'Temperature + Humidity' Controller with Graphic Display

HumiTherm GD 96

128 X 64 Monochrome Graphic Display
Universal Temperature & Humidity Inputs
Self-Tune PID Control Loops
Water Level & Door Status Monitoring
¼ DIN (96x96) Compact Enclosure

User Manual

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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

Keys
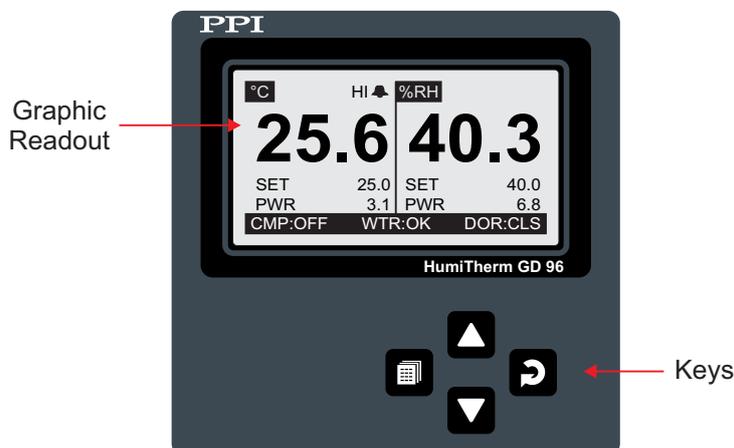
GRAPHIC READOUT

The Graphic Readout is a 128 X 64 Pixel Monochrome LCD Display. In Normal operation mode the display shows measured Process Values, Set Values, Output Powers and various Statuses like Compressor, Water Level, Door & Alarms.

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

KEYS

There are four 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 (in Set-up Mode)
▤	PAGE	Press to enter or exit set-up mode.
▼	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.
↵	ENTER	Press to store the set parameter value and to scroll to the next parameter in setup mode. Can also be used as Alarm Acknowledgment in normal operation mode.

Section 2
BASIC OPERATIONS

POWER-UP DISPLAY

Upon powering up, the display shows the Model Name (HumiTherm GD 96) followed by the Hardware Version and Software Version for approximately 2 seconds each as shown in figure 2.1(a) & 2.1(b).
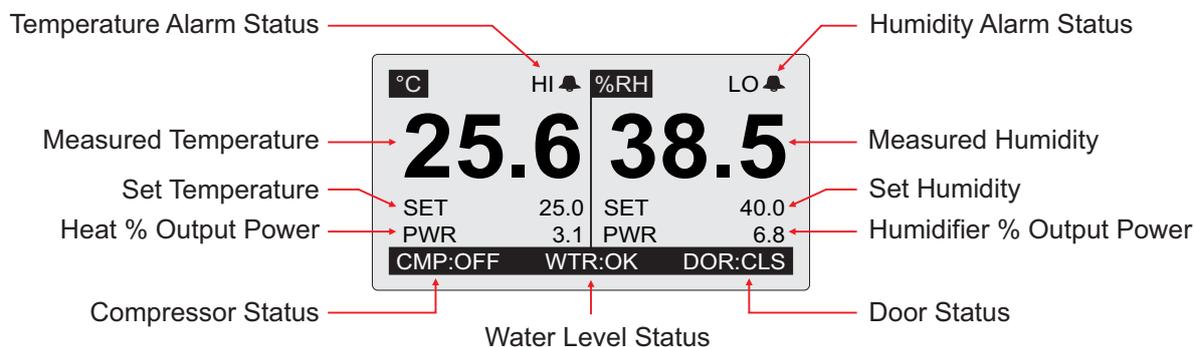
Figure 2.1 (a)

Figure 2.1(b)

HumiTherm GD 96

Hardware Version : 10

Software Version : 01

RUN MODE

After the Power-up display sequence the controller enters into RUN Mode. This is the normal operation mode wherein the controller starts PV measurements, Alarm monitoring and Control Loop execution. The information displayed is depicted in the figure 2.2 below.

Figure 2.2

Temperature Alarm Status

Humidity Alarm Status

Measured Temperature → 25.6 38.5 ← Measured Humidity

Set Temperature → SET 25.0 SET 40.0 ← Set Humidity

Heat % Output Power → PWR 3.1 PWR 6.8 ← Humidifier % Output Power

CMP:OFF WTR:OK DOR:CLS

Compressor Status

Water Level Status

Door Status

PV Error Indication

In case of measured temperature & humidity value errors, the messages listed in Table 2.1 are displayed in place of process values.

Table 2.1

Message	Error Type	Cause
OPN	Sensor Open	Sensor (RTD Pt100) Broken / Open. Not Applicable for %RH indication.
OVR	Over-range	Measured Temperature / %RH value is above 99.9 °C / % (Max. displayable value).
UNR	Under-range	Measured Temperature / %RH value is below 0.0 °C / % (Min. displayable value).

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Alarm / Tuning Status Indication

HI 🔔	High Alarm	LO 🔔	Low Alarm	TUNE	Tuning

Compressor Status Indication

COM:OFF	Compressor Off	COM:ON	Compressor On

Water Level Status Indication

WTR:HI	Water Level High	WTR:OK	Water Level Normal	WTR:LO	Water Level Low	WTR:VLO	Water Level Very Low

Door Status Indication

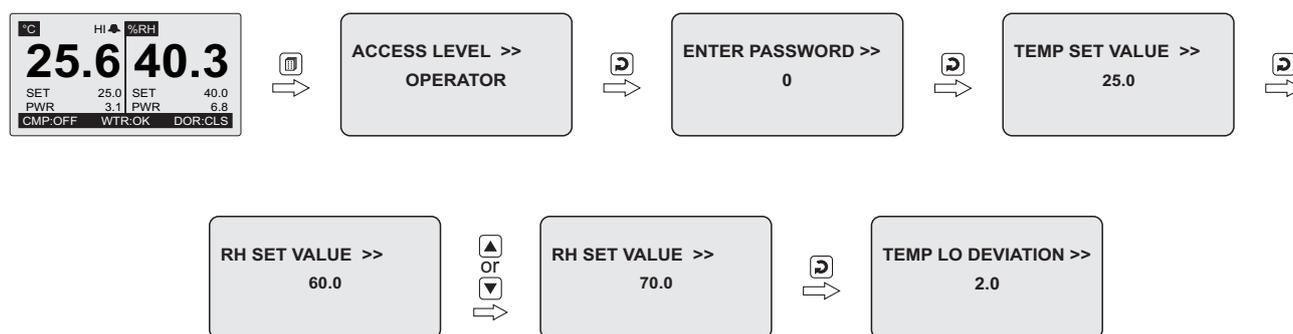| DOR:CLS	Door Close	DOR:OPN	Door Open

Section 3
OPERATOR PARAMETERS

The Operator Parameters are accessible under PASSWORD 0. The list includes Parameters for adjusting Control & Alarm setpoints for Temperature & %RH.

The Figure 3.1 shows how to access Operator Parameters. The Example illustrates changing the setpoint value for %RH from 60.0 to 70.0.

Figure 3.1

The Table 3.1 below described the Operator Parameters in detail.

