

**Introduction**

The RH/T transmitter incorporates two sensors in one attractive wall mount enclosure for the most efficient environmental monitoring and control system. It uses a field-proven RH sensor to monitor relative humidity over 0-100 %RH and a curve-matched thermistor to measure temperature over common field-selectable ranges. Two setpoint controls are also available for temperature and RH adjustment. The device may also include an occupancy override button and an external communication jack. Both measurements and setpoint signals are continuously available on separate outputs as linear 4-20 mA, 0-5 or 0-10 Vdc signals. Several configurations of the device are available with one to four outputs as required. An LCD is included for configuration and local indication of all parameters. Several operating parameters can be programmed using a keypad for specific applications including four temperature ranges and C/F display.

**Before Installation**

Read these instructions carefully before installing and commissioning the transmitter. Failure to follow these instructions may result in product damage. Do not use in an explosive or hazardous environment, with combustible or flammable gases, as a safety or emergency stop device or in any other application where failure of the product could result in personal injury. Take electrostatic discharge precautions during installation and do not exceed the device ratings.

**Mounting**

Install directly on a standard electrical box about five feet from the floor of the area to be controlled. Do not mount the sensor near doors, opening windows, supply air diffusers or other known air disturbances. Remove the enclosure cover by snapping the bottom edge loose and then unhook the cover from the base at the top edge. Route any wires through the back of the enclosure base and then through the wiring hole in the circuit board. To prevent erroneous readings due to the air temperature within the wall cavity, seal the conduit leading to the junction box. Use the two slotted mounting holes to install the base onto the electrical box or directly onto a flat wall surface with two screws but do not over-tighten. The enclosure has a multifunction base that has provisions for mounting on many standard electrical boxes. Carefully remove the pcb first to use another mounting configuration and ensure that the screw heads do not come in contact with the pcb or components. After installation the cover should be locked on by using the setscrew (1/16" or 1.5mm) located at the bottom of the enclosure.

**Wiring**

Use 22 AWG shielded wiring for all connections and do not locate the device wires in the same conduit with wiring used to supply inductive loads such as motors. Connect the cable shield to ground at the controller only. **Disconnect the power supply before making any connections to prevent electrical shock or equipment damage.** Make all connections in accordance with national and local codes.

This is a sourcing device and requires from 4 to 10 wires to implement all the features. Connect the plus dc or the ac voltage hot side to the **POWER** terminal. The power supply common is connected to the **COMMON** terminal. The device is reverse voltage protected and will not operate if connected backwards. It has a half-wave power supply so the supply common is the same as the signal common. Several devices may be connected to one power supply and the output signals all share the same common. Use caution when grounding the secondary of a transformer or when wiring multiple devices to ensure the ground point is the same on all devices and the controller.

The analog outputs are available on the **RH Output**, **TEMP Output**, **TEMP Setpoint** and **RH Setpoint** terminals. These 4-20 mA outputs operate in the Active mode and do not require a loop power supply. This means **the signal current is generated by the transmitter and must not be connected to a powered input or device damage will result.** Check the controller Analog Input to determine the proper connection before applying power. All output signals are referenced to the **COMMON** terminal. The analog output signals are typically connected directly to the Building Automation System and used as control parameters or for logging purposes.

The device is also available with either 0-5 or 0-10 Vdc voltage signal outputs which connect directly to a high impedance analog input. In either case the terminal designations are the same and the signals are referenced to **COMMON**.

The **OVERRIDE** signal is simply a dry contact referenced to the **COMMON** terminal. It is typically connected to a low-voltage digital input on the controller to indicate room occupancy when the button is activated.

The external jack is internally connected to a three-pin terminal block labeled **RING**, **MID** and **TIP** to accept a stereo phono plug for remote communication with the controller.

**Start-up**

Verify that the transmitter is properly wired and connections are tight. Apply power and note that the LCD will begin displaying the RH and temperature levels (if configured for both). The display normally toggles between the two values on a 2 second interval. All the output signals will also be available immediately after start-up.

**LCD Display**

If the device has both RH and temperature signals, then the multi-function display is factory set to display both measurement values at two second intervals. The %RH will be displayed as 0H-100H for two seconds and then the temperature will be displayed as 32F-95F for two seconds. This cycle will repeat constantly.

