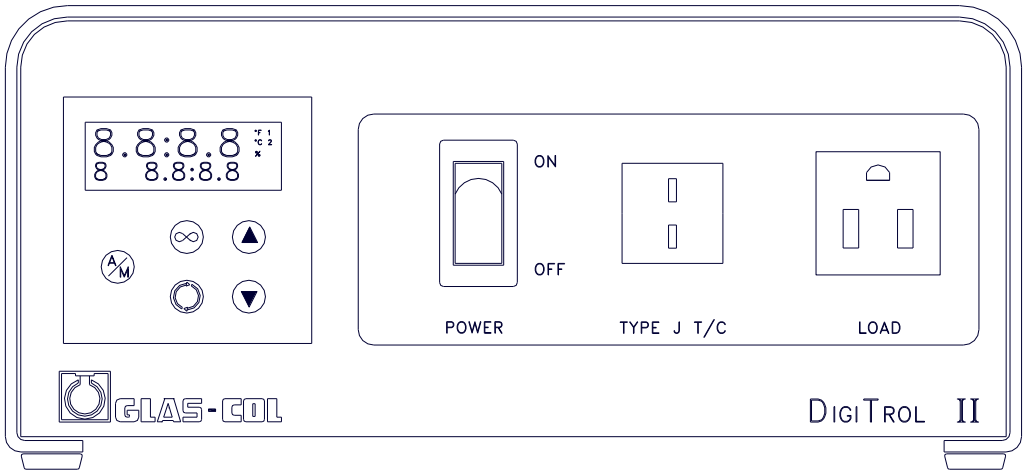
Operation Manual

Instruction Notes for DigiTrol II General Use Instruction Manual



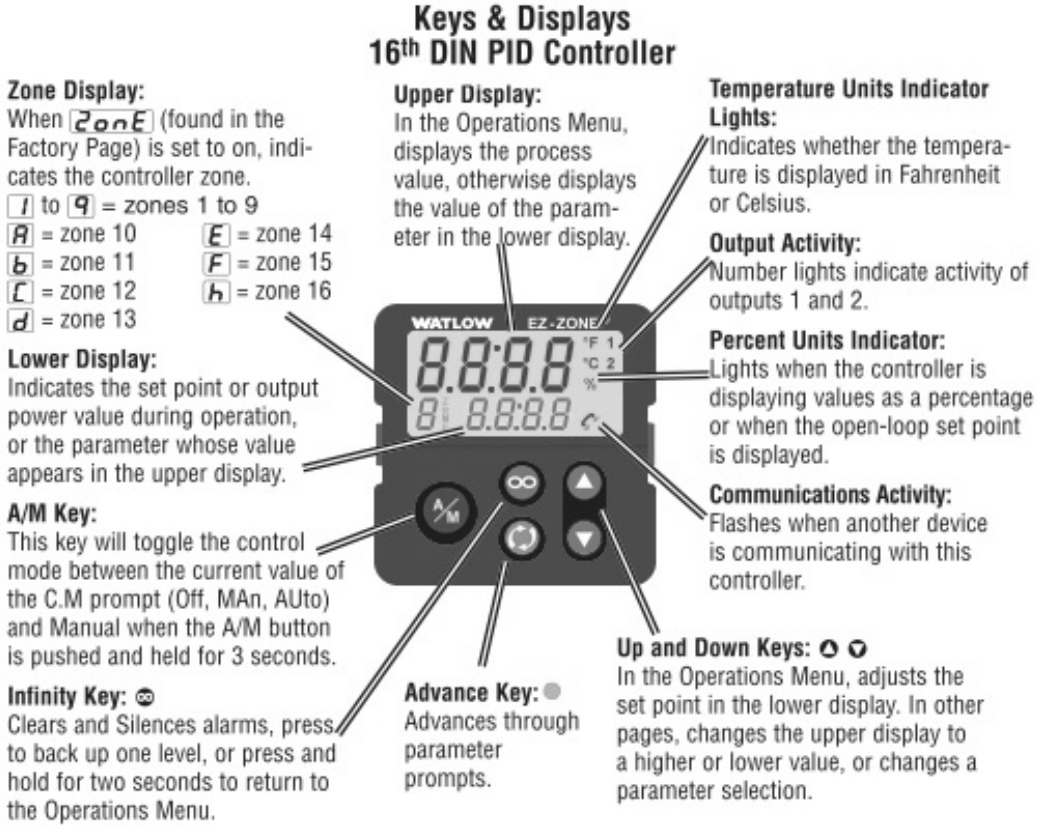
General Description

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 control also has the capability of several thermocouple types. Reference page 6 for instructions on changing thermocouple type.

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. 15-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.



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 Sensor

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.

