HumiTherm-i

PPI
The Perfection Experts

Smart
‘Temperature + Humidity’ Indicator

Version : Dry-Bulb RTD Pt100, 3-wire
Wet-Bulb RTD Pt100, 3-wire

Version : RTD Pt100, 3-wire for Temperature
DC Linear (Voltage) for Humidity

User Manual

CONTENTS

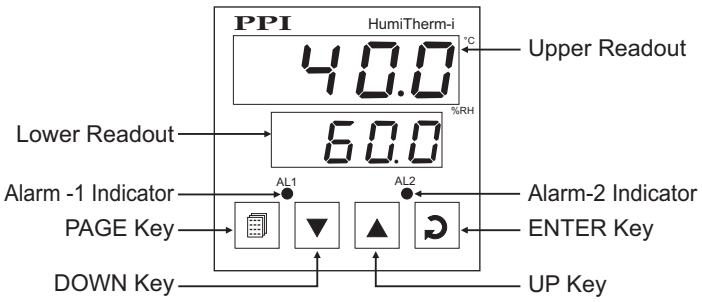
For Dry-Wet

For Temp+RH

Section 1
FRONT PANEL LAYOUT

The indicator front panel comprises of digital readouts, LED indicators and membrane keys as shown in Figure 1.1 below.

Figure 1.1



READOUTS

The Upper Readout is a 4 digit, 7-segment bright red LED display and usually displays the Temperature Value in °C or °F (depending upon the Unit selected). In Program Mode, the Upper Readout displays parameter values.

The Lower Readout is a 4 digit, 7-segment bright green LED display and usually displays Relative Humidity (RH) Value in %. Upon holding the UP or DOWN key pressed, the Lower Readout shows the Wet-Bulb Temperature in °C or °F. In Program Mode, the Lower Readout displays prompts for the parameters.

INDICATORS

There are two front panel red LED indicators. The Table 1.1 below lists each LED indicator (identified by the front panel legend) and the associated status it indicates.

Table 1.1

Indicator	Function
AL1	Flashes while the Alarm for Temperature Loop is active.
AL2	Flashes while the Alarm for RH Loop is active.

KEYS

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

The Table 1.2 below lists each key (identified by the front panel symbol) and the associated function.

Table 1.2

Symbol	Key	Function
	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 on the PAGE.

Section 2
BASIC OPERATIONS

POWER-UP

Upon power-up, all displays and indicators are lit on for approximately 3 seconds. This is followed by the indication of the indicator model name HUM1 on the Upper Readout and the firmware version v0 12 on the Lower Readout, for approximately 1 second.

MAIN DISPLAY MODE

After the Power-up display sequence, the Upper and Lower Readout starts showing the measured Temperature Value in °C or °F and the Relative Humidity in %RH, respectively. (The Wet-Bulb Temperature can be viewed on the Lower Readout by holding the UP or DOWN key pressed.) This is called the MAIN Display Mode and this is the one that shall be used most often.

PV ERROR INDICATIONS

The indicator flashes the **PV** error messages for Temperature and RH Values on Upper and Lower Readout, respectively.

Error Indication for Dry-Bulb Temperature

In case of Dry-Bulb Temperature exceeding the specified Minimum or Maximum Range or in case of input sensor (RTD Pt100) open / broken; the Upper Readout flashes the Error Messages as listed in Table 2.1 below.

Table 2.1

Message	Error Type	Cause
Or	Over-range	Dry Bulb Temperature above Max. Range
Ur	Under-range	Dry Bulb Temperature below Min. Range
OPEn	Sensor Open	Dry Bulb Sensor (RTD) Broken / Open

Error Indication for Relative Humidity (RH)

In case of Wet-Bulb sensor (RTD Pt100) open / broken or in cases where the Dry/Wet Temperatures cause an error in RH calculation, the Lower Readout flashes the Error Messages as listed in Table 2.2 below.

Table 2.2

Message	Error Type	Cause
Or	Over-range	Wet Bulb Temperature above Max. Range
Ur	Under-range	Wet Bulb Temperature below Min. Range
OPEn	Sensor Open	Wet Bulb Sensor (RTD) Broken / Open
rhEr	RH Error	This error is indicated in the following cases : • Dry Bulb Temperature above 102.0°C. • Dry Bulb Temperature below 0.0°C. • Wet Bulb depression beyond 50.0°C.
100.0	Display Freezes To 100.0%	This error is indicated in the following cases : • Wet-Bulb Temperature exceeds Dry-Bulb Temperature. • Computed % RH above 100.0%.
0.0	Display Freezes To 0.0%	Computed % RH is below 0.0%.

Note:

For both Dry and Wet Bulb 3-wire RTD sensor input, if the compensating lead is not connected or gets open, the indicator does not indicate PV error but the measured value is not compensated for the lead resistance.

OPERATOR PAGE AND PARAMETERS

The indicator provides a separate page, called *Operator Page,* for the purpose of viewing and / or resetting the stored Min. / Max. values for Dry- Bulb Temperature and %RH. The parameters on this page are available only if the Min. / Max. feature is Enabled in Page -13 parameter list.

Accessing Operator Page

Step through the following sequence to open the operator page and to adjust the operator parameter values.

1. Press and release PAGE key. The Lower Readout shows PAGE (PAGE) and Upper Readout shows 0 (0).
2. Press ENTER key. The Lower Readout shows prompt for the first available operator parameter and the Upper Readout shows value for the parameter.
3. Use UP / DOWN keys to adjust the value and then press ENTER key to store the set value and scroll to next parameter.

The indicator automatically reverts to MAIN Display Mode upon scrolling through the last operator parameter. Alternatively, use PAGE key to return to MAIN Display Mode.

The operator parameters are described in Table 2.3. Note that the parameters are presented only if 'Min / Max Monitoring' feature is enabled.

Table 2.3

Parameter Description	Settings (Default Value)
MAXIMUM DRY BULB TEMPERATURE VALUE db.Hi This parameter indicates the Maximum value attained by the Dry-Bulb Temperature. This is a read only value and is available only if Min. /Max. monitoring is enabled.	View Only
MINIMUM DRY - BULB TEMPERATURE VALUE db.Lo This parameter indicates the Minimum value attained by the Dry-Bulb Temperature. This is a read only value and is available only if Min. /Max. monitoring is enabled.	View Only
MAXIMUM %RH VALUE rh.Hi This parameter indicates the Maximum value attained by the Relative Humidity. This is a read only value and is available only if Min. /Max. monitoring is enabled.	View Only
MINIMUM PEAK OF RH rh.Lo This parameter indicates the Minimum value attained by the Relative Humidity. This is a read only value and is available only if Min. /Max. monitoring is enabled.	View Only

Parameter Description	Settings (Default Value)
RESET COMMAND rSt Available only if Min./Max. monitoring is enabled. This feature clears the current Min. / Max. values and starts afresh monitoring the Process Values for new Min & Max.	no No YES Yes (Default : No)
RESET PASS - CODE CodE For Resetting the Min. / Max. values, set the reset command to 'Yes' and then set this parameter value to the Pass - Code value stored at Supervisory level on Page-13.	0 to 250 (Default : 0)

Section 3

SET-UP MODE : ACCESS AND OPERATION

The various parameters are arranged in different groups, called PAGES, depending upon the functions they represent. Each group is assigned a unique numeric value, called PAGE NUMBER, for its access.

The parameters are always presented in a fixed format: The Lower Readout displays the parameter prompt (Identification Name) and the Upper Readout displays the set value. The parameters appear in the same sequence as listed in their respective sections.

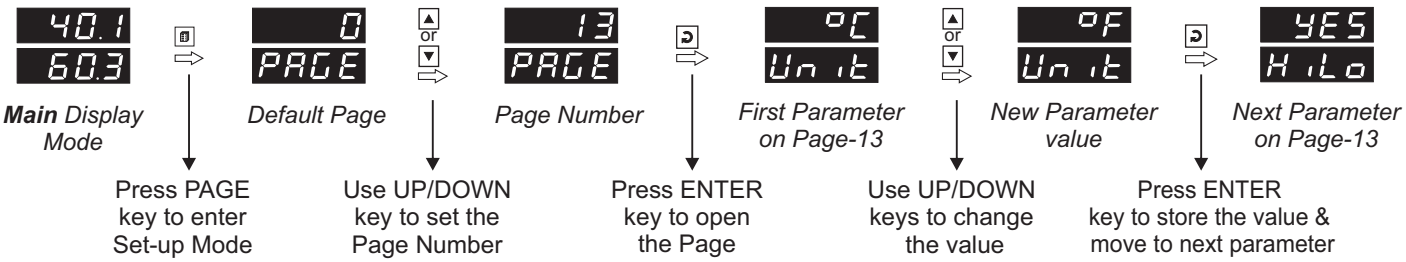
SET-UP MODE

The Set-up Mode allows the user to view and modify the parameter values. Follow the steps below for setting the parameter values:

1. Press and release PAGE key. The Lower Readout shows PAGE and the Upper Readout shows page number 0. Refer Figure 3.1.
2. Use UP / DOWN keys to set the desired PAGE NUMBER.
3. Press and release ENTER key. The Lower Readout shows the prompt for the first parameter listed in the set PAGE and the Upper Readout shows its current value. If the entered PAGE NUMBER is invalid (contains no parameter list or any associated function), the indicator reverts to the MAIN Display Mode.
4. Press and release the ENTER key until the prompt for the required parameter appears on the Lower Readout. (The last parameter in the list rolls back to the first parameter).
5. Use UP / DOWN keys to adjust the parameter value. (The display flashes if UP key is pressed after reaching the maximum value or DOWN key is pressed after reaching the minimum value).
6. Press and release the ENTER key. The new value gets stored in the indicator's non-volatile memory and the next parameter in the list is displayed.

The Figure 3.1 illustrates the example of altering the value for the parameter 'Units'.

Figure 3.1



Notes

1. *Each page contains a fixed list of parameters that are presented in a pre-determined sequence. Note however that availability of a few parameters, called Conditional Parameters, depend upon the settings for some other parameters. For example, the parameter 'Control Hysteresis' for Output-1 is available only if, the set value for the parameter 'Control Action' is 'On-Off'.*
2. *To exit the set-up mode and return to the MAIN Display Mode, press and release PAGE key.*
3. *If no key is pressed for approximately 30 seconds, the set-up mode times out and reverts to the MAIN Display Mode.*

MASTER LOCKING

The indicator facilitates locking all the PAGES (except Operator PAGE) by applying Master Lock Code. Under Locking, the parameters are available for *view only* and cannot be adjusted. The Master Lock, however does not lock the operator parameters. This feature allows protecting the rather less frequently used parameters against any inadvertent changes while making the frequently used operator parameters still available for any editing.

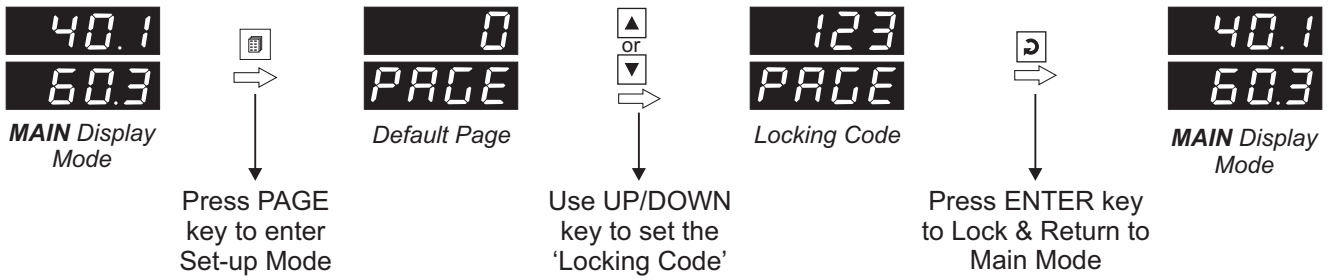
For enabling / disabling the Lock, step through the following sequence:

Locking

1. Press and release PAGE key while the indicator is in the MAIN Display Mode. The Lower Readout shows PAGE and the Upper Readout shows 0.
2. Use UP / DOWN keys to set the Page Number to 123 on the Upper Readout.
3. Press and release ENTER key. The indicator returns to the MAIN Display Mode with the Lock enabled.

