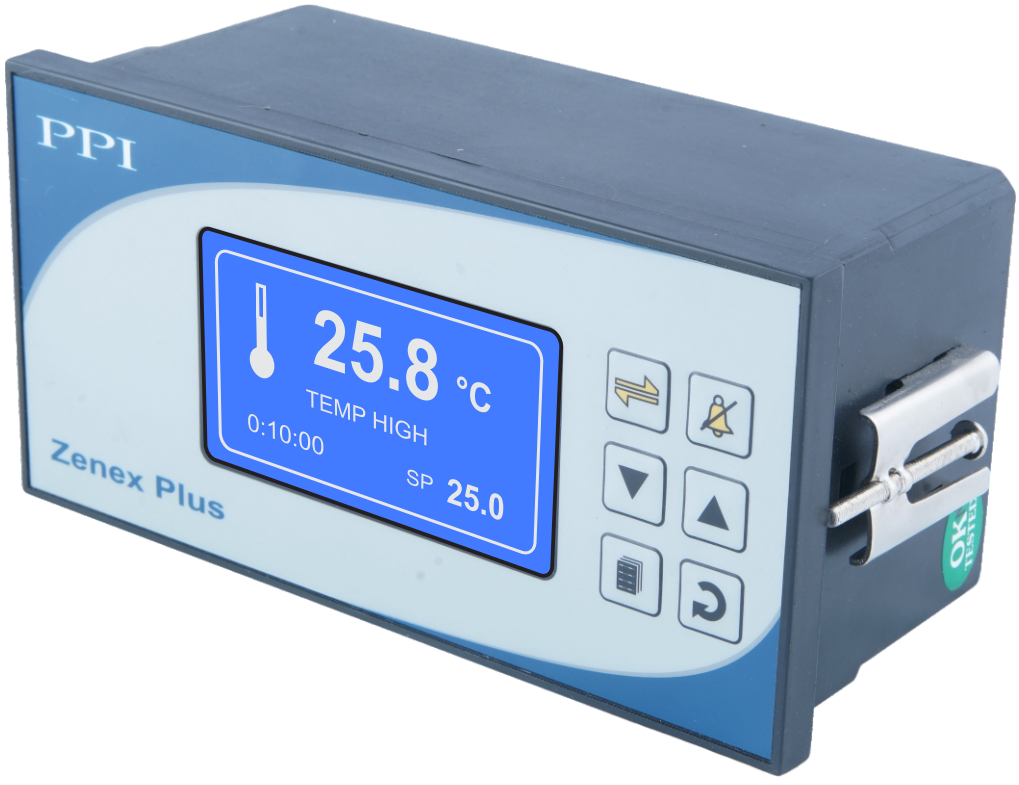
# Zenex Plus

PPI
The Perfection Experts

## Multi-Purpose Temperature Controller with Graphic Display




# User Manual

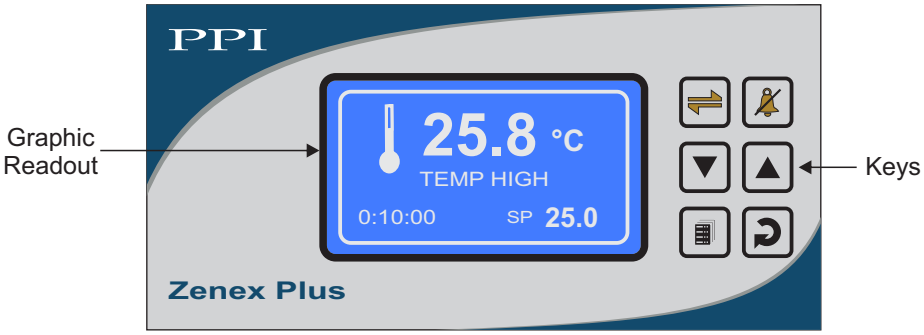
# CONTENTS

Section 1

# FRONT PANEL LAYOUT

The Controller front panel comprises of Graphic Readout and Membrane Keys as shown in Figure 1.1 below.

***Figure 1.1***




## GRAPHIC READOUT

The Graphic Readout is a 128 X 64 Pixel Monochrome LCD Display. In Normal operation mode the Readout shows measured Temperature Value, Set Temperature Value, Alarm / Process Status & Balance Time (if enabled & running). The Process Status Information can be viewed using screen scroll feature.

In Set-up Mode, the Readout displays parameter names and values that can be edited using front keys.

## KEYS

There are six tactile keys provided on the front panel for configuring the controller and setting-up the parameter values.

The Table 1.1 below lists each key (identified by the front panel symbol) and the associated function.

***Table 1.1***

| Symbol | Key | Function |
|---|---|---|
| | Scroll | Press to scroll through various Process Information Screens in Normal Operation Mode. |
| | Alarm Acknowledge | Press to acknowledge and mute (if active) alarm output. |
| | DOWN | Press to decrease the parameter value. Pressing once decreases the value by one count; keeping pressed speeds up the change. |
| | UP | Press to increase the parameter value. Pressing once increases the value by one count; keeping pressed speeds up the change. |
| | SET-UP | Press to enter or exit set-up mode. |
| | ENTER | Press to store the set parameter value and to scroll to the next parameter. |

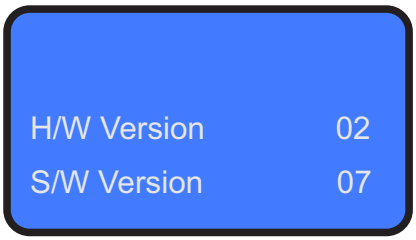
Section 2

# BASIC OPERATIONS

## POWER-UP DISPLAY

Upon power-up the controller displays model name, Hardware Version and Software Version for 2 seconds as shown in figure 2.1.

*Figure 2.1*




## RUN MODE

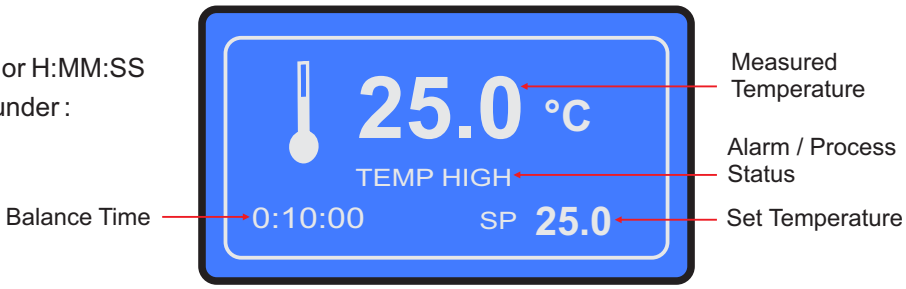
After the Power-up display the controller enters into RUN Mode. This is the normal operation mode wherein the controller starts PV measurements, Alarm monitoring and Control Loop execution.

### Main Screen

This is the default screen and its appearance depends upon whether a timer function is enabled or disabled as shown in the figures 2.2 (a) & 2.2 (b) respectively.

*Figure 2.2(a) : Timer Disabled*


*Figure 2.2(b) : Timer Enabled*



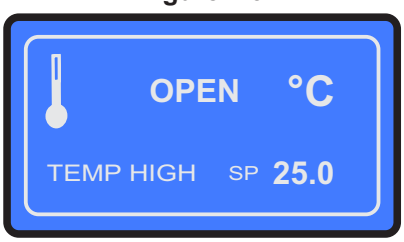

Note :
The Balance Time is shown in either HHH:MM or H:MM:SS depending upon the remaining time counts as under :
HHH:MM for 249:59 to 10:00
H:MM:SS for 9:59:59 to 0:00:00

In case of measured value errors, the messages listed in Table 2.1 flash in place of process value as illustrated in Figure 2.3.

**Table 2.1**

| Message | Error Type | Cause |
|---|---|---|
| OPEN | Sensor Open | RTD Pt100 / Thermocouple is Broken / Open |
| OVR | Over-range | Temperature above Max. Specified Range |
| UNR | Under-range | Temperature below Min. Specified Range |

**Figure 2.3**



The Alarm / Process Status space on the screen may show one or more of the several messages listed in Table 2.2 depending upon the existence of active alarms or process events. In case of co-existence of multiple active alarms or process events, the messages are scrolled one after the other with an approximate time interval of 3 seconds. Also if there is no active alarm or process event, the message space is blank.

