SUN SHIELD HUMIDITY SERIES

Installation & Operation Instructions

Phone: 1-888-967-5224
Website: workaci.com

GENERAL INFORMATION

The Solar Radiation Shield is a solution for protecting temperature and relative humidity sensors from error-producing solar radiation and precipitation. The highly reflective white wedge-shaped plates provide maximum airflow around the sensors while at the same time minimizing direct exposure to sunlight. The passive shield is shaped to allow natural air convection around the sensors so that the air temperature and relative humidity inside the shield is a good representation of the outside air. The RH Sun Shield transmitter is field selectable with a 4-20 mA, 0-5 VDC, or 0-10 VDC output signal that is equivalent to 0 to 100% RH. This sensor is designed for use with electronic controllers in commercial heating and cooling building management systems. All units are shipped from the factory set up for a 4-20 mA output. The transmitter can also include an optional temperature sensor for monitoring the space temperature.

For optimal readings, follow these tips:

- Place the shield in an open area to insure unrestricted air flow or wind
- Keep away from large radiant heat sources, such as sun exposed buildings and solar panels.
- Avoid building exhaust vents, electrical machinery, and motors.
- Do not install over or near sprinklers. Continuous moisture may damage the sensors.

MOUNTING INSTRUCTIONS

The Solar Radiation Shield is designed for two different mounting configurations such as a metal pipe with outside diameter between 1" and 1.5" (U-Bolts included) or on the side of a building or wooden post (Hardware Not included).

Pole Mounting

- Locate the four U-Bolt mounting holes on the back panel of the mounting bracket. Attach the U-Bolts, U-Bolt Washers and 5/16" Hex Nuts as shown in **Figure 2**.

FIGURE 1: ENCLOSURE DIMENSIONS

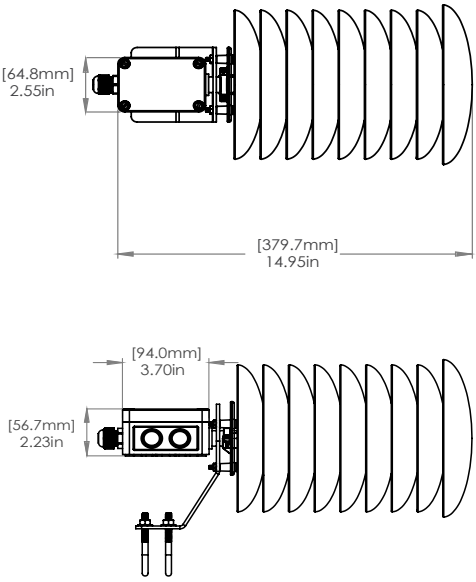
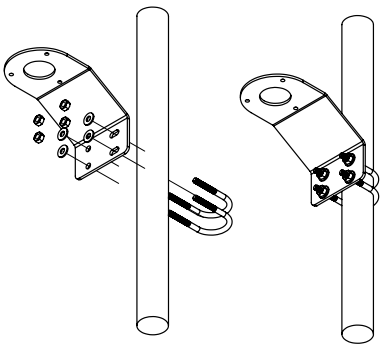


FIGURE 2: MOUNT BRACKET



Automation Components, Inc.
2305 Pleasant View Road | Middleton, WI 53562
Phone: 1-888-967-5224 | **Website:** workaci.com

Version: 6.0
I0000647

Note: The mounting bracket can be removed from the shield if needed for easier access. Loosen the two Phillip screws holding the probe retaining clip until the sensor probe/enclosure is loose enough to remove as shown in **Figure 3**.

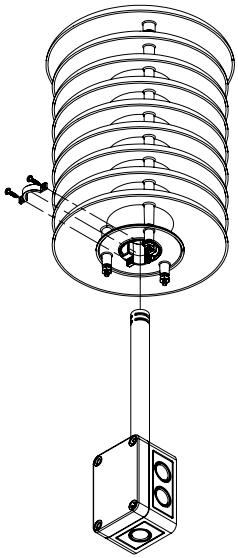
- Finger tighten the assembly around the mounting pole. With a level, make sure the solar radiation shield is level, and tighten the hex nuts with a wrench.

