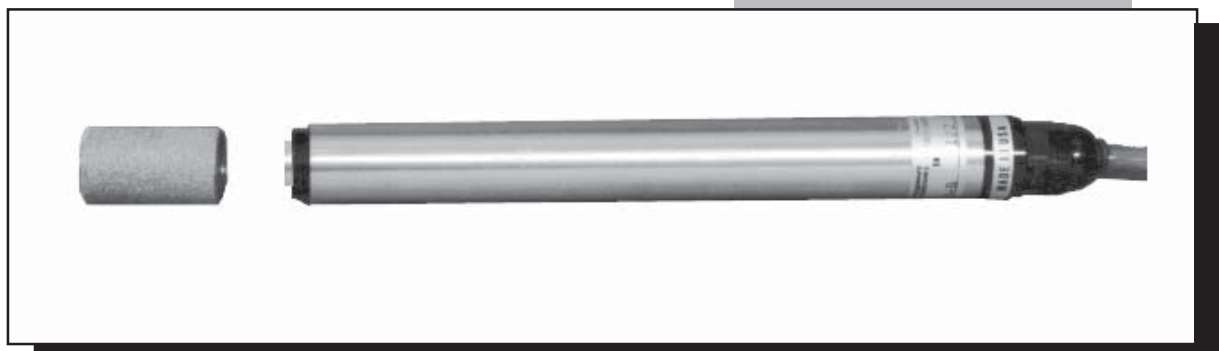


Humidity and Temperature Probe Model 5140



User's
Manual



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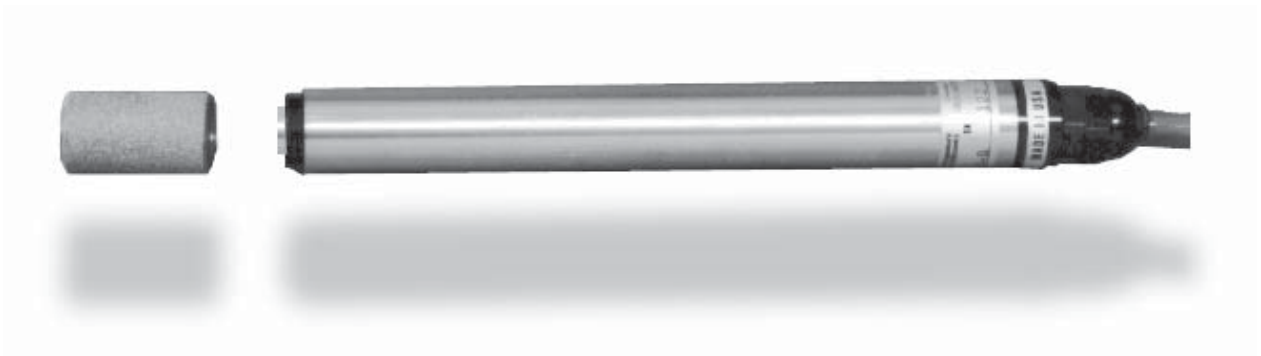
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INTRODUCTION

The All Weather Inc. Model 5140 Humidity and Temperature Probe provides accurate temperature and relative humidity measurements using a state-of-the-art design. This versatile probe is used to measure ambient temperature and humidity in Q-Net systems, where its output is combined with those of other sensors to provide an integrated weather picture.

The Model 5140 normally mounts within a self-aspirated radiation shield (SARS), such as the Model 8141-A. For optimum temperature measurement, the sensor can instead be mounted in a motor-aspirated radiation shield (MARS), such as the Model 8152-A. Neither radiation shield is included as part of the 5140, and must be ordered separately.

The sensor elements are protected from environmental contaminants by a removable sintered filter, and the sensor electronics are housed within a rugged, O-ring sealed metal case. The probe comes standard with 20 feet of attached cable.



THEORY OF OPERATION

Relative Humidity

For relative humidity measurement, the probe features a rugged polymer capacitive humidity sensor constructed directly onto a monolithic interface circuit.

Temperature

Temperature measurement is provided by a precision thin-film platinum 1,000 ohm RTD, whose resistance changes in response to temperature changes. Table 1 provides a list of corresponding temperature and resistance values.

Sensor Body

The sensor element is mounted within a rugged metal housing fitted with a replaceable sintered filter to protect it from dirt, atmospheric pollutants, and condensation.

Sensor Electronics

Solid state electronic circuits are built into each probe to produce a buffered 0.4 to 2 Vdc output (nominal) corresponding to 0 to 100% relative humidity. The slight temperature dependence of the polymer sensor is compensated over the temperature range of -40 to +55° C by means of proprietary algorithms designed into the Q-Net system.

Each probe is delivered with three calibration values. When the probe is installed into a Q-Net system, these calibration values are entered via the Q-Net keypad or via a computer running the QSoft PC software. The calibration values are then stored in battery-backed memory and used by the Q-Net system to calculate accurate RH, temperature, and dew point values.