**Table 2.2**

| Message String | Alarm / Process Status |
|---|---|
| Temp High | The measured temperature is in Process High Alarm State. |
| Temp Low | The measured temperature is in Process Low Alarm State. |
| Tuning | The Controller is Self Tuning. |
| Door Open | The Equipment / Chamber door is open for a time longer than the set 'DOOR ALRM DLY' time. |
| Timer Hold | The Countdown Timer is paused since the PV is outside Hold Band. |

**Process Status Screen**

The Process Status Screen is shown upon pressing (Scroll) key from Main Screen or upon acknowledging a new Alarm by pressing (Acknowledge) key. As depicted in Figure 2.4(a) for Old Version & 2.4(b) for New Version; the screen shows Temperature Alarm Status, Door Open / Close Status, the Heater Output Status (ON / OFF or % Power) & Compressor ON / OFF Status.

*Figure 2.4(a) :*

***Old Version***

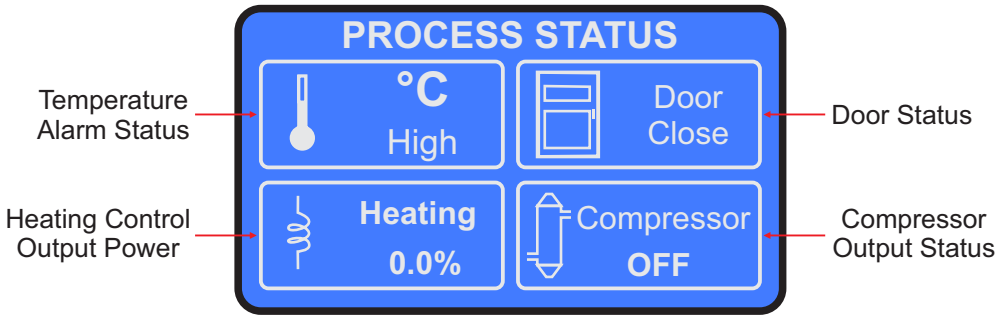



*Figure 2.4(b) :*

***New Version***

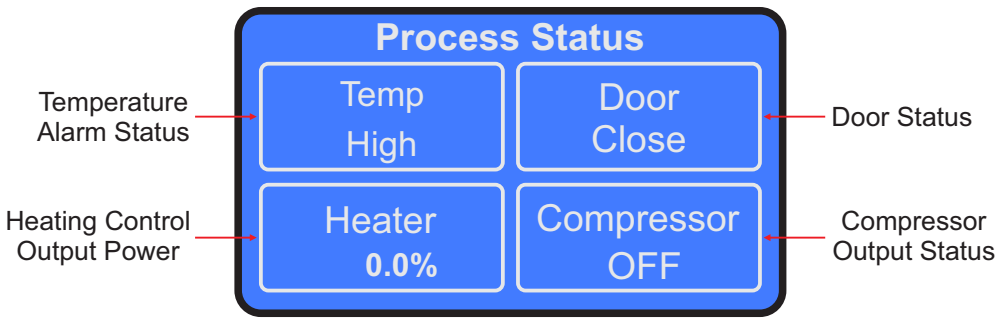


*Figure 2.5 (a)*

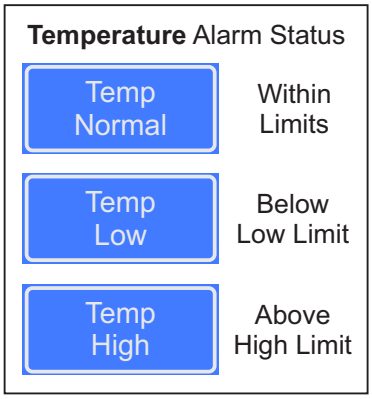



*Figure 2.5 (b)*


The Controller provides programmable Low & High deviation limits around the temperature control setpoint to monitor Alarm conditions. The screen shows either Normal or Low or High Status, as shown in Figure 2.5 (a) depending upon the deviation of measured temperature value from the control setpoint and set limits.

The Controller provides a Digital Input for interfacing Door switch that senses the door position, Open or Close. The screen indicates the door status as shown in Figure 2.5 (b).

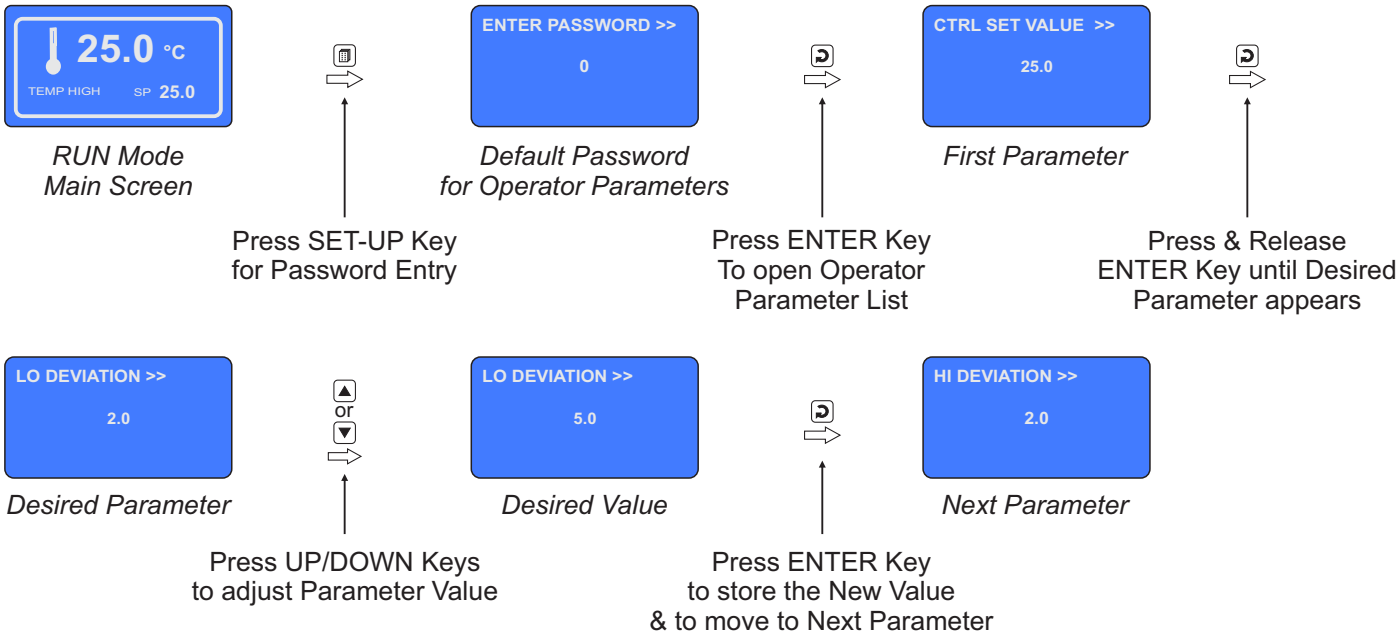
Section 3

# OPERATOR PARAMETERS

The Operator Parameters are accessible under PASSWORD 0. The list includes parameters for adjusting Control Setpoint, Alarm Setpoints & Zero-offset. If Timer is enabled then Time Interval value & Timer Start / Abort commands are also available.

The Figure 3.1 shows how to access Operator Parameters. The Example illustrates changing the Low Deviation alarm value from 2.0 to 5.0. (The Example is shown with Timer disabled).

***Figure 3.1***




The Table 3.1 below described the Operator Parameters in detail.