Surface Mounting

- Loosen the two Phillip screws holding the probe retaining clip until the sensor probe/enclosure is loose enough to remove as shown in **Figure 3**.
- Attach the mounting bracket directly to the wall or post(Hardware not included).
- Slide the sensor probe/enclosure back into the shield. Tighten the two Phillip screws holding the probe retaining clip until the sensor probe/enclosure is tight.

Install the PG11 watertight fitting supplied with the sensor if not using conduit. The outer knockout ring (PG 11/16) on housing should not be removed when using a ½" NPT conduit fitting. The 4X enclosure has (4) screws. Confirm gasketed cover is fastened securely in order to prevent any moisture being introduced into housing.
Refer to Wiring Instructions) to make necessary connections.

FIGURE 3: SENSOR PROBE/ ENCLOSURE REMOVAL



WIRING INSTRUCTIONS

PRECAUTIONS

- **Remove power before wiring. Never connect or disconnect wiring with power applied.**
- **When using a shielded cable, ground the shield only at the controller end. Grounding both ends can cause a ground loop.**
- **Do not run the temperature sensor wiring in any conduit with line voltage (24/120/230 VAC) if utilizing resistance temperature signal.**
- **It is recommended you use an isolated UL-listed class 2 transformer when powering the unit with 24 VAC. Failure to wire the devices with the correct polarity when sharing transformers may result in damage to any device powered by the shared transformer.**
- **If the 24 VDC or 24VAC power is shared with devices that have coils such as relays, solenoids, or other inductors, each coil must have an MOV, DC/AC Transorb, Transient Voltage Suppressor (ACI Part: 142583), or diode placed across the coil or inductor. The cathode, or banded side of the DC Transorb or diode, connects to the positive side of the power supply. Without these snubbers, coils produce very large voltage spikes when de-energizing that can cause malfunction or destruction of electronic circuits.**

RELATIVE HUMIDITY WIRING INSTRUCTIONS

Open the cover of the enclosure. ACI recommends 16 to 26 AWG twisted pair wires or shielded cable for all transmitters. Twisted pair may be used for 2-wire current output transmitters or 3-wire for voltage output. Refer to **FIGURE 4** (p. 3) or wiring diagrams.

TEMPERATURE WIRING INSTRUCTIONS

ACI recommends 16 to 26 AWG twisted pair wires or shielded cable for all temperature sensors.

ACI recommends a separate cable be pulled for Temperature signal only. Temperature Signal wiring must be run separate from low and high voltage wires (24/120/230VAC). All ACI thermistors and RTD temperature sensors are both non-polarity and non-position sensitive.

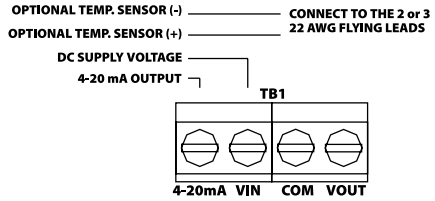
All thermistor type units are supplied with (2) flying lead wires, and all RTD's are supplied with (2) or (3) flying lead wires – see **FIGURE 6** (p. 3).

Automation Components, Inc.
2305 Pleasant View Road | Middleton, WI 53562
Phone: 1-888-967-5224 | **Website:** workaci.com

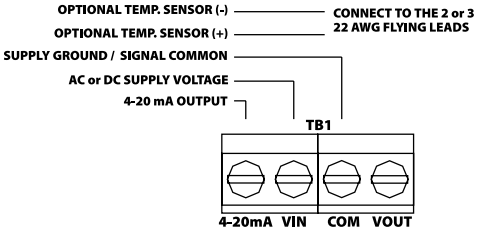
Version: 6.0
I0000647

FIGURE 4: OUTPUT SIGNALS

2 WIRE CURRENT OUTPUT SIGNAL



3 WIRE CURRENT OUTPUT SIGNAL



VOLTAGE OUTPUT SIGNAL

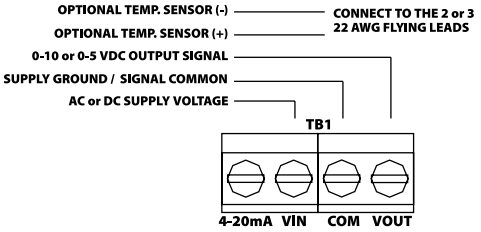


FIGURE 5: PRINTED CIRCUIT BOARD

SQUARE PCB (-4X ENCLOSURES)