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
- Thermocouple: Input grounded or ungrounded.
- Automatic cold junction compensation and break protection for sensor.
- Degrees F or degrees C display; user selectable (Factory set for °C)

Functional Operating Range
- Type B: -50 to 1816°C (-58 to 3301°F), Type C: 0 to 2315°C (32 to 4199°F)
- Type D: 0 to 2315°C (-328 to 4199°F), Type E: -270 to 1000°C (-454 to 1832°F)
- Type F: 0 to 1343°C (32 to 2449°F), Type J: -210 to 1200°C (-346 to 2192°F)
- Type K: -270 to 1371°C (-454 to 2500°F), Type N: -200 to 1300°C (-328 to 2372°F)
- Type R: -50 to 1767°C (-58 to 3213°F), Type S: -50 to 1767°C (-58 to 3213°F)
- Type T: -270 to 400°C (-454 to 752°F),

Primary Output (Heating or Cooling)
- 15 Amp, 120 Volts or 10 Amp, 240 Volts depending on model

Accuracy
- Calibration accuracy and sensor conformity: ±0.1 percent of span, ±1°C @ the calibrated ambient temperature and rated line voltage
  - Type S, 0.2 percent
  - Type T, below -50°C; 0.2 percent
- Calibration ambient temperature @ 25°C ±3°C (77°F ±5°F)
- Accuracy span: 540°C (1000°F) minimum
- Temperature stability: ±0.1°C/°C (±0.1°F/°F) rise in ambient maximum

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.

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

Change Thermocouple Input Type

1. Enter the Setup Menu by pushing and holding the UP and DOWN arrow keys.
2. Push the green advance key to step through the menu parameters.
3. Locate the [L.in] parameter. See Setup Menu chart on page 5 for reference.
4. Default value will be set for type “J” thermocouple.
5. Use the UP or DOWN arrow key to change thermocouple type. See chart below for character representation for the display.
6. Press the infinity key one time after completing thermocouple type change.

1 = 1	7 = 7	c, C = c	i = i	o = o	u, U = u
2 = 2	8 = 8	d = d	J = J	P = P	v, V = v
3 = 3	9 = 9	E = E	K = K	q = q	W = W
4 = 4	0 = 0	F = F	L = L	r = r	y = y
5 = 5	A = A	g = g	M = M	S = S	Z = Z
6 = 6	b = b	h = h	n = n	t = t	

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.

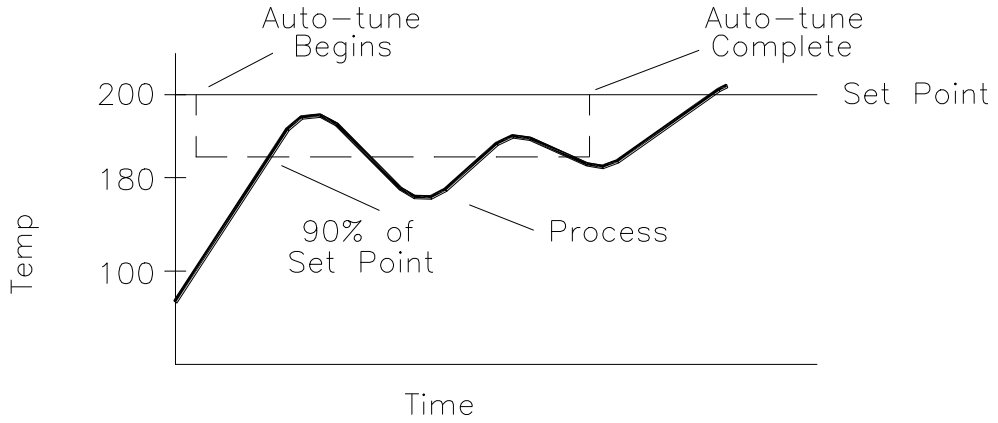
Tuning-Automatic

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.



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
Er.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
tUn1 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
rP1 Ramping 1	Controller is ramping to new set point	Ramping feature is activated	Disable ramping feature if not required
AL.h1 Alarm High AL.h2 AL.h3 AL.h4	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 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
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.

Replacement Parts:

Power cord:
If the power cord supplied with the control would become missing or damaged, replace only with the appropriate rated power cord noted by the description below.

SJT-3 14 AWG, 15 Amp, 125 VAC, less than 3 meters in length (120volt controls only)

Fuse:
Use only 250Volt fuse, 15 amp rating (120volt controls only)

Warranty
See the current Glas-Col warranty policy located under the General Sales Policy on the Glas-Col website at www.glascol.com.

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

Calibration

Contact Glas-Col for more information about calibration.

2004/108/EC Electromagnetic Compatibility Directive

EN 61326-1	**2006**		**Electrical equipment for measurement, control and laboratory use – EMC requirements (Industrial Immunity, Class B Emissions).**
EN 61000-4-2	1996	A1, A2, 2001	Electrostatic Discharge Immunity
EN 61000-4-3	2006		Radiated Field Immunity
EN 61000-4-4	2004		Electrical Fast-Transient / Burst Immunity
EN 61000-4-5	2006		Surge Immunity
EN 61000-4-6	1996	A1, 2, 3, 2005	Conducted Immunity
EN 61000-4-11	2004		Voltage Dips, Short Interruptions and Voltage Variations Immunity
EN 61000-3-2	2006		Harmonic Current Emissions
IEC 61000-3-3[1]	2005		Voltage Fluctuations and Flicker

[1]For mechanical relay loads, cycle time may need to be extended up to 150 seconds to meet flicker requirements depending on load switched and source impedance.

2006/95/EC Low-Voltage Directive

EN 61010-1	**2001**		**Safety Requirements of electrical equipment for measurement, control and laboratory use. Part 1: General requirements**

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