The Figure 3.2 below illustrates the Locking procedure.

Figure 3.2



UnLocking

Repeat the Locking procedure twice for unlocking.

Section 4
ALARM PARAMETERS FOR TEMPERATURE

Visit www.ppiindia.net for technical notes on ALARM for detailed understanding of the parameters / terminologies used for describing the Alarm parameters in this section.

The Alarm parameters for Temperature Loop are grouped on PAGE-10. Refer Table 4.1 for parameter description and settings.

Table 4.1

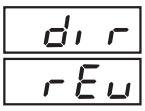
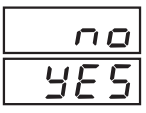
Parameter Description	Settings (Default Value)
TEMPERATURE ALARM TYPE [tYPE] *None* Disable the Alarm . *Process Low* The Alarm activates when the Temperature Value equals or falls below the 'Alarm Setpoint' value. *Process High* The Alarm activates when the Temperature Value equals or exceeds the 'Alarm Setpoint' value.	[nonE] None [P_Lo] Process Low [P_hi] Process High (Default : None)
TEMPERATURE ALARM SETPOINT [AL.SP] This parameter sets the Process High or Process Low limit for Alarm.	-50.0 to 150.0°C or -58.0 to 302.0°F (Default : For Process Low : -50.0 For Process High : 150.0)
TEMPERATURE ALARM HYSTERESIS [AL.HY] This parameter sets a differential (dead) band between the ON and OFF Alarm states. Keep it large enough to avoid frequent switching of the Alarm relay.	0.1 to 25.0 °C or °F (Default : 0.2)
TEMPERATURE ALARM LOGIC [AL.LG] Select 'Normal' if Alarm output is to activate an Audio / Visual alarm. Select 'Reverse' if Alarm output is to Trip the system.	[dir] Direct [rEv] Reverse (Default : Direct)
TEMPERATURE ALARM INHIBIT [AL.ih] *Yes* The Alarm activation is suppressed until the Temperature Value is within Alarm limits from the time the indicator is switched ON. This allows suppressing the Alarm during the start-up Alarm conditions. *No* The Alarm is not suppressed during the start-up Alarm conditions.	[no] No [YES] Yes (Default : Yes)

Section 5
ALARM PARAMETERS FOR RELATIVE HUMIDITY

Visit www.ppiindia.net for technical notes on ALARM for detailed understanding of the parameters / terminologies used for describing the Alarm parameters in this section.

The Alarm Parameters for %RH Loop are grouped on PAGE-11. Refer Table 5.1 for parameters description and settings.

Table 5.1

Parameter Description	Settings (Default Value)
%RH ALARM TYPE  *None* Disable the Alarm. *Process Low* The Alarm activates when the %RH Value equals or falls below the 'Alarm Setpoint' value. *Process High* The Alarm activates when the %RH Value equals or exceeds the 'Alarm Setpoint' value.	 None Process Low Process High (Default : None)
%RH ALARM SETPOINT  This parameter sets the Process High or Process Low limit for Alarm.	0.0 to 100.0% (Default : For Process Low : 0.0 For Process High : 100.0)
%RH ALARM HYSTERESIS  This parameter sets a differential (dead) band between the ON and OFF Alarm states. Keep it large enough to avoid frequent switching of the Alarm relay.	0.1 to 25.0% (Default : 0.2)
%RH ALARM LOGIC  Select 'Normal' if Alarm output is to activate an Audio / Visual alarm. Select 'Reverse' if Alarm output is to Trip the system.	 Direct Reverse (Default : Direct)
%RH ALARM INHIBIT  *Yes* The Alarm activation is suppressed until the %RH Value is within Alarm limits from the time the indicator is switched ON. This allows suppressing the Alarm during the start-up Alarm conditions. *No* The Alarm is not suppressed during the start-up Alarm conditions.	 No Yes (Default : Yes)

Section 6
ZERO-OFFSET PARAMETERS

The Zero-Offset Parameters are grouped on PAGE-12 and allow the user to set the Zero-Offset for Temperature and the Relative Humidity (RH) values. Refer Table 6.1 for parameter description and settings.

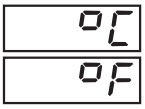
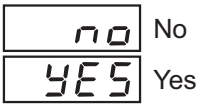
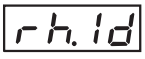
Table 6.1

Parameter Description	Settings (Default Value)
ZERO OFFSET FOR TEMP. VALUE db.oF This value is algebraically added to the measured temperature value to derive the final PV that is displayed and compared for Alarm. Final PV = Measured PV + Offset	-25.0 to +25.0°C (Default : 0.0)
ZERO OFFSET FOR %RH VALUE rh.oF This value is algebraically added to the measured %RH value to derive the final PV that is displayed and compared for Alarm. Final PV = Measured PV + Offset	-25.0 to +25.0% (Default : 0.0)

Section 7
SUPERVISORY PARAMETERS

The Supervisory Parameters are grouped on PAGE-13. These parameters allow Unit Selection for Temperature Value, Enabling / Disabling Min/Max monitoring and settings for Serial Communication. Refer Table 7.1 for parameter description and settings.

Table 7.1

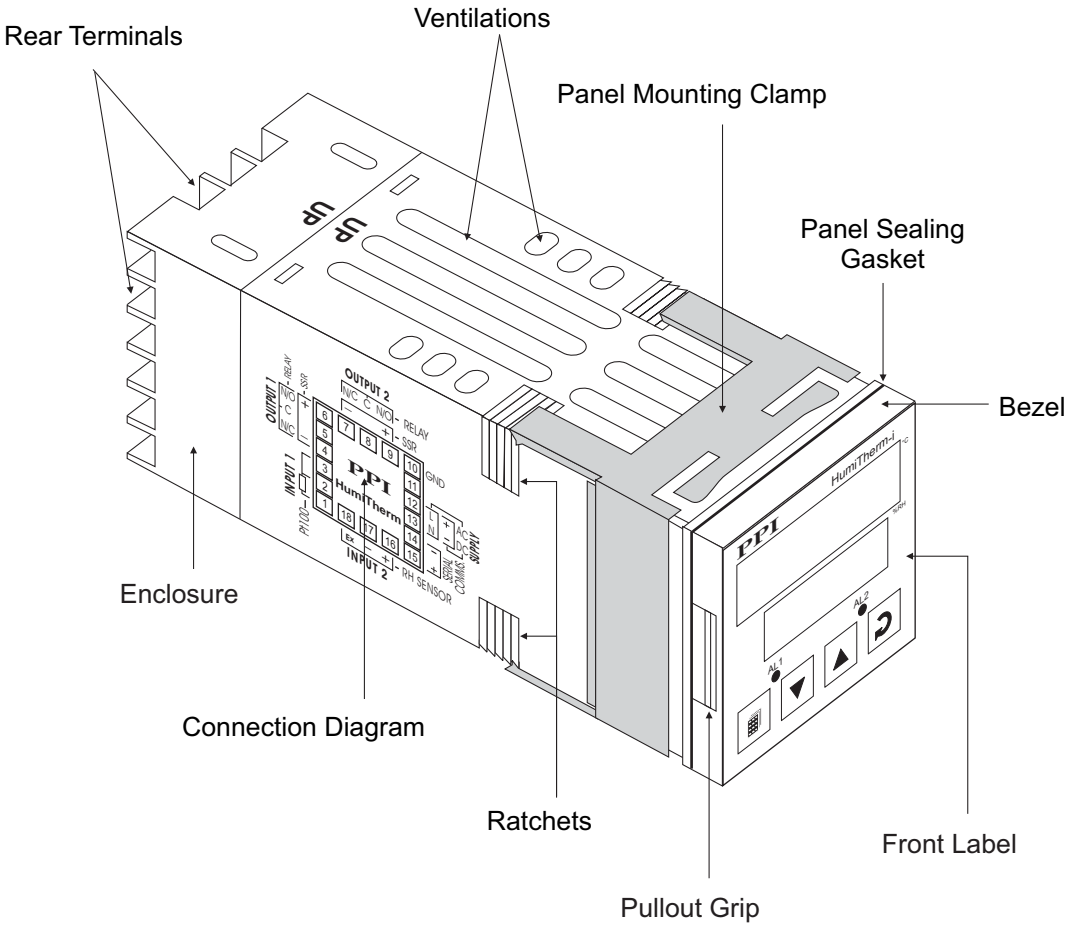
Parameter Description	Settings (Default Value)
UNIT SELECTION FOR TEMPERATURE  Select Temperature Units in °C or °F.	 (Default : °C)
DRY-BULB TEMPERATURE AND % RH MIN / MAX MONITORING  Set this parameter value to 'Yes' for enabling the Dry-Bulb Temperature and % RH monitoring for Min/Max values.	 (Default : Yes)
PASSWORD FOR RESETTING PV HIGH - LOW  This parameter allows protection against inadvertent resetting of Min/Max values. That is, the reset command is executed only if the operator sets the password that matches with this parameter value.	0 to 250 (Default : 0)
BAUD RATE  Communication speed in 'Bits per Second'. Set the value to match with the host baud rate.	 (Default : 4800)
ID NUMBER FOR TEMPERATURE LOOP  Unique numeric code assigned to the indicator for identification by the host to read or write Temperature Loop parameters.	1 to 8 (Default : 1)
ID NUMBER FOR RH LOOP  Unique numeric code assigned to the indicator for identification by the host to read or write %RH Loop parameters.	1 to 8 (Default : 2)

Section 8
HARDWARE ASSEMBLY & CONFIGURATIONS

The Figure 8.1 below shows the indicator outer-case when viewed with indicator front label upright. The indicator outer case is a rigid plastic enclosure into which the electronics assembly fits. The enclosure in turn fits into the standard DIN size panel cutout, as described in *Section 9 : Mechanical Installation*.

Notice the nomenclatures used to identify the various parts as the same are used throughout the sections describing installation, configuration and electrical connections.

Figure 8.1



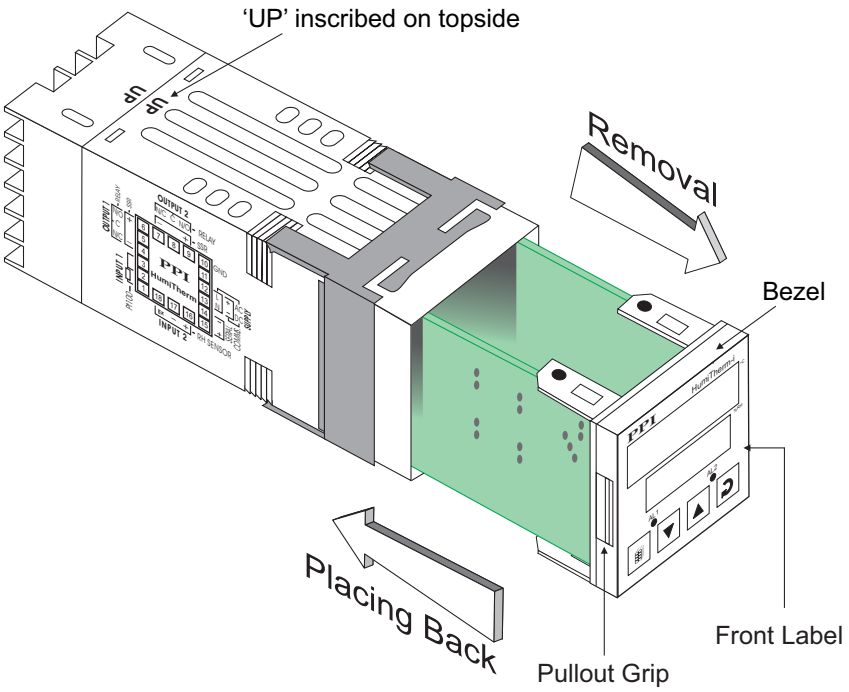
ELECTRONIC ASSEMBLY

The electronic assembly can be removed from the plastic enclosure and placed back as described below and illustrated in Figure 8.2

Removal

1. Hold the indicator with its front label upright.
2. Hold the Bezel with the fingers on the pullout grips provided on the left and right sides of the bezel. Pull the bezel outward. The assembly comes out with the bezel.