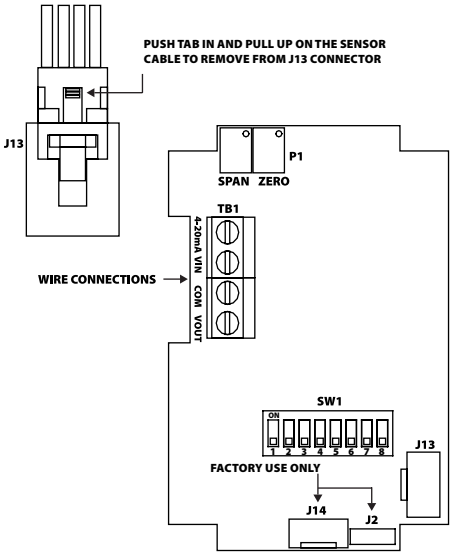
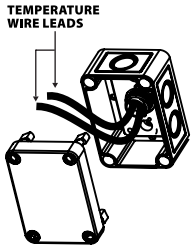
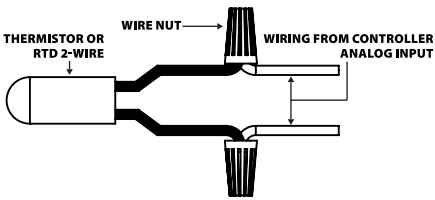


FIGURE 6: TEMPERATURE WIRING

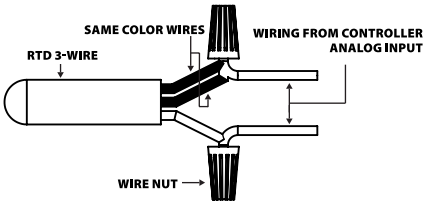
NEMA (-4X)



2-WIRE THERMISTOR or RTD WIRING



3-WIRE RTD WIRING



Automation Components, Inc.
2305 Pleasant View Road | Middleton, WI 53562
Phone: 1-888-967-5224 | **Website:** workaci.com

Version: 6.0
I0000647

WIRING INSTRUCTIONS *(Continued)*

The number of wires needed depends on the application. Connect thermistor/RTD wire leads to controller analog input wires using wire nuts, terminal blocks, or crimp style connectors. All wiring must comply with local and National Electric Codes. After wiring, attach the cover to the enclosure.

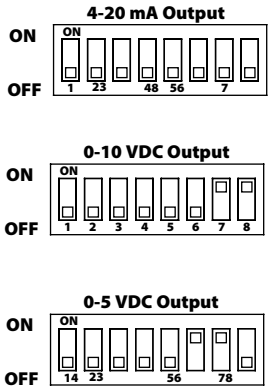
Note: When using a shielded cable, be sure to connect only (1) end of the shield to ground at the controller. Connecting both ends of the shield to ground may cause a ground loop. When removing the shield from the sensor end, make sure to properly trim the shield to prevent any chance of shorting.

Note: If the controller requires a (2) wire input for a RTD, connect the (2) common wires (same color) together. If the controller requires (3) wires, use (3) individual wires - see **FIGURE 6** (p. 3).

OUTPUT SIGNALS

Switches 6, 7, and 8 are used to set the RH output signal. Refer to **FIGURE 7** for switch settings.

FIGURE 7: OUTPUT SELECTION SWICHES



HUMIDITY REVERSE ACTING OUTPUT

The output is direct acting and can be changed to reverse acting mode. The output range stays the same but the corresponding RH value is opposite.