***Table 3.1***

| Parameter Description | Settings (Default Value) |
|---|---|
| **TIME START COMMAND >>**<br>**TIME ABORT COMMAND >>**<br>***(Available only if Timer is Enabled)***<br>These two commands are mutually exclusive.<br>Set to Yes to start Timer, if not already started.<br>Set to Yes to abort a running timer. | Yes<br>No<br>(Default : No) |
| **TIME INTERVAL (H:M) >>**<br>***(Available only if Timer is Enabled)***<br>The set time value for the timer in Hours : Minutes. | 0.01 to 249.59<br>(HH:MM)<br>(Default : 0.10) |

| Parameter Description | Settings (Default Value) |
|---|---|
| **CTRL SET VALUE >>**<br>This parameter sets the value at which the controller attempts to maintain the measured temperature value. | Setpoint LO limit to Setpoint HI limit<br>(Default : 25.0) |
| **LO DEVIATION >>**<br>This Parameter sets a negative deviation (offset) limit with respect to the '*Control Set-point*'. The Alarm is activated if the measured temperature value falls below this limit. | 0.2 to 99.9<br>(Default : 2.0) |
| **HI DEVIATION >>**<br>This Parameter sets a negative deviation (offset) limit with respect to the '*Control Set-point*'. The Alarm is activated if the measured temperature value exceeds this limit. | 0.2 to 99.9<br>(Default : 2.0) |
| **CHANGE PASSWORD >>**<br>The Controller is shipped from the factory with a default password (0) for accessing the parameters reserved for Operator. However, if required the password can be changed by setting the new value for this parameter.<br>(The new password replaces the old password. That is, the old password is no longer valid. it is user's responsibility to memorize the password.) | 1 to 100<br>(Default : 0) |

# Section 4
# SUPERVISORY PARAMETERS

The various parameters have been assembled in different groups under the default factory password 123.

Refer Table 4.1 below for a quick summary of parameters under different groups. Each parameter has been described in subsequent sections.

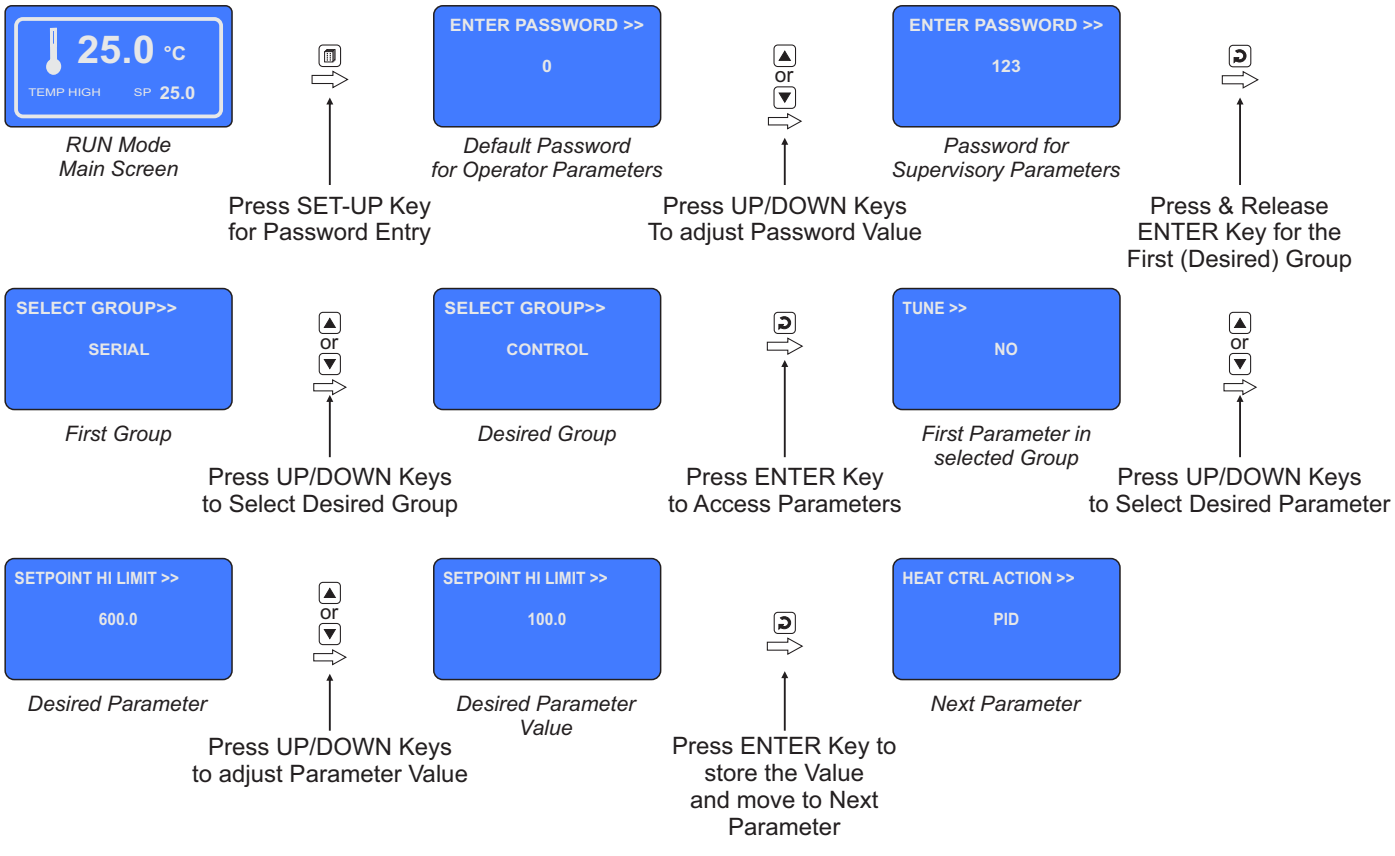
**Table 4.1**

| Group | Parameters |
|---|---|
| Serial Parameter | Device ID, Baud Rate, Parity, Serial Write |
| Sensor Input | Zero Offset |
| Control | Tune, Setpoint Low Limit, Setpoint High Limit, Compressor Set-point, Compressor Hysteresis, Heat Control Action, Heat Hysteresis, CZ Proportional Band, CZ Integral Time, CZ Derivative Time, HZ Proportional Band, HZ Integral Time, HZ Derivative Time, Cycle Time, Overshoot Inhibit, Cutoff Factor |
| Password | Change Password |
| Exit | Exit Setup Mode |

### Accessing Group & Parameters

The Figure 4.1 below illustrates how to access the group and parameters. The example shows changing the value for the parameter 'Setpoint High Limit' from 600.0 to 100.0 that is located under group 'Control'.

***Figure 4.1***



**Notes**

The Last Parameter in the selected Group rolls back to the 'SELECT GROUP' screen again to avoid re-entering the password in case parameters under multiple groups need to be set.

**Parameter Descriptions**

The various Supervisory Parameters have been described with their respective group & sub-group.

## SUPERVISORY > SENSOR INPUT

| Parameter Description | Settings (Default Value) |
|---|---|
| **ZERO OFFSET >>**<br>This value is algebraically added to the measured Temperature Value at control channel to derive the final value that is displayed and compared for alarm / control. Use this value to nullify any known constant error.<br><br>Final Value = Measured Value + Offset | -50.0 to 50.0<br>(Default : 0.0) |

## SUPERVISORY > SERIAL PARAMETERS

| Parameter Description | Settings (Default Value) |
|---|---|
| **DEVICE ID >>**<br>Unique numeric code assigned to the indicator for identification by the host. Set the value as required by the host. | 1 to 127<br>(Default : 1) |
| **BAUD RATE >>**<br>Communication speed in 'Bits per Second'. Set the value to match with the host baud rate. | 2400<br>4800<br>9600<br>19200<br>38400<br>57600<br>(Default : 9600) |
| **PARITY >>**<br>One of the communication error trapping features. Select the data packet parity as implemented by the host protocol. | None<br>Even<br>Odd<br>(Default : Even) |
| **SERIAL WRITE PERMISSION >>**<br>Setting to 'No' disallows the host to set / modify any parameter value. The host, however, can read the value. | No<br>Yes<br>(Default : No) |

