



User Instructions

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

OPERATING AND SAFETY INSTRUCTIONS for

**Digitrol II Temperature Control
CATALOG #104A PL624CE, 10 amp, 240 volts, 50/60 Hz.**

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 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", or "T" thermocouple input 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 switch.
2. 10-amp output.
3. Control mode
 - PID control mode (factory default) with Auto-tune algorithm.
 - ON / OFF control mode programmable (user programmable).
 - Manual Control Mode (user programmable)
4. Solid State Relay output.
5. Circuit protection (fuse)
6. Low profile housing.
7. Safety feature- Output is de-energized if sensing device is unplugged or damaged.

Control Sensor

The DigiTrol II is furnished with a 104A TC105_ thermocouple. For the 104A PL624CE, this probe is an Iron-Constantan thermocouple (Type J). For the 104A PL624KCE, this probe is a Chromel-Alumel thermocouple (Type K). For the 104A PL624TCE, this probe is a Copper-Constantan thermocouple (Type T). Each thermocouple probe is sheathed in a 1/8" diameter x 6" long stainless steel sheath. It is furnished with a 48" extension wire with stainless steel overbraid and a polarized plug. The control may be used with any thermocouple which has lead resistance less than 100 ohms.

Control Sensor Placement

Proper placement of the sensor can eliminate many problems associated in the total 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 heating source. In processes where heat demand is variable, the probe should be placed close to the work area. Experimenting with probe location should be tried to provide optimum results for your particular process.

Keys & Displays 16th DIN PID Controller

Zone Display:

When **Zone** (found in the Factory Page) is set to on, indicates the controller zone.

1 to **9** = zones 1 to 9

A = zone 10

b = zone 11

C = zone 12

d = zone 13

E = zone 14

F = zone 15

h = zone 16

Lower Display:

Indicates the set point or output power value during operation, or the parameter whose value appears in the upper display.

A/M Key:

This key will toggle the control mode between the current value of the C.M prompt (Off, MAn, AUto) and Manual when the A/M button is pushed and held for 3 seconds.

Infinity Key: ∞

Clears and Silences alarms, press to back up one level, or press and hold for two seconds to return to the Operations Menu.

Upper Display:

In the Operations Menu, displays the process value, otherwise displays the value of the parameter in the lower display.

Temperature Units Indicator Lights:

Indicates whether the temperature is displayed in Fahrenheit or Celsius.

Output Activity:

Number lights indicate activity of outputs 1 and 2.

Percent Units Indicator:

Lights when the controller is displaying values as a percentage or when the open-loop set point is displayed.

Communications Activity:

Flashes when another device is communicating with this controller.



Up and Down Keys: ⬆ ⬇

In the Operations Menu, adjusts the set point in the lower display. In other pages, changes the upper display to a higher or lower value, or changes a parameter selection.

Advance Key: •

Advances through parameter prompts.

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. Turn 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 process, use the **Up/Down** arrow keys to enter the desired set point temperature. This is shown in the lower display. Auto-tuning is recommended in all applications. Auto-tuning allows the control to set the PID parameters without those parameters being manually entered/calculated 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 8 for instruction on performing the auto-tune function.

It is recommended that the auto-tune feature be used every time the process temperature set point has been changed. If the process is being repeated, the parameters learned in the initial setup are stored in the memory of the control and the auto-tune process isn't required to be repeated in most applications.

Control Values:

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 | Max temperature for sensor type | 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 |

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. 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.

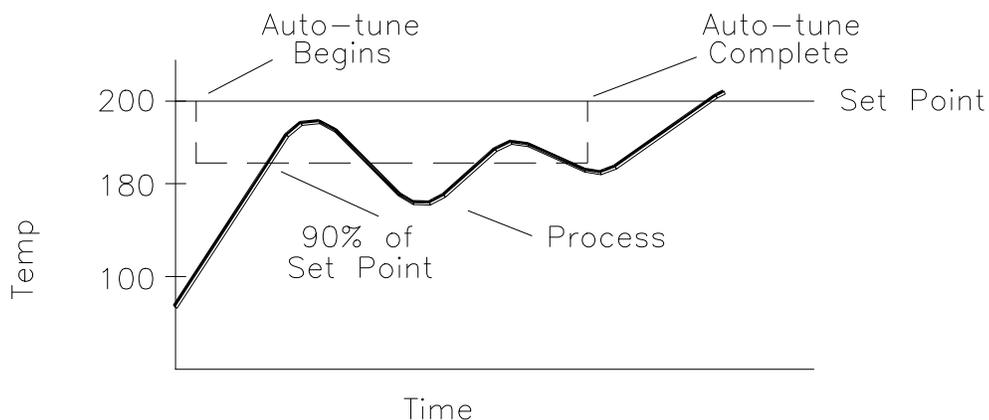
Tuning-Automatic

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 till the auto tune is 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.



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 lower display.
3. Change the parameter to **YES** 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. When tuning is complete, the lower display indicates only the set point.
5. When tuning is complete, the lower display indicates setpoint only and Aut reverts to OFF. The control installs appropriate PID tuning parameters and retains them in the non-volatile memory.

*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

| Indication | Description | Possible Causes | Corrective Action |
|---|--|---|---|
| Err 1 Error Input | Sensor does not provide a valid signal to controller | Sensor improperly wired or open, Incorrect setting or sensor type, or Calibration corrupt | Correct wiring or replace sensor, Match setting to sensor, or Check calibration of controller |
| Aut 1 Autotuning 1 | Controller is auto-tuning the control loop | User started the auto-tune function | Wait until auto-tune completes or disable auto-tune feature |
| rP 1 Ramping 1 | Controller is ramping to new set point | Ramping feature is activated | Disable ramping feature if not required |
| ALh 1 Alarm High ALh 2 ALh 3 ALh 4 | Sensor input above high alarm set point | Temperature is greater than alarm set point | Over temperature, or Set alarm source to proper setting |

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, 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

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

Cleaning

If cleaning is necessary, using only a damp cloth with only water, wipe only the exterior of the control chassis.

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.
- (2) 4 character LED display.
- Thermocouple receptacle and 3 wire load receptacle.

Input

- Type J, K, and T thermocouple: Input grounded or ungrounded. (T/C type associated with the model number)
- Automatic cold junction compensation and break protection for sensor.
- Degrees F or degrees C display; user selectable (Factory set for °C)

| | |
|----------------------|-------------------------|
| Range Type J: | -200°C to 1200°C |
| Range Type K: | -200°C to 1370°C |
| Range Type T: | -200°C to 400°C |

Primary Output (Heating or Cooling)

- 10 Amp / 240 VAC

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.

Calibration

Contact Glas-Col for more information about calibration.

Agency Approvals

The products defined in the document are CE marked and conform to the following standards:

- EMC: EC Directive 89/336/EEC
EN55011 class B also referred to as CISPR 11 class B
EN50082-1
- Safety: Safety Directive 73/23/EEC
EN601010-1: 1993 safety requirements for electrical equipment for measurement,
control and laboratory use-General requirements.

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, overheating, 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. Normally expendable parts are not covered by this warranty.

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.

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