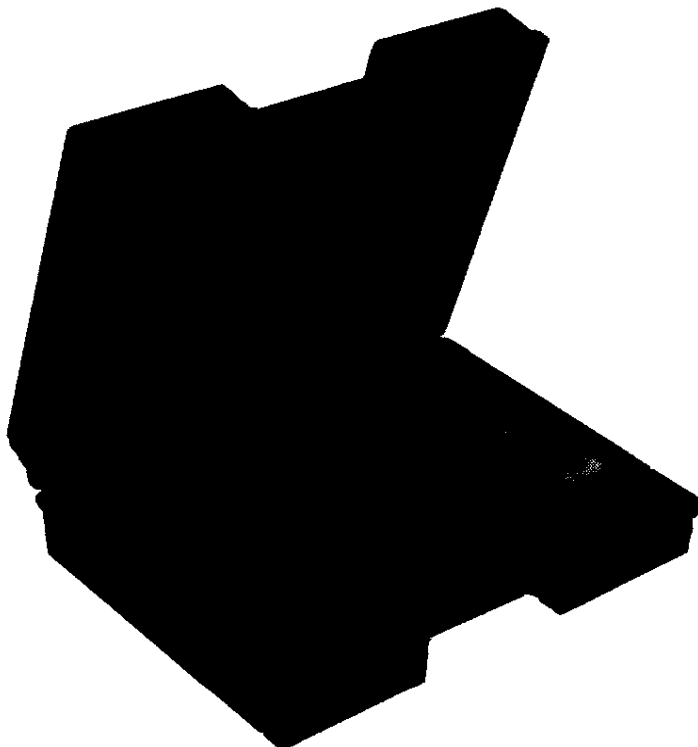


RH200 and RH201

Handheld Hygrometer/Thermometer



Operator's Manual
M398/1290

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SECTION 1 INTRODUCTION

The OMEGA® RH-200 and RH-201 Handheld Humidity and Temperature Meters, both measure the relative humidity and temperature of air.

1.1 RH-200 Hygrometer/Thermometer

The RH-200 is a compact RH and temperature sensor and digital readout all in one instrument. The integral RH sensor is a thin-film capacitor of advanced design with a protective stainless steel sensor guard. It has an accuracy of $\pm 2\%$ RH with a resolution of 1% RH and can be field calibrated. The integral thermistor will measure temperature from 32 to 104°F (0 to 40°C), which is displayed with an accuracy of $\pm 2^\circ\text{F}$ (1°C). The display is a three digit LCD readout and the instrument is powered by a 9V battery.

1.2 RH-201 Hygrometer/Thermometer

The RH-201 is an RH and Temperature Measuring Instrument and Kit, featuring an analog voltage output for use with chart recorders. The Kit contains a remote RH/Temperature probe, a handheld digital indicator, an AC power converter, and recorder leads all in a rugged plastic carrying case. An optional humidity calibration kit is also available.

The RH/Temperature probe contains a thin-film capacitive sensor and a type-K (Cromega™/Alomega™) thermocouple sensor. The handheld LCD indicator has two connectors built-in: a multi-pin for RH, and a subminiature type-K thermocouple socket for temperature. The mating connectors are attached to the probe's retractable sensor cable. The probe can be field calibrated by two adjustable potentiometer screws on the handle of the probe. A slide switch on the digital readout allows the user to change between RH and temperature readings.

The RH-201 LCD readout indicates either relative humidity in steps of 1% RH or temperature in steps of 1°F (RH-201F) or 1°C (RH-201C). The operating humidity range is 0% to 97% RH. The operating temperature range of the probe is 32 to 158°F (0 to 70°C). The RH-201 is also capable of independent temperature measurement, using any one of a variety of OMEGA type-K thermocouple probes. The analog output voltage provides a 1 mV per % RH or 1 mV per degree C or F for chart recorders.

SECTION 2 UNPACKING

Remove the Packing List and verify that all equipment has been received. If there are any questions about the shipment, please call OMEGA Customer Service Department at 1-800-622-2378; International (203) 359-1660.

Upon receipt of shipment, inspect the container and equipment for any signs of damage. Take particular note of any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

NOTE

The carrier will not honor any claims unless all shipping material is saved for their examination. After examining and removing contents, save packing material and carton in the event reshipment is necessary.