Table 3.1

Parameter Description	Settings (Default Value)
TEMP SET VALUE >> Set Value for Temperature Control.	SP Low Limit to SP High Limit for Temperature (Default : 25.0)
RH SET VALUE >> Set Value for %RH Control.	SP Low Limit to SP High Limit for RH (Default : 60.0)
TEMP LO DEVIATION >> (**Available only if Temperature Low Deviation Alarm is Enabled**) This Parameter sets a negative deviation (offset) limit with respect to the '*Control Set-point*' for Temperature. The Alarm is activated if the measured temperature value falls below this limit.	0.2 to 99.9 (Default : 2.0)
TEMP HI DEVIATION >> (**Available only if Temperature High Deviation Alarm is Enabled**) This Parameter sets a negative deviation (offset) limit with respect to the '*Control Set-point*' for Temperature. The Alarm is activated if the measured temperature value exceeds this limit.	0.2 to 99.9 (Default : 2.0)

Parameter Description	Settings (Default Value)
RH LO DEVIATION >> (**Available only if RH Low Deviation Alarm is Enabled**) This Parameter sets a negative deviation (offset) limit with respect to the '*Control Set-point*' for %RH. The Alarm is activated if the measured RH value falls below this limit.	0.2 to 99.9 (Default : 2.0)
RH HI DEVIATION >> (**Available only if RH High Deviation Alarm is Enabled**) This Parameter sets a negative deviation (offset) limit with respect to the '*Control Set-point*' for %RH. The Alarm is activated if the measured RH value exceeds this limit.	0.2 to 99.9 (Default : 2.0)
CHANGE PASSWORD >> 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. Set to 'Yes' for changing the Password.	No Yes (Default : No)
NEW PASSWORD >> This parameter is presented if 'Change Password' is set to 'Yes'. Set the new password value.	0 to 3000 (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.

Tabel 4.1

Group	Parameters
Serial Communication	Device ID, Baud Rate, Parity, Serial Write Permission
PV Offset	Temperature Zero Offset, RH Zero Offset
Temp/RH Alarm Enable / Disable	Temperature Low Alarm, Temperature High Alarm, RH Low Alarm, RH High Alarm
Password	Change Password
Exit	Exit Set-up Mode (No / Yes)

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 'RH ZERO OFFSET' from 0.0 to 1.5 that is located under group 'PV OFFSET'.

Figure 4.1
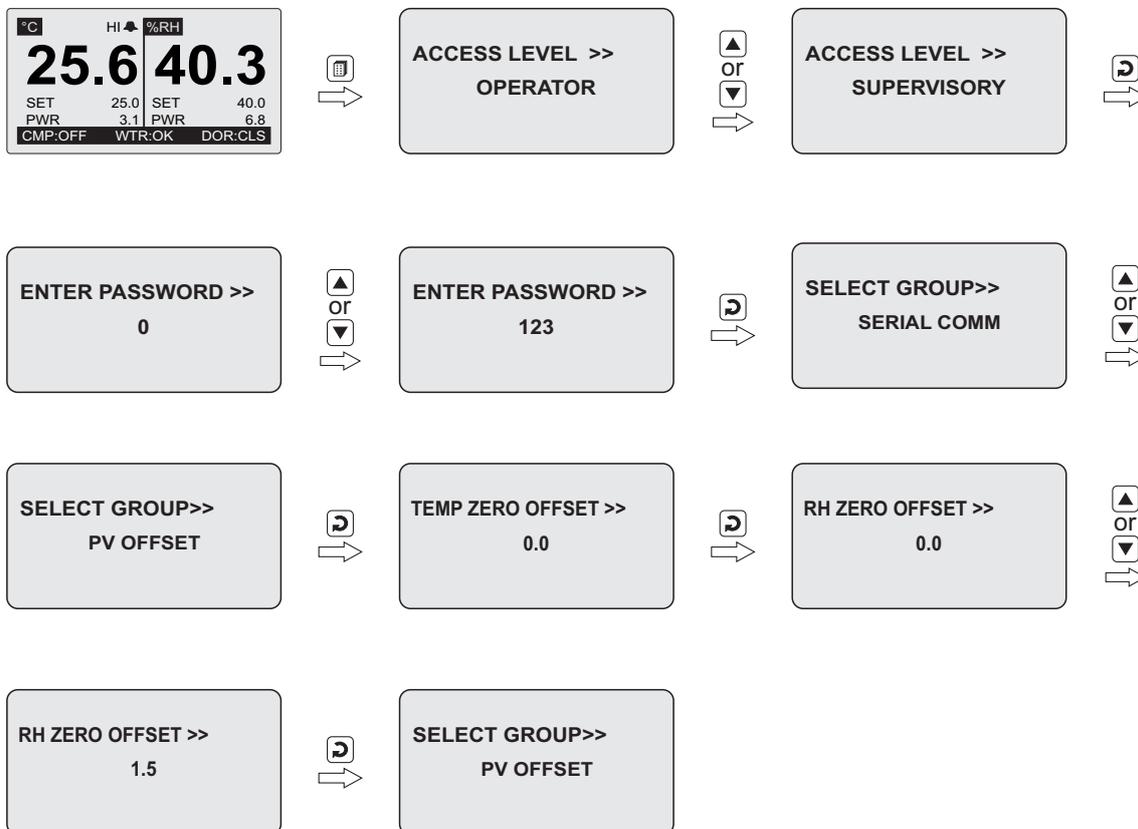
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Notes

1. 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.

2. Select group 'EXIT' & set parameter 'EXIT SET-UP MODE' to 'YES' for returning to Main Display Mode. Alternately use Setup Key for instant revert to Main Display Mode.

Parameter Descriptions

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

SUPERVISORY > SERIAL COMM

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

SUPERVISORY > PV OFFSET

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

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SUPERVISORY > TEMPERATURE / RH ALARM ENABLE

Parameter Description	Settings (Default Value)
TEMP LOW ALARM >> **TEMP HIGH ALARM >>** These parameters allow Enabling or Disabling Temperature Low & High Deviation Alarms independently.	Disable Enable (Default : Enable)
RH LOW ALARM >> **RH HIGH ALARM >>** These parameters allow Enabling or Disabling Temperature Low & High Deviation Alarms independently.	Disable Enable (Default : Enable)

SUPERVISORY > PASSWORD

Parameter Description	Settings (Default Value)
CHANGE PASSWORD >> The Controller is shipped from the factory with a default password (123) for accessing the parameters reserved for Operator. However, if required the password can be changed by setting the new value for this parameter. Set to 'Yes' for changing the Password.	No Yes (Default : No)
NEW PASSWORD >> This parameter is presented if 'Change Password' is set to 'Yes'. Set the new password value.	0 to 3000 (Default : 123)

SUPERVISORY > EXIT

Parameter Description	Settings (Default Value)
EXIT SETUP MODE >> Select 'Yes' to quit *Setup* mode and return to *Main Display* mode.	NO YES (Default : NO)

Section 5
FACTORY PARAMETERS

The various parameters have been assembled in groups and sub-groups under the default factory password 321.

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

Table 5.1

Group	Sub-Group	Parameters
Temperature Setting	Alarm	Hysteresis, Inhibit
	Control	Tune, Set-point Low Limit, Set-point High Limit, Proportional Band, Integral Time, Derivative Time, Cycle Time
	Sensor Input	Input Type, Signal Low, Signal High, Range Low, Range High
Humidity Setting	Alarm	Hysteresis, Inhibit
	Control	Tune, Set-point Low Limit, Set-point High Limit, Proportional Band, Integral Time, Derivative Time, Cycle Time
	Sensor Input	Input Type, Signal Low, Signal High, Range Low, Range High
Compressor Setting		Compressor Strategy, Time Delay [Sec], Boundary or Control Setpoint, Control Zones
Boiler Water Level	------	Enable/Disable, Water Level Strategy, Switch - 1 Logic, Switch - 2 Logic
Door Open	------	Enable/Disable, Switch Logic, Door Alarm Delay
Factory Default	------	Set to Default Yes/No
Exit	------	Exit Set-up Mode Yes/No

Accessing Group/Sub-group & Parameters

The Figure 5.1 below illustrates how to access the group/sub-group and parameters. The example shows changing the value for the parameter 'Proportional Band' for Humidity Control that is located under group 'Humidity Settings' & sub-group 'Control'.