Figure 8.2

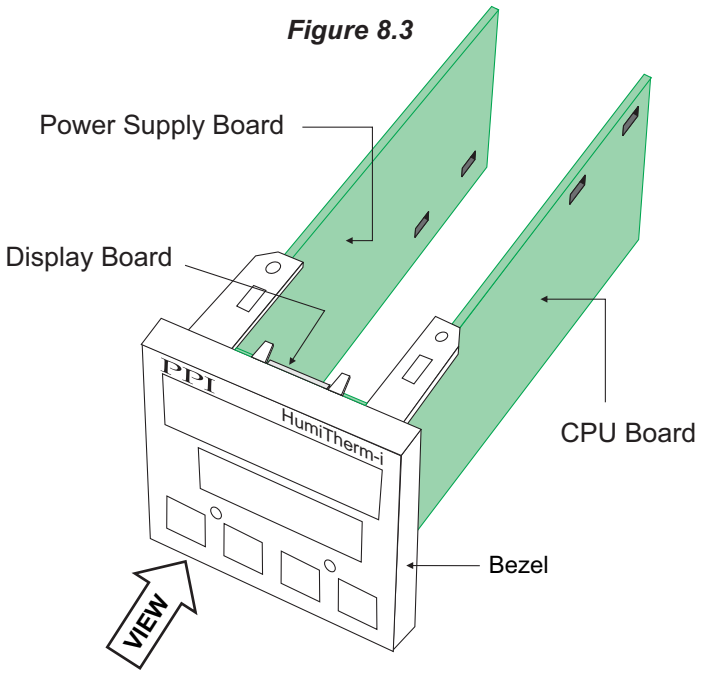


Placing Back

1. Hold the bezel with the front label upright.
2. Hold the enclosure such that the UP inscribed on the enclosure is on the topside. Insert the bezel gently with the boards on either side sliding into the guides provided inside of the enclosure.
3. Ensure that the bezel fits in tight on the enclosure-front to secure the panel-sealing gasket.

The Figure 8.3 below shows the basic electronics assembly of the indicator (without any plug-in modules). The basic electronics assembly of the indicator comprises of 3 Printed Circuit Boards. As shown in the figure, when viewed from the front, the CPU board is to the right, Power-supply board is to the left and the Display board is behind the bezel.

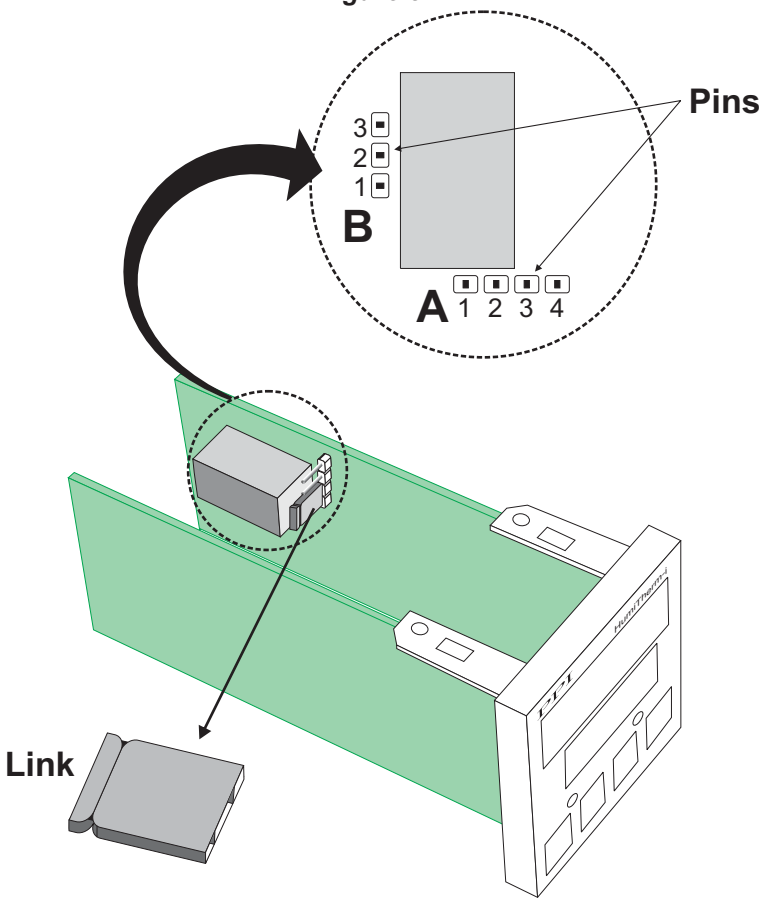
Figure 8.3



JUMPER SETTINGS FOR OUTPUT-1 (ALARM-1)

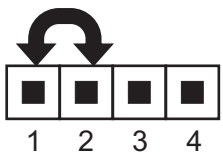
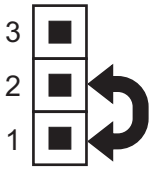
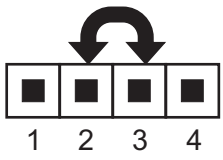
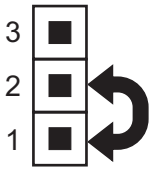
The Output-1 is user configurable for Relay or SSR voltage pulses. The selection requires proper jumper-settings prior to electrical connections.

Figure 8.4



The jumper settings are provided in the form of Pins & Link arrangement on the CPU board towards the rear end. Notice that, there are two such arrangements; one of 4 -Pins marked A and the other of 3-Pins marked B in the Figure 8.4. Two Links are provided, one each for A and B. Place the links to short two adjoining Pins as shown in Table 8.1 below for proper configuration.

Table 8.1

Output Type	Jumper Setting - A	Jumper Setting - B
Relay		
SSR Voltage Pulses		

The double-headed arrows, in Table 8.1, show the positions of the adjoining Pins that require shorting using the Link. The wiring connections must also be made in accordance with the selected output type (NO, C) for Relay; Positive(+) & Negative(-) for SSR.

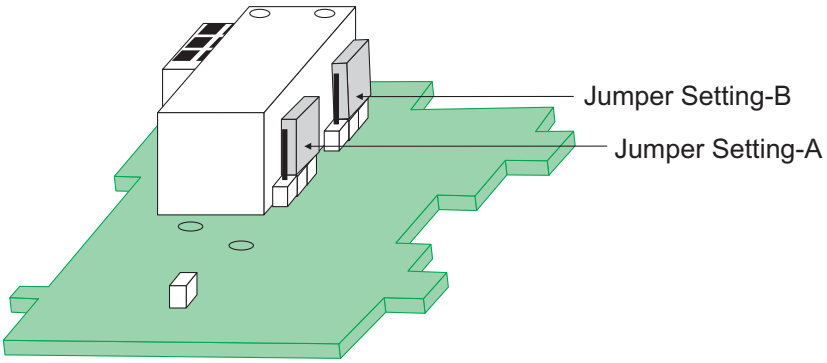
MOUNTING PLUG-IN MODULES

The indicator supports Input-2 (DC Linear Voltage) module which is mandatary for measuring Relative Humidity (RH) Value and 2 optional plug-in modules, viz. Output-2 (Relay/SSR) module and Serial Communication module. These modules are either pre-fitted while the indicator is shipped from the factory or can be fitted by the user if ordered separately. Both the optional modules have female connector (socket) mounted on them, which fit into the respective male connector (plug) provided on Power-supply board

Output-2 Module (Alarm-2)

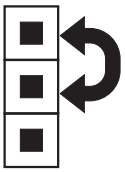
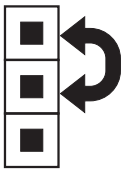
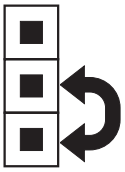
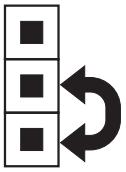
The Output-2 module provides, jumper selectable, Relay or SSR output. The Figure 8.5 below shows the output module and the jumper arrangement.

Figure 8.5



As shown in above Figure, there are 2 jumper arrangements marked A and B. The selection between Relay and SSR requires both these jumpers A and B to be set appropriately as shown in Table 8.2. The double headed arrows show the adjoining Pins that require shorting using the Link.

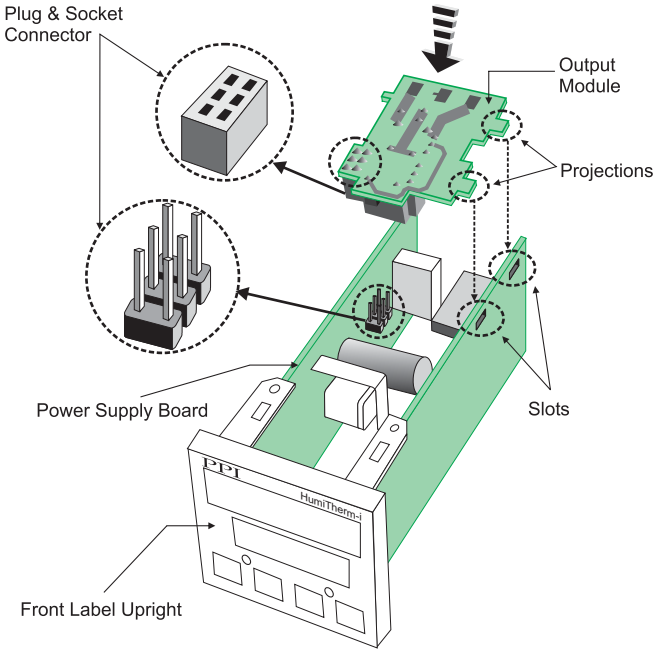
Table 8.2

Output Type	Jumper Setting - A	Jumper Setting - B
Relay (Arrangement shown in Figure 8.4)		
SSR Voltage Pulses		

The Figures 8.6 below illustrates how to mount the plug-in Output-2 module. Notice the orientation of the indicator and a few identifying components shown in figure to help locate the plugs for the modules. Ensure that the socket snap-fits into the plug and the 2 Projections of the module board fit into the 2 Slots provided on the Power-supply board for proper electrical contacts and secured fitting.

Figure 8.6

Mounting Output-2 Module



For plugging out the module(s), follow the steps below:

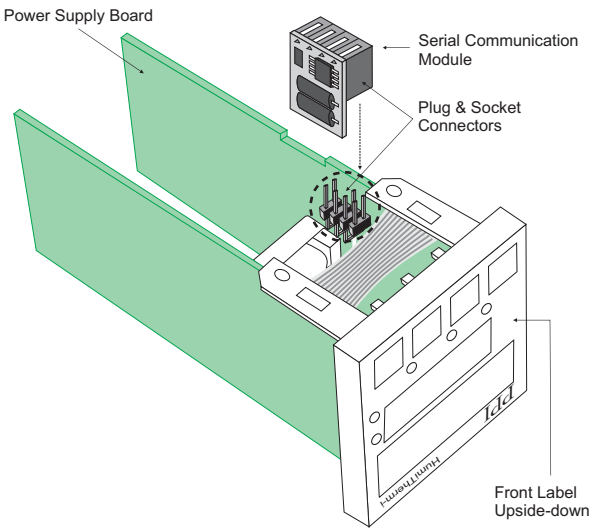
1. Gently pull apart the Power-supply board and the CPU board until the projections of the module board come out of the slots.
2. Pull the module outward to unlock the socket from the plug.

Serial Communication Module

The plug for the Serial Communication module is located on the Power-supply board. The Figure 8.7 below illustrates how to plug-in the Serial Communication module. To plug (or unplug) the module simply insert (or remove) the socket into (or from) the plug.