SECTION 3 OPERATION

3.1 Operating Procedure for RH-200

Simply switch the RH-200 on by using the switch on the left of the instrument. If no display is shown, or "BAT" appears in the display, the battery should be changed. A standard 9V battery is recommended.

3.2 Operating Procedure for RH-201

Connect the probe to the RH-201. Note that two connectors must be plugged in: a multipin type for RH and a subminiature thermocouple socket for temperature. Set the side-mounted switch to "%RH" to measure relative humidity, or "Temp" (up) to measure temperature.

If no display is shown, or "BAT" appears in the display, the battery should be changed. A standard 9V battery is recommended. The RH-201 can also be powered from the AC adaptor (included). Simply plug one end of the adaptor into a wall socket and the other end into the socket marked "Ext 6 Vdc".

The display indicates either temperature, in steps of 1°C or °F, or relative humidity in steps of 1% RH. Check that both functions are working and responding to change (i.e. by breathing gently on the probe end).

The RH-201 is also capable of independent temperature measurement by connecting a type-K thermocouple probe to the yellow thermocouple input socket. OMEGA has a large selection of type-K probes to pick from to fit a variety of applications. When an independent type-K probe is used, the operating temperature range is -22° to 840°F (-30° to 450°C).

At all times that the RH-201 is operating, an analog voltage is available at the Recorder Output (2.5 mm jack socket), which corresponds to the reading being displayed at the time (RH or temperature). This is suitable for feeding a remote digital display (D.V.M.) or chart recorder. The output is 1 millivolt per %RH or degree (C or F) and the external device should have an input impedance of 100K ohms or more.

When using a chart recorder for long term monitoring (2 hours or more), it is advisable to operate the instrument from the AC adaptor, to avoid losing information due to battery failure.

3.3 Probe Operation

The RH-200 is supplied with a PVC sensor cover which should be removed before making measurements. The RH-201 is supplied with a stainless steel sensor guard which may be left on when making measurements in industrial environments. Care should be taken when changing the guard, to avoid contact with the humidity or temperature sensor, whose performance is due to small size and precise construction. Use of the metal guard will protect them from both physical damage and most airborne contaminants. Keep guard clean of clogging particles.

SECTION 4 MAINTENANCE

4.1 Sensor Filter Guard Cleaning

When the stainless steel sensor guard is used as a protective filter, it must be removed and cleaned to avoid problems with obstruction or incorrect readings due to the build-up of material which can increase or decrease the local RH. Normally water can be used, with an air-blast from inside to outside of the filter, followed by drying in an oven at not more than 300°F (250°C).

Fatty or oily deposits can be removed by use of solvents such as trichlorethylene or perchlorethylene.

CAUTION

Never use detergents or surfactants, as these are difficult to remove and will cause non-linear readings.

4.2 Sensor Cleaning

Proper use of the sensor guard should reduce the chance of sensor contamination. In the event of accidental pollution, the following steps may be taken, though success cannot be guaranteed.

NOTE

Do not touch the humidity sensor, not even with the softest material.

1. **Dust:** Use a gentle air stream, e.g., from a squeeze-bulb used for cleaning camera lenses. If this does not blow off the dust, use a stream of distilled water from a wash-bottle, holding the probe downwards, so that water drips clear from the sensor. Dry, in a dust free environment, using a hair-dryer to speed the drying process, if required.

2. **Oily pollution:** Use a stream of perchlorethylene to remove contamination.

After any cleaning process, it is advisable to recheck the humidity calibration (see Section 5).

In general, if the sensor cannot be calibrated even after cleaning, the sensor or probe requires replacement. This also applies where mechanical damage (such as scratches) has occurred.

SECTION 5 HUMIDITY CALIBRATION

Periodic checking, and resetting if necessary, of the calibration of the RH-200 and RH-201 is advised. All sensors are subject to changes over extended periods of time. This becomes more important when the sensor has been exposed to an environment which may contain contaminants of various kinds.

NOTE

When recalibration cannot be achieved, and contamination is suspected, the sensor may be cleaned, as described in Section 4.2, and the calibration check repeated.

The frequency of calibration checks depends on the amount of use, and the nature of the environment measured. There is no definite schedule for any one unit, therefore the calibration frequency should be determined from experience with the product.

