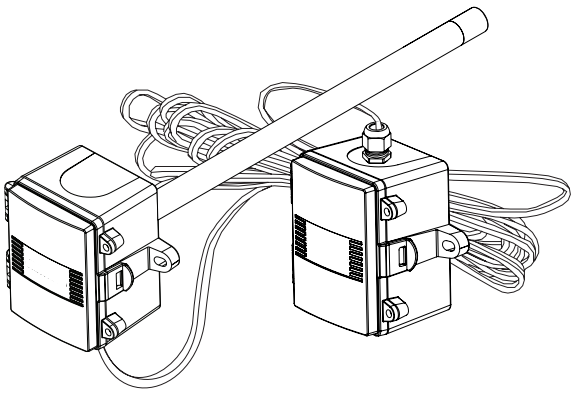
Remote Duct Network Humidity/Temperature Sensor

HNRDEM - Installation Instructions



INTRODUCTION

The remote duct network humidity/temperature sensor uses a highly accurate and reliable Thermoset Polymer based capacitance humidity sensor and curve-matched NTC thermistor temperature sensor together with state-of-the-art digital linearization and temperature compensated circuitry to monitor humidity and temperature levels and transmit values via Modbus communication to a building automation system. A hinged, gasketed weatherproof ABS enclosure provides ease of installation.

BEFORE INSTALLATION

Read these instructions carefully before installing and commissioning the humidity/temperature sensor. 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. **Follow electrostatic discharge precautions during installation and do not exceed the device ratings.**

MOUNTING

The humidity/temperature sensor installs directly into any air duct with a minimum width/diameter of 25.5 cm (10″). Select a suitable installation area, ensuring an appropriate place for the remote transmitter to be mounted on a vertical service is accessible. Avoid areas where the sensor is exposed to vibrations.

Once a suitable location is selected, drill a 15 -20 mm (0.6″ - 0.75″) hole for the probe.

Slide the probe in the drilled hole until the enclosure is flush against the duct. The airflow direction is not important. Secure the enclosure to the duct with two #10 x 25 mm (1″) self tapping screws (not provided). Tighten screws until the enclosure is tight against the duct and there is no movement of the enclosure as shown in Figure 1.

A foam gasket on the back of the enclosure provides a tight seal against any air leaks.

To mount the remote transmitter, select a suitable vertical surface within the 3m (9.8') distance that the provided FT-6 plenum rated cable allows and use the integrated mounting tabs to secure the enclosure to the selected surface. See Figure 1.

If the sensor-to-transmitter cable must be disconnected from the transmitter, ensure it is reconnected following the color code on the PCB.

The enclosures have a hinged cover with a latch. Open the cover by pulling slightly on the latch on the right side of the enclosure. At the same time pulling on the cover, as illustrated in Figure 2.

