240V, 50/60 Hz.



Specifications:

Ambient Temperature:	77°F/25°C +/-5°
Operating Environment:	0 to 90% relative humidity
Rating:	15 Amps Max. Total; 120VAC;50/60 Hz.
	10 Amps Max. Total; 240VAC; 50/60Hz.

Unpack the control and set it on the bench top where desired. The rubber adhesive feet hold the unit securely in place.

Plug the power cord from the control into a grounded outlet. The power switch for the control is located on the front of the unit. Connect the thermocouple (included) to the control along with the power connection(s) for the load(s).

The 104A PLSM112 and 104A PLSM124 controls can be used with one load. The 104A PLSM212 and 104A PLSM224 controls can be used with one or two loads. The 104A PLSM312 controls can be used with one, two or three loads. NOTE: The loads do not have to be balanced but all loads must combine to: 15A max (120V units) or 10A max (240V units).

How to Setup and Operate each Channel

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 right 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. The PID values in the control need to be set prior to running the system with your particular heater. The auto-tuning allows the control to adapt PID parameters without those parameters being manually entered 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.
See page 9 and 10 for instructions on initiating the auto-tune procedure.
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.

Control Sensor

Proper placement of the sensor can eliminate many problems in the operation of the 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 ^{o}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 or (RTD) and 3-wire load receptacle.

Input

- Type J, K , T thermocouple or (RTD): 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)

Accuracy

- Calibration accuracy: 0.1% of span.
- Temperature stability: 0.2 ^{o}F / ^{o}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 ^{o}F / 0 to 65 ^{o}C; 0 to 90% RH, non-condensing.

Operation Menu

Upon power up of the control, using the advance key will scroll through the various prompts found in the Operations Menu. At any point within the Operations menu to return to the default display push the Infinity ∞ key.

	Parameter Name	Glas-col value	Default
	Operation Page		
[AUt]	Autotune	Default	no
[C;M]	Control Mode Active	Default	AUto
[h;Pb]	Heat Proportional Band	Default	25.0 F or 14.0 C
[C;Pb]	Cool Proportional Band	Default	25.0 F or 14.0 C
[ti]	Time Integral	Default	180
[td]	Time Derivative	Default	0
[o;tb1]	Time Base Output 1	Default	1.0 or 20.0
[o;tb2]	Time Base Output 2	Default	1.0 or 20.0
[A;Lo]	Alarm Low Set Point	N/A	32.0 F or 0.0 C
[A;hi]	Alarm High Set Point	N/A	300.0 F or 150.0 C
[i;CA]	Calibration Offset	Default	0.0

Setup Menu

To enter the Setup Menu push and hold the up and down arrow keys for approximately 3 seconds. Once there, push the green advance key to scroll through to the prompt of choice and then use the up and down arrow keys to change the range. At any point within the Setup menu to return to the default display push the Infinity ∞ key.

Parameter	Parameter Name	Glas-col Factory Setting	Default
	Setup Page		
[LoC]	Lockout Menu	Default	5
[SEn]	Sensor Type	Default	tC
[Lin]	Linearization	SET FOR TC INPUT TYPE	J
[dEC]	Decimal	Default	0
[C_F]	Display Units	C	F
[r;Lo]	Range Low	Default	0.0
[r;hi]	Range High	Default	9,999.0
[Fn1]	Function of Output 1	Heat	oFF
[o;ty]	Output Type	Default	voLt
[Fn2]	Function of Output 2	Default	oFF
[h;Ag]	Heat Algorithm	Default	PID
[hSC]	Hysteresis (Heat & Cool)	Default	3.0 F or 2.0 C
[C;Ag]	Cool Algorithm	Default	oFF
[A;ty]	Alarm Type	Default	oFF
[A;hy]	Alarm Hysteresis	Default	1.0
[A;LA]	Alarm Latching	Default	nLAt
[A;bL]	Alarm Blocking	Default	oFF
[A;Si]	Alarm Silencing	Default	oFF
[A;dSP]	Alarm Display	Default	on
[rP]	Ramp Action	Default	oFF
[r;rt]	Ramp Rate	Default	1.0
[o;hi1]	Power Scale Output High 1	Default	100.0
[o;hi2]	Power Scale Output High 2	Default	100.0
[PAr1]	Upper or Left Display	Default	AC.Pu
[PAr2]	Lower or Right Display	Default	AC.SP
[Ad;S]	Zone Address - Standard Bus Com	Default	1

Navigating the Factory Page

To go to the Factory Page from the Home Page, press and hold both the Advance and Infinity keys for six seconds.

- Press the Advance Key to enter the menu of choice.
- If a submenu exists (more than one instance), press the Up or Down key to select and then press the Advance Key to enter.
- 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.

