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e-mail: sales@omegaeng.nl

Czech Republic:
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Tel: +420 (0)59 6311899 FAX: +420 (0)59 6311114
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France:
11, rue Jacques Cartier, 78280 Guyancourt, France
Tel: +33 (0)1 61 37 2900 FAX: +33 (0)1 30 57 5427
Toll Free in France: 0800 466 342
e-mail: sales@omega.fr

Germany/Austria:
Daimlerstrasse 26, D-75392 Deckenpfronn, Germany
Tel: +49 (0)7056 9398-0 FAX: +49 (0)7056 9398-29
Toll Free in Germany: 0800 639 7678
e-mail: info@omega.de

United Kingdom:
ISO 9002 Certified
One Omega Drive, River Bend Technology Centre
Northbank, Irlam, Manchester
M44 5BD United Kingdom
Tel: +44 (0)161 777 6611 FAX: +44 (0)161 777 6622
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HANDHELD HUMIDITY METERS

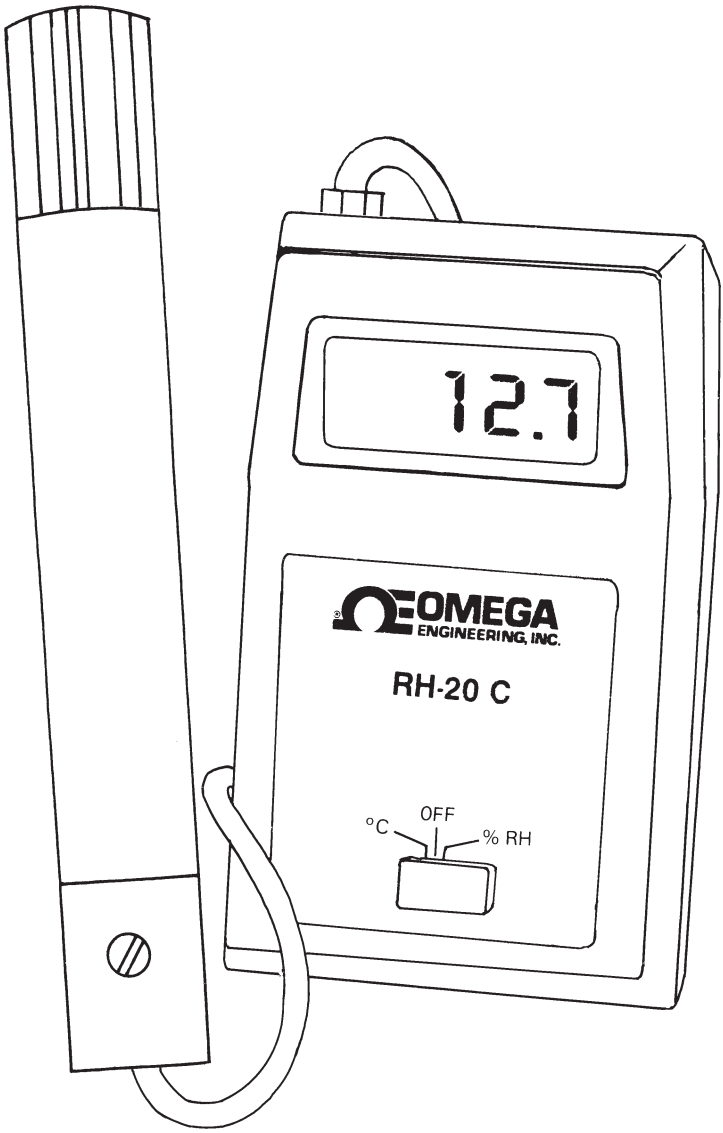

Figure 1 RH-20C

SECTION 1 INTRODUCTION

1.1 GENERAL DESCRIPTION

OMEGA's RH-10, RH-20 and RH-21 are rugged handhelds digital meters which provide accurate and easy measurement of relative humidity (Model RH-10) and temperature (Models RH-20 and RH-21). These units are ideal for checking RH in the air conditioning, storage, heating and environmental industries as well as computer rooms. It's applications, however, are not limited to those uses.

The RH-10 measures 10% to 95% RH, with a resolution of 0.1% RH. This instrument provides a liquid crystal display (LCD) for clear readout, and a display HOLD switch. The RH-10 also comes complete with a built-in humidity sensor.