Figure 1

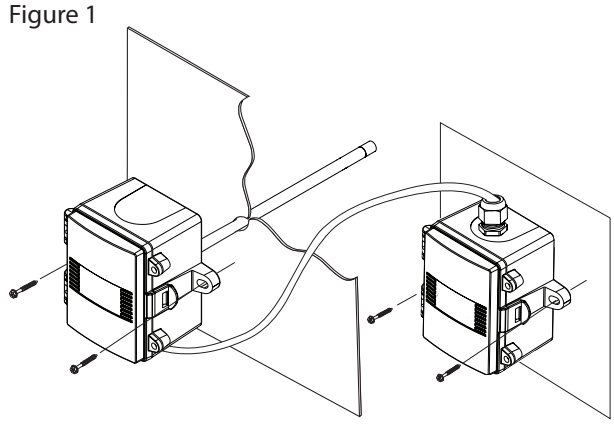


Figure 2

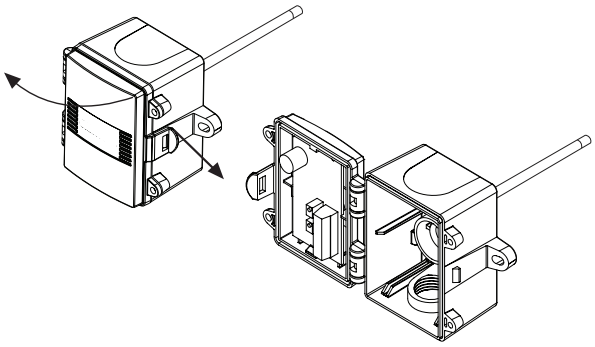
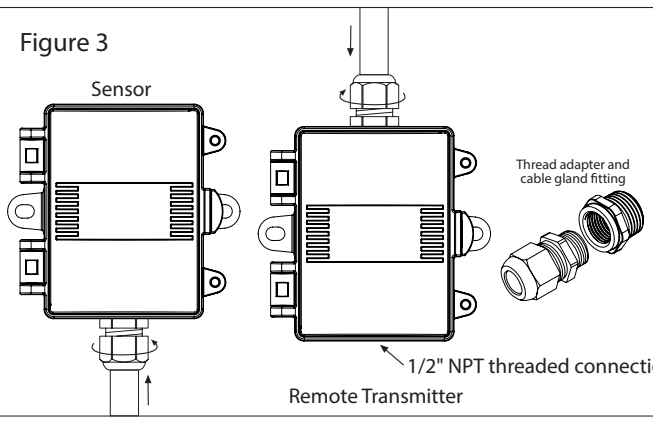


Figure 3



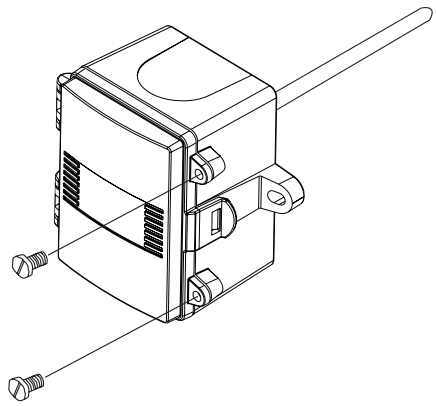
Phone: +1 506 853 3057 Web: www.greystoneenergy.com

A 1/2" NPT threaded connection hole is provided in the bottom of the remote transmitter enclosure. Screw the cable gland connector in until tight. Feed FT-6 plenum rated cable through the cable gland and secure. See Figure 3.

Make wiring connections as per the "Wiring" illustrations on Page 2.

Swing door closed until securely latched. For added security, 2 screws are provided that may be installed in the integrated screw tabs. See Figure 4.