5.1 Humidity Calibration Kit

OMEGA offers a Humidity Calibration Kit (RH-201-CAL) for both the RH-200 and RH-201. This kit is comprised of two salt reference chambers a 0.5% RH and 75% RH reference. Also included is a threaded ring adaptor that is used when calibrating the RH-200.

5.2 Principles of Operation of the RH Calibration Kit

The ZERO reference chamber contains a molecular sieve dessicant, which absorbs any moisture present within the container. The enclosed air space should therefore remain dry within 0.5% RH for a very long period. As long as the seal is in good condition and the container remains closed when not in use, many hundreds of calibration check operations can be satisfactorily carried out.

The 75% RH Reference Chamber is based on the established method of a saturated aqueous salt solution, but designed in such a way as to give quick response, low temperature coefficient, and be maintenance-free. If the cover is replaced quickly after use, several hundred calibrations should be possible before replacement is necessary.

5.3 Accuracy of Humidity Reference Chambers

When new, the 0.5% RH chamber should provide a reference of 0.5% RH \pm 0.25% after 10 hours, or 1 to 1.25% after only 10 minutes. The 75% chamber should be within \pm 1% of 75% RH at 20° - 25°C within 30 seconds.

With age, and depending on the time exposed to atmosphere, both chambers will gradually drift towards the normal ambient humidity in which they are kept. The life of the chamber is dependent upon how long the active chemicals are exposed to the atmosphere.

Each chamber can withstand exposure to atmosphere in excess of 1 hour without noticeable error - equivalent to about 350 operations.

If there is doubt that the capsules are no longer active, a simple test can be performed. Slightly warm the capsule while it is fitted to the probe - grasping it tightly in the hand is usually sufficient. If it is still active, the hygrometer reading will increase slightly, then recover.

If it is no longer active, the reading will decrease.

It is not recommended that the 75% reference be used outside the recommended temperature range of 59° to 95°F although deterioration will not occur between 32° and 122°F.

It is estimated that the capsule life will exceed 1 year in normal use, if the above procedures are followed.

5.4 Humidity Calibration - Zero Potentiometer

Carefully unscrew the sensor guard from the RH-200 meter or RH-201 probe, avoiding damage to the sensor. RH-200 only: Screw the threaded adaptor (provided with the RH-201-CAL kit) onto the RH-200 meter. Unscrew the cover of the 0.5% RH chamber and carefully screw the chamber over the sensor. Tighten to form a seal, but do not overtighten. Turn on the meter and set to read "%RH".

Within about 10 minutes the atmosphere inside the chamber will have stabilized to within 1% of true zero. If greater accuracy is needed, it is necessary to allow several hours - preferably overnight, after which the reference will reach within 0.25% of true zero.

If adjustment is needed, set the zero potentiometer (Figure 5.1) to show zero on the display. Care should be taken to set the zero as accurately as possible. The recorder output of the RH-201 can be used, with a digital voltmeter, to insure accurate zero setting.

The zero and span potentiometers are located as follows:

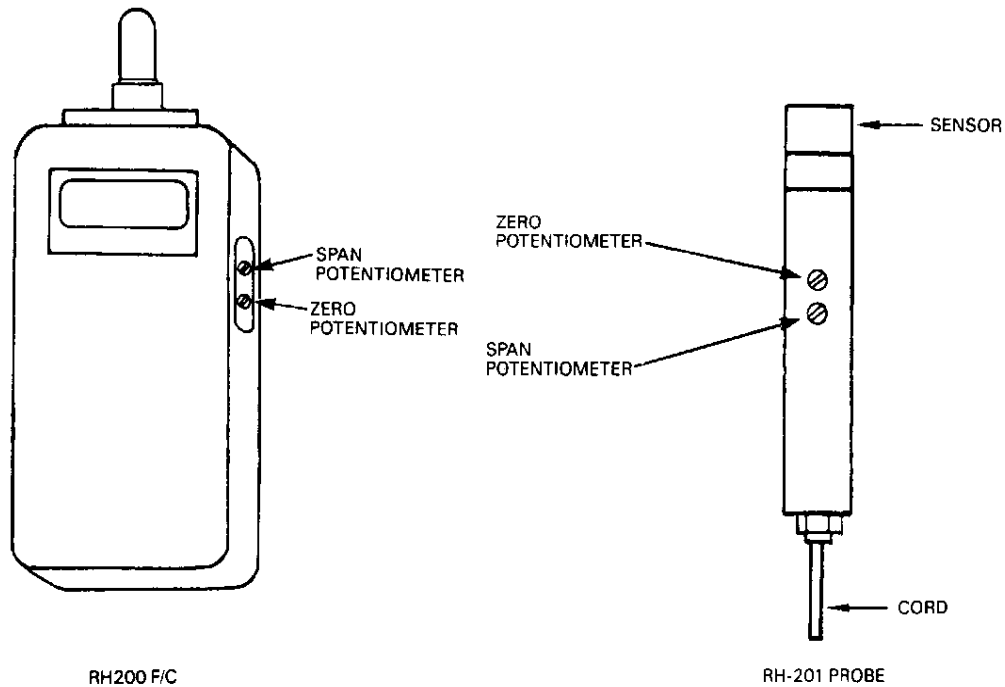


Figure 5-1 Calibration Adjustments

RH-200: Access to the zero and span potentiometers is through the side of the case as shown in Figure 5.1. The zero adjustment is below the span adjustment.

RH-201: The zero and span potentiometers are located in the probe handle. (See Figure 5-1.) The zero adjustment is the hole nearer the sensor; the span adjustment, nearer the base of the probe.

When done setting the zero potentiometer, carefully unscrew the reference chamber and immediately replace its cover.

5.5 Humidity Calibration - Span Potentiometer

When using the 75% reference, take a quick look inside as soon as the stopper is removed to check for droplets of moisture on the inside wall. If they are present, quickly wipe inside using a suitable cloth before fitting over the sensor.

Unscrew the top of the 75% RH salt reference chamber and carefully screw the chamber onto the RH-200 or the end of the humidity probe.

Within about 30 seconds, the atmosphere inside the chamber will have stabilized to within 1% of 75% RH at 68° to 77°F (20° to 25°C).

If necessary adjust the span potentiometer (see Figure 5-1) as soon as display stability is achieved (within a few minutes).

When calibration is complete, unscrew the reference chamber from the meter and replace its cover. Carefully put the sensor guard back over the sensor, once again avoiding damage to the sensor.

NOTE

Always set the Zero potentiometer first - the subsequent Span adjustment will not interact, and it is not necessary to recheck zero.

SECTION 6 TEMPERATURE CALIBRATION

NOTE

The RH-200 and RH-201 are calibrated at the factory. The warranty is void if the temperature calibration pots are tampered with. Contact OMEGA Engineering for service information.

The following procedures are necessary only if the unit is operating out of specification and is no longer under warranty. These procedures should be performed by a qualified technician.

6.1 Introduction

The solid state design of the RH-200 and RH-201 meters means that the initial calibrations should be maintained for several years, assuming no component failure.

For confidence checking, the temperature readouts can be compared with another thermometer of known accuracy. Allow both units to stabilize. Compare both readings. If either the RH-200 or RH-201 is out of spec, and still under warranty, call OMEGA Engineering for service. If the unit is out of warranty, the following procedures may be performed by a QUALIFIED TECHNICIAN only.

6.2 Equipment Needed

The following equipment is necessary when calibrating the temperature portion of the RH-201 Meter:

- A type-K thermocouple simulator/calibrator
- Type-K thermocouple wire
- A type-K subminiature thermocouple connector (male)(SMP-K-M)
- Small slotted screw-driver
- Soldering Iron

6.3 Temperature Calibration Procedure, RH-200F/C

1. Turn off the RH-201. Disassemble the unit by removing the 3 screws from the back. Unscrew the 3 brass screws inside (note that the lower screw holds the carrying strap). Slide the sensor housing off of the case. Carefully lift the PC board out of the case. Lay the unit down on a bench, being careful not to allow it to short out on anything.
2. Locate the 2 solder pins labelled PL2 on the component side of the PC board. Disconnect the 2 temperature sensor leads soldered to these points on the opposite side of the board. See figure 6-1 for component layout.
3. Connect a variable resistance source such as a Decade box to these 2 points.
4. Switch the unit on in the temperature mode.
5. a. RH-200F: Set the resistance box to 32650 ohms. Set RV4 to display a maximum reading (for highest sensitivity) and adjust RV5 to give a reading of 32.0 (± 0.1). Seal the pot in position. Next set the resistance box to 5326 ohms and adjust RV4 to display a reading of 103.1 ± 0.1 . Seal the pot in position. See figure 6-1 for pot locations.

b. RH-201C: Set RV5 fully clockwise and seal. Set the resistance box to 5326 ohms and adjust RV4 for a display reading of 39.5 (± 0.1). Seal the pot in position. See Figure 6-1 for pot locations.
6. Switch the unit off and remove leads from the resistance box.
7. Reattach the thermistor wires to the pin positions on PL2. Note: the connections are not polarized and should be made to the outside pins (the center pin is not connected).
8. Switch on to temperature and check that the display reads ambient temperature ($\pm 1^{\circ}\text{C}$ or 2°F as applicable).