Example:

Direct Acting (DA)
0-10 V output mode,
0 V = 0% RH and 10 V = 100% RH

Reverse Acting (RA)
0-10 V output mode,
0 V = 100% and 10 V = 0%

To change the transmitter to reverse acting or back to direct acting, set switch 4 to ON to put the unit in setup mode. After switch 4 is on, turning switch 2 to ON will put the unit in direct/reverse acting mode. When switch 2 is set to ON, the output can be used to show if the unit is in direct or reverse acting mode. For direct acting, the output will be 1 V for 0-5 V, 2 V for 0-10 V, and 7.2 mA for 4-20 mA. For reverse acting the output will be 4 V for 0-5 V, 8 V for 0-10 V, and 16.8 mA for 4-20 mA.

With switches 2 and 4 ON, each time switch 5 is set to ON the output will change to reverse acting or direct acting.

To reset the unit to the default setting, toggle both switches 5 and 6 ON then OFF while both switches 2 and 4 are ON.

When all calibration is completed, remember to place the switches back into the positions that correspond to the output needed as shown in **FIGURE 7**.

RH CALIBRATION INSTRUCTIONS

Note: This is only a single point calibration. All transmitters are factory calibrated to meet/exceed published specifications. Field adjustment should not be necessary.

The dipswitch allows the user to calibrate the sensor through the software. Setting switch 4 ON will put the transmitter into setup mode allowing the increment and decrement to work.

Once in setup mode, the output will change to 50% (2.5 V for 0-5 V, 5 V for 0-10 V, 12 mA for 4-20 mA). Each increment or decrement step will cause the output to change by 0.1 V for 0-5 V, 0.2 V for 0-10 V, and 0.32 mA for 4-20 mA in setup mode.

Automation Components, Inc.
2305 Pleasant View Road | Middleton, WI 53562
Phone: 1-888-967-5224 | **Website:** workaci.com

Version: 6.0
I0000647

RH CALIBRATION *(Continued)*

This can be used to show the user how far offset the transmitter is. To see the starting point again set switch 1 ON. This will show the 50% output again. When the unit is out of setup mode the output will go back to RH output. The maximum offset is 10%. There can be a total of 20 increments.

Increment RH Output

This will shift the RH output linearly up in 0.5% steps. Switch 4 must be set to ON first. After switch 4 is on, each time switch 5 is set ON the RH output will increase by 0.5%. The increase goes into effect each time switch 5 is set to ON.

Decrement RH Output

This will shift the RH output linearly down in 0.5% steps. Switch 4 must be set to ON first. After switch 4 is on, each time switch 6 is set ON the RH output will decrease by 0.5%. The decrease goes into effect each time switch 6 is set to ON.

Reset RH Output

This will reset the RH output back to the original calibration. Switch 4 must be set to ON first. After switch 4 is on, toggle switches 5 and 6 ON then OFF. After 5 and 6 are OFF slide switch 4 OFF.

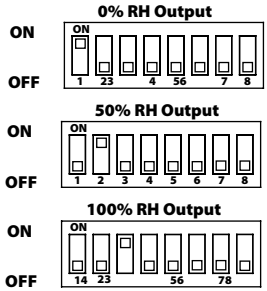
When all calibration is completed, remember to place the switches back into the positions that correspond to the output needed as shown in **FIGURE 8**.

TEST INSTRUCTIONS

Test mode will make the transmitter output a fixed 0%, 50%, or 100% value. The sensor will not affect the transmitter output. This is used for trouble-shooting or testing only.

Switches 1, 2, and 3 are used for test mode. The output will be a fixed 0%, 50%, or 100% signal that corresponds to the output selected with switches 6, 7, and 8. Refer to **FIGURE 8** for switch settings.

