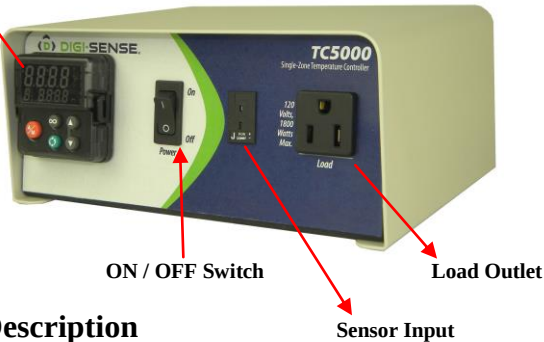


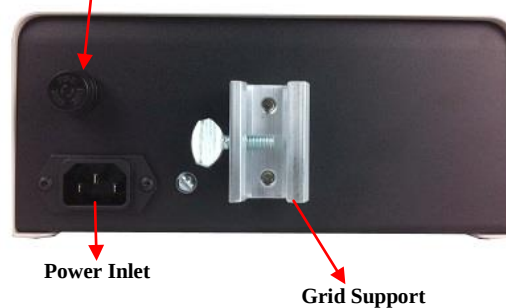
Operation Manual

Instruction Notes for 3622561, 3622562, 3622563, 3622564

Digital Control Module



Load Fuse



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", "T" thermocouple, or RTD (model 3622564) 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. 15-amp output.
3. Control **PID with Auto-tune algorithm, solid state relay**
4. Circuit protection (fuse)
5. Low profile housing.
6. Safety feature- Output is de-energized if sensing device is unplugged or damaged.

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. 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 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

- 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)

Range Type J:	-200°C to 1200°C
Range Type K:	-200°C to 1370°C
Range Type T:	-200°C to 400°C
Range Type RTD:	-200°C to 800°C

Primary Output (Heating or Cooling)

- 15A @ 120VAC or 10A @ 240VAC depending on model

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.

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.

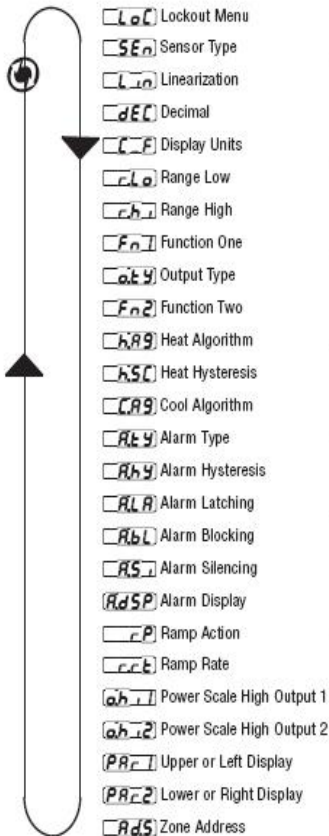
Setup Menu

- 
- ☐ **LoC** Lockout Menu
 - ☐ **SEn** Sensor Type
 - ☐ **Lin** Linearization
 - ☐ **dEC** Decimal
 - ☐ **C_F** Display Units
 - ☐ **rLo** Range Low
 - ☐ **rHi** Range High
 - ☐ **Fn1** Function One
 - ☐ **oTy** Output Type
 - ☐ **Fn2** Function Two
 - ☐ **hAg** Heat Algorithm
 - ☐ **hSC** Heat Hysteresis
 - ☐ **CAG** Cool Algorithm
 - ☐ **ALy** Alarm Type
 - ☐ **ALy** Alarm Hysteresis
 - ☐ **ALH** Alarm Latching
 - ☐ **ALB** Alarm Blocking
 - ☐ **ASL** Alarm Silencing
 - ☒ **ALdSP** Alarm Display
 - ☐ **rP** Ramp Action
 - ☐ **rRt** Ramp Rate
 - ☐ **oH1** Power Scale High Output 1
 - ☐ **oH2** Power Scale High Output 2
 - ☐ **PRL** Upper or Left Display
 - ☐ **PRR** Lower or Right Display
 - ☐ **AdS** Zone Address