The RH-20 measures 10% to 95% RH, with a resolution of 0.1% RH. The remote probe measures 32° to 175°F (0° to 80°C), with a resolution of 0.1°F or °C. The RH-20 provides an LCD for clear readout, and also includes a handheld remote sensing probe.

The RH-21 measures 5% to 95% RH, with a resolution of 0.1% RH. The remote probe measures −5°F to 175°F (−20°C to 80°C). The RH-21 humidity sensor is a thin film capacitive sensor with a 15 second response time for humidity measurements.

1.2 RH-10 FEATURES

- Measures RH from 10% to 95%
- Accuracy; ±2.0% RH
- Resolution; 0.1% RH
- Integral Humidity Sensor
- Hold function

1.3 RH-20 FEATURES (see Figure 1)

- Measures RH from 10% to 95%
- Measures Temperature from 32°F to 175°F (0°C to 80°C)
- Accuracy; ±2.0% RH and ±1 °F or °C
- Resolution; 0.1% RH and 0.1°F or °C
- Remote Humidity/Temp. Probe with 4½ foot cable

1.4 RH-21 FEATURES

- Measures RH from 5% to 95%
- Measures Temperature from −5°F to 175°F (−20°C to 80°C)
- Accuracy; ±2.0% RH and ±1°F or °C
- Resolution; 0.1% RH and 0.1°F or °C
- Fast RH Response Time
- Remote Humidity/Temp Probe with 4½ foot cable

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 .

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 claim 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.

Please note that the following items are in the box:

RH-10: RH-10 Humidity Meter, Carrying Case, 9 V Battery, and Operator's Manual

RH-20: RH-20 Humidity/Temperature Meter, Humidity/Temperature Probe, Carrying Case, 9 V Battery, and Operator's Manual

RH-21: RH-21 Humidity/Temperature Meter, Humidity/Temperature Probe, Carrying Case, 9 V Battery, and Operator's Manual

SECTION 3 ASSEMBLY

3.1 BATTERY INSTALLATION

Gently slide the battery cover open on the back of the unit (use a small screwdriver to depress the tab, if necessary). Plug in the 9 V battery observing polarity, place in compartment and gently slide the cover closed. When sliding the battery cover closed, it may be helpful to slightly depress the battery cover tab to help guide the tab into the slot.

3.2 PROBE ASSEMBLY (RH-20 and RH-21 only)

Attach the Humidity/Temperature Probe to the connector on top of the unit, observing the key inside the connector. Hand tighten the knurled threaded fitting to ensure a good connection.

SECTION 4 OPERATING INSTRUCTIONS

4.1 RH-10 MEASURING HUMIDITY

The RH-10 is simple to operate. Install the battery as described in Section 3.1. To read humidity, move the front panel slide switch to the middle position (marked ON). Hold instrument (or place it) in the location where RH is to be checked. Response time is 2-3 minutes from 10% to 50% (up to 90% of measuring value), and 3-5 minutes from 50% to 90% RH. These times are based on circulating air. In still air, response time is 20-30 minutes.

If you desire to read a particular RH and then hold that reading, move the slide switch all the way to the right (marked HOLD).

Return the slide switch to the far left position to turn the RH-10 OFF.

4.2 RH-20/RH-21 MEASURING HUMIDITY AND TEMPERATURE

The RH-20 and RH-21 are both simple to operate. Install the battery and probe as described in Section 3-1. Push the front panel slide switch all the way to the right to read relative humidity. Hold probe (or place it) in the location where RH is to be checked.

RH-20: RH response time is 2-3 minutes from 10% to 50% (up to 90% of measuring value), and 3-5 minutes from 50% to 90% RH. These times are based on circulating air. In still air, reponse time is 20-30 minutes.

RH-21: RH response time, up to 90% of measuring value is 15 seconds.

To read the temperature, push the slide switch to the far left position. The temperature response time is approximately 1 minute to steady state conditions.

Return the slide switch to the center position to turn the RH-20/RH-21 OFF.