Figure 5.1
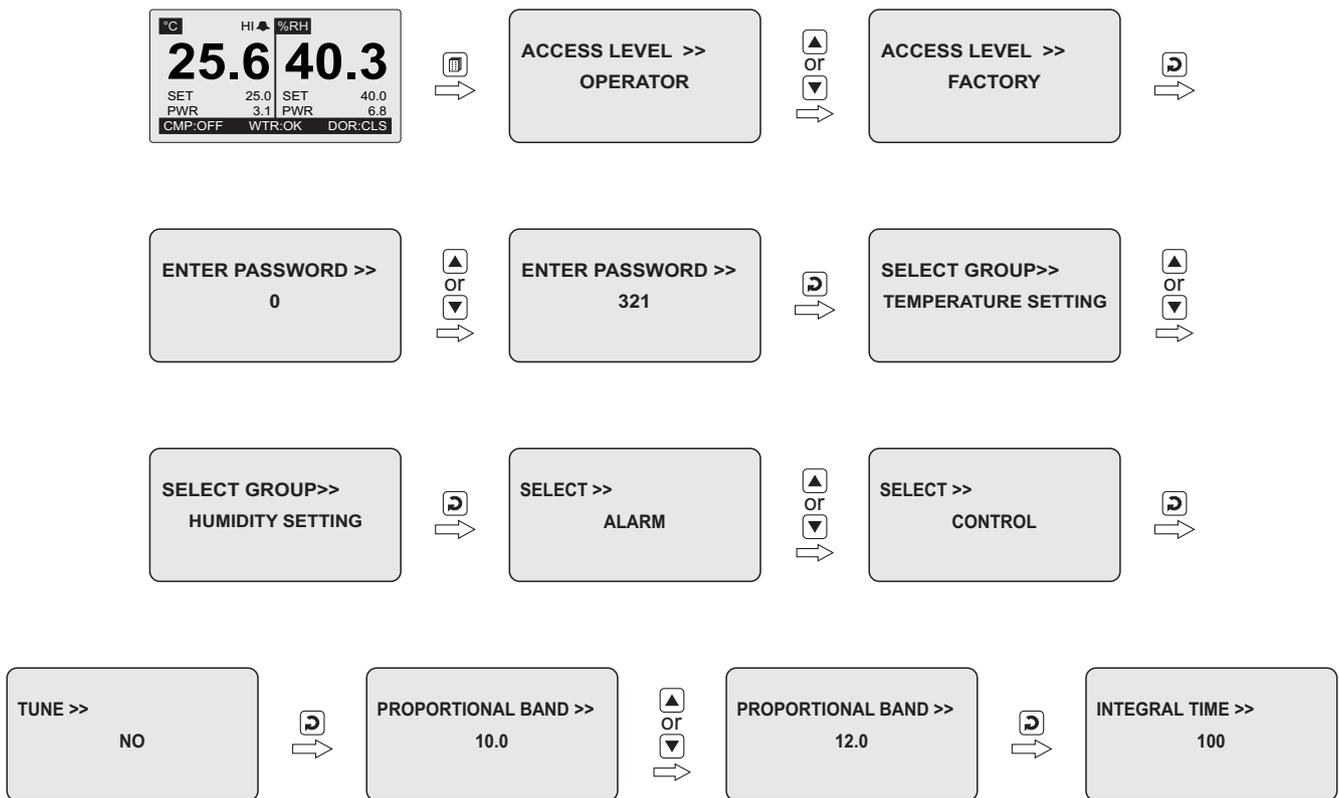
Notes

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

2. Select group 'EXIT' & set parameter 'EXIT SET-UP MODE' to 'YES' for returning to Main Display Mode. Alternately use Set-up Key for instant revert to Main Display Mode.

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For convenience this Temperature Settings group is further divided into 3 sub-groups : Alarm Parameters, Control Parameters & Sensor Input Parameters.

FACTORY > TEMPERATURE > ALARM

Parameter Description	Settings (Default Value)
HYSTERESIS >> 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 (Default : 0.2)
INHIBIT >> *No* The Alarm is not suppressed during the start-up Alarm conditions. *Yes* 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.	NO YES (Default : NO)

FACTORY > TEMPERATURE > CONTROL

Parameter Description	Settings (Default Value)
TUNE >> Set 'No' to abort and 'Yes' to activate the Tuning operation. *Note* : The tuning is always performed simultaneously on both Temperature & Humidity.	NO YES (Default : NO)
SETPOINT LO LIMIT >> Minimum permissible setpoint value for Temperature control.	0.0 to SETPOINT HI LIMIT (Default : 10.0)
SETPOINT HI LIMIT >> Maximum permissible setpoint value for Temperature control.	SETPOINT LO LIMIT to 99.9 (Default : 99.9)

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Parameter Description	Settings (Default Value)
Control Zones : Dual	
CZ PROP BAND >> Sets proportional gain for Cool Pre-dominant zone.	0.1 to 999.9 (Default : 50.0)
CZ INTEGRAL TIME >> Sets integral time constant in Seconds for Cool Pre-dominant zone. Setting the value to 0, cuts-off integral action.	0 to 3600 Sec (Default : 100 Sec)
CZ DERIVATIVE TIME >> Sets derivative time constant in Seconds for Cool Pre-dominant zone. Setting the value to 0, cuts-off derivative action.	0 to 600 Sec (Default : 16 Sec)
HZ PROP BAND >> Sets proportional gain for Heat Pre-dominant zone.	0.1 to 999.9 (Default : 50.0)
HZ INTEGRAL TIME >> Sets integral time constant in Seconds for Heat Pre-dominant zone. Setting the value to 0, cuts-off integral action.	0 to 3600 Sec (Default : 100 Sec)
HZ DERIVATIVE TIME >> Sets derivative time constant in Seconds for Heat Pre-dominant zone. Setting the value to 0, cuts-off derivative action.	0 to 600 Sec (Default : 16 Sec)
CYCLE TIME >> Sets the total 'On + Off' time in seconds for time proportional power output through Relay / SSR.	0.5 to 100.0 Sec (Default : 10.0 Sec)
Control Zones : Single	
PROPORTIONAL BAND >> Sets proportional gain (% output power per unit error).	0.1 to 999.9 (Default : 50.0)
INTEGRAL TIME >> Sets integral time constant in Seconds. Setting the value to 0, cuts-off integral action.	0 to 3600 Sec (Default : 100 Sec)
DERIVATIVE TIME >> Sets derivative time constant in seconds. Setting the value to 0, cuts-off derivative action.	0 to 600 Sec (Default : 16 Sec)
CYCLE TIME >> Sets the total 'On + Off' time in seconds for time proportional power output through Relay / SSR.	0.5 to 100.0 Sec (Default : 10.0 Sec)

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FACTORY > TEMPERATURE > SENSOR INPUT

Parameter Description	Settings (Default Value)
INPUT TYPE >> Select Input type in accordance with the type of Temperature sensor / transmitter connected for measurement.	RTD Pt100 0-20mA 4-20mA 0-5V 0-10V 1-5V (Default : RTD Pt100)
SIGNAL LO >> *(Available for DC linear V & mA Inputs only)* The transmitter output signal value corresponding to Range Low process value. Refer *Appendix-A : DC Linear Signal Interface* for details.	
SIGNAL HI >> *(Available for DC linear V & mA Inputs only)* The transmitter output signal value corresponding to Range High process value. Refer *Appendix-A : DC Linear Signal Interface* for details.	

Input Type	Settings
0 to 20 mA	0.00 to 20.00
4 to 20 mA	4.00 to 20.00
0 to 5 V	0.000 to 5.000
0 to 10 V	0.00 to 10.00
1 to 5 V	1.000 to 5.000

Parameter Description	Settings (Default Value)
RANGE LO >> *(Available for DC linear V & mA Inputs only)* The process value corresponding to the Signal Low value from the transmitter. Refer *Appendix-A : DC Linear Signal Interface* for details.	-199.9 to 999.9 Counts (Default : 0.0)
RANGE HI >> *(Available for DC linear V & mA Inputs only)* The process value corresponding to the Signal High value from the transmitter. Refer *Appendix-A : DC Linear Signal Interface* for details.	-199.9 to 999.9 Counts (Default : 100.0)
FILTER TIME >> Sets the time constant, in seconds, for the low-pass digital filter applied to the measured temperature. 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 Seconds (in steps of 0.5 Seconds) (Default : 2.0 sec.)