FIGURE 8: TEST SELECTION SWITCHES



RH CONVERSION FORMULAS

	4 -20 mA	0-5 VDC	0-10 VDC
Formula:	([mA signal] -4) / 0.16 = percent RH	[VDC signal] / 0.05 = percent RH	[VDC signal] / 0.10 = percent RH
Example:	12 mA output signal (12 - 4) / 0.16 = 50% RH	1.25 vdc output signal 1.25 / 0.05 = 25% RH	7.50 vdc output signal 7.50 / 0.10 = 75% RH

Automation Components, Inc.
2305 Pleasant View Road | Middleton, WI 53562
Phone: 1-888-967-5224 | **Website:** workaci.com

Version: 6.0
I0000647

PRODUCT SPECIFICATIONS

RELATIVE HUMIDITY SPECIFICATIONS

SENSOR SPECIFIC	
RH Supply Voltage: (Reverse Polarity Protected)	**4-20 mA:** 250 Ω Load: 15 - 40 VDC / 18 - 28 VAC | **500 Ω Load:** 18 - 40 VDC / 18 - 28 VAC **0-5 VDC:** 12 - 40 VDC / 18 - 28 VAC | **0-10 VDC:** 18 - 40 VDC / 18 - 28 VAC
RH Supply Current (VA):	**Voltage Output:** 8 mA max (0.32 VA) | **Current Output:** 24 mA max (0.83 VA)
RH Output Load Resistance:	**4-20 mA:** 700 Ω maximum | **0-5 VDC or 0-10 VDC:** 4K Ω Minimum
RH Output Signal:	**2-wire:** 4 - 20 mA (Default) | **3-wire:** 0-5 or 0-10 VDC and 4 - 20 mA (Field Selectable)
RH Accuracy @ 77°F (25°C):	+/- 1% over 20% RH Range between 20 to 90% | +/- 2%, 3%, or 5% from 10 to 95%
RH Measurement Range:	0-100%
Operating RH Range:	0 to 95% RH, non-condensing (Conformally Coated PCB's)
Operating Temperature Range:	-40 to 140 °F (-40 to 60 °C)
Storage Temperature Range:	-40 to 149 °F (-40 to 65 °C)
RH Stability | Repeatability | Sensitivity:	Less than 2% drift / 5 years | 0.5% RH | 0.1% RH
RH Response Time (T63):	20 Seconds Typical
RH Sensor Type:	Capacitive with Hydrophobic Filter
RH Transmitter Stabilization Time:	30 Minutes (Recommended time before doing accuracy verification)
RH Connections | Wire Size:	Screw Terminal Blocks (Polarity Sensitive) | 16 (1.31 mm^2) to 26 AWG (0.129 mm^2)
RH Terminal Block Torque Rating:	4.43 to 5.31 lb-in (0.5 to 0.6 Nm)
Enclosure Specifications (Flammability, Temperature, NEMA/IP Rating):	**"-4X" Enclosure:** Polystyrene Plastic, UL94-V2, NEMA 4X (IP 66)
Sensing Tube Material | Filter Material:	**"-4X" Enclosure:** Schedule 40 PVC (White) | Slotted PVC without filter

TEMPERATURE SENSOR SPECIFICATIONS (OPTIONAL)

SENSOR NON-SPECIFIC		
Lead Wire Length	14" (35.6 cm) | 22 AWG (0.65 mm)	
Insulation Rating	Etched Teflon (PTFE) Colored Leads | Mil Spec 1678/4 Type E	
THERMISTOR		
Sensor Output @ 25 °C (77 °F): (Lead Wire Colors)	**A/1.8K:** 1.8 KΩ nominal (Red/Yellow) **A/3K:** 3 KΩ nominal (White/Brown) **A/AN (Type III):** 10 KΩ nominal (White/White) **A/AN-BC:** 5.238 KΩ nominal (White/Yellow) **A/CP (Type II):** 10 KΩ nominal (White/Green)	**A/CSI:** 10 KΩ nominal (Green/Yellow) **A/10KS:** 10 KΩ nominal (White/Blue) **A/10K-E1:** 10 KΩ nominal (Gray/Orange) **A/20K:** 20 KΩ nominal (Brown/Blue) **A/100KS:** 100 KΩ nominal (Black/Yellow)
Accuracy @ 0-70 °C (32 - 158 °F):	**A/1.8K Series:** +/- 0.5 °C @ 25 °C (77 °F) and (+/-1.0 °C) (+/-1.8 °F)	**A/10K-E1 Series:** +/- 0.3 °C (+/- 0.54 °F) **All Else:** +/- 0.2 °C (+/- 0.36 °F)
PLATINUM		
Sensor Output @ 0 °C (32 °F):	**A/100:** 100 Ω nominal	**A/1K:** 1 KΩ nominal
Accuracy:	+/- 0.06% Class A (Tolerance Formula: +/- °C = (0.15 °C + (0.002 * |t|)) where |t| is the absolute value of Temperature above or below 0 °C in °C)	
	@ -40 °C (-40 °F): +/- 0.23ºC (+/- 0.414ºF) **@ 0 °C (32 °F):** +/- 0.15 °C (+/- 0.27 °F)	**@ 60 °C (140 °F):** +/- 0.27 °C (+/- 0.49 °F)
NICKEL		
Sensor Output @ 21.1 °C (70 °F):	1 KΩ nominal (Red/Red)	
Accuracy:	**@ -40 °C (-40 °F):** +/- 1.52 °C (+/- 2.73 °F) **@ 0 °C (32 °F):** +/- 0.4 °C (+/- 0.72 °F)	**@ 21.1 °C (70 °F):** +/- 0.17 °C (+/- 0.34 °F) **@ 54.4 °C (130 °F):** +/- 0.56 °C (+/- 1.00°F)
BALCO		
Sensor Output @ 21.1 °C (70 °F):	1 KΩ nominal (Orange/Yellow)	
Accuracy:	**@ 21.1 °C (70 °F):** +/- 1%	