Setup Menu 16 th & 32 nd DIN PID Controller		
Display	Parameter Name Description	Range (Defaults are shown bold)
LoC [LoC]	Lockout Menu Set the security clearance level. The user can access the selected level and all lower levels. Appears if: Always	1 to 5 1 Operations Menu (read only, A/M button disabled)* 2 Operations Menu (A/M button disabled, Set point R/W)* 3 Operations Menu (A/M button enabled, Set point R/W, Control Mode R/W)* 4 Operations Menu R/W access* 5 Operations Menu and Setup Menu full R/W access *You can change the security level at any level
SEn [SEn]	Sensor Type Set the analog sensor type to match the device wired to this input. Appears if: Always	☐ EC Thermocouple ☐ Volts Volts dc ☐ mA Millamps dc ☐ RTD RTD 100 Ω
Lin [Lin]	Linearization Set the linearization to match the thermocouple type wired to this input. For example, select ☐ H for a type K thermocouple. Appears if: Sensor Type is set to Thermocouple.	☐ J J ☐ K K ☐ N N ☐ S S ☐ T T
dEC [dEC]	Decimal Set the precision of the displayed value. Appears if: Always	☐ 0 Whole ☐ 00 Tenths ☐ 000 Hundredths
C_F [C_F]	Display Units Select which units will be displayed. Appears if: Always	☐ F °F ☐ C °C
rLo [r.Lo]	Range Low Set the low range of the set point. Appears if: Always	-1,999.000 to 9,999.000 0.0
rHi [r.hi]	Range High Set the high range of the set point. Appears if: Always	-1,999.000 to 9,999.000
Fn1 [fn1]	Function of Output 1 Select which function will drive this output. Appears if: If output 1 is ordered	☐ OFF Off ☐ COOL Cool ☐ HEAT Heat ☐ ALM Alarm
oTy [o.ty]	Output Type Select whether the process output will operate in volts or millamps. Appears if: A process output (PM _ C _ F _ _ AAAB _ _)	☐ Volts Volts ☐ mA Millamps

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.

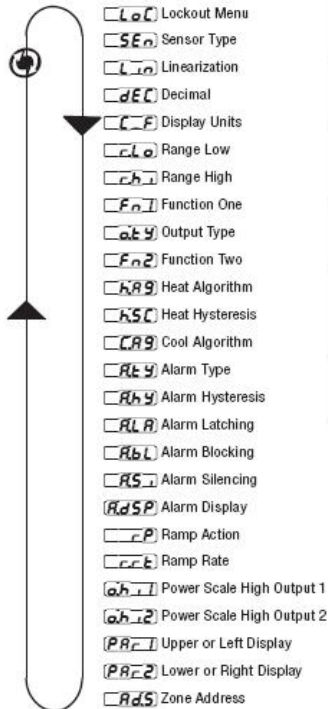
Setup Menu



Setup Menu 16 th & 32 nd DIN PID Controller		
Display	Parameter Name Description	Range (Defaults are shown bold)
∞ Fn2 [fn2]	Function of Output 2 Select which function will drive this output. Appears if: If output 2 is ordered	∞ Off ∞ Cool ∞ Heat ∞ Alarm
∞ hAg [hAg]	Heat Algorithm Set the heat control method. Appears if: Output 1 or 2 set to heat	∞ Off ∞ PID ∞ On-Off
∞ hSC [hSC]	Hysteresis (Heat & Cool) Set the control switching hysteresis for on-off control. This determines how far into the "on" region the process value needs to move before the output turns on. Appears if: Heat or Cool Algorithm is set to On-Off.	0 to 9,999.000°F or units 0 to 5,555.000°C Units, 3.0°F or 2.0°C
∞ CAG [C.Ag]	Cool Algorithm Set the cool control method. Appears if: If Output 1 or 2 is set to cool	∞ Off ∞ PID ∞ On-Off
∞ Aty [A.ty]	Alarm Type Select how the alarm will or will not track the set point. Appears if: Always	∞ Off ∞ Process Alarm ∞ Deviation Alarm
∞ Ahy [A.hy]	Alarm Hysteresis Set the hysteresis for an alarm. This determines how far into the safe region the process value needs to move before the alarm can be cleared. Appears if: When alarm type is set to process or deviation alarm	0.001 to 9,999.000°F or units 0.001 to 5,555.000°C Units, 1.0°F or 1.0°C
∞ ALA [A.LA]	Alarm Latching Turn alarm latching on or off. A latched alarm has to be turned off by the user. Appears if: When alarm type is set to process or deviation alarm	∞ Non-Latching ∞ Latching
∞ AbL [A.bL]	Alarm Blocking Select when an alarm will be blocked. After startup and/or after the set point changes, the alarm will be blocked until the process value enters the normal range. Appears if: When alarm type is set to process or deviation alarm	∞ Off ∞ Startup ∞ Set Point ∞ Both
∞ AS [A.SI]	Alarm Silencing Turn alarm silencing on to allow the user to disable the output tied (configured) to this alarm. Appears if: When alarm type is set to process or deviation alarm	∞ Off ∞ On
∞ AdSP [A.dSP]	Alarm Display Display an alarm message when an alarm is active. Appears if: When alarm type is set to process or deviation alarm	∞ Off ∞ On

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.