## SUPERVISORY > CONTROL

| Parameter Description | Settings (Default Value) |
|---|---|
| **TUNE >>**<br>***(Available for Heat Only / Heat+Cool Control Strategy)***<br>Set 'Yes' to activate and 'No' to abort the Tuning operation. | Yes<br>No<br>(Default : No) |
| **SETPOINT LO LIMIT >>**<br>This parameter sets the minimum limit on the Control Setpoint value. | For Thermocouple Input :<br>-200 to Setpoint HI Limit<br>For RTD Input :<br>-99.9 to Setpoint HI Limit<br>(Default : 0.0) |
| **SETPOINT HI LIMIT >>**<br>This parameter sets the maximum limit on the Control Setpoint value. | For Thermocouple Input :<br>Setpoint LO Limit to 9999<br>For RTD Input :<br>Setpoint LO Limit to 600.0<br>(Default : 600.0) |
| **COMPRESSOR SETPOINT >>**<br>***(Available for 'Heat + Cool' Control with Compressor PV based Strategy)***<br>This Setpoint Value is compared with the process value to switch the compressor On/Off with the set compressor hysteresis. | 0.0 to 100.0<br>(Default : 45.0) |
| **COMPRESSOR HYST >>**<br>***(Available for 'Cool Only' & 'Heat + Cool' Control with Compressor PV based Strategy)***<br>Differential (dead) band between the compressor ON and OFF states. | 0.1 to 99.9<br>(Default : 2.0) |
| **HEAT CTRL ACTION >>**<br>***(Available for 'Heat Only' & 'Heat+Cool' Control Strategy)***<br>*On-Off*<br>The control algorithm tends to maintain the PV at SP by either switching the output (say, Heater) fully OFF or fully ON. The On and Off switching is differentiated by the user settable 'Hysteresis Band'.<br>*PID*<br>The control algorithm uses a 2nd order equation to compute the '% Output Power' required to maintain the PV at SP. The constants P, I, D are automatically set by the controller. | ON-OFF<br>PID<br>(Default : PID) |
| **HEAT HYST >>**<br>***(Available for 'ON-OFF' Heat Control Action)***<br>Sets a differential (dead) band between the ON and OFF states. Keep it large enough to avoid frequent switching of the load without losing the desired control accuracy. | 0.1 to 99.9<br>(Default : 0.2) |

| Heat Only Control | Heat + Cool<br>Control Zone : Single | Heat + Cool<br>Control Zone : Dual |
|---|---|---|
| **PROPORTIONAL BAND >>**<br>0.1 to 999.9<br>(Default : 50.0) | **PROPORTIONAL BAND >>**<br>0.1 to 999.9<br>(Default : 50.0) | **CZ PROP BAND >>**<br>*Proportional Band for Cool Pre-dominant zone*<br>0.1 to 999.9<br>(Default : 50.0) |
| **INTEGRAL TIME >>**<br>0 to 3600 sec<br>(Default : 100 sec) | **INTEGRAL TIME >>**<br>0 to 3600 sec<br>(Default : 100 sec) | **CZ INTEGRAL TIME >>**<br>*Integral Time for Cool Pre-dominant zone*<br>0 to 3600 sec<br>(Default : 100 sec) |
| **DERIVATIVE TIME >>**<br>0 to 600 sec<br>(Default : 16 sec) | **DERIVATIVE TIME >>**<br>0 to 600 sec<br>(Default : 16 sec) | **CZ DERIVATIVE TIME >>**<br>*Derivative Time for Cool Pre-dominant zone*<br>0 to 600 sec<br>(Default : 16 sec) |
| **CYCLE TIME >>**<br>0.5 to 100.0 sec<br>(Default : 10.0 sec) | **CYCLE TIME >>**<br>0.5 to 100.0 sec<br>(Default : 10.0 sec) | **HZ PROP BAND >>**<br>*Proportional Band for Heat Pre-dominant zone*<br>0.1 to 999.9<br>(Default : 50.0) |
| **OVERSHOOT INHIBIT >>**<br>Enable<br>Disable<br>(Default : Disable) | **OVERSHOOT INHIBIT >>**<br>Enable<br>Disable<br>(Default : Disable) | **HZ INTEGRAL TIME >>**<br>*Integral Time for Heat Pre-dominant zone*<br>0 to 3600 sec<br>(Default : 100 sec) |
| **CUTOFF FACTOR >>**<br>1.0 to 2.0 sec<br>(Default : 1.2 sec) | **CUTOFF FACTOR >>**<br>1.0 to 2.0 sec<br>(Default : 1.2 sec) | **HZ DERIVATIVE TIME >>**<br>*Derivative Time for Heat Pre-dominant zone*<br>0 to 600 sec<br>(Default : 16 sec) |
| | | **CYCLE TIME >>**<br>0.5 to 100.0 sec<br>(Default : 10.0 sec) |
| | | **OVERSHOOT INHIBIT >>**<br>Enable<br>Disable<br>(Default : Disable) |
| | | **CUTOFF FACTOR >>**<br>1.0 to 2.0 sec<br>(Default : 1.2 sec) |

**PROPORTIONAL BAND**
Sets proportional gain (% power per unit error). Defined in same units and resolution as that for PV.

**INTEGRAL TIME**
Sets integral time constant in Seconds. Setting the value to 0, cuts-off the integral action.

**DERIVATIVE TIME**
Sets derivative time constant in seconds. Setting the value to 0, cuts-off the derivative action.

**CYCLE TIME**
Sets the total 'On + Off' time in seconds for time proportional power output through Relay / SSR for OP1.

**OVERSHOOT INHIBIT**
Set this parameter to 'Enable' if the process exhibits unacceptable overshoot upon start-up or a step change in SP. If enabled, the controller controls the rate of change of PV to minimize overshoot while approaching the target SP.

**CUTOFF FACTOR**
This parameter adjusts the effectiveness of the Overshoot Inhibit feature. Increase the value if the overshoot is curbed but the PV takes longer to reach the SP. Decreases the value if the overshoot persists.

## SUPERVISORY > PASSWORD

| Parameter Description | Settings (Default Value) |
|---|---|
| **CHANGE PASSWORD >>**<br>The Controller is shipped from the factory with a default password (123) for accessing the parameters reserved for the equipment manufacturer. However, if required the password can be changed by setting the new value for this parameter.<br><br>(The new password replaces the old password. That is, the old password is no longer valid. it is user's responsibility to memorize the password.) | 1000 to 1999<br>(Default : 123) |

## SUPERVISORY > EXIT

| Parameter Description |
|---|
| **EXIT SETUP MODE >>**<br>Select to quit *Setup* mode and return to *Main Display* mode. |

# Section 5
# FACTORY PARAMETERS

The various parameters have been assembled in various group under the default factory password 321.

Refer Table 5.1 below for a quick summary of parameters under different groups. Each parameter has been described in subsequent sections.