SECTION 5 SENSOR INFORMATION AND MAINTENANCE

5.1 RH-10/RH-20 HUMIDITY SENSOR

The RH sensor consists of a double sided, gold-plated plastic foil which is mounted in a perforated plastic housing. The foil functions as the dielectric of a plate capacitor, and the gold-plating on both sides of the foil acts as the electrodes. Under the influence of humidity, the dielectric constant of the foil changes, and with it, the capacitance of the sensor. Through an electronic circuit, the capacitance of the sensor is converted into a DC voltage signal. This DC voltage is digitally indicated as percent RH.

5.2 RH-21 HUMIDITY SENSOR

The relative humidity sensor in the RH-21 is a thin film capacitance sensor. It consisits of a single capacitor, capacitance of which varies according to the water molecules absorbed by the active polymer.

The characteristics are not altered when operating in conditions close to saturation. However, using the sensor at high humidity and combined with the moistening risk of the sensitive element, can momentarily falsify the measurements.

For example, a permanent measurement or an extended duration measurement (> 30 minutes) higher than 90% leads to a phenomena of ''secondary absorption''. This results in an evolution able to reach about +6% of a relative humidity close to saturation. This evolution is memorized by the sensor. A return to ambient conditions (40% to 50% RH) for up to 24 hours might be necessary to return the sensor to its original characteristics.

5.3 RH-20/RH-21 TEMPERATURE SENSOR

The temperature sensor in the Humidity/Temperature probe consists of a 100 ohm platinum RTD sensor. It conforms to the European (E) curve where α = 0.00385 ohms/ohm/°C.

An RTD (Resistance Temperature Detector) operates on the principle of change in electrical resistance in wire as a function of temperature. These sensors are desirable when accuracy over a wide temperature range is important. RTD's are stable over long periods of continuous use, which makes them very reliable.

5.4 HUMIDITY SENSOR HANDLING

Due to its design, and the ease of access, the humidity sensor must be handled with care. AVOID ANY CONTACT with fingers or with products that could be harmful to the good permeability of the electrode and dielectric.

The sensor should not come into contact with dirt or other foreign material and must not be immersed in water or other liquids. Incorrect readings can be caused by build-up of material, which can increase or decrease the true relative humidity value.

5.5 HUMIDITY SENSOR CLEANING AND MAINTENANCE

Use no solvents stronger than DISTILLED WATER to clean the humidity sensor. If necessary, rinse the sensor with distilled water, being careful not to touch it with your fingers. After rinsing, the sensor should air dry for at least 24 hours (preferably over an air flow register).

SECTION 6 PRECAUTIONS WHEN TAKING RH MEASUREMENTS

Apart from the need to take reasonable care when using these instruments, there are precautions to be taken when measuring humidity.

6.1 AIR CIRCULATION

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

6.2 TEMPERATURE

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

6.3 AIR VELOCITY

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

6.4 ATMOSPHERIC PRESSURE EFFECTS

Air pressure effects are often neglected, but can be significant. As an example, for the same temperature, air measured at 1050 millibars (1.04 atm) may give an RH of 70%, whereas the same air at 950 millibars (0.94 atm) will read 77% RH.

SECTION 7 HUMIDITY CALIBRATION PREPARATION

NOTE

The RH-10, RH-20 and RH-21 are calibrated at the factory. The following procedures are necessary only if the unit is operating out of specification. These procedures should be performed by a qualified technican.

7.1 UNDERSTANDING SALT SOLUTION REFERENCES

When a closed air space is maintained in equilibrium with a saturated aqueous salt solution, the relative humidity of the enclosed air remains constant as long as the temperature and pressure do not change.

It is important to note that the solutions must remain saturated for these relative humidities to be valid. Increases in ambient temperature will require agitation of the solution to ensure saturated conditions. To prevent this from becoming a problem, the solutions, once prepared, should be kept in a temperature-controlled room.

To calibrate these instruments, it is necessary for the user to prepare two saturated salt solutions—one to simulate 22% RH and one to simulate 80% RH.