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For convenience this Humidity (%RH) Settings group is further divided into 3 sub-groups : Alarm Parameters, Control Parameters & Sensor Input Parameters.

FACTORY > HUMIDITY (RH) > ALARM

Parameter Description	Settings (Default Value)
HYSTERESIS >> 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 (Default : 0.2)
INHIBIT >> *No* The Alarm is not suppressed during the start-up Alarm conditions. *Yes* The Alarm activation is suppressed until the %RH value is within Alarm limits from the time the controller is switched ON. This allows suppressing the Alarm during the start-up Alarm conditions.	NO YES (Default : NO)

FACTORY > HUMIDITY (RH) > CONTROL

Parameter Description	Settings (Default Value)
TUNE >> Set 'No' to abort and 'Yes' to activate the Tuning operation. *Note* : The tuning is always performed simultaneously on both Temperature & Humidity.	NO YES (Default : NO)
SETPOINT LO LIMIT >> Minimum permissible setpoint value for %RH control.	0.0 to SETPOINT HI LIMIT (Default : 10.0)
SETPOINT HI LIMIT >> Maximum permissible setpoint value for %RH control.	SETPOINT LO LIMIT to 99.9 (Default : 99.9)

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Parameter Description	Settings (Default Value)
Control Zones : Dual	
CZ PROP BAND >> Sets proportional gain for Cool Pre-dominant zone.	0.1 to 999.9 (Default : 50.0)
CZ INTEGRAL TIME >> Sets integral time constant in Seconds for Cool Pre-dominant zone. Setting the value to 0, cuts-off integral action.	0 to 3600 Sec (Default : 100 Sec)
CZ DERIVATIVE TIME >> Sets derivative time constant in Seconds for Cool Pre-dominant zone. Setting the value to 0, cuts-off derivative action.	0 to 600 Sec (Default : 16 Sec)
HZ PROP BAND >> Sets proportional gain for Heat Pre-dominant zone.	0.1 to 999.9 (Default : 50.0)
HZ INTEGRAL TIME >> Sets integral time constant in Seconds for Heat Pre-dominant zone. Setting the value to 0, cuts-off integral action.	0 to 3600 Sec (Default : 100 Sec)
HZ DERIVATIVE TIME >> Sets derivative time constant in Seconds for Heat Pre-dominant zone. Setting the value to 0, cuts-off derivative action.	0 to 600 Sec (Default : 16 Sec)
CYCLE TIME >> Sets the total 'On + Off' time in seconds for time proportional power output through Relay / SSR.	0.5 to 100.0 Sec (Default : 10.0 Sec)
Control Zones : Single	
PROPORTIONAL BAND >> Sets proportional gain (% output power per unit error).	0.1 to 999.9 (Default : 50.0)
INTEGRAL TIME >> Sets integral time constant in Seconds. Setting the value to 0, cuts-off integral action.	0 to 3600 Sec (Default : 100 Sec)
DERIVATIVE TIME >> Sets derivative time constant in seconds. Setting the value to 0, cuts-off derivative action.	0 to 600 Sec (Default : 16 Sec)
CYCLE TIME >> Sets the total 'On + Off' time in seconds for time proportional power output through Relay / SSR.	0.5 to 100.0 Sec (Default : 10.0 Sec)

FACTORY > HUMIDITY (RH) > SENSOR INPUT

Parameter Description	Settings (Default Value)
INPUT TYPE >> Select Input type in accordance with the type of %RH sensor / transmitter connected for measurement.	0-20mA 4-20mA 0-5V 0-10V 1-5V (Default : 0-5V)
SIGNAL LO >> *(Available for DC linear V & mA Inputs only)* The transmitter output signal value corresponding to Range Low process value. Refer *Appendix-A : DC Linear Signal Interface* for details.	*(see table below)*
SIGNAL HI >> *(Available for DC linear V & mA Inputs only)* The transmitter output signal value corresponding to Range High process value. Refer *Appendix-A : DC Linear Signal Interface* for details.	*(see table below)*
RANGE LO >> *(Available for DC linear V & mA Inputs only)* The process value corresponding to the Signal Low value from the transmitter. Refer *Appendix-A : DC Linear Signal Interface* for details.	-199.9 to 999.9 Counts (Default : 0.0)
RANGE HI >> *(Available for DC linear V & mA Inputs only)* The process value corresponding to the Signal High value from the transmitter. Refer *Appendix-A : DC Linear Signal Interface* for details.	-199.9 to 999.9 Counts (Default : 100.0)
FILTER TIME >> Sets the time constant, in seconds, for the low-pass digital filter applied to the measured humidity. 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 Seconds (in steps of 0.5 Seconds) (Default : 2.0 sec.)

Settings table for SIGNAL LO / SIGNAL HI:

Input Type	Settings
0 to 20 mA	0.00 to 20.00
4 to 20 mA	4.00 to 20.00
0 to 5 V	0.000 to 5.000
0 to 10 V	0.00 to 10.00
1 to 5 V	1.000 to 5.000

Default :
Signal Low 0.000
Signal High 5.000

Compressor Switching Strategies

The PPI "Temperature + Humidity" composite controllers offer different programmable strategies for compressor switching to meet different design approaches by the manufacturers of Humidity Chambers. The various strategies and the implementations are described here.

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 below.
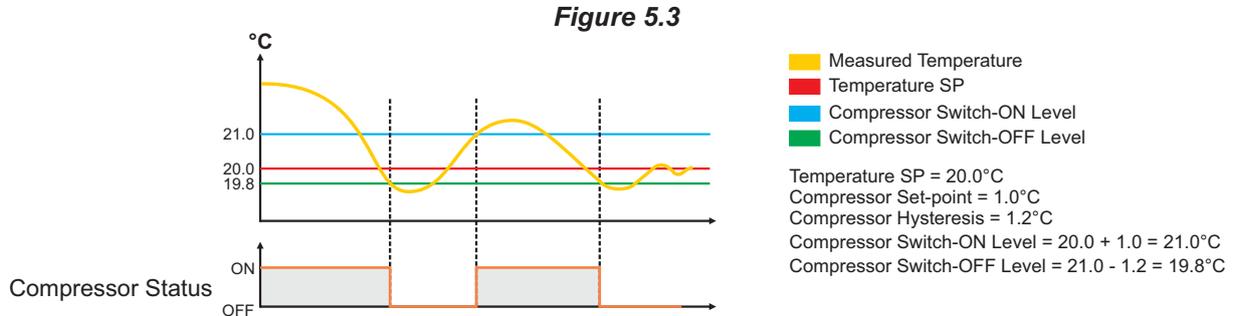
Figure 5.2
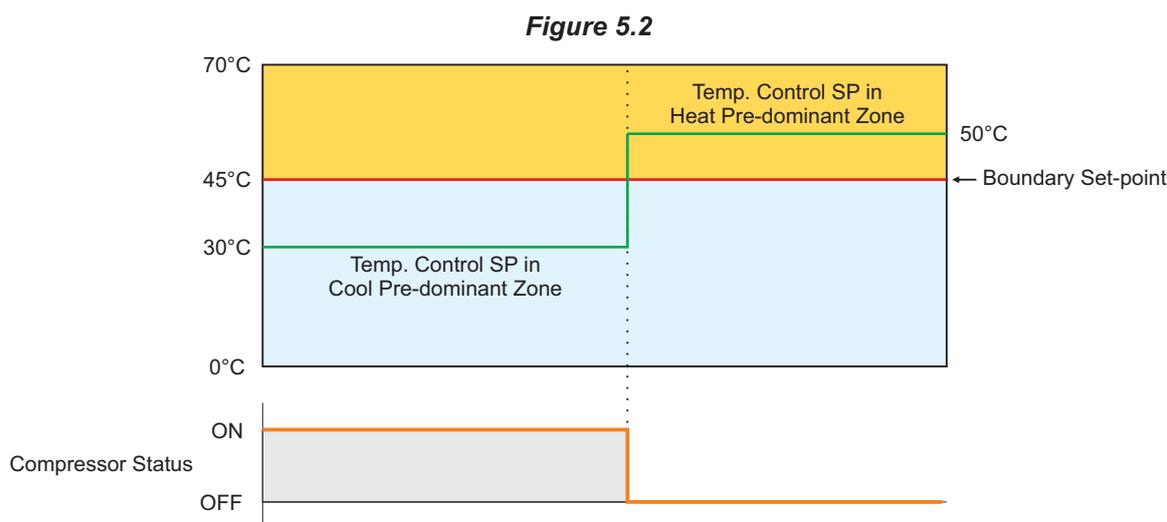
The zone at and above the boundary SP (▭) is referred as Heat Pre-dominant zone and that below the boundary SP (▭) is referred as Cool Pre-dominant zone. The controller automatically switches between the two zones depending upon the Temperature SP. If the Temperature SP is below boundary SP, Cool Pre-dominant 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 chamber air temperature. The controller switches the compressor ON or OFF based on the comparison between the chamber temperature value and the Temperature SP. Refer Figure 5.3 below.