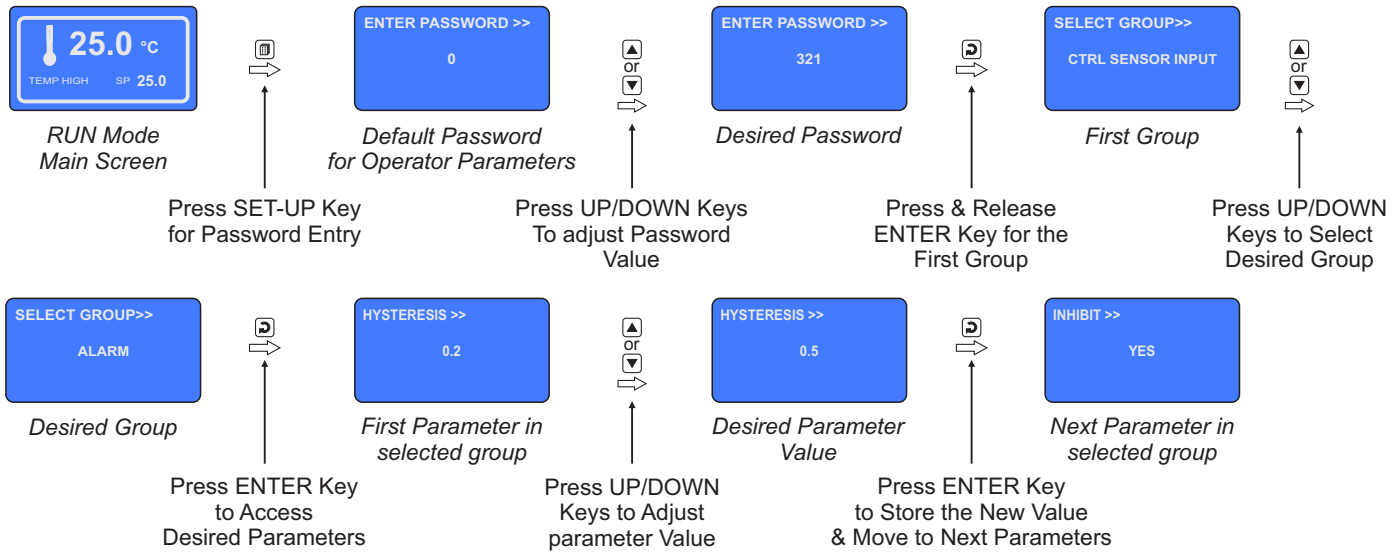
**Table 5.1**

| Group | Parameters |
|---|---|
| Sensor Input | Input Type, Filter Constant |
| Alarm | Hysteresis, Inhibit |
| Heat Cool Select | Control Strategy, Compressor Strategy, Boundary Set Value, Control Zones, Time Delay (Sec) |
| Timer | Enable, Start Band, Holdback Strategy, Hold Band, Heat Off, Cool Off, Power Recovery |
| Door Open | Enable/Disable, Switch Logic, Door Alarm Delay |
| Factory Default | Set to Default Yes/No |
| Password | Change Password |
| Exit | Exit Setup Mode |

### Accessing Group & Parameters

The Figure 5.1 below illustrates how to access the group and parameters. The example shows changing the value for the parameter 'Hysteresis' that is located under group 'Alarm' from 0.2°C to 0.5°C.

***Figure 5.1***




### Notes

The Last Parameter in the selected Group rolls back to the 'SELECT GROUP' screen again to avoid re-entering the password in case parameters under multiple groups need to be set.

**Parameter Descriptions**

The various Factory Parameters have been described with their respective group & sub-group.

## FACTORY > CONTROL SENSOR INPUT

| Parameter Description | Settings (Default Value) |
|---|---|
| **INPUT TYPE >>**<br>Select Input type in accordance with the type of Temperature sensor (Thermocouple / RTD) connected for measurement. | Refer Table 5.2<br>(Default : RTD Pt100) |
| **FILTER CONSTANT >>**<br>Sets the time constant, in Seconds, for the low-pass digital filter applied to the measured PV. The filter helps smoothing / averaging the signal input and removing the undesired noise. The higher the filter value the lower the indication response to the PV changes and vice-a-versa. | 0.5 to 60.0<br>(Default : 0.5) |

***Table 5.2***

| Option | Range (Min. to Max.) | Resolution & Unit |
|---|---|---|
| Type J (Fe-K) | 0 to +960°C | 1 °C |
| Type K (Cr-Al) | -200 to +1376°C | |
| Type T (Cu-Con) | -200 to +387°C | |
| Type R (Rh-13%) | 0 to +1771°C | |
| Type S (Rh-10%) | 0 to +1768°C | |
| Type B | 0 to +1826°C | |
| Type N | 0 to +1314°C | |
| Reserved for customer specific Thermocouple type not listed above. The type shall be specified in accordance with the ordered (optional on request) Thermocouple type. | | |
| RTD Pt100 | -99.9 to +600.0°C | 0.1 °C |

## FACTORY > ALARM PARAMETERS

| Parameter Description | Settings (Default Value) |
|---|---|
| **HYSTERESIS >>**<br>This parameter sets a differential (dead) band between the ON and OFF Alarm status change. Keep it large enough to avoid frequent switching of the Alarm Status/Relay. | 0.1 to 99.9<br>(Default : 0.2) |
| **INHIBIT >>**<br>*Yes*<br>The Alarm activation is suppressed until the Temperature value is within Alarm limits from the time the controller is switched ON. This allows suppressing the Alarm during the start-up Alarm conditions.<br><br>*No*<br>The Alarm is not suppressed during the start-up Alarm conditions. | YES<br>NO<br>(Default : YES) |

## FACTORY > HEAT COOL SELECT

The PPI “Multi-Purpuse Temperature Controller” provides control outputs for driving, both, heating & cooling sources. The user can enable any one or both outputs depending upon the test equipment type and application. If both outputs are enabled (by setting the parameter ‘Control Strategy’ to *Heat + Cool*) and if the cooling source is compressor then the controller offers various strategies for switching the compressor as described below.

### Compressor Switching Strategies

1. **Compressor Off**

   The compressor is kept Off. This strategy is usually selected for temperature values significantly above the ambient temperature.

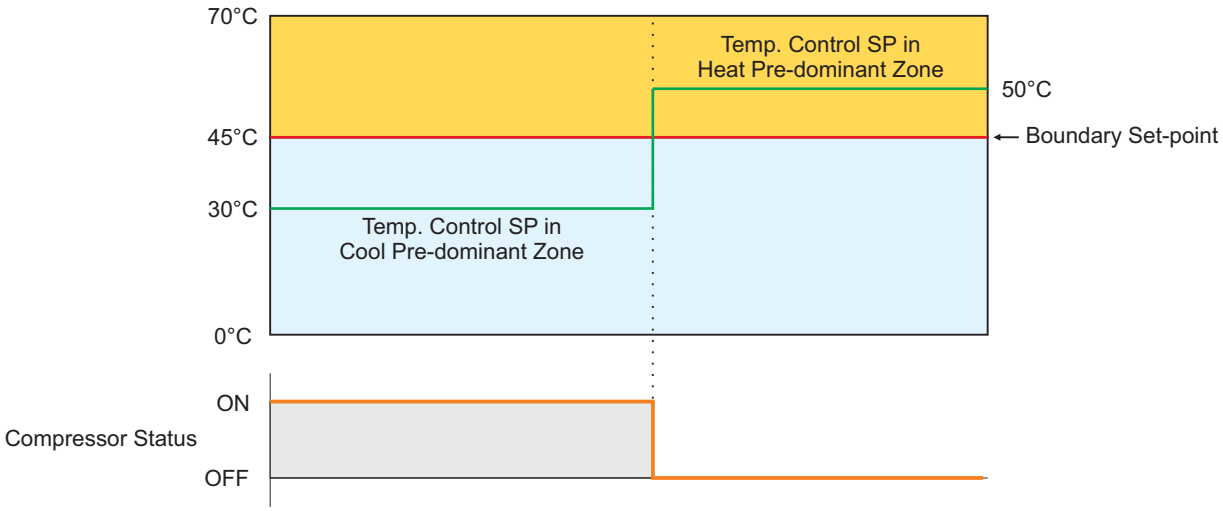
2. **Compressor On**

   The compressor is kept On regardless of the measured or set temperature value. This strategy is usually selected for temperature values significantly below the ambient temperature.

3. **SP Based Strategy**

   In this strategy, the chamber temperature range is split in two zones by setting the parameter 'Boundary Set-point' (BSP). Refer Figure 5.2.

*Figure 5.2*




The zone at and above the boundary SP ( ) is referred as Heat Pre-dominant zone and that below the boundary SP ( ) is referred as Cool Pre-dominant zone. The controller automatically switches between the two zones depending upon the Temperature SP. If the Temperature SP is below boundary SP, Cool Pre-dominant zone is active and the compressor is kept ON. If the Temperature SP is at or above boundary SP, Heat Pre-dominant zone is active and the compressor is kept OFF. This strategy eliminates the need for the user to manually switch the compressor ON or OFF.