Figure 8.7

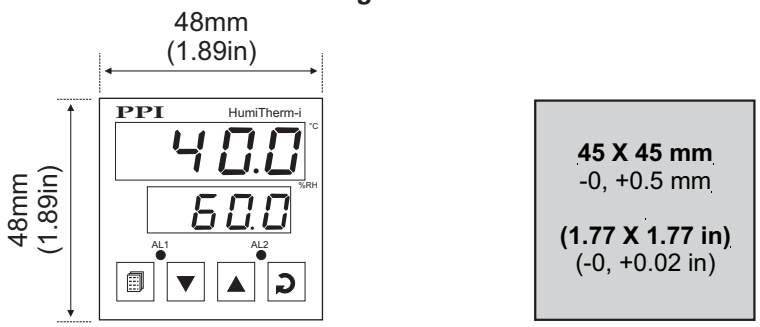
Mounting Serial Communication Module



Section 9
MECHANICAL INSTALLATION

The Figure 9.1 shows the indicator front outer dimensions and the panel cutout requirements.

Figure 9.1



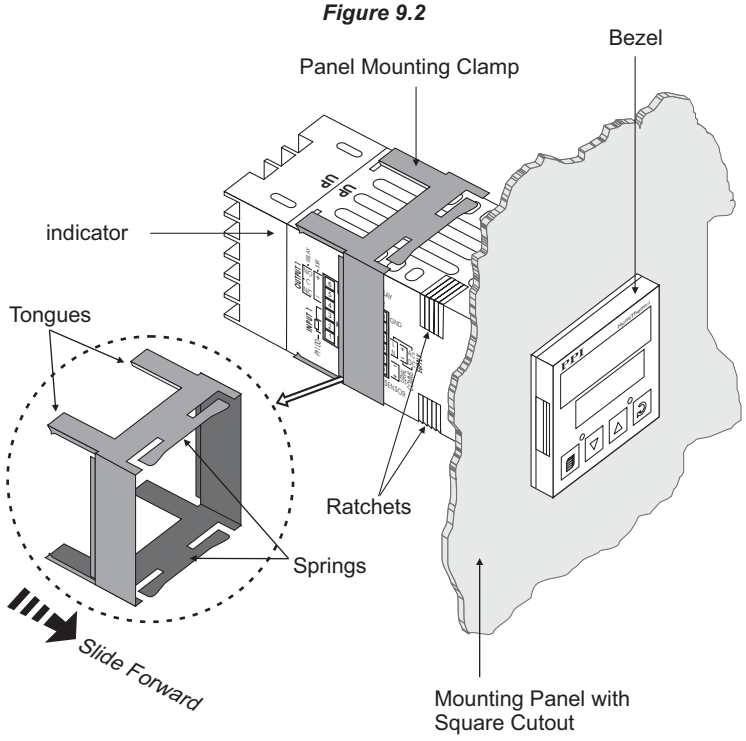
Front View **Panel Cutout**

PANEL MOUNTING

Follow the steps below for mounting the indicator on panel:

1. Prepare a square cutout to the size shown in Figure 9.1.
2. Remove the Panel Mounting Clamp from the indicator enclosure and insert the rear of the indicator housing through the panel cutout from the front of the mounting panel.
3. Hold the indicator gently against the mounting panel such that it positions squarely against the panel wall, see Figure 9.2. Apply pressure only on the bezel and not on the front label.
4. Slide the mounting clamp forward until it is firmly in contact with the rear face of the mounting panel and the tongues of the clamp engage in the ratchets on the indicator enclosure, as shown in Figure 9.2. Ensure that the springs of the clamp push firmly against the rear face of the mounting panel for secured mounting.

Figure 9.2



Section 10
ELECTRICAL CONNECTIONS

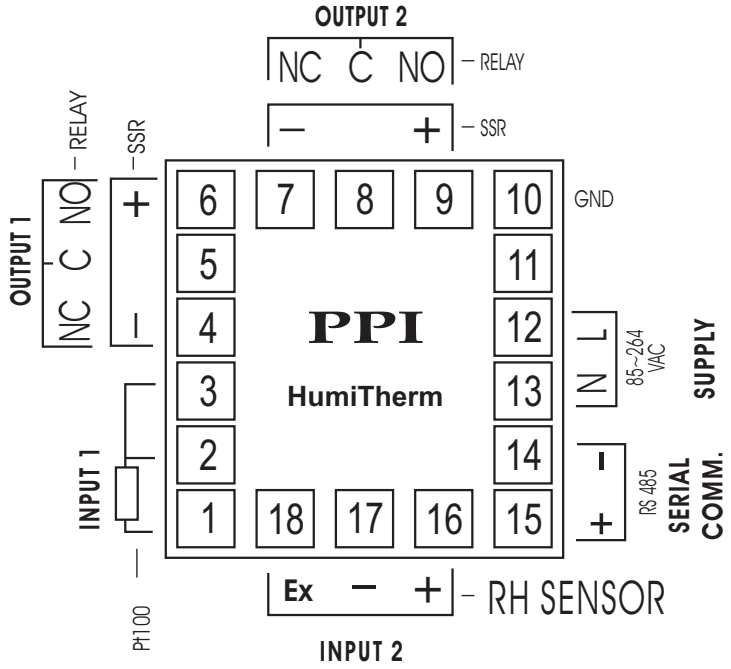
WARNING
MISHANDLING / NEGLIGENCE CAN RESULT IN PERSONAL DEATH OR SERIOUS INJURY.

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 indicator.
3. Run power supply cables separated from the low-level signal cables (like RTD, DC Linear (Voltage) signals, 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 indicator 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 indicator supply is switched-off while making/removing any connections or removing the indicator from its enclosure.

CONNECTION DIAGRAM

The Electrical Connection Diagram is shown on the left side of the indicator enclosure. The diagram shows the terminals viewed from the REAR SIDE with the indicator label upright. Refer the label provided on the Rear Side for terminal numbers. The rear panel electrical wiring connection diagram is shown in Figure10.1 below.

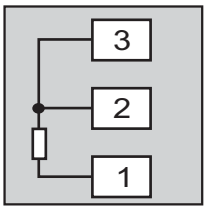
Figure 10.1



DESCRIPTIONS

INPUT-1 : RTD Pt100, 3-Wire (Terminals 1, 2 and 3)

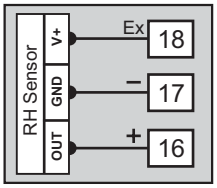
Figure 10.2 (a)



The indicator accepts 3-wire RTD Pt100 as input for measuring Dry Bulb Temperature Value. Connect single leaded end of RTD bulb to terminal 1 and the double leaded ends to terminal 2 and 3 (interchangeable) as shown in Figure 10.2 (a). Use copper conductor leads of very low resistance for RTD connections. Ensure that all 3 leads are of the same gauge and length. Use single run cables avoiding any intermediate joints.

INPUT-2 : DC Linear Voltage (Terminals 16,17 & 18)

Figure 10.2 (b)

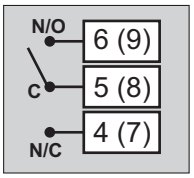


Connect Signal (OUT), Common (GND) and Supply (V+) cables from RH Sensor to terminals 16, 17 & 18, respectively as shown in Figure 10.2 (b). Terminal 18 provides +5Vdc @ 20mA excitation supply for the Sensor. Use copper conductor leads of very low resistance for connections. Use single run cables avoiding any intermediate joints.

OUTPUT-1 (ALARM-1) & OUTPUT-2 (ALARM-2)

The Output-1 and Output-2 (if fitted) can be configured as either Relay or SSR Drive Output. The configuration is through hardware jumper settings as described in *Section 8: Hardware Assembly & Configurations.* The terminals for Relay or SSR Drive are as shown in Figure 10.3 (a) & 10.3 (b), respectively. The numbers in brackets indicates the terminal numbers for Output-2 and those outside brackets indicates the terminal numbers for Output-1.

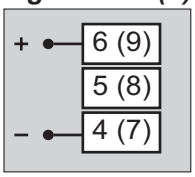
Figure 10.3 (a)



Relay

Potential-free Relay changeover contacts N/O (Normally Open) and C (Common) rated 2A/240 VAC (resistive load) are provided as Relay output. Use external auxiliary device like contactor with appropriate contact rating for driving the actual load.

Figure 10.3 (b)

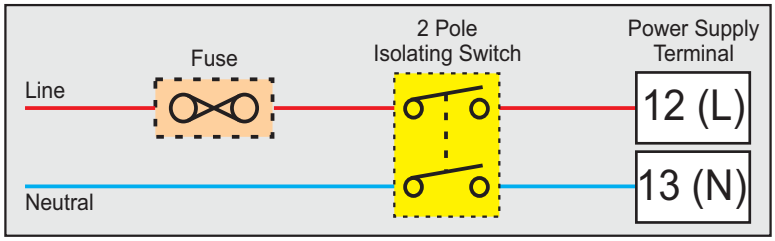


Drive for SSR

DC Voltage level is generated for switching the external SSR (Solid State Relay) which in turn switches the load. Connect (+) and (-) terminals of SSR to indicator terminals 6 and 4, respectively. Use Zero-Crossover, 3 to 30 VDC operated SSR.

POWER SUPPLY

Figure 10.4

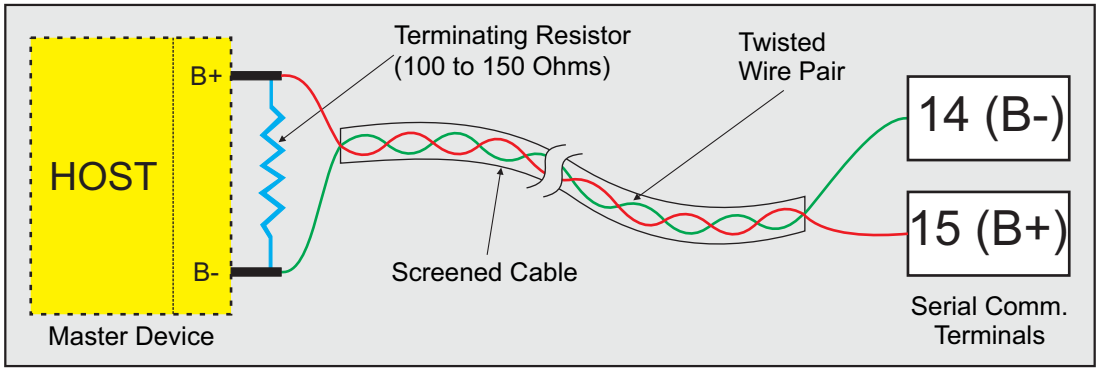


The indicator is supplied with power connections suited for 85 to 264 VAC line supply. Use well-insulated copper conductor wire of the size not smaller than 0.5mm^2 for power supply connections. Connect Line (Phase) supply line to terminal 12 and the Neutral (Return) supply line to terminal 13 as shown in Figure 10.4 above. The indicators is not provided with fuse and power switch. If necessary, mount them separately. Use a time lag fuse rated 1A @ 240 VAC.

SERIAL COMMUNICATION PORT

Connect terminal 15 and 14 of the indicator to (+) and (-) terminals of the Master device for RS485 port. For RS232 port connect terminal 15 to TXD (Transmit), Terminal 14 to RXD (Receive) and Terminal 10 to GND (Ground). To ensure reliable operation of the Serial Communication Link (without data corruption due to line noise or reflections), use a pair of twisted wires inside screened cable with the terminating resistor (100 to 150 Ohms) at one end, as shown in Figure 10.5 below.