Figure 4



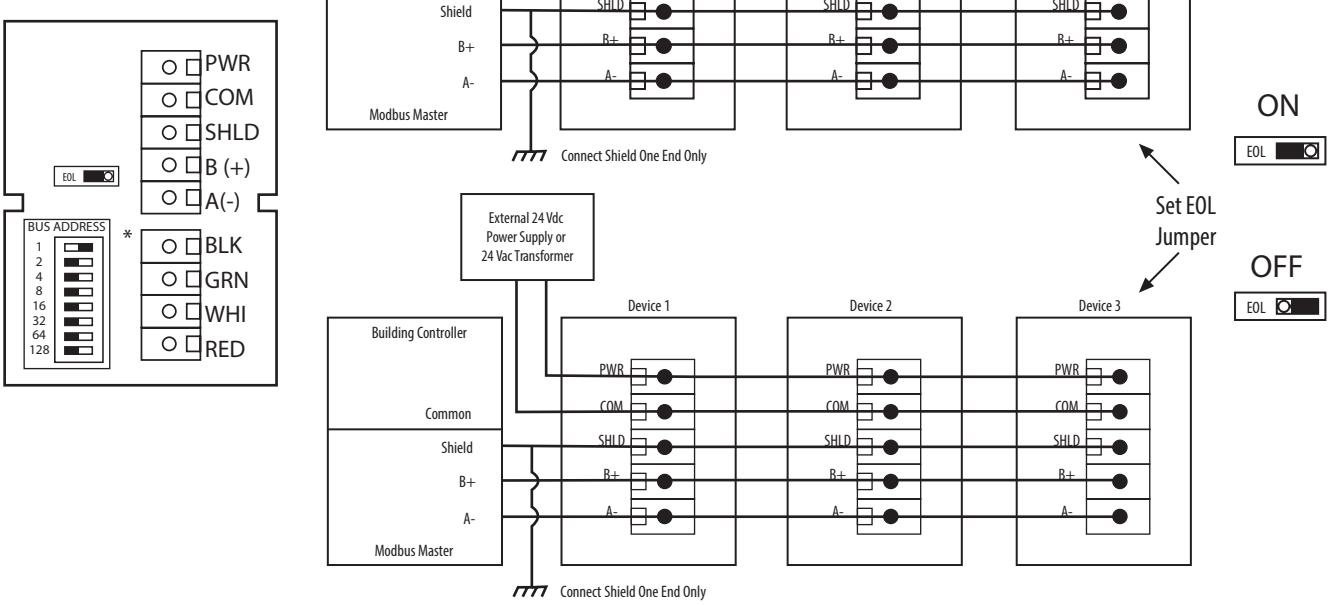
WIRING

Deactivate the 24 Vac/dc power supply until all connections are made to the device to prevent electrical shock or equipment damage. Use 14-22 AWG shielded wire for all connections and do not locate the device wires in the same conduit with wiring used to supply inductive loads such as motors. Pull at least six inches of wire into the enclosure and complete the wiring connections according to the wiring diagram. Make all connections in accordance with national and local codes.

Connect the plus DC or the AC voltage hot side to the PWR terminal and the power supply common is connected to the COM terminal. The device has a half-wave power supply so use caution when wiring multiple devices to that the circuit ground point is the same on all devices and the controller. Use caution if 24 Vac power is used and one side of the transformer is earth grounded. In general, the transformer should NOT be connected to earth ground when using devices with an RS-485 network connection. The device is reverse voltage protected and will not operate if connected backwards.

Connect the RS-485 network with twisted shielded pair to the terminals marked A-, B+, and SHLD (shield) as shown in Figure 5. The positive wire connects to B+ and the negative wire connects to A- and the cable shield must be connected to the SHLD terminals of each device. If the device is connected to the end of the

Figure 5



* Connect the black wire into the terminal block labeled BLK.
Connect the green wire into the terminal block labeled GRN.
Connect the white wire into the terminal block labeled WHI.
Connect the red wire into the terminal block labeled RED.

network, and end-of-line (EOL) termination resistor (121 Ω) should be installed in parallel with the A- and B+ terminals. This device includes a network termination jumper and will connect the resistor correctly on the PCB. Simply move the PCB jumper to the EOL position as shown in Figure 5 and no external resistor is required. The ground wire of the shielded pair should be connected to earth ground at the end of the network and the master is not grounded. Do not run bus wiring in the same conduit as line voltage wiring.

A network segment is a single shielded wire loop run between several devices (nodes) is a daisy chain configuration. The total segment length should be less than 1220 meters (4000 feet) and the maximum number of nodes on one segment is 127. Nodes are any device connected to the loop and include controllers, repeaters and sensor such as the Network Humidity/Temperature Sensor but does not include the EOL terminators. To install more devices, or to increase the network length, repeaters will be required for proper communication. The maximum daisy chain length (segment) depends on transmission speed (baud rate), wire size and number of nodes. If communication is slow or unreliable, it may be necessary to wire two daisy chains to the controller with a repeater for each segment.

NETWORK COMMUNICATION

The device parameters must be set before connection to the network and will ensure that each device has a unique Modbus address. The local DIP switch is used to set the Modbus address (1-255) as shown in Figure 6.

The factory default network configuration is:

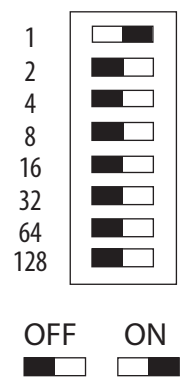
Baud Rate: Auto Baud Rate Detection (4800, 9600, 19200, 38400, or 76800)
Parity: None
Stop Bits: 1
CRC: A001 (CRC-16 reverse)
Delay: 0 (minimum)

Note that the Modbus network configuration may be customized at the factory if required. For example, the parity and stop bit parameters may be factory configured to suit specific applications.

The humidity/temperature sensor operates as a slave. It will not communicate unless a master is connected to the network and sends a request for information, then the slave will answer. If the device does not communicate properly, first check that the communication wires are not reversed. Then check that the slave address has a unique setting for the network segment it is connected to. Finally, verify that the device baud rate, parity bit, stop bit and RTU mode CRC polynomial are correct for the network it is connected to.