Figure 5.3

■ Measured Temperature
■ Temperature SP
■ Compressor Switch-ON Level
■ Compressor Switch-OFF Level

Temperature SP = 20.0°C
Compressor Set-point = 1.0°C
Compressor Hysteresis = 1.2°C
Compressor Switch-ON Level = 20.0 + 1.0 = 21.0°C
Compressor Switch-OFF Level = 21.0 - 1.2 = 19.8°C

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;

$$\text{Compressor Switch - ON Level} = (\text{Temperature SP}) + (\text{Compressor Set-point})$$

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;

$$\text{Compressor Switch - OFF Level} = (\text{Compressor Switch-ON Level}) - (\text{Compressor Hysteresis})$$
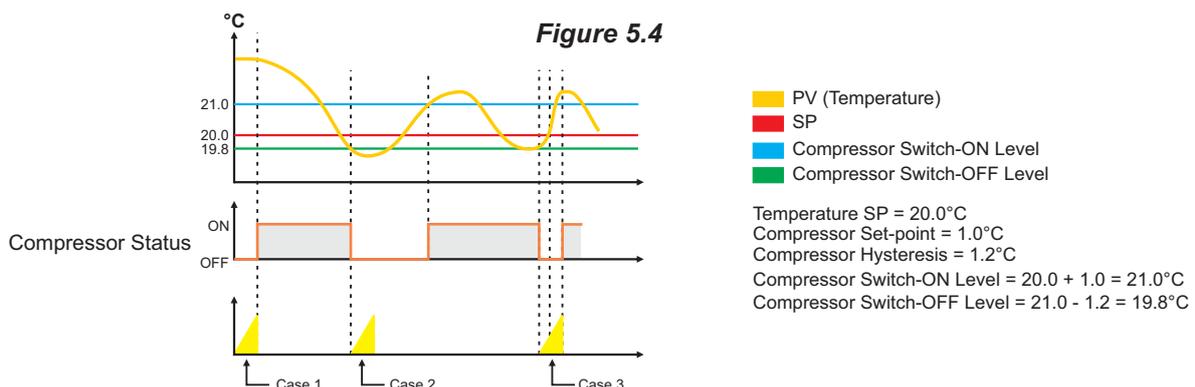
The hysteresis inserts a dead band between the Compressor Switch-ON Level and Compressor Switch-OFF Level to avoid frequent switching of the compressor.

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

■ PV (Temperature)
■ SP
■ Compressor Switch-ON Level
■ Compressor Switch-OFF Level

Temperature SP = 20.0°C
Compressor Set-point = 1.0°C
Compressor Hysteresis = 1.2°C
Compressor Switch-ON Level = 20.0 + 1.0 = 21.0°C
Compressor Switch-OFF Level = 21.0 - 1.2 = 19.8°C

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

Control Strategy : Heat + Cool		
COMPRESSOR STRATEGY >>		CONT. OFF CONT. ON SP BASED PV BASED (Default : CONT. ON)
CONT. ON	SP BASED	PV BASED
TIME DELAY [SEC] >> 0 to 1000 Sec (Default : 200 Sec)	**BOUNDARY SET VALUE >>** 0.0 to 100.0 (Default : 45.0)	**COMPRESSOR SP >>** 0.0 to 100.0 (Default : 2.0)
	CONTROL ZONES >> SINGLE DUAL (Default : SINGLE)	**HYSTERESIS >>** 0.1 to 99.9 (Default : 2.0)
	TIME DELAY [SEC] >> 0 to 1000 Sec (Default : 200 Sec)	**TIME DELAY [SEC] >>** 0 to 1000 Sec (Default : 200 Sec)

FACTORY > BOILER WATER LEVEL

Parameter Description	Settings (Default Value)
ENABLE >> Set to 'Yes' if water level Sensor(s) is mounted for detecting Low water level.	NO YES (Default : NO)
WATER LEVEL STARTEGY >> *Single Switch* A single float type sensor is installed for detecting low water level. *Dual Switch Low / High* A Sensor with two switches for detecting both Low & High levels is installed. *Dual Switch Low / Very Low* A Sensor with two switches for detecting two different water levels as Low & Very Low is installed.	SINGLE SWITCH DUAL SWITCH LO-HI DUAL SWITCH LO-VLO (Default : SINGLE SWITCH)
SWITCH-1 LOGIC >> *Open : Water level Low* The water level is considered *Low* if the switch is OPEN. *Close : Water Level Low* The water level is considered *Low* if the switch is CLOSE.	OPEN : WATER LO CLOSE : WATER LO (Default : CLOSE : WATER LO)
SWITCH-2 LOGIC >> (Available only if water Level Sensor with Dual Switches is installed) **Case-1 : *Water Level Strategy is 'Dual Switch Low / High'*** *Open : Water Level High* The water level is considered *High* if the switch is OPEN. *Close : Water Level High* The water level is considered *High* if the switch is CLOSE. **Case-2 : *Water Level Strategy is 'Dual Switch Low / Very Low'*** *Open : Water Level Very Low* The water level is considered *Very Low* if the switch is OPEN. *Close : Water Level Very Low* The water level is considered *Very Low* if the switch is CLOSE.	OPEN : WATER HI CLOSE : WATER HI (Default : CLOSE : WATER HI) **OR** OPEN : WATER VLO CLOSE : WATER VLO (Default : CLOSE : WATER VLO)

'Temperature + Humidity' Controller with Graphic Display

FACTORY > DOOR OPEN

Parameter Description	Settings (Default Value)
ENABLE >> Set to 'Yes' if Switch is mounted for detecting door *Open / Close* position.	NO YES (Default : NO)
SWITCH LOGIC >> *Open : Door Open* The Door position is considered *Open* if the switch is OPEN. *Close : Door Open* The Door position is considered *Open* if the switch is CLOSE.	OPEN : DOOR OPEN CLOSE : DOOR OPEN (Default : CLOSE : DOOR OPEN)
DOOR ALRM DLY [SEC] >> 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 (Default : 60 Sec)

FACTORY > FACTORY DEFAULT

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

FACTORY > PASSWORD

Parameter Description	Settings (Default Value)
CHANGE PASSWORD >> The Controller is shipped from the factory with a default password (321) for accessing the parameters reserved for Operator. However, if required the password can be changed by setting the new value for this parameter. Set to 'Yes' for changing the Password.	No Yes (Default : No)
NEW PASSWORD >> This parameter is presented if 'Change Password' is set to 'Yes'. Set the new password value.	0 to 3000 (Default : 321)

FACTORY > EXIT

Parameter Description	Settings (Default Value)
EXIT SETUP MODE >> Select 'Yes' to quit *Setup* mode and return to *Main Display* mode.	NO YES (Default : NO)

Section 6
MECHANICAL INSTALLATION

Installation Precautions

Ensure the following precautions are taken while installing the device:

1. *Environment*
   Install in a location free from corrosive/combustible gases and electrically conductive pollutants.