6.4 Temperature Calibration Procedure, RH-201F/C

1. Turn off the RH-201. Disconnect the probe. Disassemble the unit by removing the 3 screws from the back of the unit. Unscrew 3 threaded brass screws next (note that the lower screw holds the carrying strap). Slide the connector housing off of the case. Carefully lift the PC board out of the case. Lay the unit down on a bench, being careful not to allow it to short out on anything.
2. Set the type-K calibrator to output 32°F for the RH-201F (0°C for the RH-201C). Connect the calibrator to the type-K female connector on the RH-201. The display should read 32°F (0°C). If not, adjust VR1 until the display reads correctly (see Figure 6-2).

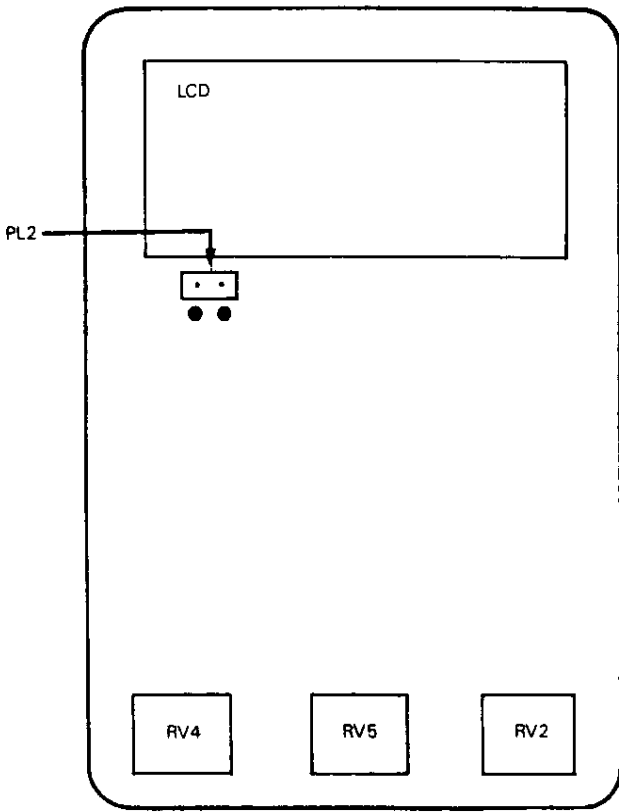


Figure 6-1 Temperature Calibration Pots and Input Connection Location for RH-200 F/C