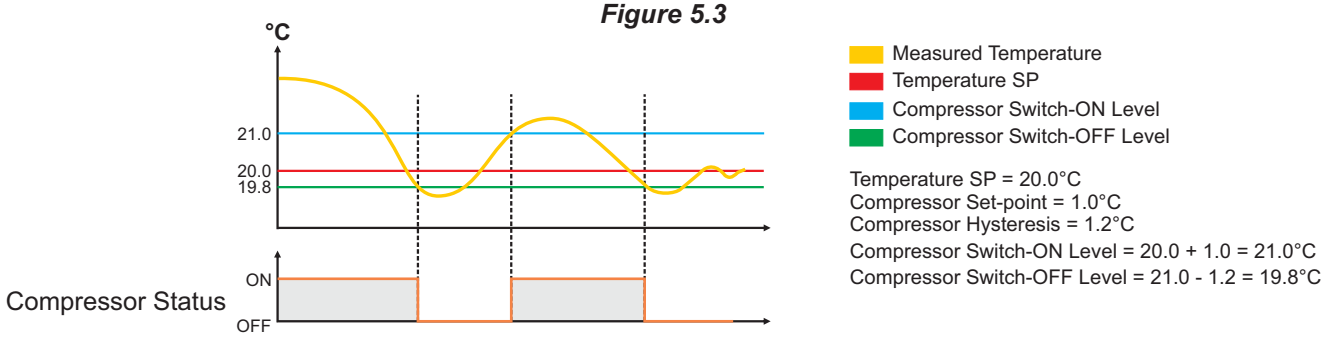
If the parameter *Control Zones* is set to “Dual”; separate tuning can be performed in the Cool and Heat Pre-dominant zones for accurate control in each zone. The controller maintains separate sets of Proportional Band, Integral Time & Derivative Time constants for each zone that are automatically selected and used by the controller depending upon the active zone.

However, if the parameter *Control Zones* is set to “Single”; the controller uses a single set of Proportional Band, Integral Time & Derivative Time constants for both zones.

### 4. PV Based Strategy

In this strategy, the compressor is switched to cool down the air temperature. The controller switches the compressor ON or OFF based on the comparison between the Measured & Set Temperature values. Refer Figure 5.3 below.

*Figure 5.3*




The compressor is turned ON if the chamber air temperature value is above the Temperature SP by an amount set by the parameter 'Compressor Set-point'. That is;

Compressor Switch - ON Level = (Temperature SP) + (Compressor Set-point)

Once the air temperature falls below Compressor Switch-ON Level by an amount set by the parameter 'Compressor Hysteresis', the compressor is turned OFF. That is;

Compressor Switch - OFF Level = (Compressor Switch-ON Level) – (Compressor Hysteresis)

The hysteresis inserts a dead band between the Compressor Switch-ON Level and Compressor Switch-OFF Level to avoid frequent switching of the compressor.

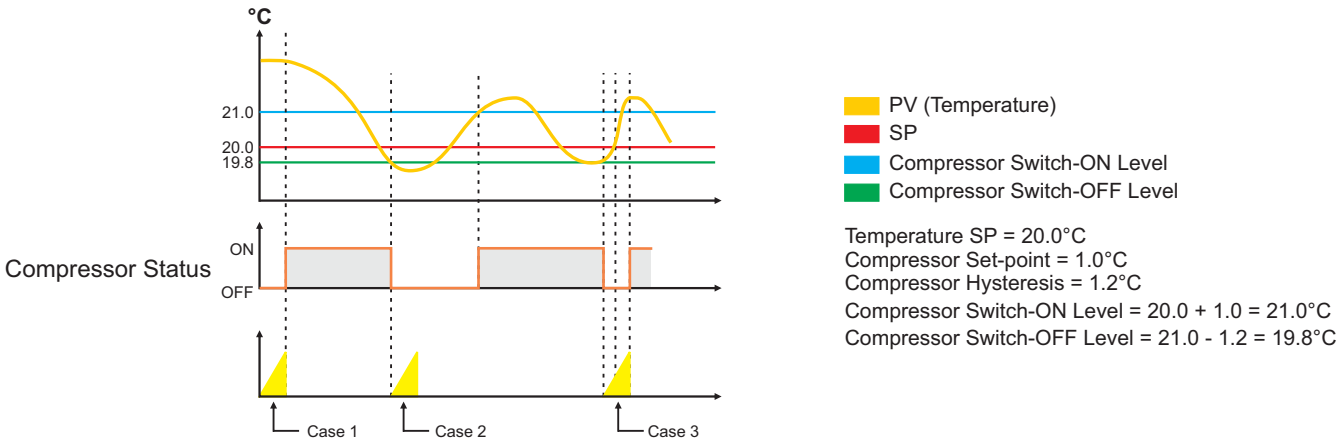
## Compressor Time Delay

Once the compressor is switched off, a time delay is desired before it is turned ON again. The time delay prevents the possible damage due to short cycling. When the compressor switches off, it spins backward as pressure equalizes. If compressor is energized while it is still spinning backward, it continues to run backward until it trips on internal overloads. This may cause damage to the compressor.

The time delay cycle is executed every time the compressor is turned off. The compressor turning off may be a result of power failure or the on-off control algorithm executed by the controller. The controller in “Auto Mode” monitors the Process Value (PV) against the Set-Point (SP) and attempts to switch the compressor *ON* or *OFF* depending upon whether the PV is *above* or *below* the SP.

The time delay starts counting down from the instance the compressor is switched off. The compressor is inhibited from switching-on until the delay elapses regardless of the difference between the PV and SP. Once the time delay is elapsed, the control algorithm switches the compressor ON as and when the PV is above SP.

***Figure 5.4***




The figure 5.4 above illustrates 3 cases. Case (1) illustrates power-up delay. In case (2); the time elapses before PV rises above the SP. The compressor is thus switched ON as soon as the PV rises above the SP. In case (3); the PV rises above the SP while the time delay is still in progress. The compressor is switched ON as soon as the delay time elapses.

Table 5.2 lists various parameters required for setting-up appropriate compressor switching strategy and associated parameters.

**For parameter description the user is requested to read the preceding section.**

## Table 5.2

<table>
<tr><th colspan="2">Parameter Description</th><th>Settings<br>(Default Value)</th></tr>
<tr><td colspan="2">CONTROL STRATEGY >><br><br>Heat Only<br>Used in applications like Heating Oven, Vacuum Oven, Muffle Furnace, etc.; that require raising the temperature above ambient. The HTR (Heater) control output switches ‘heating source’ for maintaining the temperature at desired setpoint. The CMP (Compressor) control output is inactive (kept off).<br><br>Cool Only<br>Used in applications like Deep Freezer, Cold Cabinet, Lab Refrigerator, etc.; that require lowering the temperature below ambient. The CMP (Compressor) control output switches ‘cooling source’ for maintaining the temperature at desired setpoint. The HTR (Heater) control output is inactive (kept off).<br><br>Heat + Cool<br>Used in applications like Environment Chamber, BOD Incubator, etc.; that require either lowering the temperature below or rasing the temperature above ambient. Both, the CMP (Compressor) and HTR (Heater) control outputs switch ‘cooling source’ & ‘heating source’, respectively, for maintaining the temperature at desired setpoint.</td><td>Heat Only<br>Cool Only<br>Heat + Cool<br>(Default : Heat + Cool)</td></tr>
<tr><td colspan="3">Control Strategy : Cool Only</td></tr>
<tr><td colspan="2">TIME DELAY (SEC) >></td><td>0 to 1000 Sec<br>(Default : 200 Sec)</td></tr>
<tr><td colspan="3">Control Strategy : Heat + Cool</td></tr>
<tr><td colspan="2">COMPRESSOR STRATEGY >></td><td>CONT. OFF<br>CONT. ON<br>SP BASED<br>PV BASED<br>(Default : SP BASED)</td></tr>
<tr><td>CONT. ON</td><td>SP BASED</td><td>PV BASED</td></tr>
<tr><td rowspan="3">TIME DELAY (SEC) >><br>0 to 1000 Sec<br>(Default : 200 Sec)</td><td>BOUNDARY SET VALUE >><br>0.0 to 100.0<br>(Default : 45.0)</td><td rowspan="3">TIME DELAY (SEC) >><br>0 to 1000 Sec<br>(Default : 200 Sec)</td></tr>
<tr><td>CONTROL ZONES >><br>SINGLE<br>DUAL<br>(Default : SINGLE)</td></tr>
<tr><td>TIME DELAY (SEC) >><br>0 to 1000 Sec<br>(Default : 200 Sec)</td></tr>
</table>