Figure 6

DIP Switch Position								
128	**64**	**32**	**16**	**8**	**4**	**2**	**1**	**Modbus Address**
OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	**1**
OFF	OFF	OFF	OFF	OFF	OFF	ON	OFF	**2**
OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	**3**
OFF	OFF	OFF	OFF	OFF	ON	OFF	OFF	4
↓	↓	↓	↓	↓	↓	↓	↓	↓
ON	ON	ON	ON	ON	ON	ON	OFF	**254**
ON	ON	ON	ON	ON	ON	ON	ON	**255**



MODBUS PROTOCOL

This section describes the implementation of the Modbus protocol. It is intended to assist control system programmers who may need to add support to their systems to communicate with this device. The device communicates on standard Modbus networks using RTU mode transmission. It operates as a slave device (address from 1 to 255) and expects a Modbus master device to transmit queries, which it will answer.

RTU MESSAGE FORMAT

Modbus Framing	8 bit binary
Data Bits	start bits --- 1 data bits --- 8 parity bits --- none stop bits --- 1
Baud Rate	Auto Baud Rate Detection (4800, 9600, 19200, 38400, or 76800)
Duplex	Half duplex
Error Checking	Cyclical Redundancy Check (CRC) CRC-16 Reversed --- polynomial x16+x15+x2+x0 (0xA001)
Latency	More than 3.5 characters --- minimum

RTU FRAMING SUPPORT AND BIT SEQUENCES

Start	1	2	3	4	5	6	7	8	Stop

MODBUS REGISTER ADDRESSING

Modbus Address	Typical Offset	Units	Data Type	Access	Notes
40001	+0	°C/°F	Word	Read	16-bit integer, TEMPERATURE_VALUE x 10 Multiplier = 10 -400 to 1000 for -40.0 to 100.0°C, -400 to 2120 for -40.0 to 212.0°F
40002	+1	%RH	Word	Read	16-bit integer, RELATIVE_HUMIDITY_VALUE Multiplier = 10 0 to 1000 for 0.0 to 100.0 %RH
40003	+2	°C/°F	Word	Read/ Write	16-bit integer TEMPERATURE_OFFSET= -10 to 10 C_OFFSET = TEMPERATURE_OFFSET / 2 = -5.0 to 5.0°C F_OFFSET = TEMPERATURE_OFFSET = -10 to 10°F
40004	+3	%RH	Word	Read/ Write	16-bit integer, RH_OFFSET = -10 to 10 RH_OFF = RH_OFFSET = -10 to 10 %RH
40005	+4		Word	Read/ Write	16-bit integer, TEMPERATURE_UNITS 0 = °C, 1 = °F

RTU FUNCTION CODES

0x03 --- Read holding registers

Query

Slave address (0x01 to 0xFF)	Function code (0x03)	Starting address MSB	Starting address LSB	Quantity of Registers MSB	Quantity of Registers LSB	CRC LSB	CRC MSB

*Starting address = 0x0000 to 0xFFFF, Quantity of registers = 0x0001 to 0x0005

Response

Slave address (0x01 to 0xFF)	Function code (0x03)	Byte count 2N	Register value MSB	Register value LSB	...	CRC LSB	CRC MSB

*N = Quantity of registers

0x06 --- Write single register

Query

Slave address (0x01 to 0xFF)	Function code 0x06	Register address MSB	Register address LSB	Register value MSB	Register value LSB	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	Function code 0x06	Register address MSB	Register address LSB	Register value MSB	Register value LSB	CRC LSB	CRC MSB

*Register address = 0x0000 to 0xFFFF, Registers value = 0x0000 to 0xFFFF

Exception Response

Slave address (0x01 to 0xFF)	Function code + 0x80	Exception code 0x01, 0x02 or 0x03	CRC LSB	CRC MSB

*An exception response is only returned if the CRC is correct
Exception code 01 --- illegal function, 02 --- illegal address, 03 --- illegal data value

The RTU function codes supported by the RH/T sensor are shown below.

Note that the registers may be read individually or all registers may be read at the same time by changing the query as shown below.

To read the temperature value only...

0x03 --- Read TEMPERATURE_VALUE

Query

Slave address (0x01 to 0xFF)	0x03	0x00	0x00	0x00	0x01	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x03	0x02	Register value MSB	Register value LSB	CRC LSB	CRC MSB

*Register value = 0xFE70 to 0x003E8, corresponding to -40.0 to 100.0°C (multiplier = 10)
or = 0xFE70 to 0x0848, corresponding to -40.0 to 212.0°F (multiplier = 10)

The temperature value is either in °C (default) or °F depending on the value of the TEMPERATURE_UNITS register.
This register has a multiplier of 10, the application must divide by 10 to obtain the correct value.