Figure 10.5

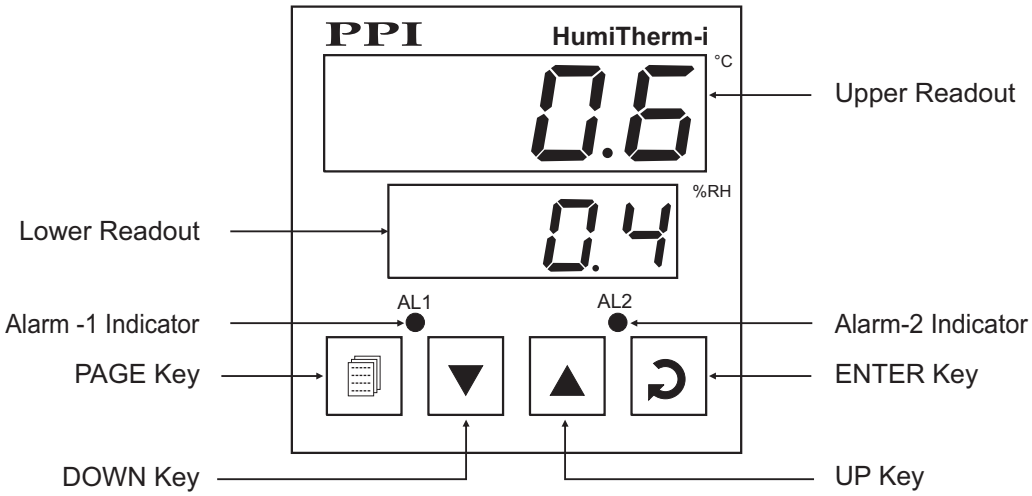


HumiTherm-i Temp+RH

Section 1
FRONT PANEL LAYOUT

The indicator front panel comprises of digital readouts, LED indicators and membrane keys as shown in Figure 1.1 below.

Figure 1.1



READOUTS

The Upper Readout is a 4 digit, 7-segment bright red LED display and usually displays the Temperature Value in °C or °F (depending upon the Unit selected). In Program Mode, the Upper Readout displays parameter values.

The Lower Readout is a 4 digit, 7-segment bright green LED display and usually displays Relative Humidity (RH) Value in %. In Program Mode, the Lower Readout displays prompts for the parameters.

The indications on the Upper and Lower Readouts, in general, depend on the mode of operation and parameter configuration. Refer respective sections for more details.

INDICATORS

There are two front panel red LED indicators. The Table 1.1 below lists each LED indicator (identified by the front panel legend) and the associated status it indicates.

Table 1.1

Indicator	Function
AL1	Flashes while the Alarm for Temperature Loop is active.
AL2	Flashes while the Alarm for RH Loop is active.

KEYS

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

The Table 1.2 below lists each key (identified by the front panel symbol) and the associated function.

Table 1.2

Symbol	Key	Function
	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 on the PAGE.

Section 2
BASIC OPERATIONS

POWER-UP

Upon power-up, all displays and indicators are lit on for approximately 3 seconds. This is followed by the indication of the indicator model name HUm. On the Upper Readout and the firmware version v0.12 on the Lower Readout, for approximately 1 second.

MAIN DISPLAY MODE

After the Power-up display sequence, the Upper and Lower Readout starts showing the measured Temperature Value in °C or °F and the Relative Humidity in %RH, respectively. This is called the MAIN Display Mode and this is the one that shall be used most often.

PV ERROR INDICATIONS

The indicator flashes the PV error messages for Temperature and RH Values on Upper and Lower Readout, respectively.

Error Indication for Temperature Value

In case of Temperature Value exceeding the specified Minimum or Maximum Range or in case of input sensor (RTD Pt100) open / broken; the Upper Readout flashes the Error Messages as listed in Table 2.1 below.

Table 2.1

Message	Error Type	Cause
Or	Over-range	Dry Bulb Temperature above Max. Range
Ur	Under-range	Dry Bulb Temperature below Min. Range
OPEn	Sensor Open	Dry Bulb Sensor (RTD) Broken / Open

Note:

For 3-wire RTD sensor input, if the compensating lead (connected at rear panel terminal number 3) is not connected or gets open, the indicator does not indicate PV error but the measured value is not compensated for the lead resistance.

Error Indication for Relative Humidity (RH) Value

The RH Sensor / Transducer output is either DC Voltage (e.g. 0 - 5 V, 1 - 3.3 V, etc.) or DC Current (e.g. 4 - 20 mA). Thus, an open or broken sensor means either 0 V or 0 mA output. In this case the indicator reads the %RH that corresponds to this signal output. For example, consider 0-5V signal scaled to display 0.0 to 100.0 %RH. The Upper Readout then shows approximately 0.0 %RH (corresponding to 0 V) upon sensor open / broken.

OPERATOR PAGE AND PARAMETERS

The indicator provides a separate page, called *Operator Page,* for the purpose of viewing and / or resetting the stored Min. / Max. values for Dry-Bulb Temperature and %RH. The parameters on this page are available only if the Min. / Max. feature is Enabled in Page -13 parameter list.

Accessing Operator Page

Step through the following sequence to open the operator page and to adjust the operator parameter values.

1. Press and release PAGE key. The Lower Readout shows PAGE (PAGE) and Upper Readout shows 0 (0).

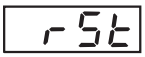
2. Press ENTER key. The Lower Readout shows prompt for the first available operator parameter and the Upper Readout shows value for the parameter.

3. Use UP / DOWN keys to adjust the value and then press ENTER key to store the set value and scroll to next parameter.

The indicator automatically reverts to MAIN Display Mode upon scrolling through the last operator parameter. Alternatively, use PAGE key to return to MAIN Display Mode.

The operator parameters are described in Table 2.2. Note that the parameters are presented only if 'Min / Max Monitoring' feature is enabled.

Table 2.2.

Parameter Description	Settings (Default Value)
MAXIMUM DRY BULB TEMPERATURE VALUE  This parameter indicates the Maximum value attained by the Dry-Bulb Temperature. This is a read only value and is available only if Min. /Max. monitoring is enabled.	View Only
MINIMUM DRY BULB TEMPERATURE VALUE  This parameter indicates the Minimum value attained by the Dry-Bulb Temperature. This is a read only value and is available only if Min. /Max. monitoring is enabled.	View Only
MAXIMUM %RH VALUE  This parameter indicates the Maximum value attained by the Relative Humidity. This is a read only value and is available only if Min. /Max. monitoring is enabled.	View Only
MINIMUM PEAK OF RH  This parameter indicates the Minimum value attained by the Relative Humidity. This is a read only value and is available only if Min. /Max. monitoring is enabled.	View Only
RESET COMMAND  Available only if Min./Max. monitoring is enabled. This feature clears the current Min./Max. values and starts afresh monitoring the Process Values for new Min & Max.	 No  Yes (Default : No)
RESET PASS - CODE  For Resetting the Min. / Max. values, set the reset command to 'Yes' and then set this parameter value to the Pass - Code value stored at Supervisory level on Page-13.	0 to 250 (Default : 0)

Section 3
SET-UP MODE : ACCESS AND OPERATION

The various parameters are arranged in different groups, called PAGES, depending upon the functions they represent. Each group is assigned a unique numeric value, called PAGE NUMBER, for its access.

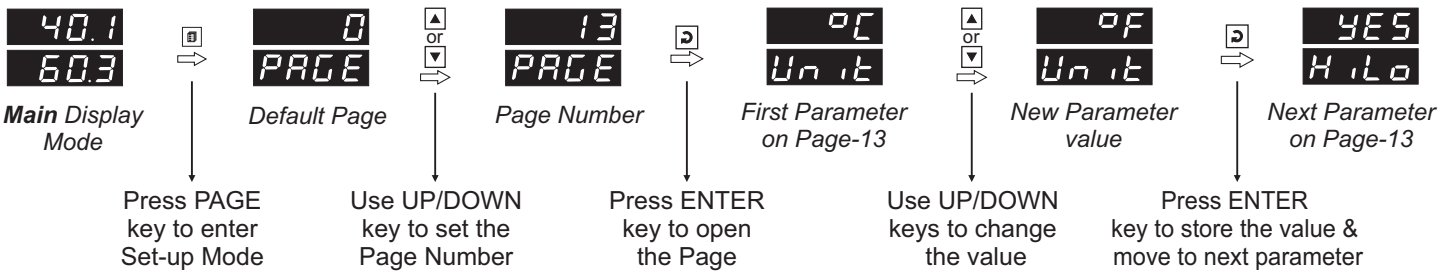
The parameters are always presented in a fixed format: The Lower Readout displays the parameter prompt (Identification Name) and the Upper Readout displays the set value. The parameters appear in the same sequence as listed in their respective sections.

SET-UP MODE
The Set-up Mode allows the user to view and modify the parameter values. Follow the steps below for setting the parameter values:

1. Press and release PAGE key. The Lower Readout shows PAGE and the Upper Readout shows page number 0. Refer Figure 3.1.
2. Use UP / DOWN keys to set the desired PAGE NUMBER.
3. Press and release ENTER key. The Lower Readout shows the prompt for the first parameter listed in the set PAGE and the Upper Readout shows its current value. If the entered PAGE NUMBER is invalid (contains no parameter list or any associated function), the indicator reverts to the MAIN Display Mode.
4. Press and release the ENTER key until the prompt for the required parameter appears on the Lower Readout. (The last parameter in the list rolls back to the first parameter).
5. Use UP / DOWN keys to adjust the parameter value. (The display flashes if UP key is pressed after reaching the maximum value or DOWN key is pressed after reaching the minimum value).
6. Press and release the ENTER key. The new value gets stored in the indicator's non-volatile memory and the next parameter in the list is displayed.

The Figure 3.1 illustrates the example of altering the value for the parameter 'Units'.

Figure 3.1



Notes

1. *Each page contains a fixed list of parameters that are presented in a pre-determined sequence. Note however that availability of a few parameters, called Conditional Parameters, depend upon the settings for some other parameters. For example, the parameter 'Control Hysteresis' for Output-1 is available only if, the set value for the parameter 'Control Action' is 'On-Off'.*
2. *To exit the set-up mode and return to the MAIN Display Mode, press and release PAGE key.*
3. *If no key is pressed for approximately 30 seconds, the set-up mode times out and reverts to the MAIN Display Mode.*

MASTER LOCKING

The indicator facilitates locking all the PAGES (except Operator PAGE) by applying Master Lock Code. Under Locking, the parameters are available for *view only* and cannot be adjusted. The Master Lock, however does not lock the operator parameters. This feature allows protecting the rather less frequently used parameters against any inadvertent changes while making the frequently used operator parameters still available for any editing.

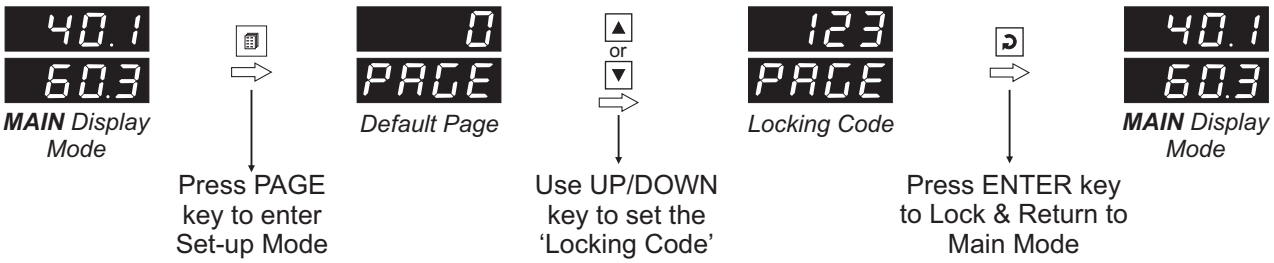
For enabling / disabling the Lock, step through the following sequence:

Locking

1. Press and release PAGE key while the indicator is in the MAIN Display Mode. The Lower Readout shows PAGE and the Upper Readout shows 0.
2. Use UP / DOWN keys to set the Page Number to 123 on the Upper Readout.
3. Press and release ENTER key. The indicator returns to the MAIN Display Mode with the Lock enabled.

The Figure 3.2 below illustrates the Locking procedure.