7.2 CHOOSING EQUIPMENT FOR HUMIDITY CALIBRATION

The following equipment is needed when RH calibrating the RH-10/RH-20/RH-21:

- Two glass or plastic containers complete with a lid that forms a good seal (see NOTE below for container details)
- Distilled water
- Lithium Chloride (simulates 11% RH)
- Sodium Chloride (simulates 76% RH)

* (Optional) Alternate Calibration solutions…see Table 7.1

NOTE

The choice of calibration containers merits a more detailed description. The type of container you pick depends on how resourceful you are- coupled with a description of the sensor and the set-up itself. The following should help:

RH-10 CONTAINER: If calibrating the RH-10, a small container with a top like a rubber stopper should do. Imagine the RH-10 sensor to look like a small disk (the size of a dime) dangling on the end of two small wires. The container you choose should be large enough to allow for about a ¼ inch of salt solution on the bottom, and tall enough to dangle the humidity sensor inside the container without it touching the solution. The top should be a snug fitting rubber stopper with a little ''cut-out'' on the edge to avoid crushing the wires when the top is closed (yet still maintaining a seal).

RH-20/RH-21 CONTAINER: If calibrating the RH-20 or RH-21, the first inch of the probe must be sealed inside the container, while the base of the probe (where the cal pots are) is still accessible. The container should be large enough to allow for about a ¼ inch of salt solution on the bottom, and tall enough so that the sensor is inside the container, yet not touching the solution on the bottom.

TEMPERATURE VS RELATIVE HUMIDITY		
SALT SOLUTION	**RH AT 68°F (20°C)**	**RH AT 77°F (25°C)**
Lithium Chloride	11%	11%
Potassium Acetate	22%	22%
Potassium Carbonate	44%	43%
Ammonium Nitrate	65%	62%
Sodium Chloride	76%	75%
Ammonium Sulfate	81%	80%

Table 7-1: Alternate Calibration Solutions

The top should be a snug fitting rubber stopper with a round cutout large enough to accommodate the .75 inch diameter probe (measured with the sensor cap removed). The outer most diameter of the probe shaft is .93 inches, but each side has a crevice along the length of the probe. These crevices will not allow for proper sealing, hence the seal should be made along the smaller inside diameter. Have a ¼" diameter rubber stopper on hand to seal the container when the probe is not installed in the cap.

Table 7.1 lists some alternate calibration solutions that can be used to simulate other relative humidity values. If you do not have the recommended lithium chloride or sodium chloride salts, the others in this table will do. Just be sure to adjust the displays to the associated RH reading as found in Table 7.1.

7.3 PREPARING THE SALT SOLUTION REFERENCES FOR HUMIDITY CALIBRATION

To simulate 11% RH, fill the bottom of the calibration container approximately ¼ full of distilled water. Add lithium chloride until the solution is saturated (solution is saturated when an additional crystal of solute added to the solution does not enter into the solution). Keep the container closed for at least one hour, with the temperature of the solution constant (68°F to 77°F; 20°C to 25°C) to prevent the concentration of the salt solution from changing.

To simulate 76% RH, follow the same procedure for making the 11% RH above, only this time add sodium chloride to the distilled water (until saturated) instead of the lithium chloride.

SECTION 8 DISASSEMBLING THE INSTRUMENTS FOR CALIBRATION PURPOSES

Disassemble only what is necessary to perform the various calibration:

RH-10—For Humidity Calibration . . . . . Disassemble case

RH-20—For Humidity Calibration . . . . . Disassemble probe only
For Temperature Calibration . . . .Disassemble case only

RH-21—For Humidity Calibration . . . . . Disassemble probe only
For Temperature Calibration . . . Disassemble case only

8.1 INSTRUCTIONS TO DISASSEMBLE THE CASE

Disassemble the case of any of the three units in the same manner. The slide knob on the front panel slide switch must be pried off. The knob is a hollow plastic piece that is ''hot-melt'' glued to a plastic shaft emerging from the printed circuit (pc) board mounted slide switch.

A tool that is thin and strong (much like a jeweler's screw driver) will be necessary to pry the knob from the shaft. Care must be taken not to mar the label on the instrument. (A piece of masking tape across the edge of the label will help to protect it from unnecessary scratches.) Carefully wedge the blade between the knob and the cover near the bottom of the instrument. Gently raise and lower the blade until the knob pops off.

NOTE

If the knob is laying very tight against the surface of the instrument, it may be necessary to first remove the back cover and press the PC board up against the inside of the top cover. This will allow for a small space in which to wedge the thin blade.

To remove the back cover, use a mid-size phillips-head screw driver to take out the four screws on the back of the case. Take care not to strip the plastic case when replacing the screws.