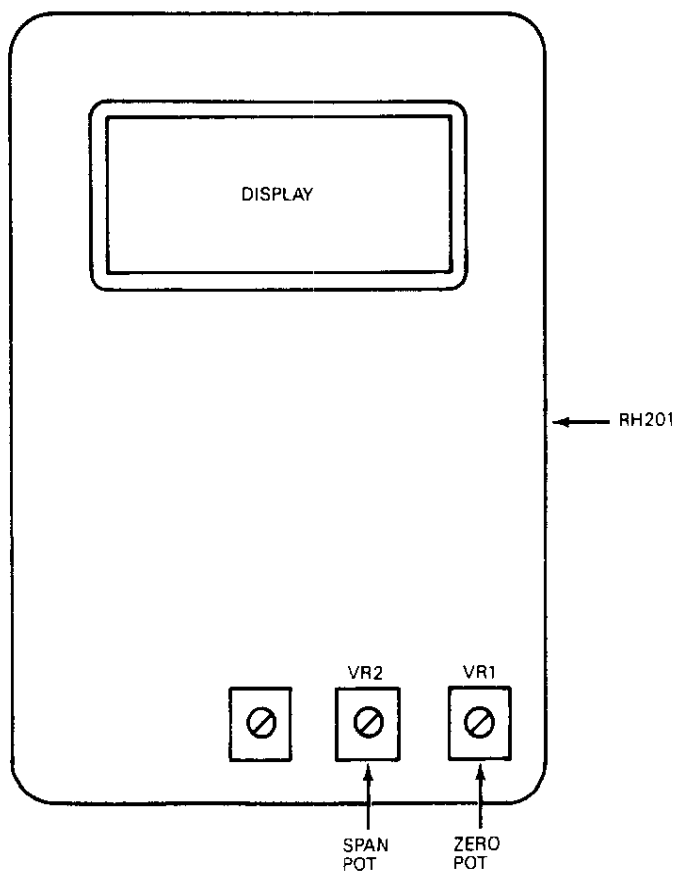


Figure 6-2 Temperature Calibration Pots for the RH-201 F/C

3. Set the calibrator to output 572°F (300°C). Adjust VR2 until the display reads 570°F (299°C). This is a deliberate offset to give optimum linearity over the complete range.

4. Disconnect the calibrator from the thermocouple socket. Check that the display reads "-1".

5. Short circuit the female socket (with a paperclip) and confirm that the RH-201 reads the ambient temperature.

Temperature calibration is complete. Turn off the RH-201 and carefully re-assemble it (take notice to include the strap under the first set of screws).

SECTION 7 NOTES ON HUMIDITY MEASUREMENT

7.1 Physical Damage to Sensors

Either or both sensors (humidity and temperature) can be damaged irreparably by contact. Care should be taken when removing the stainless steel guard.

7.2 Pollution and the Sensors

In many cases, airborne pollution can be filtered out using the metal guard (see Section 4 for cleaning instructions). Care should, however, be taken where organic solvents are being used.

7.3 RH Measurement in Response to Temperature

Though the RH-201 humidity sensor response is virtually insensitive to temperature over the normal operating range, temperature itself affects relative humidity. This dependence (typically 0.5% RH for 0.1°C temperature change) means that when taking a cold probe into a warmer atmosphere, RH readings will initially be high and conversely when a warm probe is taken into a cold atmosphere, readings will initially be low. Where these changes are likely to occur, the stainless steel guard should be removed, and the probe waved gently from side to side to speed up the air flow.

The response to RH change, with constant temperature, is much faster.

In all cases, the user should wait until the display is stable before taking readings.

7.4 Precautions in RH Measurement

Apart from the need to take reasonable care when using the RH-200 and RH-201, there are precautions to be taken in measuring relative humidity.

7.4.1 Air Circulation

Without air circulation there will be humidity differentials across a room or chamber.

7.4.2 Temperature

The temperature differences which exist across a room or chamber, though small, will have a large effect on relative humidity. In a typical case, the RH may vary by 0.5% for a temperature difference of 0.1°C (0.2°F)

7.4.3 Air Velocity

Some air velocity is necessary to get accurate results and fast response time. If necessary, the probe can be moved gently from side to side.

7.4.4 Atmospheric Pressure Effects

Air pressure effects are often neglected, but can be significant. As an example, for the same temperature, air measured at 1050 mB (millibars) may give an RH of 70%, whereas the same air at 950 mB will read 77% RH.

7.4.5 Condensation

This can occur at high RH when the probe is below the ambient dewpoint. (Dewpoint can be calculated from RH and Temperature, see Table 7-1). Though the RH-200 and RH-201 humidity sensors will recover from this, it should be avoided if possible.

TABLE 7-1
DEWPOINT TEMPERATURE (°C) AT ATMOSPHERIC PRESSURE
14.5 PSI (100 mB)

Ambient Temp. °F (°C)	14°F (-10°C)	32°F (0°C)	50°F (10°C)	68°F (20°C)	86°F (30°C)	104°F (40°C)	122°F (50°C)	140°F (60°C)	158°F (70°C)
RH									
10%	-33.6	-25.4	-18.2	-11.2	-4.4	2.6	10.1	19.4	25.1
20%	-27.0	-18.3	-10.7	-3.2	4.6	12.8	20.9	28.9	36.8
30%	-22.9	-13.9	-6.0	1.9	10.5	19.1	27.6	36.1	44.9
40%	-20.0	-10.7	-2.7	6.0	14.9	24.0	32.5	41.4	50.2
50%	-17.6	-8.2	0.1	9.2	18.4	27.4	36.7	45.7	54.9
60%	-15.6	-6.1	2.6	12.0	21.3	30.5	40.1	49.3	58.7
70%	-13.9	-4.3	4.8	14.3	23.8	33.3	43.0	52.5	62.2
80%	-12.5	-2.7	6.7	16.4	26.1	35.8	45.5	55.3	64.9
90%	-11.2	-1.3	8.4	18.3	28.0	39.9	47.8	57.8	67.8
100%	-10.0	0.0	10.0	20.0	30.0	40.0	50.0	60.0	70.0