Figure 3.2



UnLocking

Repeat the Locking procedure twice for unlocking.

Section 4
ALARM PARAMETERS FOR TEMPERATURE

*visit **www.ppindia.net** for technical notes on ALARM for detailed understanding of the parameters / terminologies used for describing the Alarm parameters in this section.*

The Alarm Parameters for Temperature Loop are grouped on PAGE-10. Refer Table 4.1 for parameter description and settings.

Table 4.1

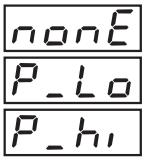
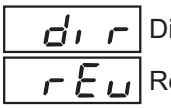
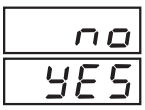
Parameter Description	Settings (Default Value)
TEMPERATURE ALARM TYPE tYPE *None* Disable the Alarm . *Process Low* The Alarm activates when the Temperature Value equals or falls below the 'Alarm Setpoint' value. *Process High* The Alarm activates when the Temperature Value equals or exceeds the 'Alarm Setpoint' value.	nonE None P_Lo Process Low P_hi Process High (Default : None)
TEMPERATURE ALARM SETPOINT AL.SP This parameter sets the Process High or Process Low limit for Alarm.	-50.0 to 150.0°C or -58.0 to 302.0°F (Default : For Process Low : -50.0 For Process High : 150.0)
TEMPERATURE ALARM HYSTERESIS AL.HY This parameter sets a differential (dead) band between the ON and OFF Alarm states. Keep it large enough to avoid frequent switching of the Alarm relay.	0.1 to 25.0 °C or °F (Default : 0.2)
TEMPERATURE ALARM LOGIC AL.LG Select 'Normal' if Alarm output is to activate an Audio / Visual alarm. Select 'Reverse' if Alarm output is to Trip the system.	dir Direct rEv Reverse (Default : Direct)
TEMPERATURE ALARM INHIBIT AL.inh *Yes* The Alarm activation is suppressed until the Temperature Value is within Alarm limits from the time the indicator is switched ON. This allows suppressing the Alarm during the start-up Alarm conditions. *No* The Alarm is not suppressed during the start-up Alarm conditions.	no No YES Yes (Default : Yes)

Section 5
ALARM PARAMETERS FOR RELATIVE HUMIDITY

Visit www.ppiindia.net for technical notes on ALARM for detailed understanding of the parameters / terminologies used for describing the Alarm parameters in this section.

The Alarm Parameters for %RH Loop are grouped on PAGE-11. Refer Table 5.1 for parameters description and settings.

Table 5.1

Parameter Description	Settings (Default Value)
%RH ALARM TYPE  *None* Disable the Alarm . *Process Low* The Alarm activates when the %RH Value equals or falls below the 'Alarm Setpoint' value. *Process High* The Alarm activates when the %RH Value equals or exceeds the 'Alarm Setpoint' value.	 None Process Low Process High (Default : None)
%RH ALARM SETPOINT  This parameter sets the Process High or Process Low limit for Alarm.	0.0 to 100.0% (Default : For Process Low : 0.0 For Process High : 100.0)
%RH ALARM HYSTERESIS  This parameter value sets a differential (dead) band between the ON and OFF Alarm states. Keep it large enough to avoid frequent switching of the Alarm relay.	0.1 to 25.0% (Default : 0.2)
%RH ALARM LOGIC  Select 'Normal' if Alarm output is to activate an Audio / Visual alarm. Select 'Reverse' if Alarm output is to Trip the system.	 Direct Reverse (Default : Direct)
%RH ALARM INHIBIT  *Yes* The Alarm activation is suppressed until the %RH Value is within Alarm limits from the time the indicator is switched ON. This allows suppressing the Alarm during the start-up Alarm conditions. *No* The Alarm is not suppressed during the start-up Alarm conditions.	 No Yes (Default : Yes)

Section 6
ZERO-OFFSET PARAMETERS

The Zero-Offset Parameters are grouped on PAGE-12 and allow the user to set the Zero-Offset for Temperature and the Relative Humidity (RH) values. Refer Table 6.1 for parameter description and settings.

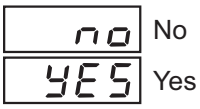
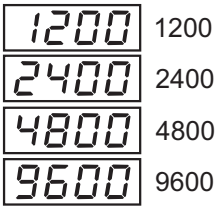
Table 6.1

Parameter Description	Settings (Default Value)
ZERO OFFSET FOR TEMP. VALUE  This value is algebraically added to the measured temperature value to derive the final PV that is displayed and compared for Alarm. Final PV = Measured PV + Offset	-25.0 to +25.0°C (Default : 0.0)
ZERO OFFSET FOR %RH VALUE  This value is algebraically added to the measured %RH value to derive the final PV that is displayed and compared for Alarm. Final PV = Measured PV + Offset	-25.0 to +25.0% (Default : 0.0)

Section 7
SUPERVISORY PARAMETERS

The Supervisory Parameters are grouped on PAGE-13. These parameters allow Unit Selection for Temperature Value, Enabling/Disabling Min/Max monitoring and settings for Serial Communication. Refer Table 7.1 for parameter description and settings.

Table 7.1

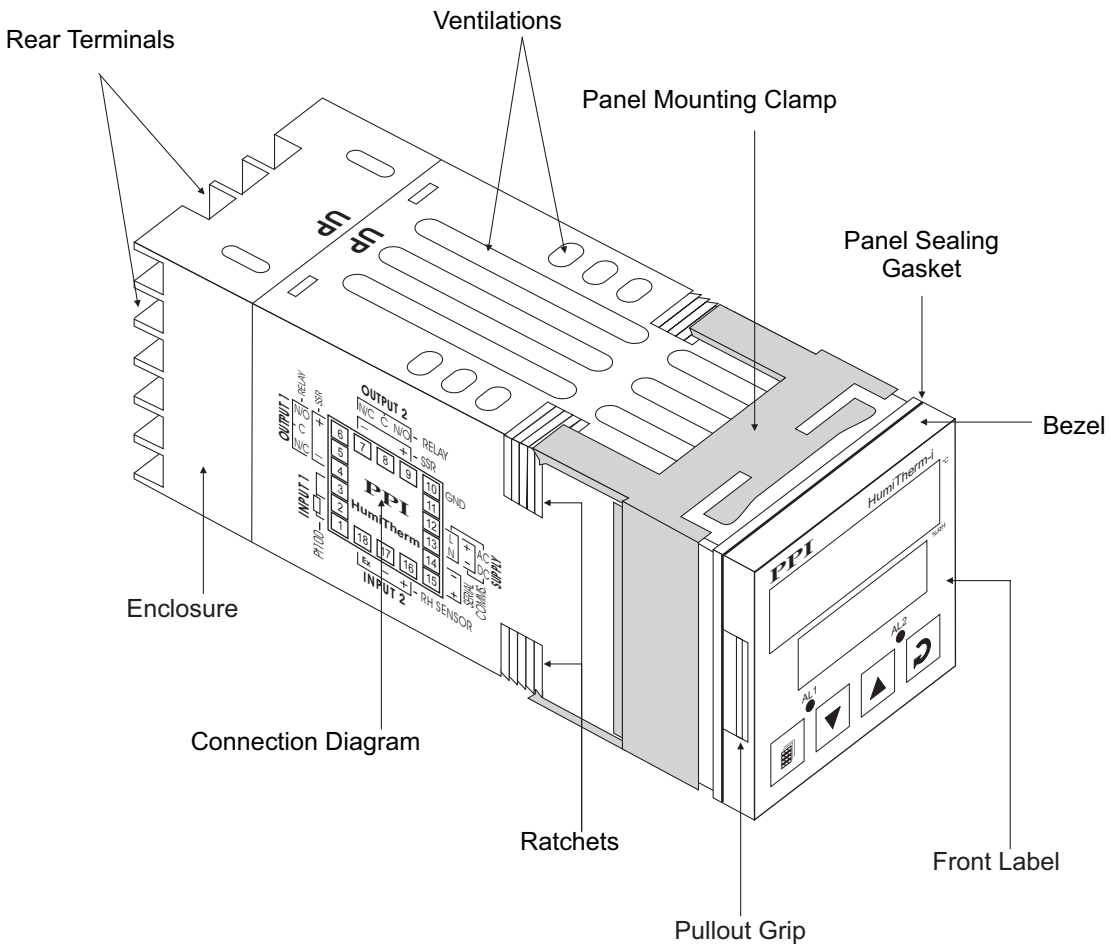
Parameter Description	Settings (Default Value)
UNIT SELECTION FOR TEMPERATURE  Select Temperature Units in °C or °F.	 (Default : °C)
DRY-BULB TEMPERATURE AND % RH MIN / MAX MONITORING  Set this parameter value to 'Yes' for enabling the Dry-Bulb Temperature and % RH monitoring for Min/Max values.	 (Default : No)
PASSWORD FOR RESETTING PV HIGH - LOW  This parameter allows protection against inadvertent resetting of Min/Max values. That is, the reset command is executed only if the operator sets the password that matches with this parameter value.	0 to 250 (Default : 0)
BAUD RATE  Communication speed in 'Bits per Second'. Set the value to match with the host baud rate.	 (Default : 4800)
ID NUMBER FOR TEMPERATURE LOOP  Unique numeric code assigned to the indicator for identification by the host to read or write Temperature Loop parameters.	1 to 8 (Default : 1)
ID NUMBER FOR RH LOOP  Unique numeric code assigned to the indicator for identification by the host to read or write %RH Loop parameters.	1 to 8 (Default : 2)

Section 8
HARDWARE ASSEMBLY & CONFIGURATIONS

The Figure 8.1 below shows the indicator outer-case when viewed with indicator front label upright. The indicator outer case is a rigid plastic enclosure into which the electronics assembly fits. The enclosure in turn fits into the standard DIN size panel cutout, as described in *Section 9 : Mechanical Installation*.

Notice the nomenclatures used to identify the various parts as the same are used throughout the sections describing installation, configuration and electrical connections.

Figure 8.1



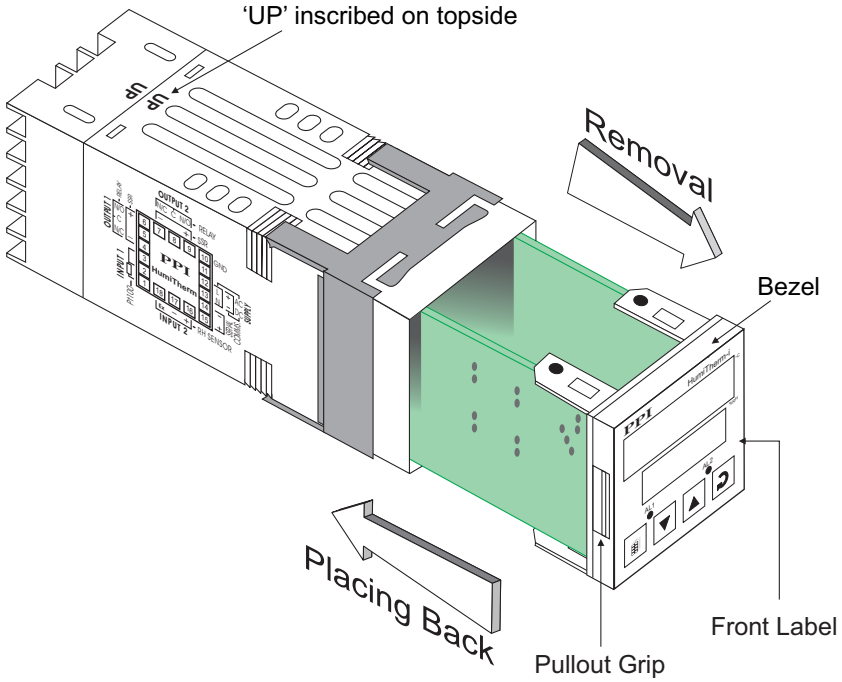
ELECTRONIC ASSEMBLY

The electronic assembly can be removed from the plastic enclosure and placed back as described below and illustrated in Figure 8.2

Removal

1. Hold the indicator with its front label upright.
2. Hold the Bezel with the fingers on the pullout grips provided on the left and right sides of the bezel. Pull the bezel outward. The assembly comes out with the bezel.