If the device is only configured for one parameter, RH or T, then only one parameter will be displayed continuously. The Installer Menu can be used to modify the displayed information. For RH and T devices, the installer can select to only display RH or temperature continuously. The device supports four temperature ranges that may also be selected in the menu. The default is 32-95 °F but this may be changed to 0-35 °C and the output signal will stay the same. Also, the temperature range may be changed to 32-122 °F or 0-50 °C and the output signal scaling will change to match the display.

**Outputs (Available outputs depend on the configuration)**

The RH output is scaled such that 4-20 mA (or 0-5 or 0-10 Vdc) equals 0-100 %RH and is temperature compensated over the full 0-50 °C temperature range. The temperature output is scaled such that 4-20 mA (or 0-5 or 0-10 Vdc) equals either 0-35 °C, 32-95 °F, 0-50 °C or 32-122 °F depending on which range is selected in the menu. The factory default range is 32-95 °F.

In addition, there may also be one or two setpoint output signals. These outputs are also 4-20 mA (or 0-5 or 0-10 Vdc). Scaling is determined by parameters set in the Installer Menu. If available, the temperature setpoint signal factory defaults to 72 ± 5 °F. In this case, a setpoint equal to 72 °F would cause an output signal of 12 mA or 50% of the range (4-20 mA). Each step up or down will cause a proportional change in the output to either 20 mA or 4 mA.

The following table shows the changes that would result from -5 to +5 on the setpoint control with a midpoint of 72 °F:

	<b>Setpoint Temperature</b>	<b>4-20 mA Device</b>	<b>0-5 Vdc Device</b>	<b>0-10 Vdc Device</b>
<b>-5</b>	67 °F	4.0 mA	0.0 Vdc	0 Vdc
<b>-4</b>	68 °F	5.6 mA	0.5 Vdc	1 Vdc
<b>-3</b>	69 °F	7.2 mA	1.0 Vdc	2 Vdc
<b>-2</b>	70 °F	8.8 mA	1.5 Vdc	3 Vdc
<b>-1</b>	71 °F	10.4 mA	2.0 Vdc	4 Vdc
<b>Midpoint</b>	72 °F	12.0 mA	2.5 Vdc	5 Vdc
<b>+1</b>	73 °F	13.6 mA	3.0 Vdc	6 Vdc
<b>+2</b>	74 °F	15.2 mA	3.5 Vdc	7 Vdc
<b>+3</b>	75 °F	16.8 mA	4.0 Vdc	8 Vdc
<b>+4</b>	76 °F	18.4 mA	4.5 Vdc	9 Vdc
<b>+5</b>	77 °F	20.0 mA	5.0 Vdc	10 Vdc

The Installer Menu can be used to change both the midpoint and the range. The midpoint may be changed from 63-81 °F or 17-27 °C and the range can be either ± 5 or ± 10 °. The display and output scaling will change to match the selected range.

The RH setpoint operates in a similar manner. The factory default midpoint is 45 %RH and the range is ± 5 %RH to result in a control of 40, 41, 42, 43, 44, 45, 46, 47, 48, 49 and 50 %RH. The output signal is scaled the same as shown above. Again, the midpoint may be change in the Installer Menu from 20-70 %RH and the range can be either ± 5 or ± 10 %RH.

Note that all programmed parameters and the actual setpoint values are saved in non-volatile memory so the device will remember the settings after a power-outage.

**Setpoint Operation (Depends on the hardware configuration)**

The device may either have 0, 1 or 2 setpoint controls. If the device has no setpoint control, then the UP and DOWN buttons will not be available to the user and the device will only display RH or T or both and will only have the corresponding outputs.

If the device has only one setpoint control, either RH or T, then the unit will have two buttons labeled UP and DOWN for setpoint adjustment. During normal operation, the LCD displays either RH or T or both depending on the hardware configuration and program settings. When either the UP or DOWN buttons are pressed the display will change to setpoint mode. This is indicated by a flashing display. The display will show the previous setpoint setting such as 25C or 77F for temperature setpoint or 45H for humidity setpoint. If no other action is taken for 5 seconds then the device will reset to normal operation. While the display is still flashing the setpoint can be modified by pressing the UP or DOWN buttons to increase or decrease the setpoint value. The LCD will update to show the new setpoint and the output signal will update accordingly. When the desired setpoint is shown on the LCD, leave the unit for 5 seconds to reset to normal operation and save the new setting. Note that the setpoint can only be set around the programmed midpoint and within the programmed range, either  $\pm 5$  or  $\pm 10$ , as set in the Installer Menu.