NOTE
To obtain the dewpoint temperatures in Fahrenheit, use the formula: °F = (°C × $\frac{9}{5}$) + 32

SECTION 8 SPECIFICATIONS

MEASURING RANGES:

Humidity:	0% to 97% RH
Temperature:	
RH-200/F/C:	32 to 104°F (0 to 40°C)
RH-201 with Integral Probe:	32 to 160°F (0 to 70°C)
with Separate T/C Probe:	-22 to 840°F (-30 to 450°C)

AMBIENT OPERATING TEMPERATURE:

Instruments:	32 to 104°F (0 to 40°C)
RH-201 Probe:	32 to 158°F (0 to 70°C)

ACCURACY:

Humidity:	±2% RH
Temperature:	
RH-200:	±2°F (1°C)
RH-201:	±0.7% of reading ±1 (°C or °F)

RESOLUTION:

Humidity:	1% RH
Temperature:	
RH-200:	0.1°F or 0.1°C
RH-201:	1°F or 1°C

TEMPERATURE COEFFICIENT OF HUMIDITY SENSOR:

Negligible

RECORDER OUTPUT (RH-201 Only):

Humidity Signal:	1 mV per % RH
Temperature Signal:	1 mV per °F or °C
Output Connector:	2.5 mm jack (female) Tip positive
Recorder/DVM Input Impedance:	Not less than 100K

POWER REQUIREMENTS:

DC Operation:	9 volt battery
110 Vac Operation:	110V to 6V DC Power Adaptor (@50 mA)
220 Vac Operation:	220V to 6V DC Power Adaptor
Power Adaptor Connector:	3.5 mm jack (male), Tip positive

BATTERY LIFE:

25 hours typical with
intermittent use

DIMENSIONS:

Instrument:	
RH-200:	6.4" H x 2.8" W x 1.4" D (163 x 70 x 35 mm)
RH-201:	5.3"H x 2.8"W x 1.4"D (134 x 70 x 35 mm)
RH-201 Probe:	0.9"D x 8.0"L (23 x 202 mm)

WEIGHT:

Instrument with Battery:	8.5 ounces (240 grams)
RH-201 Probe:	6 ounces (165 grams)

OMEGA[®] ... Your Source for Process Measurement and Control

TEMPERATURE

- ☑ Thermocouple, RTD & Thermistor Probes, Connectors, Panels & Assemblies
- ☑ Wire: Thermocouple, RTD & Thermistor
- ☑ Calibrators & Ice Point References
- ☑ Recorders, Controllers & Process Monitors
- ☑ Infrared Pyrometers

PRESSURE/STRAIN/FORCE

- ☑ Transducers & Strain Gauges
- ☑ Load Cells & Pressure Gauges
- ☑ Displacement Transducers
- ☑ Instrumentation & Accessories

FLOW/LEVEL

- ☑ Rotameters, Gas Mass Flowmeters & Flow Computers
- ☑ Air Velocity Indicators
- ☑ Turbine/Paddlewheel Systems
- ☑ Totalizers & Batch Controllers

pH/CONDUCTIVITY

- ☑ pH Electrodes, Testers & Accessories
- ☑ Benchtop/Laboratory Meters
- ☑ Controllers, Calibrators, Simulators & Pumps
- ☑ Industrial pH & Conductivity Equipment

DATA ACQUISITION

- ☑ Data Acquisition and Engineering Software
- ☑ Communications-Based Acquisition Systems
- ☑ Plug-in Cards for Apple, IBM & Compatibles
- ☑ Datalogging Systems
- ☑ Recorders, Printers & Plotters

HEATERS

- ☑ Heating Cable
- ☑ Cartridge & Strip Heaters
- ☑ Immersion & Band Heaters
- ☑ Flexible Heaters
- ☑ Laboratory Heaters