2. *Temperature & Humidity*
   Avoid rapid temperature changes that may cause condensation. Ensure ambient conditions do not exceed the specified temperature and humidity limits.

3. *Electromagnetic Interference (EMI)*
   Protect the installation site from excessive electrostatic or electromagnetic interference.

4. *Vibration & Shock*
   Do not mount the device in areas with high vibration or mechanical shock.

5. *External Elements*
   Keep the device away from dust, salt air, direct sunlight, and radiant heat sources.

Outer Dimensions

Refer to Figure 6.1 for the outer dimensions of the device.

Figure 6.1

Front View

Side View
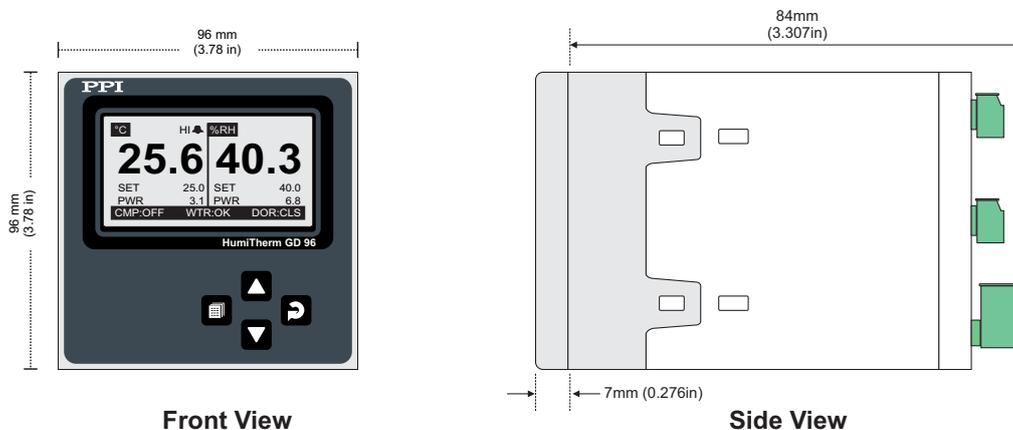
Figure 6.2

Panel Cutout & Spacing Requirements

- Cutout Size
  [92 × 92, mm, -0, +0.5 mm]
  [3.622" × 3.622", -0, +0.02"]
- Minimum Spacing
  Maintain the recommended clearance if installing multiple devices on the same panel.
- Reference
  See Figure 6.2 for panel cutout dimensions and spacing guidelines.

Panel Cutout

92 X 92 mm
-0, +0.5 mm

(3.622" X 3.622")
(-0", +0.02")

38mm (1.5")

10mm (0.39")
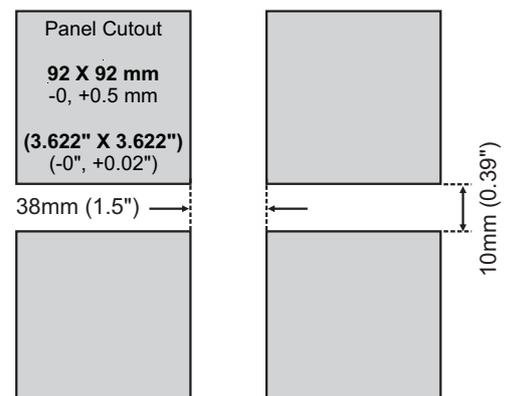
Panel Mounting Instructions

Figure 6.3

Bezel

Mounting Clamp

Screw

L-Projections

Mounting Panel with Square Cutout
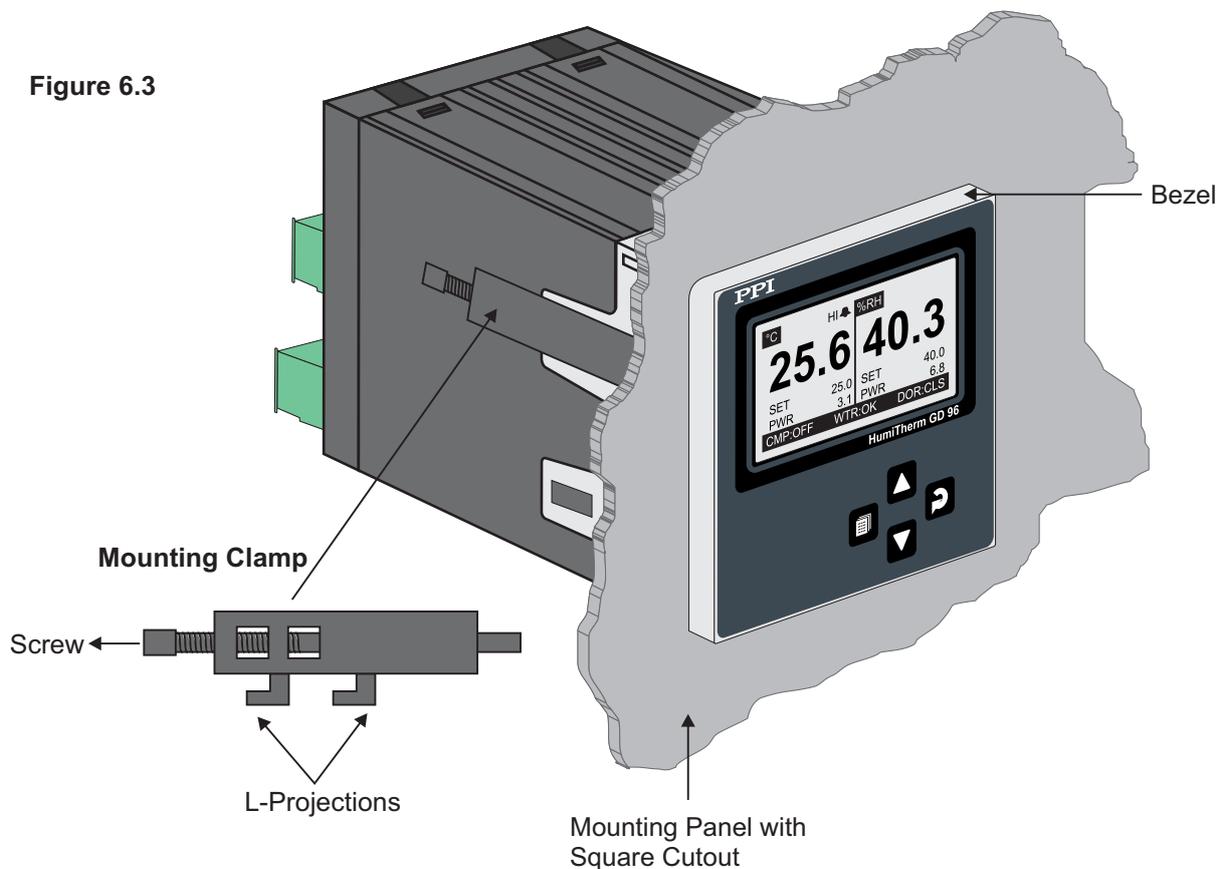
Follow these steps to securely mount the device on a panel:

1. Prepare the Cutout
   Create a square cutout on the panel according to the dimensions in Figure 6.2.

2. Remove Mounting Clamps
   Detach the Mounting Clamps from the device enclosure.

3. Insert the device:
   - From the front of the panel, insert the rear side of the device housing through the cutout.
   - Ensure the device sits squarely against the panel wall.
   - Caution: Apply pressure only on the bezel, not on the front label.