## FACTORY > TIMER PARAMETERS

| Parameter Description | Settings (Default Value) |
|---|---|
| **ENABLE >>**<br>*Yes*<br>Timer function and Start / Abort commands are enabled.<br><br>*No*<br>Timer function and Start / Abort commands are disabled. | No<br>Yes<br>(Default : No) |
| **START BAND >>**<br>After issuance of start command, the timer starts counting down once the PV enters the process band around SP defined by this parameter value. | 0 to 999.9<br>(Default : 0.5) |
| **HOLDBACK STRATEGY >>**<br>*None*<br>PV based timer pause is not required.<br><br>*Up*<br>Timer is paused if PV is outside holdband *above* SP.<br><br>*Down*<br>Timer is paused if PV is outside holdband *below* SP.<br><br>*Both*<br>Timer is paused if PV is outside holdband either *above* or *below* SP. | None<br>Up<br>Down<br>Both<br>(Default : None) |
| **HOLD BAND >>**<br>Sets the temperature limit(s) with respect to the SP for the timer to pause. The timer holds on counting should the PV cross the limit(s). | 0.1 to 999.9<br>(Default : 0.5) |
| **HEAT OFF >>**<br>Heater is turned off, once Timer operation is over. | No<br>Yes<br>(Default : No) |
| **COOL OFF >>**<br>Compressor is turned off, once Timer operation is over. | No<br>Yes<br>(Default : No) |
| **POWER RECOVERY >>**<br>*Abort*<br>The timer operation is suspended until a new start command is issued.<br><br>*Re-Start*<br>The timer re-runs the complete time.<br><br>*Continue*<br>The Timer resumes operation for the balance time. | Abort<br>Restart<br>Continuous<br>(Default : Restart) |

## FACTORY > DOOR OPEN

| Parameter Description | Settings (Default Value) |
|---|---|
| **ENABLE >>**<br>Set to 'Yes' if Switch is mounted for detecting door *Open / Close* position. | YES<br>NO<br>(Default : NO) |
| **SWITCH LOGIC >>**<br>*Close : Door Open*<br>The Door position is considered *Open* if the switch is CLOSE.<br>*Open : Door Open*<br>The Door position is considered *Open* if the switch is OPEN. | CLOSE : DOOR OPEN<br>OPEN : DOOR OPEN<br>(Default : CLOSE : DOOR OPEN) |
| **DOOR ALRM DLY (SEC) >>**<br>This parameter sets a timer. From the time the door is opened, the timer begins counting down. If the door is not closed before the timer reaches 0, the *Door Open* alarm is activated. | 0 to 1000 Sec<br>(Default : 60 Sec) |

## FACTORY > FACTORY DEFAULT

| Parameter Description | Settings (Default Value) |
|---|---|
| **SET TO DEFAULT >>**<br>Set to 'Yes' to set all the parameter values to their Default Values. | YES<br>NO<br>(Default : NO) |

## FACTORY > PASSWORD

| Parameter Description | Settings (Default Value) |
|---|---|
| **CHANGE PASSWORD >>**<br>The Controller is shipped from the factory with a default password (321) for accessing the parameters reserved for the equipment manufacturer. However, if required the password can be changed by setting the new value for this parameter.<br>(The new password replaces the old password. That is, the old password is no longer valid. it is user's responsibility to memorize the password.) | 2000 to 2999<br>(Default : 321) |

## FACTORY > EXIT

| Parameter Description |
| --- |
| **EXIT SETUP MODE >>**<br>Select to quit *Setup* mode and return to *Main Display* mode. |

Section 6

# PANEL MOUNTING AND ELECTRICAL CONNECTIONS

**WARNING**
**MISHANDLING / NEGLIGENCE CAN RESULT IN PERSONAL DEATH OR SERIOUS INJURY.**

## PANEL CUTOUT

*Figure 6.1(a) : Old Version*

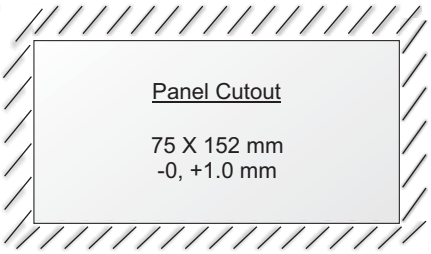
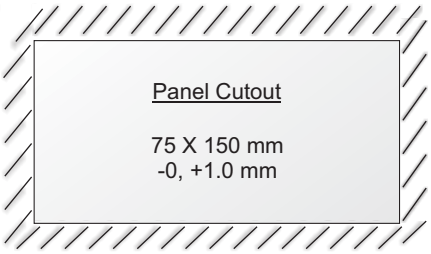



*Figure 6.1(b) : New Version*




## PANEL MOUNTING

Follow the steps below for mounting the instrument on panel :

1. Prepare a cutout to the size shown in Figure 6.1.
2. Remove the Panel Mounting Clamp from the instrument Enclosure.
3. Insert the rear of the enclosure through the panel cutout from the front of the mounting panel.
4. Fix the mounting clamp pair such that it ensures secured mounting of the enclosure against the panel wall.

## ELECTRICAL CONNECTIONS

1. The user must rigidly observe the Local Electrical Regulations.
2. Do not make any connections to the unused terminals for making a tie-point for other wires (or for any other reasons) as they may have some internal connections. Failing to observe this may result in permanent damage to the controller.
3. Run power supply cables separated from the Sensor cables (Thermocouple / RTD). If the cables are run through conduits, use separate conduits for power supply cable and low-level signal cables.
4. Use appropriate fuses and switches, wherever necessary, for driving the high voltage loads to protect the controller from any possible damage due to high voltage surges of extended duration or short-circuits on loads.
5. Take care not to over-tighten the terminal screws while making connections.
6. Make sure that the controller supply is switched-off while making/removing any connections or removing the controller from its enclosure.

## CONNECTION DIAGRAM

The Electrical Connection Diagram is shown on the Top (Old Version) or Back (New Version) side of the controller enclosure. The diagram shows the terminals viewed from the **REAR SIDE** with the controller Front Label upright. Refer figure 6.2(a) for Old Version & 6.2(b) for New Version.