Parameter	Parameter Name	Glas-col value	Defaults
[CUSt] [FCty]	**Custom Menu - Factory Page**		
[PAr]	Parameter 1	Default	AC.Pu
[PAr]	Parameter 2	Default	AC.SP

[diAg] [FCty]	**Diagnostics Menu - Operation Page**		
[Pn]	Part Number	Read Only	
[rEu]	Software Revision	Read Only	
[S;bLd]	Software Build	Read Only	
[Sn]	Serial Number	Read Only	
[dAtE]	Date of Manufacture	Read Only	
[USr;r]	User Restore Settings		nonE
[2onE]	Zone	Default	oFF
[Chan]	Channel	Default	oFF

[CAL] [FCty]	**Calibration Menu - Operation Page**		
[1] [CAL]	**Instance 1**		
[Mu]	Electrical Measurement	Read Only	
[EL;io]	Electrical Input Offset	Default	0.000
[EL;iS]	Electrical Input Slope	Default	1.000
[1] [CAL]	**Instance 1**		
[ELo;o]	Electrical Output Offset	Default	0.000
[ELo;S]	Electrical Output Slope	Default	1.000

Control mode operation

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. It 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.

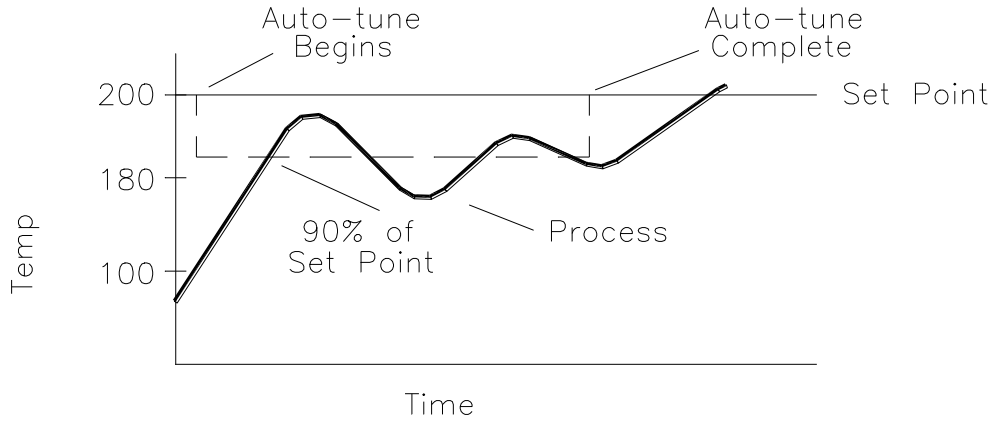
Tuning-Automatic

It is recommended that auto-tuning be used each time a new process is initiated. If the process is being duplicated, the parameters learned in the initial auto tune setup are stored in the memory of the control and the auto-tune procedure isn't required in most applications.

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 setting is hEAt and heat algorithm (h.Ag, page 5) is set for PID mode. The heat algorithm setting is set for PID from the factory. When the auto-tune sequence has started, the lower display will flash between tun1-attn and the main operation screen.

Changing the set point, while in auto-tune mode, will not change the set point value. The displayed value will change but the control has locked in the original set point value tell the auto tune in complete or has been turned off by the user. Once the control has finished "learning" the system, it returns to standard PID control with the values automatically set. Auto-tuning is complete within 80 minutes. In order for the control to successfully complete auto-tune, the process must cross the 90% set point value 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 will operate with the factory default PID values.



Screen 1

Screen 2

To start auto-tuning:

1. Set the set point value with the arrow keys to the desired temperature of operation.
2. Press the **Advance** key until the Aut prompt appears in the right display.
3. Change the parameter to **YES** (displayed in left portion of display) with the arrow keys.
4. Press the **Infinity** key to display the set point and sensor temperatures. While the control is in the auto-tuning mode, the display will alternate between the set point and the "Aut" prompt (Screen 1 & Screen 2). When tuning is complete, the lower display indicates only the set point.
5. When tuning is complete, the right display indicates setpoint only and Aut will revert to OFF. The control will use the auto-tuned PID values and retains them in the non-volatile memory. These values will be used on any further heating processes.
6. Repeat auto-tune process if heater/process is being changed.

*To abort auto-tuning, the operator must reset Aut to OFF. Auto-tuning may also be aborted by cycling power off and on. In all cases, aborting auto-tuning restores all original factory default values.

Temperature overshoot

In most cases this is due to a small sample size being heated with a high wattage heater. The control is set at the factory with the Power Scale High Output 1 (o.hi1) setting with a value of 100. This value can be adjusted in the setup menu, reference page 5 for instructions on how to access and navigate through the setup menu. If excessive temperature overshoot is occurring, adjust the value to 50 and start the heating process from ambient room temperature. If more than desired temperature overshoot is still occurring, decrease to a lower value and repeat heating process from ambient room temperature. If the process temperature doesn't achieve the set point temperature or takes more than desired amount of time to reach set point temperature, increase the power scale high output 1 value. This process can take several value changes to obtain proper temperature control with your particular application setup. It is recommended to initiate the Auto-Tune process again after the proper power scale high output 1 value has been determined for your application.

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, the power to the control needs to be cycled.

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 steeping 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, predicative 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

Glas-Col controls do not require regularly scheduled maintenance. However, regular inspection is recommended. Glas-Col controls should be protected from chemical spillage, mechanical damage and corrosive atmospheres so far as possible. Contamination, overheating and general misuse will greatly reduce the life of the control.

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 Material Authorization (RMA) number before returning a Glas-Col item.

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 changed for all standard products returned to stock.

Glas-Col, LLC
711 Hulman Street, P.O. Box 2128, Terre Haute, IN 47802-0128
Phone. (812) 235-6167, Fax. (812) 234-6975
E-mail: pinnacle@glascol.com
Web: www.glascol.com