Mounting

The Model 5140 is used to measure ambient temperature and humidity in Q-Net systems, where it is normally mounted within a self-aspirated radiation shield (SARS), such as the Model 8141-A. For optimum temperature measurement, the sensor can instead be mounted in a motor-aspirated radiation shield (MARS), such as the Model 8152-A. Neither radiation shield is included as part of the 5140, and must be ordered separately.

Cable

Each probe comes standard with 20 feet of attached cable.

RESISTANCE (\hat{y})	TEMP ($^{\circ}$ C)
769.015	-60
807.873	-50
846.576	-40
885.132	-30
923.550	-20
961.837	-10
1000.000	0
1038.042	10
1075.963	20
1113.764	30
1151.445	40
1189.005	50
1226.445	60

Table 1. Resistance versus temperature—Model 5140

INSTALLATION

The Model 5140 can be mounted within either a self-aspirated radiation shield (SARS), such as the Model 8141-A, or a motor-aspirated radiation shield (MARS), such as the Model 8152-A. The MARS provides the highest accuracy, since it maintains the sensor's immediate environment at the level most consistent with the outside environment.

SARS Installation

All Weather Inc.'s SARS units provide passive shielding and aspiration for sensors that are sensitive to environmental effects such as solar radiation, wind, and precipitation. The Model 5140 mounts within the SARS by means of a threaded adapter on the underside of the SARS. The sensor cable is hard-wired to the appropriate Qualimetrics Sensor Interface (QSI) channel within the Q-Net StationPac according to the diagrams in **Figure 1**. Consult the Q-Net system configuration table included with your Q-Net system to determine the proper QSI channel.

The temperature portion of the sensor can be wired in either a two-wire or four-wire configuration. The two wire configuration uses the same two wires for applying current to the sensor as for measuring the voltage across the RTD element. In the four-wire configuration, voltage is measured directly

across the 1,000 ohm platinum RTD element, eliminating the resistance of the wire itself from the measurement. The two-wire configuration is normally employed, since the resistance added by the wire is negligible in relation to the 1,000 ohm sensing element. In longer cable runs, however, this resistance may become a factor. Consult All Weather Inc. if long cable runs are anticipated.

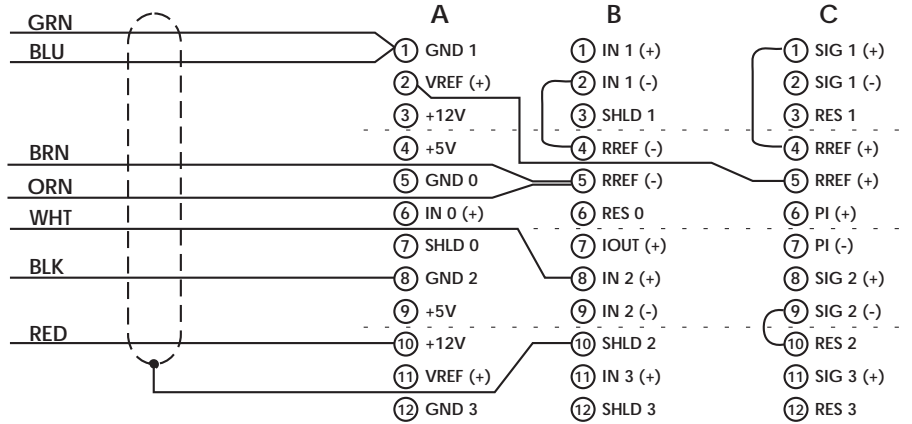
For detailed mounting and installation instructions for the SARS and Model 5140, refer to the manual included with the SARS. For detailed Q-Net installation and operation instructions, consult the Q-Net User's Manual.

MARS Installation

All Weather Inc.'s MARS units employ a motor-driven fan to maintain the conditions within the shield at a consistent level for accurate monitoring of ambient conditions. The Model 5140 mounts to brackets within the MARS unit. The sensor cable is hard-wired to the appropriate Qualimetrics Sensor Interface (QSI) channel within the Q-Net StationPac.

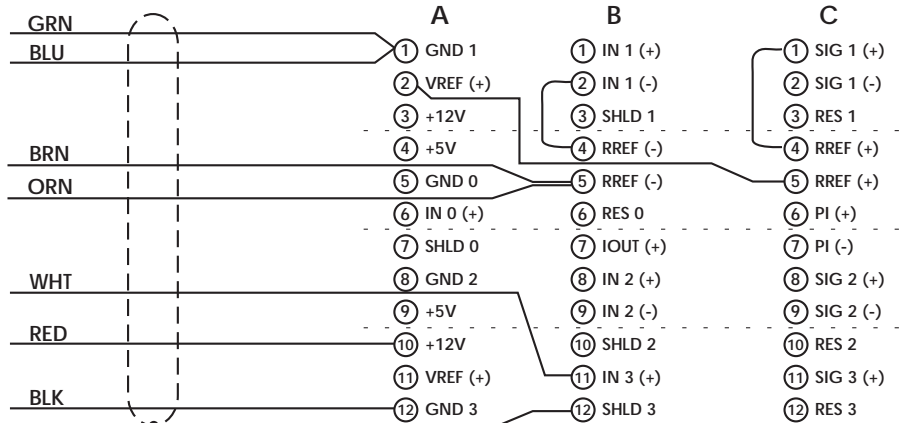
These installations require special consideration, and wiring diagrams will be provided separately with the Q-Net system manuals. Contact All Weather Inc. for details on using the Model 5140 with a MARS unit.