*Figure 6.2(a) :*

## *Old Version*

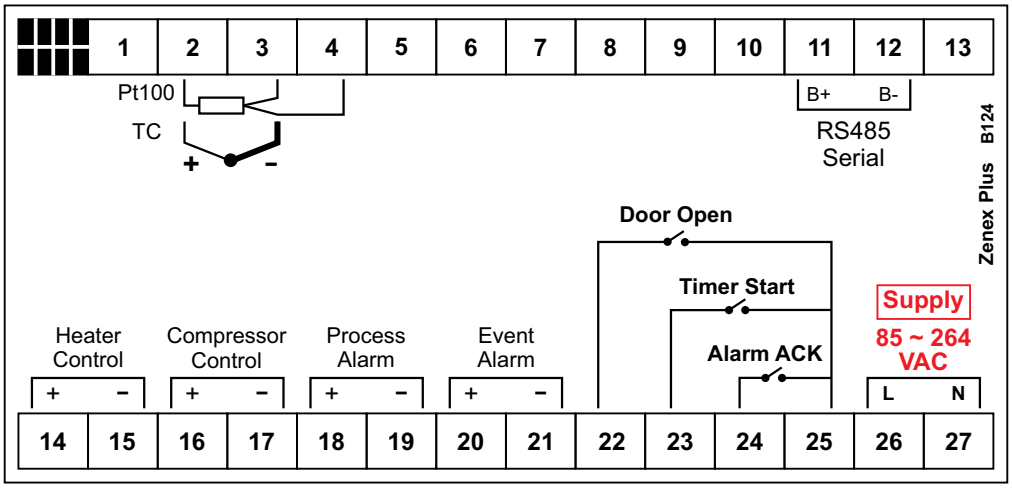
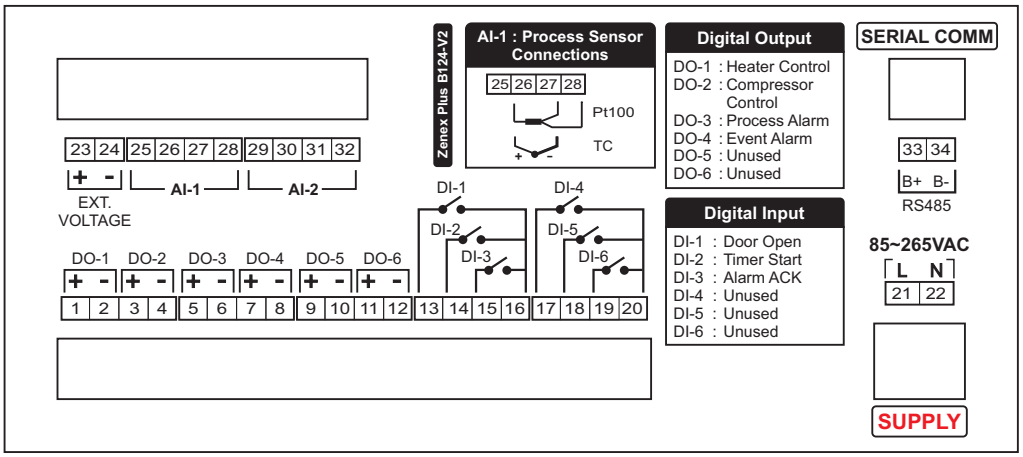



*Figure 6.2(b) :*

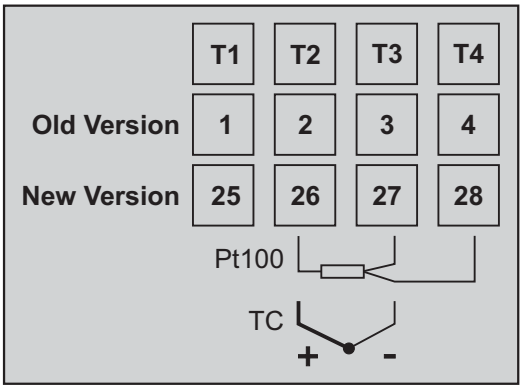
## *New Version*




### TEMPERATURE SENSOR INPUT

Connect Thermocouple or 3-wire RTD Pt100 sensor as shown below.

*Figure 6.3*




**RTD Pt100, 3-wire**

Connect single leaded end of RTD bulb to terminal T2 and the double leaded ends to terminals T3 and T4 (interchangeable) as shown in Figure 6.3. Use low resistance copper conductor leads of the same gauge and length. Avoid joints in the cable.

**Thermocouple**

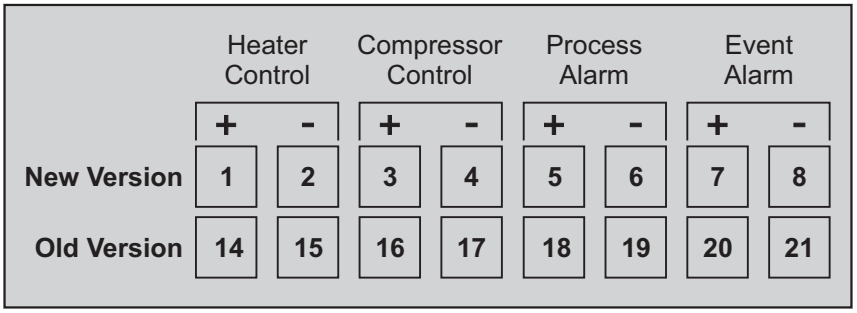
Connect Thermocouple Positive (+) to terminal T2 and Negative (-) to terminal T3 as shown in Figure 6.3. Use correct type of extension lead wires or compensating cable. Avoid joints in the cable.

## DIGITAL OUTPUTS

**Heater Control Output**
**Compressor Control Output**
**Process Alarm Output**
**Event Alarm Output**

All the above Control & Alarm outputs are Voltage pulses (12VDC @ 40mA) for driving external SSR or Relay. The '+' and '-' terminals are for voltage 'Source' and 'Return' paths, respectively. Refer Figure 6.4 below.

**Figure 6.4**

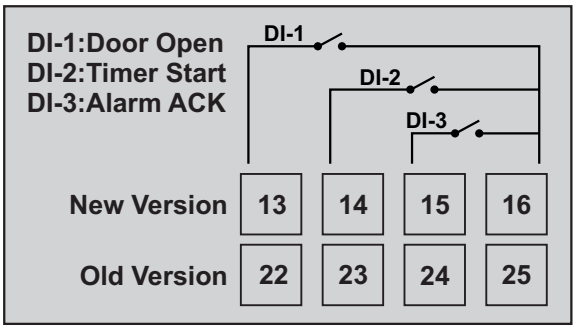



## DIGITAL INPUTS

**Door Open**
**Timer Start**
**Alarm Acknowledge**

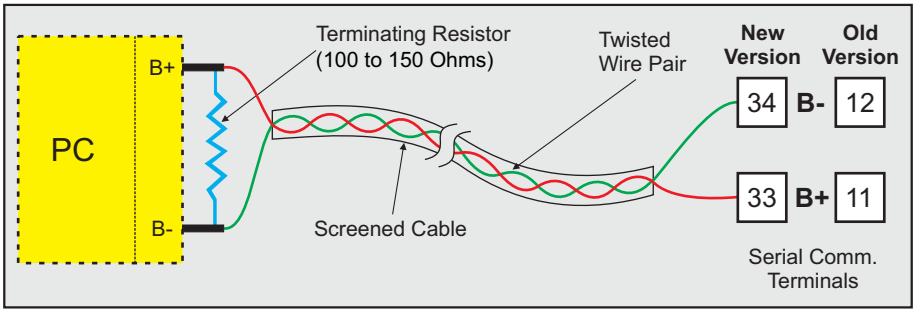
Potential-free contact closure input terminals are provided as digital inputs. An 'Open' or 'Close' switch position is detected as input. Refer Figure 6.5.

**Figure 6.5**




## PC COMMUNICATION PORT

**Figure 6.6**



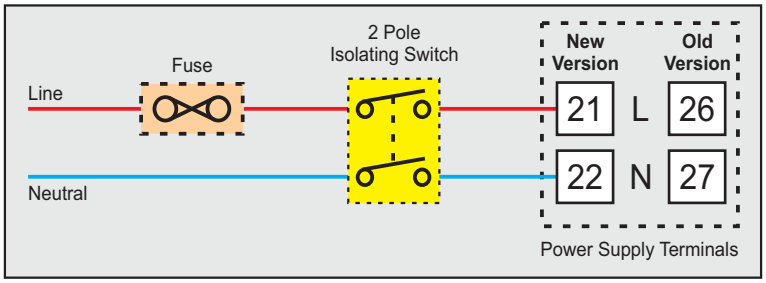

The controller Communication Port is RS485 and requires a similar port at the host (master) end. If, however, the host port is different (say, RS232 or USB), use appropriate protocol converter (say, RS485-RS232 or USB to RS485) for interface.

For reliable noise free communication, use a pair of twisted wires inside screened cable as shown in Figure 6.6. The wire should have less than 100 ohms / km nominal DC resistance (Typically 24 AWG or thicker). Connect the terminating resistor (Typically 100 to 150 ohm) at one end to improve noise immunity.

## POWER SUPPLY

As standard, the module is supplied with power connections suited for 85 to 264 VAC line supply. Use well-insulated copper conductor wire of the size not smaller than 0.5mm² for power supply connections ensuring proper polarity as shown in Figure 6.7. The module is not provided with fuse and power switch. If necessary, mount them separately. Use a time lag fuse rated 1A @ 240 VAC.

**Figure 6.7**



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