Figure 8.2

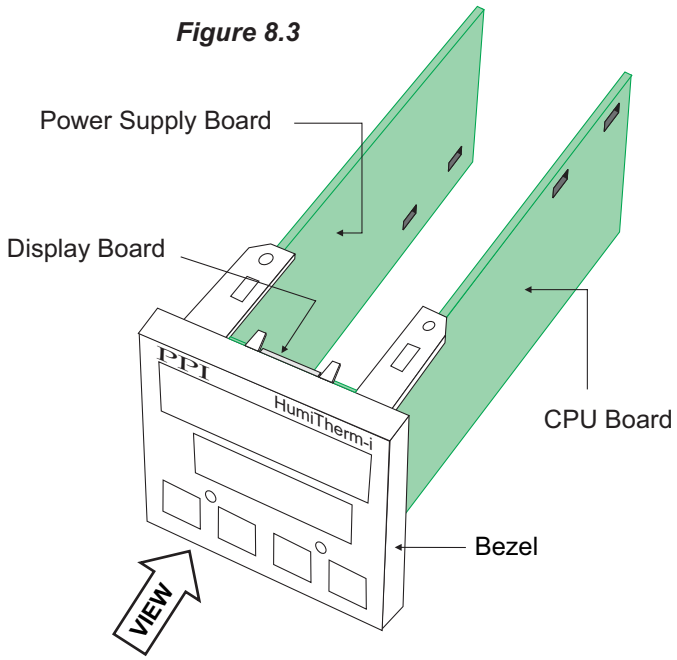


Placing Back

1. Hold the bezel with the front label upright.
2. Hold the enclosure such that the UP inscribed on the enclosure is on the topside. Insert the bezel gently with the boards on either side sliding into the guides provided inside of the enclosure.
3. Ensure that the bezel fits in tight on the enclosure-front to secure the panel-sealing gasket.

The Figure 8.3 below shows the basic electronics assembly of the indicator (without any plug-in modules). The basic electronics assembly of the indicator comprises of 3 Printed Circuit Boards. As shown in the figure, when viewed from the front, the CPU board is to the right, Power-supply board is to the left and the Display board is behind the bezel.

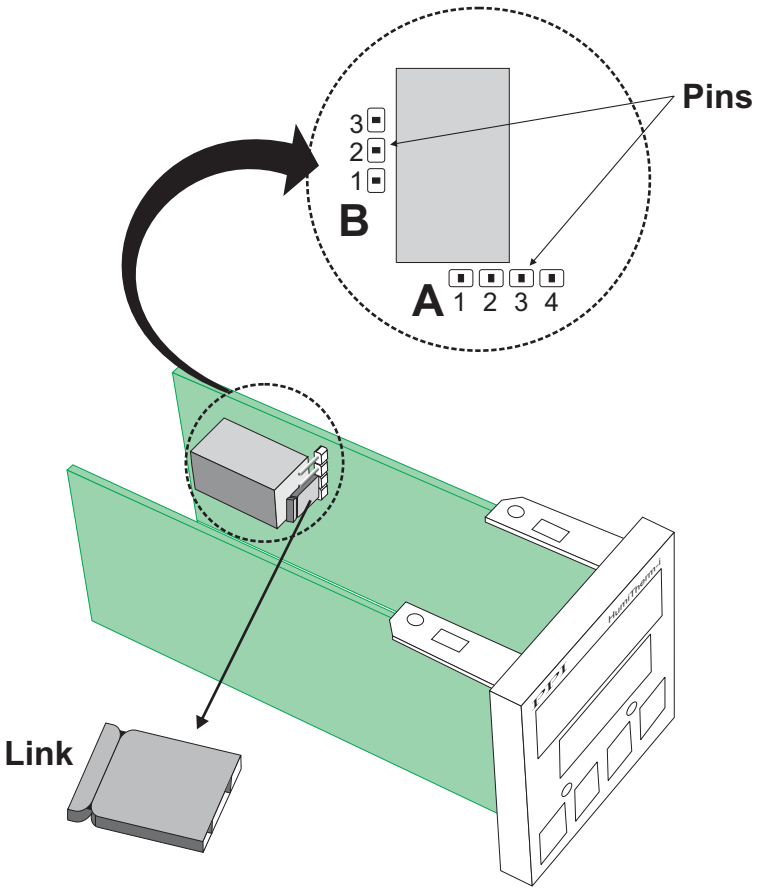
Figure 8.3



JUMPER SETTINGS FOR OUTPUT-1 (ALARM-1)

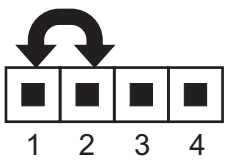
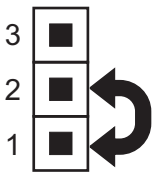
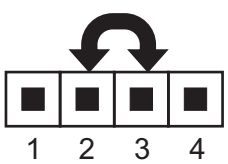
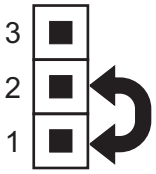
The Output-1 is user configurable for Relay or SSR voltage pulses. The selection requires proper jumper-settings prior to electrical connections.

Figure 8.4



The jumper settings are provided in the form of Pins & Link arrangement on the CPU board towards the rear end. Notice that, there are two such arrangements; one of 4 -Pins marked A and the other of 3-Pins marked B in the Figure 8.4. Two Links are provided, one each for A and B. Place the links to short two adjoining Pins as shown in Table 8.1 below for proper configuration.

Table 8.1

Output Type	Jumper Setting - A	Jumper Setting - B
Relay		
SSR Voltage Pulses		

The double-headed arrows, in Table 8.1, show the positions of the adjoining Pins that require shorting using the Link. The wiring connections must also be made in accordance with the selected output type (NO, C) for Relay; Positive (+) & Negative (-) for SSR.

MOUNTING PLUG-IN MODULES

The indicator supports Input-2 (DC Linear Voltage) module which is mandatary for measuring Relative Humidity (RH) Value and 2 optional plug-in modules, viz. Output-2 (Relay/SSR) module and Serial Communication module. These modules are either pre-fitted while the indicator is shipped from the factory or can be fitted by the user if ordered separately. Both the optional modules have female connector (socket) mounted on them, which fit into the respective male connector (plug) provided on Power-supply board

Output-2 Module (Alarm-2)

The Output-2 module provides, jumper selectable, Relay or SSR output. The Figure 8.5 below shows the output module and the jumper arrangement.

As shown in above Figure, there are 2 jumper arrangements marked A and B. The selection between Relay and SSR requires both these jumpers A and B to be set appropriately as shown in Table 8.2. The double headed arrows show the adjoining Pins that require shorting using the Link.

Figure 8.5

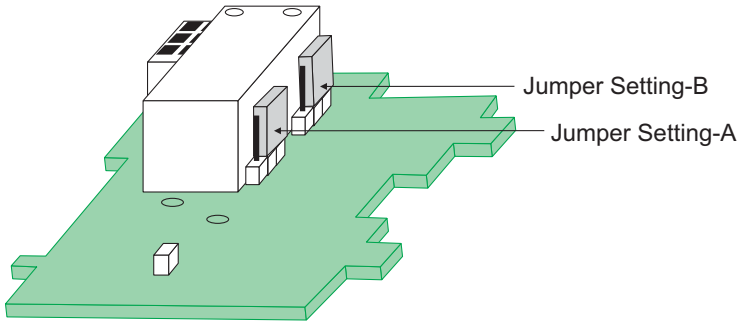
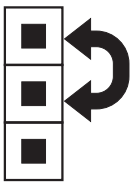
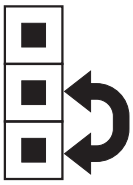
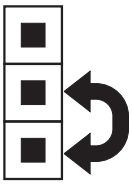


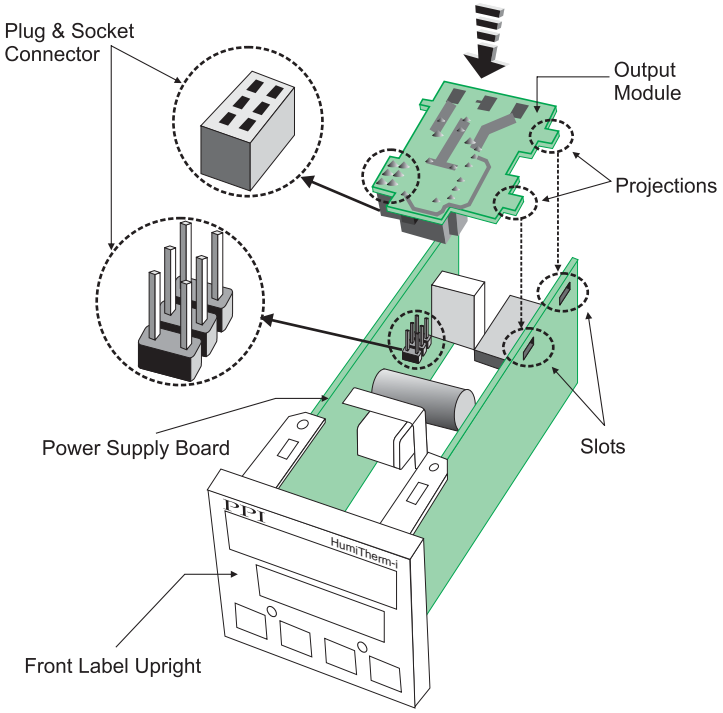
Table 8.2

Output Type	Jumper Setting - A	Jumper Setting - B
Relay (Arrangement shown in Figure 8.4)		
SSR Voltage Pulses		

The Figures 8.6 below illustrates how to mount the plug-in Output-2 module. Notice the orientation of the indicator and a few identifying components shown in figure to help locate the plugs for the modules. Ensure that the socket snap-fits into the plug and the 2 Projections of the module board fit into the 2 Slots provided on the Power-supply board for proper electrical contacts and secured fitting.

Figure 8.6

Mounting Output-2 Module



For plugging out the module(s), follow the steps below:

1. Gently pull apart the Power-supply board and the CPU board until the projections of the module board come out of the slots.

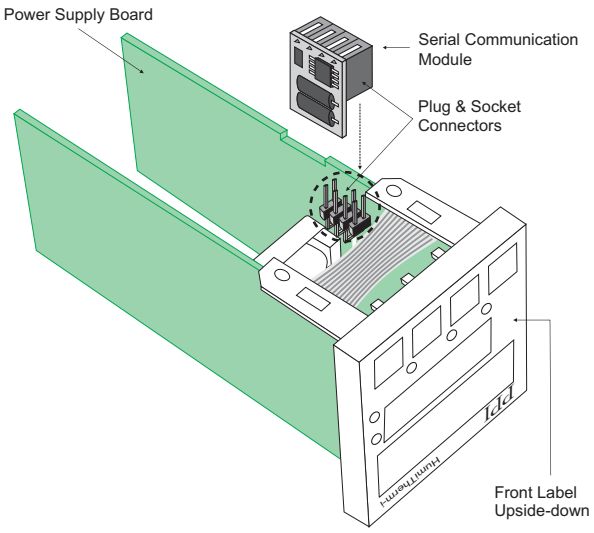
2. Pull the module outward to unlock the socket from the plug.

Serial Communication Module

The plug for the Serial Communication module is located on the Power-supply board. The Figure 8.7 below illustrates how to plug-in the Serial Communication module. To plug (or unplug) the module simply insert (or remove) the socket into (or from) the plug.