If the device has two setpoint controls, for both RH and T, then the unit will have the UP and DOWN buttons plus an additional button labeled MODE. Operation is the same as described above except the device will show the flashing temperature setpoint first when either UP or DOWN is pressed. The T setpoint may be modified at this time by using the UP or DOWN buttons as before, or the RH setpoint may be accessed by pressing the MODE button and then modified with the UP or DOWN buttons. So to access the RH setpoint, first the T setpoint must be accessed. All changes are saved on exit after 5 seconds.

**Menu Configuration (Menu items depend on the hardware configuration)**

There are two menus that are controlled by three buttons on the circuit board labeled UP, DOWN and MODE.

The **Installer Menu** has several items as shown below and each menu item flashes to indicate the mode. Press and hold the <MODE> key and then press the <DOWN> key for 2 seconds to enter the menu. Release both keys. Then press the <MODE> key a second time to advance to step 2. Each press of the <MODE> key advances the menu item and saves any changes. At the last step, the <MODE> key will exit the menu.

The <UP> and <DOWN> keys are used to make changes to program variables by scrolling through the available options. Installer Menu operation is explained below and the factory default values are shown. Note that items that are not applicable to the hardware configuration are skipped in the menu so the menu may skip from item 4 to item 6 for example.

<MODE> + <DOWN>      Hold keys for 2 seconds to enter the Installer Menu

1.    C/F            1\_F      The temperature scale defaults to Fahrenheit (F). It can be changed to Celsius (C) using <UP>. Press the <MODE> key to save a change and to go to the next item.

<MODE>

2.    Temperature Range    235      Two temperature ranges are available, 0-35 °C (32-95 °F) or 0-50 °C (32-122 °F). This can be changed with <UP> or <DOWN>. Press <MODE> to save and go to the next item.

<MODE>

3.    Display Mode            3\_3      Select parameters displayed on the LCD. 1 = T continuously, 2 = RH continuously and 3 = RH and T alternately every 2 seconds. Change with <UP> or <DOWN> and press <MODE> to save and go to the next item.

<MODE>

4.    Temperature Offset      4\_0      Use <UP> or <DOWN> to add or subtract an offset from the temperature output signal and LCD. Default is 0 but can be changed from -5 to +5 degrees. Use <MODE> to save and advance menu.

<MODE>

- 5. RH Offset      5\_0      Use <UP> or <DOWN> to add or subtract an offset from the RH output signal and LCD. Default is 0 but can be changed from -9 to +9 %RH. Use <MODE> to save and advance the menu.  
<MODE>
  
- 6. T Setpoint Midpoint      672      The default temperature setpoint midpoint is 72 for °F or 22 for °C. This can be changed using <UP> or <DOWN> to 63-81°F or 17-27 °C. Use <MODE> to save and advance the menu.  
<MODE>
  
- 7. T Setpoint Range      7\_5      The default temperature setpoint range is ± 5°. This can be changed using <UP> or <DOWN> to ± 10°. Use <MODE> to save and advance the menu.  
<MODE>
  
- 8. RH Setpoint Midpoint      845      The default RH setpoint midpoint is 45 %RH. This can be changed using <UP> or <DOWN> from 20-70 %RH. Use <MODE> to save and advance the menu.  
<MODE>
  
- 9. RH Setpoint Range      9\_5      The default RH setpoint range is ± 5 %RH. This can be changed using <UP> or <DOWN> to ± 10 %RH. Use <MODE> to save and exit the Installer menu.  
<MODE>      Exits the Installer Menu and returns to normal operation.

The **Calibration Menu** is normally not used except at the factory. It has several items as shown below and each menu item (10-14, Hxx and rES) flashes to indicate the mode. Press and hold the <MODE> key and then press the <UP> key for 5 seconds to enter the menu. Release both keys. Then press the <MODE> key a second time to advance to the next step. Each press of the <MODE> key advances the menu item and saves any changes. At the last step, the <MODE> key will exit the menu.