To read the RH value only....
0x03 --- Read RELATIVE_HUMIDITY_VALUE

Query

Slave address (0x01 to 0xFF)	0x03	0x00	0x01	0x00	0x01	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x03	0x02	Register value MSB	Register value LSB	CRC LSB	CRC MSB

*Register value = 0x0000 to 0x03E8, corresponding to 0 to 100 %RH (multiplier = 10)

This register has a multiplier of 10, the application must divide by 10 to obtain the correct value.

To read all the registers with one query...
0x03 --- Read ALL REGISTERS

Query

Slave address (0x01 to 0xFF)	0x03	0x00	0x00 (Note 1)	0x00	0x05 (Note 2)	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x03	0x0A (Note 3)	Register Value MSB	Register value LSB	CRC LSB	CRC MSB

Note 1: The starting address (A) may be 0x0000 to 0x0004. The read multiple feature will read all registers from the starting address forward. If the starting address is 0x0000 then registers 40001 to 40005 can be read. If the starting address is 0x0002 then the registers 40003 to 40005 can be read.

Note 2: The quantity of registers (N) may be 0x0001 to 0x0005, but must be limited to 5 - A. If the starting address (A) is set to 0x0000 the N may be 0x0001 to 0x0005. If the starting address is set to 0x0001 then the N may be 0x0001 to 0x0004.

Note 3: The byte count (B) will always be 2N. If the registers (N) is 0x0001 then B will be 0x02. If N is 0x0005 then B will be 0x0A.

0x06 --- Write TEMPERATURE_OFFSET

Query

Slave address (0x01 to 0xFF)	0x06	0x00	0x02	Register value MSB	Register value LSB	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x06	0x00	0x02	Register value MSB	Register value LSB	CRC LSB	CRC MSB

*This register is used to add or subtract an offset to the temperature value if necessary to conform to a local reference.

Register value = 0xFFF6 to 0x000A for -10 to 10
For °C operation, this corresponds to T_OFFSET / 2 = -5.0 to 5.0°C. ie: 0x0003 => 3/2 = +1.5°C offset.
For °F operation, this corresponds to T_OFFSET = -10 to 10°F. ie: 0x0003 => +3°C offset.
The operating temperature units (°C or °F) for the device should be selected first, then add any offset if necessary.

0x06 --- Write RH_OFFSET

Query

Slave address (0x01 to 0xFF)	0x06	0x00	0x03	Register value MSB	Register value LSB	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x06	0x00	0x03	Register value MSB	Register value LSB	CRC LSB	CRC MSB

*This register is used to add or subtract an offset to the RH value if necessary to conform to a local reference. Register value = 0xFFF6 to 0x000A for -10 to 10, corresponding to RH_OFFSET = -10 to 10 %RH
ie: 0x0003 => 3 = +3 %RH offset.

The operating temperature units (°C or °F) for the device should be selected first, then add any offset if necessary.

0x06 --- Write TEMPERATURE_UNITS

Query

Slave address (0x01 to 0xFF)	0x06	0x00	0x04	0x00	Register value LSB	CRC LSB	CRC MSB

Response

Slave address (0x01 to 0xFF)	0x06	0x00	0x04	0x00	Register value LSB	CRC LSB	CRC MSB

*Register value = 0x0000 = sets the device to °C operation
= 0x0001 = sets the device to °F operation