Figure 8.7

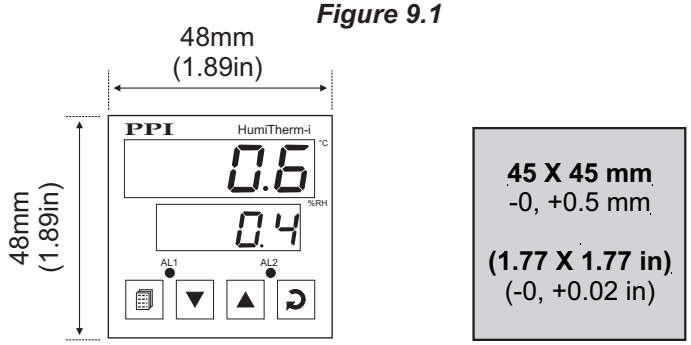
Mounting Serial Communication Module



Section 9
MECHANICAL INSTALLATION

The Figure 9.1 shows the indicator front outer dimensions and the panel cutout requirements.

Figure 9.1



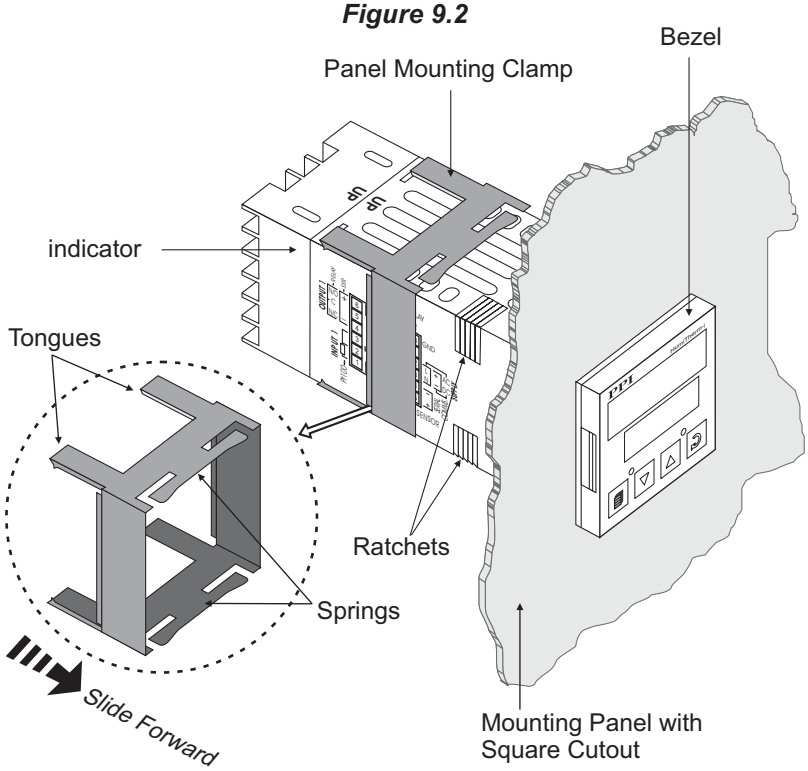
Front View **Panel Cutout**

PANEL MOUNTING

Follow the steps below for mounting the indicator on panel:

1. Prepare a square cutout to the size shown in Figure 9.1.
2. Remove the Panel Mounting Clamp from the indicator enclosure and insert the rear of the indicator housing through the panel cutout from the front of the mounting panel.
3. Hold the indicator gently against the mounting panel such that it positions squarely against the panel wall, see Figure 9.2. Apply pressure only on the bezel and not on the front label.
4. Slide the mounting clamp forward until it is firmly in contact with the rear face of the mounting panel and the tongues of the clamp engage in the ratchets on the indicator enclosure, as shown in Figure 9.2. Ensure that the springs of the clamp push firmly against the rear face of the mounting panel for secured mounting.

Figure 9.2



Section 10
ELECTRICAL CONNECTIONS

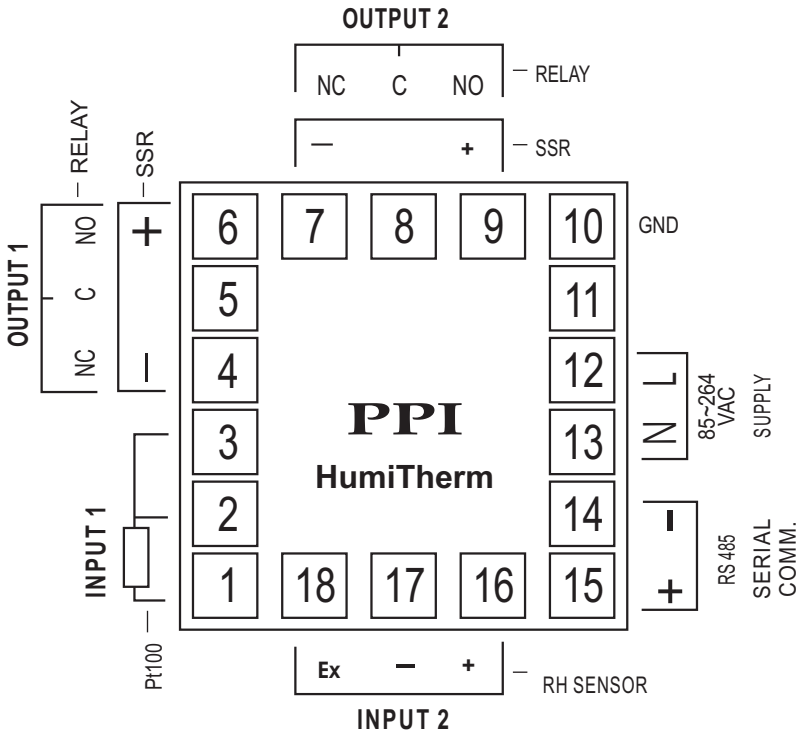
WARNING
MISHANDLING / NEGLIGENCE CAN RESULT IN PERSONAL DEATH OR SERIOUS INJURY.

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 indicator.
3. Run power supply cables separated from the low-level signal cables (like RTD, DC Linear (Voltage) signals, 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 indicator 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 indicator supply is switched-off while making/removing any connections or removing the indicator from its enclosure.

CONNECTION DIAGRAM

The Electrical Connection Diagram is shown on the left side of the indicator enclosure. The diagram shows the terminals viewed from the REAR SIDE with the indicator label upright. Refer the label provided on the Rear Side for terminal numbers. The rear panel electrical wiring connection diagram is shown in Figure10.1 below.

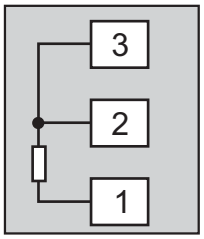
Figure 10.1



DESCRIPTIONS

INPUT-1 : RTD Pt100, 3-Wire (Terminals 1, 2 and 3)

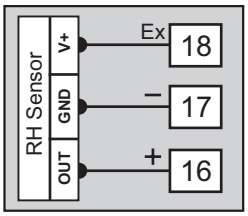
Figure 10.2 (a)



The indicator accepts 3-wire RTD Pt100 as input for measuring Dry Bulb Temperature Value. Connect single leaded end of RTD bulb to terminal 1 and the double leaded ends to terminal 2 and 3 (interchangeable) as shown in Figure 10.2 (a). Use copper conductor leads of very low resistance for RTD connections. Ensure that all 3 leads are of the same gauge and length. Use single run cables avoiding any intermediate joints.

INPUT-2 : DC Linear Voltage (Terminals 16,17 & 18)

Figure 10.2 (b)

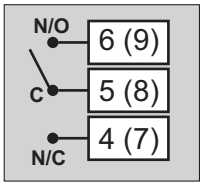


Connect Signal (OUT), Common (GND) and Supply (V+) cables from RH Sensor to terminals 16, 17 & 18, respectively as shown in Figure 10.2 (b). Terminal 18 provides +5Vdc @ 20mA excitation supply for the Sensor. Use copper conductor leads of very low resistance for connections. Use single run cables avoiding any intermediate joints.

OUTPUT-1 (ALARM-1) & OUTPUT-2 (ALARM-2)

The Output-1 and Output-2 (if fitted) can be configured as either Relay or SSR Drive Output. The configuration is through hardware jumper settings as described in *Section 8: Hardware Assembly & Configurations.* The terminals for Relay or SSR Drive are as shown in Figure 10.3 (a) & 10.3 (b), respectively. The numbers in brackets indicates the terminal numbers for Output-2 and those outside brackets indicates the terminal numbers for Output-1.

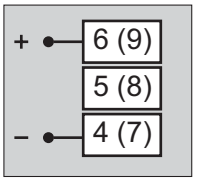
Figure 10.3 (a)



Relay

Potential-free Relay changeover contacts N/O (Normally Open) and C (Common) rated 2A/240 VAC (resistive load) are provided as Relay output. Use external auxiliary device like contactor with appropriate contact rating for driving the actual load.

Figure 10.3 (b)

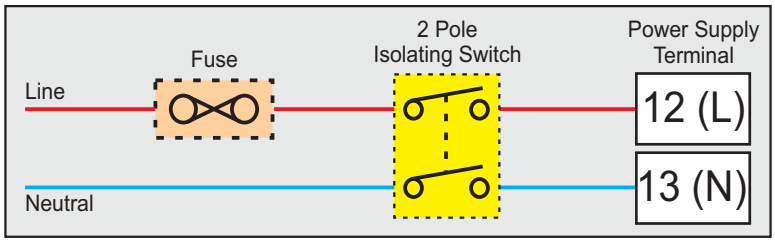


Drive for SSR

DC Voltage level is generated for switching the external SSR (Solid State Relay) which in turn switches the load. Connect (+) and (-) terminals of SSR to indicator terminals 6 and 4, respectively. Use Zero-Crossover, 3 to 30 VDC operated SSR.

POWER SUPPLY

Figure 10.4

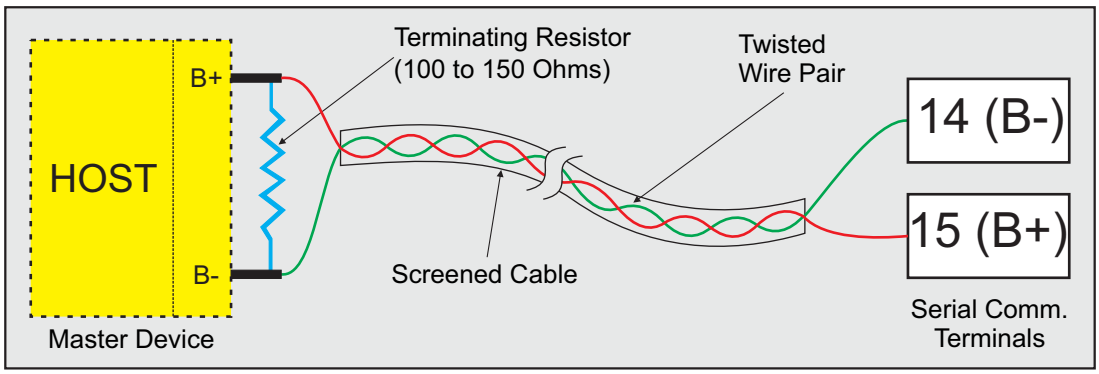


The indicator is supplied with power connections suited for 85 to 264 VAC line supply. Use well-insulated copper conductor wire of the size not smaller than 0.5mm^2 for power supply connections. Connect Line (Phase) supply line to terminal 12 and the Neutral (Return) supply line to terminal 13 as shown in Figure 10.4 above. The indicators is not provided with fuse and power switch. If necessary, mount them separately. Use a time lag fuse rated 1A @ 240 VAC.

SERIAL COMMUNICATION PORT

Connect terminal 15 and 14 of the indicator to (+) and (-) terminals of the Master device for RS485 port. For RS232 port connect terminal 15 to TXD (Transmit), Terminal 14 to RXD (Receive) and Terminal 10 to GND (Ground). To ensure reliable operation of the Serial Communication Link (without data corruption due to line noise or reflections), use a pair of twisted wires inside screened cable with the terminating resistor (100 to 150 Ohms) at one end, as shown in Figure 10.5 below.

Figure 10.5



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