Setup Menu

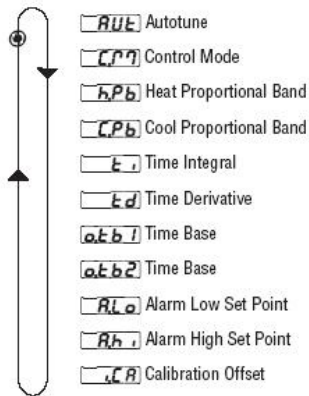


Setup Menu 16 th & 32 nd DIN PID Controller		
Display	Parameter Name Description	Range (Defaults are shown bold)
∞ Ramp Action [r.P]	Ramp Action Select when the controller's set point will ramp to the defined end set point. Appears if: Always	∞ Off ∞ Startup (SetPt) Set Point Change (both) Both
∞ Ramp Rate [r.Rt]	Ramp Rate Set the rate for the set point ramp. Set the time units for the rate with the Ramp Scale parameter. Appears if: Ramp Action is set to Startup, Set Point or Both.	1.0°F or u 1.0°C Degrees or units per hour
∞ Power Scale Output High 1 [o.hi1]	Power Scale Output High 1 Set maximum value of output 1 range. Appears if: Output 1 is set to heat	0.0 to 100% 100.0
∞ Power Scale Output High 2 [o.hi2]	Power Scale Output High 2 Set maximum value of output 2 range. Appears if: Output 2 is set to heat	0.0 to 100% 100.0
∞ Upper or Left Display [PAR1]	Upper or Left Display Select parameter to display. Appears if: Always	(RCP) Active Process Value (none) none
∞ Lower or Right Display [PAR2]	Lower or Right Display Select parameter to display. Appears if: Always	(RSP) Active Set Point ∞ Alarm High Set Point ∞ Alarm Low Set Point (none) None
∞ Zone Address [Ad.S]	Zone Address - Standard Bus Communication Set zone address from 1-16. Appears if: Always	1-16 1

Operations 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.

Operations Menu



Operations Menu 16 th & 32 nd DIN PID Controller		
Display	Parameter Name Description	Range (Defaults are shown bold)
∞ AUT [AUT]	Autotune Start an autotune. While active the upper or left and lower or right display will flash ti and td . Appears if: Heat or cool algorithm set to PID	∞ No ∞ Yes
∞ CM [C.M]	Control Mode Active View the current control mode. Appears if: Always	∞ Off ∞ Auto ∞ Manual
∞ HPb [h.Pb]	Heat Proportional Band Set the PID proportional band for the heat outputs. Appears if: Heat algorithm set to PID	0 to 9,999.000°F or units 0 to 5,555.000°C Units, 25.0°F or 14.0°C
∞ CPb [C.Pb]	Cool Proportional Band Set the PID proportional band for the cool outputs. Appears if: Cool algorithm set to PID	0 to 9,999.000°F or units 0 to 5,555.000°C Units, 25.0°F or 14.0°C
∞ ti [ti]	Time Integral Set the PID integral for the outputs. Appears if: Heat or cool algorithm set to PID	0 to 9,999 seconds per repeat 180.0
∞ td [td]	Time Derivative Set the PID derivative time for the outputs. Appears if: Heat or cool algorithm set to PID	0 to 9,999 seconds 0.0 seconds
∞ tb1 [o.tb1]	Time Base Output 1 Set the time base for fixed-time-base control. Appears if: Output 1 set to heat or cool with control algorithm set to PID.	0.1 to 60.0 seconds (solid-state relay or switched dc) 5.0 to 60.0 seconds (mechanical relay & NO-ARC power control) 1 sec. [SSR & sw dc], 20.0 sec. [mech. relay & NO-ARC]
∞ tb2 [o.tb2]	Time Base Output 2 Set the time base for fixed-time-base control. Appears if: Output 2 set to heat or cool with control algorithm set to PID.	0.1 to 60.0 seconds (solid-state relay or switched dc) 5.0 to 60.0 seconds (mechanical relay & NO-ARC power control) 1 sec. [SSR & sw dc], 20.0 sec. [mech. relay & NO-ARC]
∞ ALo [A.Lo]	Alarm Low Set Point Process - set the process value that will trigger a low alarm. Deviation - set the span of units from the closed loop set point that will trigger a low alarm. Appears if: If Alarm Type (A.ty) is set to Process or Deviation Alarm	-1,999.000 to 9,999.000°F or units -1,128.000 to 5,537.000°C Units, 32.0°F or 0.0°C
∞ AHi [A.hi]	Alarm High Set Point Process - set the process value that will trigger a high alarm. Deviation - set the span of units from the closed loop set point that will trigger a high alarm. Appears if: If Alarm Type (A.ty) is set to Process or Deviation Alarm	-1,999.000 to 9,999.000°F or units -1,128.000 to 5,537.000°C Units, 300.0°F or 150.0°C
∞ CA [i.CA]	Calibration Offset Set an offset value for a process output. Appears if: Always	-1,999.000 to 9,999.000°F or units -1,110.555 to 5,555.000°C 0.0