Automation Components, Inc.
2305 Pleasant View Road | Middleton, WI 53562
Phone: 1-888-967-5224 | **Website:** workaci.com

Version: 6.0
I0000647

TROUBLESHOOTING

HUMIDITY READING PROBLEM	SOLUTION(S)
No Reading	• Check that you have the correct supply voltage at the power terminal blocks. • Check that wiring configurations and all DIP switch settings are as in **FIGURE 4** and **7**. • Verify that the terminal screws are all connected tightly and that all of the wires are firmly in place.
Erratic Readings	• Verify that all of the wires are terminated properly. • Make sure that there is no condensation on the board. • Check that the input power is clean. In areas of high RF interference or noise, shielded cable may be necessary to stabilize signal.
Inaccurate Readings	• Verify proper mounting location to confirm no external factors (see mounting locations above). • Check the output (voltage or current) against a highly accurate recently calibrated secondary reference. Measue RH at the location of the sensor using the secondary reference, then calculate the RH percentage using the **RH CONVERSION FORMULAS** (p. 5). Compare the calculated output to reference. • If the sensor is brand new, leave the sensor powered for at least 30 minutes to stabilize. • If you suspect that the transmitter is not reading within the specified tolerance, please contact ACI for further assistance.
TEMPERATURE (Optional) PROBLEM	**SOLUTION(S)**
Sensor Reading Is Incorrect	• Verify sensor wiring to controller is not damaged and has continuity • Verify sensor or wires are not shorted together • Verify controller is setup for correct sensor curve • Disconnect sensor wires, and take a resistance (ohm) reading with a multimeter • Compare the resistance reading to the Temperature Vs Resistance Curves online: *http://www.workaci.com/content/thermistor-curves-0* • Verify proper mounting location to confirm no external factors
Sensor Reads Infinity/Very High Resistance	• Sensor or wires are open
Sensor Reads Low Resistance	• Sensor or wires are shorted together
Erratic Readings	• Bad wire connections

WARRANTY

The ACI Outside Series RH sensors are covered by ACI's Five (5) Year Limited Warranty, which is located in the front of ACI'S SENSORS & TRANSMITTERS CATALOG or can be found on ACI's website: www.workaci.com.

W.E.E.E. DIRECTIVE

At the end of their useful life the packaging and product should be disposed of via a suitable recycling centre. Do not dispose of with household waste. Do not burn.

Automation Components, Inc.
2305 Pleasant View Road | Middleton, WI 53562
Phone: 1-888-967-5224 | **Website:** workaci.com

Version: 6.0
I0000647

NOTES

Automation Components, Inc.
2305 Pleasant View Road
Middleton, WI 53562
Phone: 1-888-967-5224
Website: workaci.com