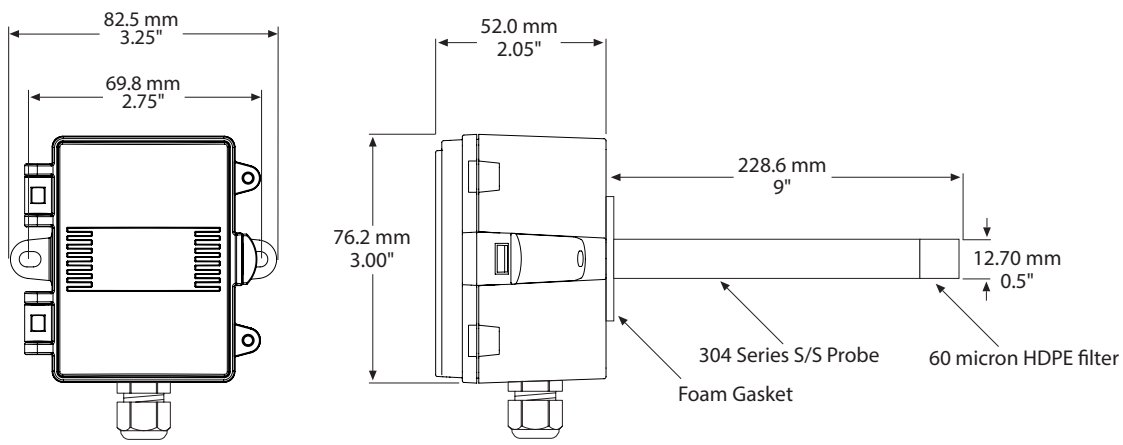
Exception Response

Slave address (0x01 to 0xFF)	Function code + 0x80	Exception code * 0x01, 0x02 or 0x03	CRC LSB	CRC MSB

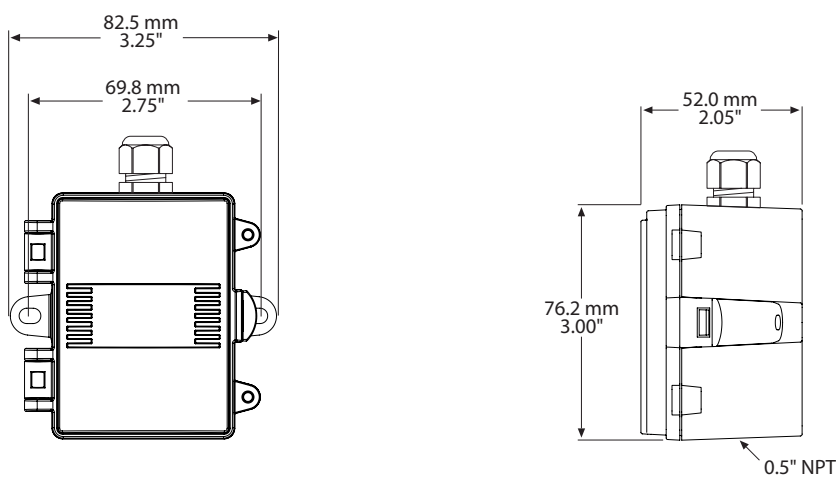
*An exception response is only returned if the CRC is correct
Exception code 01 --- illegal function
Exception code 02 --- illegal address
Exception code 03 --- illegal data value

DIMENSIONS

Sensor



Remote Transmitter



SPECIFICATIONS

TEMPERATURE SENSOR

Temperature Sensor ..... 20 KΩ NTC thermistor
Sensor Accuracy..... ±0.2°C (±0.4°F) @ 0 to 70°C (32 to 158°F)
Probe Sensing Range..... -40 to 50°C (-40 to 122°F), 5 to 95 %RH non-condensing
Resolution ..... 0.1°C/°F

RELATIVE HUMIDITY

Sensor..... Thermoset polymer based capacitive
Accuracy ..... ±2 RH
Range..... 0-100 %RH
Resolution ..... 0.1 %RH
Hysteresis ..... ±1.5 %RH
Response Time ..... 15 seconds typical
Stability ..... ±1.2 %RH typical @ 50 %RH in 5 years

MODBUS COMMUNICATION

Hardware..... 2 wire RS-485
Software..... Native Modbus MS/TP protocol (RTU)
Baud Rate ..... 4800, 9600, 19200, 38400, or 76800 (auto-detect)
Address Range..... 1 to 255 (switch selectable)
Parity ..... None
Stop Bits..... 1
Error Checking..... CRC-16 reverse (A001)

GENERAL

Power Supply..... 15 - 30 Vac/dc (non-isolated half-wave rectified)
Consumption ..... 10 mA max @ 24 Vdc
Protection Circuitry..... Reverse voltage protected, overvoltage protected
Operating Environment..... -40 to 50°C (-40 to 122°F), 5 to 95 %RH non-condensing
Probe Material ..... Stainless steel with porous filter
Probe Diameter..... 12.7mm (0.5")
Probe Length ..... 230 mm (9")
Wire Material..... FT-6 plenum rated cable
Wire Length ..... 3 m (9.8")
Wiring Connection..... Screw terminal block (14 to 22 AWG)
Enclosure..... ABS, UL94-V0, IP65 (NEMA 4X)
Dimensions..... 82.5mm W x 76.2mm H x 52.0mm D (3.25" x 3.0" x 2.05")
Country of Origin.....Canada

PRINTED IN CANADA