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.

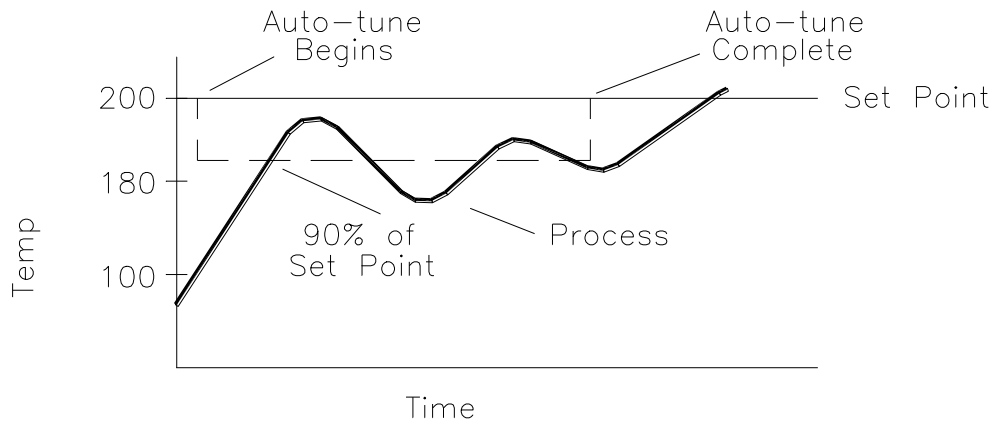
Tuning-Automatic

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 with a value of 100. This value can be adjusted in the setup menu, reference page 6 for instructions on how to change value. If excessive temperature overshoot is occurring, adjust the value to 50 and start the heating process from ambient room temperature. If excessive temperature overshoot is still occurring, decrease to a lower value and repeat heating process from ambient room temperature. If the process temperature never makes it to the set point temperature value, 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
 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
 Autotuning 1	Controller is autotuning the control loop	User started the autotune function	Wait until autotune complests or disable autotune feature
 Ramping 1	Controller is ramping to new set point	Ramping feature is activated	Disable ramping feature if not required
 Alarm High   	Sensor input above high alarm set point	Temperature is greater than alarm set point	Check casue of 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, 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.

Warranty

Digi-Sense, for itself does hereby offer a warranty for products from the date of receipt by the user, under normal and proper usage, against defects in workmanship and materials for 12 months, and will repair or replace any defective part(s) without charge when same is shipped Prepaid to Digi-Sense from which the product was originally purchased.

Should the nature of any defect require that the product, or any constituent portion thereof, be returned to Digi-Sense, Vernon Hill, Illinois, prepaid for service, a condition precedent to any return shall be the procurement of authorization from Digi-Sense assigning a **Return Goods Number** to the product or part requiring service.

Parts and accessories manufactured by others are warranted only to the extent of the regular warranty of the manufacturer or supplier of such materials and only insofar as Digi-Sense is able to transfer the benefits of warranty coverage, if any, to the user. Any adequately warranted defective part or accessory manufactured or supplied by others may be exchanged through Digi-Sense for a replacement part is shipped prepaid and received at Digi-Sense within 30 days from the date any replacement part is obtained by the user.

This warranty supersedes and is given in lieu of all implied warranties, and is void if the user causes damages from improper usage of product under normal operating conditions.

12 MONTHS LIMITED WARRANTY ON ALL PARTS AND LABOR IS GIVEN BY DIGI-SENSE.

CATALOG NUMBER 3622561, 3622562, 3622563, or 3622564

SERIAL NUMBER _____

DATE OF PURCHASE _____

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