4. Secure with Mounting Clamps:
   - Attach each clamp so that its L-projections fit into the holes on the left and right sides of the enclosure.
   - Tighten the screws until the clamps firmly secure the device against the panel wall.

5. Reference
   - See Figure 6.3 for panel mounting.

'Temperature + Humidity' Controller with Graphic Display

Section 7

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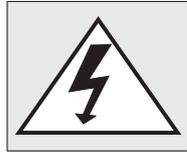
⚠ **WARNING**
MISHANDLING / NEGLIGENCE CAN RESULT IN PERSONAL DEATH OR SERIOUS INJURY.

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 low-level signal cables (like **RTD, DC** Linear Current/Voltage, etc.). 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 back side of the controller enclosure. The diagram shows the terminals viewed from the **REAR SIDE** with the controller label upright.
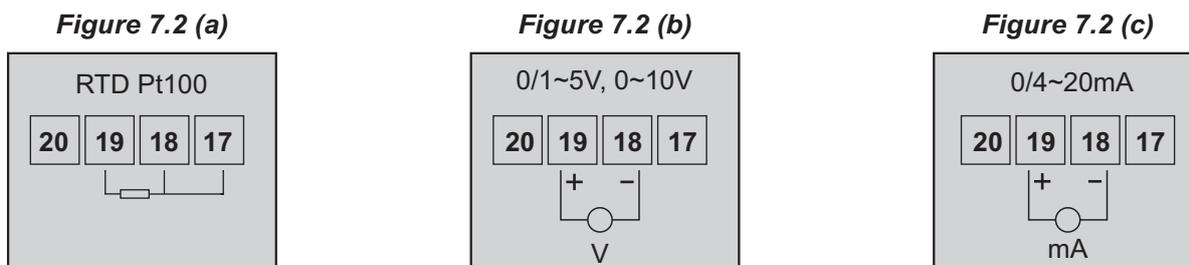
Figure 7.1
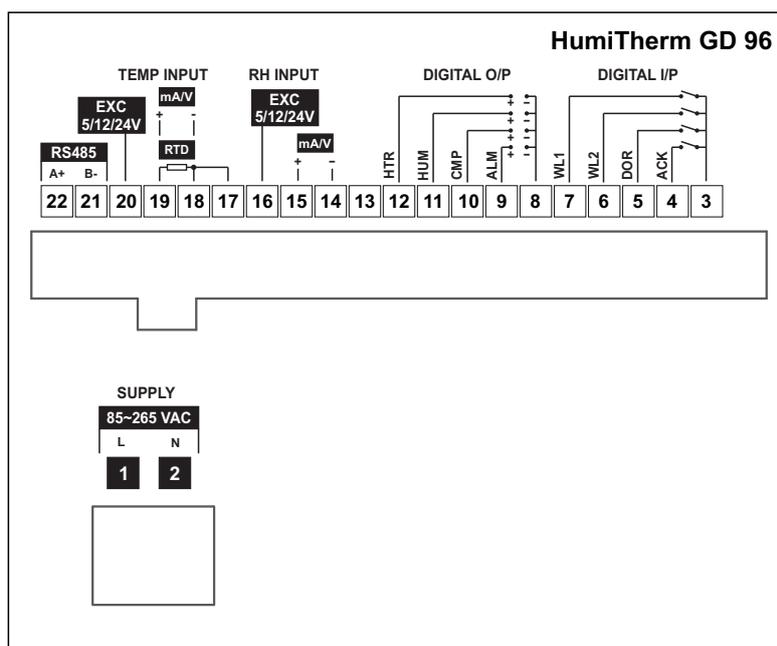
DESCRIPTIONS

The back panel connections are described as under:

Temperature (°C) Sensor / Transmitter Input (Terminals : 20, 19, 18, 17)

The Controller accepts RTD Pt100 (3-wire / 2-wire) or DC Current (mA) / DC Voltage (V) as Temperature input. The connections are described below.

Figure 7.2 (a)   *Figure 7.2 (b)*   *Figure 7.2 (c)*

RTD Pt100, 3-wire

Connect single leaded end of RTD bulb to terminal 19 and the double leaded ends to terminals 18 & 17 as shown in Figure 7.2 (a). Use copper conductor leads of very low resistance ensuring that all 3 leads are of the same gauge and length. Avoid joints in the cable.

Temperature Transmitter with DC Voltage (V) Output

The Figures 7.2 (b) depicts wiring connections for voltage output transmitter. The Excitation Voltage can be obtained from an external source or from the controller.

Temperature Transmitter with DC Current (mA) Output

The Figures 7.2 (c) depicts wiring connections for current output transmitter. The Excitation Voltage can be obtained from an external source or from the controller.

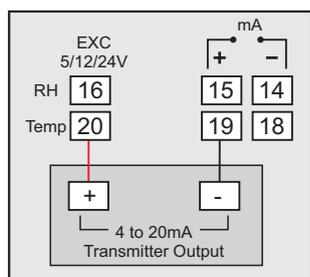**Humidity (%RH) Transmitter Input** (Terminals : 16, 15, 14, 13)

The Controller accepts DC Current (mA) / DC Voltage (V) as Humidity input. The connections are described below.

Humidity Transmitter with DC Voltage (V) Output

The Figures 7.3(a) depicts wiring connections for voltage output transmitter. The Excitation Voltage can be obtained from an external source or from the controller.

Humidity Transmitter with DC Current (mA) Output

The Figures 7.3(b) depict wiring connections for current output transmitter. The Excitation Voltage can be obtained from an external source or from the controller.

*Figure 7.3 (a)*   *Figure 7.3 (b)*
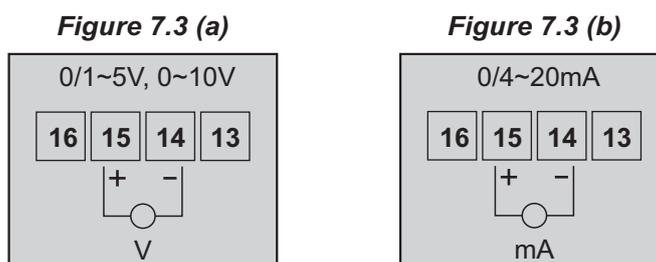
Transmitter Excitation Voltage

- The Excitation Voltage for powering external transmitters are provided on terminals 20 & 16 for Temperature & Humidity, respectively.
- The device provides a 5VDC @ 15 mA as standard. Optionally 12VDC @ 15 mA or 24VDC @ 50 mA is supplied.
- Wiring for different transmitter types are illustrated in below figures. The 1 to 3.6V output is only for example, the actual output could be any other values like 0 to 5V, 0 to 10V, etc.

2-wire Current Transmitter
(5/12/24VDC Supply)
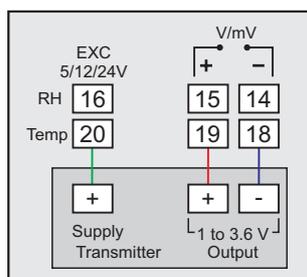
3-wire Voltage Transmitter
(5/12/24VDC Supply)
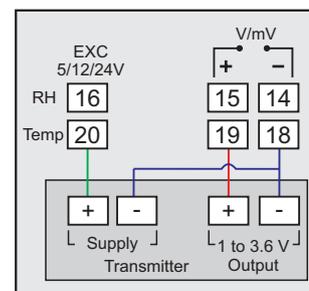
4-wire Voltage Transmitter
(5/12/24VDC Supply)

Heater Control Output (terminals : 12, 8)
Humidity Control Output (terminals : 11, 8)
Compressor Control Output (terminals : 10, 8)
Alarm Output (terminals : 9, 8)

All the above control & alarm outputs are Voltage pulses (12VDC @ 20mA, Short-circuit protected) for driving external SSR or Relay. The '+' and '-' terminals are for voltage 'Source' and 'Return' paths, respectively.