The <UP> and <DOWN> keys are used to make changes to program variables by scrolling through the available options. Calibration Menu operation is explained below and the factory default values are shown. Note that items that are not applicable to the hardware configuration are skipped in the menu so the menu may skip from item 10 to item 12 for example.

This device is completely calibrated with high precision references and equipment at the factory and it is very unlikely that either the output signals or the RH sensor will require calibration over the lifetime of the product. Other sources of error such as wiring or software scaling should be eliminated before attempting to change the device calibration. If calibration is necessary, follow the instructions in the Calibration section.

In case the calibration is inadvertently changed or performed incorrectly, the rES (Restore Defaults) menu item can be used to change all settings back to the original values as shipped from the factory. This also includes all calibration constants so the device may be completely restored to it's original state.

<MODE> + <UP>      Hold keys for 5 seconds to enter the Calibration Menu

- 10. Configuration Mode      10\_6      This item sets the software function to the hardware available on the pcb and should not be changed. 1=RH+RH Setpoint, 2=T+T Setpoint, 3=RH+T, 4=RH+T+T Setpoint, 5=RH+T+RH Setpoint, 6=RH+T+T Setpoint + RH Setpoint. Use <MODE> to save and advance the menu.  
<MODE>

- 11. Calibrate RH 20mA / 5V      11xx      This item allows calibration of the RH 20 mA or voltage output signal. Use <UP> or <DOWN> to set the RH output to exactly 20.0 mA. Use <MODE> to save and advance the menu.

<MODE>

**12. Calibrate T 20mA / 5V**    **12xx**    This item allows calibration of the temperature 20 mA or voltage output signal. Use <UP> or <DOWN> to set the T output to exactly 20.0 mA. Use <MODE> to save and advance the menu.

<MODE>

**13. Cal RH SP 20mA / 5V**    **13xx**    Allows calibration of the RH Setpoint 20 mA or voltage output signal. Use <UP> or <DOWN> to set the RH Setpoint output to exactly 20.0 mA. Use <MODE> to save and advance the menu

<MODE>

**14. Cal T SP 20mA / 5V**    **14xx**    Allows calibration of the T Setpoint 20 mA or voltage output signal. Use <UP> or <DOWN> to set the T Setpoint output to exactly 20.0 mA. Use <MODE> to save and advance the menu

<MODE>

**15. Calibrate 20 %RH**    **H20**    This item allows calibration of the RH sensor at 20 %RH and 25 °C. Apply a stable 20 %RH environment and press <UP> + <DOWN> to calibrate. Use <MODE> to skip to the next item.

<MODE>

**16. Calibrate 80 %RH**    **H80**    This item allows calibration of the RH sensor at 80 %RH and 25 °C. Apply a stable 80 %RH environment and press <UP> + <DOWN> to calibrate. Use <MODE> to skip to the next item.

<MODE>

**17. Restore Defaults**    **rES**    Press the <UP> and <DOWN> keys at the same time to restore all factory defaults and calibration to the original factory settings.

<MODE>                      Exits the calibration menu and returns to normal operation.

**Calibration**

If necessary, the 4-20 mA or voltage outputs can be calibrated as described previously in the Menu Configuration section by using the keypad and a meter connected to the output.

**Specifications**

**Temperature**            Sensor ..... 10K Ohm Type 7 Curve matched thermistor  
 Accuracy ..... ± 0.2 °C (± 0.4 °F)  
 Range ..... 0-35 °C (32-95 °F) or 0-50 °C (32-122 °F) programmable  
 Offset ..... ± 5 ° programmable  
 Display ..... °C or °F programmable

**RH**                        Sensor ..... Thermoset polymer based capacitive  
 Accuracy ..... ± 2 %RH  
 Range ..... 0-100 %RH  
 Temperature Compensation .. 0-50 °C (32-122 °F)  
 Hysteresis ..... ± 2%RH  
 Response Time ..... 15 seconds typical  
 Stability ..... ± 1%RH typical @ 50 %RH in 5 years  
 Offset ..... ± 9 %RH programmable

**T Setpoint**            Midpoint ..... 17-27 °C or 63-81 °F programmable  
 Range ..... ± 5 or ± 10 ° of the midpoint programmable