Channels 1 (Temp.) & 2 (RH)



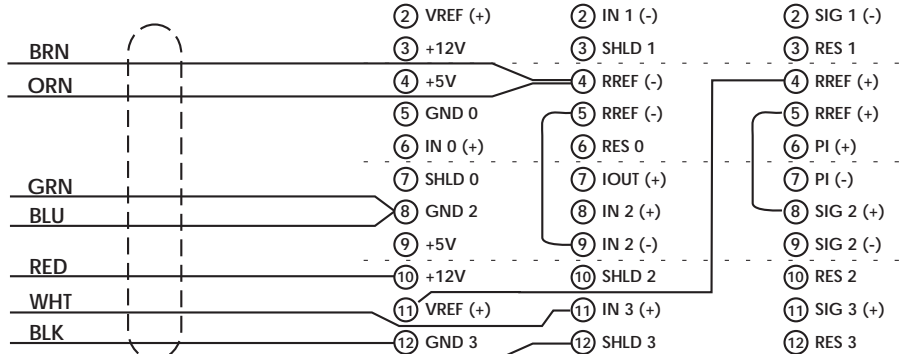
Sensor Model 5140

Channels 1 (Temp.) & 3 (RH)



Sensor Model 5140

Channels 2 (Temp.) & 3 (RH)



Sensor Model 5140

Figure 1
Model 5140 wiring for all QSI channels (SARS installation)

CALIBRATION

The model 5140 is calibrated at the factory, and cannot be calibrated in the field. If recalibration is required, return the sensor to the factory for service.

CALIBRATION RECORD

Each Model 5140 is calibrated at the factory to give accurate temperature and humidity readings over its full operating range. To allow for the slight variations between sensors, three calibration points are used to ensure consistent operation. These calibration numbers are printed on the Model 5140's label, and should be transcribed to this page by the user upon unpacking of the sensor. These numbers are required for configuration of a Q-Net system, and may be requested by Customer Service representatives during problem calls. Keep this page as part of your Q-Net system's configuration record.

Model 5140 Humidity and Temperature Probe	
Serial Number	_____
0° C	_____y
0% RH	_____V
75% RH	_____V

MAINTENANCE

The Model 5140 normally requires no maintenance, other than ensuring that the MARS or SARS is free of obstructions, and periodically cleaning the sintered filter.

To clean the filter, unscrew it from the sensor body and submerge it in warm, soapy water. The filter may be lightly scrubbed to remove embedded dirt or debris. Rinse the filter and allow it to dry thoroughly before replacing it on the sensor body.

SPECIFICATIONS

General

Excitation voltage	8 to 13 Vdc
Temperature range	-55 to +55° C
Current consumption	0.4 mA nominal
Surge protection	Series resistors; 1.5 kW zener diodes

Relative Humidity

Sensing element	Thin film capacitor
Measuring range	0-100 % RH
Response time to 90% of step change in RH	3 minutes
Output signal	0.4 to 2 VDC nominal
Output impedance	1.0k Ohm, $\pm 0.2\%$
Known voltage outputs provided for calibration	Outputs at 0 and 75.3% RH
Accuracy (Q-Net use):	
0 to 90% RH	$\pm 3\%$ RH
90 to 100% RH	$\pm 4\%$ RH
Hysteresis	$\pm 0.5\%$ RH typical
Repeatability	$\pm 0.5\%$ RH
TC of zero offset	$\pm 0.007\%$ RH/°C
Temperature effect (non-Q-Net use)	0 to 55° C: -0.16% RH/°C @ 50% RH -40 to 0° C: $+0.44\%$ RH/°C @ 50% RH

Note: When the model 5140 is used in a Q-Net system, temperature effects are digitally compensated so as to realize an accuracy of $\pm 4\%$ over the temperature range of -40 to +55° C, 0-100% relative humidity.

Temperature

Sensing element	Thin film platinum
Resistance at 0° C	1000 ± 2.0 Ohm
Coefficient "alpha"	3.75 Ohms/°C
Known resistance value provided for calibration	0° C value ± 0.1 Ohm
Temperature range	-55 TO +55° C
Temperature rise due to RH sensing element	0.2° C
Accuracy (after subtraction of temperature rise)	± 0.5 ° C

(See Table 1 for resistance versus temperature values.)



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