Water Level Switch-1 Digital Input (Terminals 7, 3)
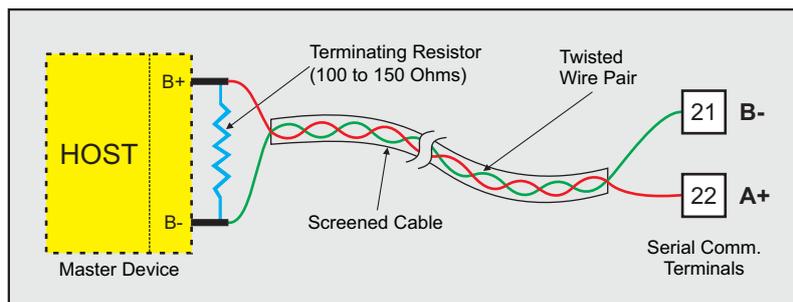**Water Level Switch-2 Digital Input** (Terminals 6, 3)
Door Open Digital Input (Terminals 5, 3)
Alarm Acknowledge Digital Input (Terminals 4, 3)

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

**PC COMMUNICATION PORT** (Terminals 22, 21)

Figure 7.4

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

For reliable noise free communication, use a pair of twisted wires inside screened cable as shown in Figure 7.4. 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 (Terminals 1, 2)

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 7.5. 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 7.5
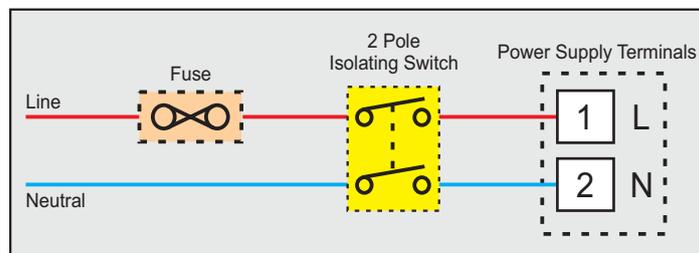
APPENDIX A
DC LINEAR SIGNAL INTERFACE

Overview

Various transmitters generate different signal types, such as mV, V, or mA, with distinct signal ranges. To ensure compatibility with a wide range of transmitters, PPI products offer configurable Signal Type and Range settings.

Common industry-standard signal ranges include:
- 0 to 80 mV, 0 to 160 mV
- 0 to 5 V, 1 to 5 V, 0 to 10 V
- 0 to 20 mA, 4 to 20 mA

Additionally, since transmitters output different signal ranges corresponding to specific process values (e.g., a 1 to 4.5 V signal may represent 5% to 95% RH), PPI products allow users to configure the process value range and resolution.

Required Parameters for Linear Transmitter Interface

For interfacing linear transmitters, the following six parameters must be configured:

Parameter	Definition	Example
Input Type	Defines the standard DC signal type in which the transmitter signal range falls.	4 to 20 mA
Signal Low	The minimum signal value corresponding to the lowest process value.	4.00 mA
Signal High	The maximum signal value corresponding to the highest process value.	20.00 mA
PV Resolution	Defines the smallest measurable unit for the process value.	0.01 psi
Range Low	The process value corresponding to Signal Low.	0.00 psi
Range High	The process value corresponding to Signal High.	5.00 psi

Mathematical Representation

The relationship between transmitter signal values and the corresponding process values follows a straight-line equation:
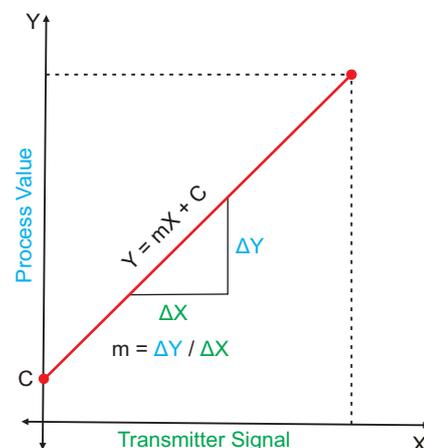
$$Y = mX + C$$

Where;

X : Signal Value from Transmitter

Y : Process Value Corresponding to X

C : Process Value Corresponding to X = 0 (Y-intercept)

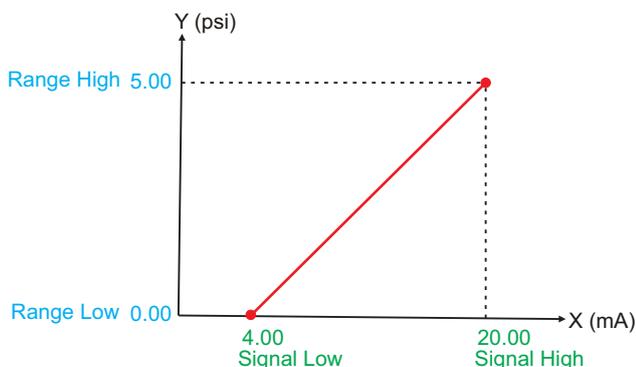m : Slope (Change in Process Value per unit Change in Signal Value)

Examples of Transmitter Configurations

Example 1:

Pressure Transmitter (**4 to 20 mA** corresponding to **0 to 5 psi**)
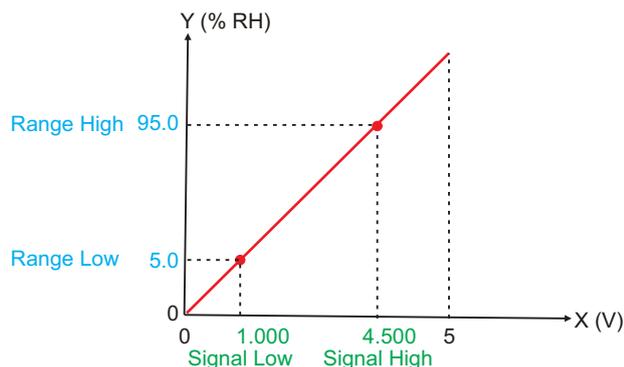
Input Type   : 4-20 mA
Signal Low   : 4.00 mA
Signal High   : 20.00 mA
PV Resolution : 0.01
Range Low   : 0.00
Range High   : 5.00

Example 2

Humidity Transmitter (**1 to 4.5 V** corresponding to **5 to 95 %RH**)
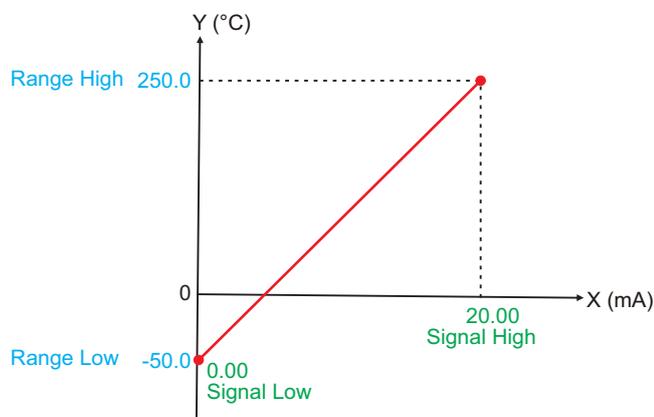
Input Type   : 0-5 V
Signal Low   : 1.000 V
Signal High   : 4.500 V
PV Resolution : 0.1
Range Low   : 5.0
Range High   : 95.0

Example 3

Temperature Transmitter (**0 to 20 mA** corresponding to **-50 to 250 °C**)

Input Type   : 0-20 mA
Signal Low   : 0.00 mA
Signal High   : 20.00 mA
PV Resolution : 0.1
Range Low   : -50.0
Range High   : 250.0

Process Precision Instruments   (An ISO 9001 : 2008 Company)

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