8.2 INSTRUCTIONS TO DISASSEMBLE THE PROBE (RH-20/RH-21 ONLY)

NOTE

Recalibrating the humidity portion is necessary only if the unit is operating out of specification and is no longer under warranty. Doing so before the warranty expires will void the warranty of the instrument.

However, a check of the humidity values can be made without disturbing the probe or the warranty label. Follow the procedures in Section 9.2 to check the relative humidity accuracy.

Recalibration should be performed by a qualified technician only.

Two access holes for the humidity calibration potentiometers are located underneath the warranty label on the Humidity/Temperature Probe. TOTAL disassembly of the Humidity/Temperature probe is NOT recommended when recalibrating the humidity portion of the RH-20 and RH-21. Follow the directions below to expose these pots for adjustment purposes.

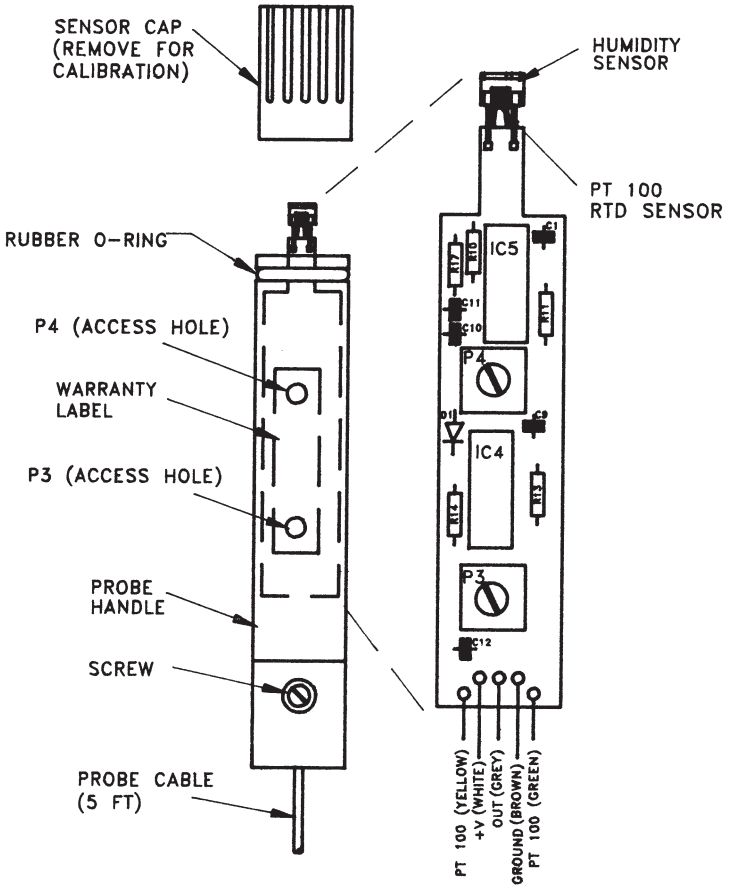

Figure 8-1 RH-20/RH-21 Probe

Refer to Figure 8-1 when reading the following instructions. Find the two 5⁄32 inch access openings located at opposite ends under the warranty label. Run your finger along the label and feel for the depressions. Pop openings in the label (at the depressions) big enough to access the pots with a small screw driver.

Next, carefully remove the sensor cap from the probe handle. This is done by firmly grasping the sensor cap and the lower end of the probe enclosure. Carefully twist in opposite directions of each other and pull. Do not bend the assembly, since you could damage it. Be careful not to touch the sensors. The unit is now ready for RH calibration.

SECTION 9 HUMIDITY CALIBRATION PROCEDURES

Prepare the 11% and the 76% calibration salts in their respective containers as described in Section 7.3. Let the two containers and the meter stabilize at room temperature (68°F to 77°F) for at least an hour before calibrating.

9.1 RH-10 HUMIDITY CALIBRATION

1. Disassemble the case of the RH-10 as described in Section 8.1. Carefully remove the humidity sensor from the RH-10 case. Wiggle the sensor ever so slightly to help free it and the silicone rubber from the case. Extreme caution must be taken when handling the sensor.
2. Open the cover of the 11% salt solution (lithium chloride) and quickly put the RH-10 humidity sensor inside. Be sure not to immerse the sensor in the liquid. Close the cover to form a seal, being careful not to pinch the wires. Let the display and sensor stabilize for at least an hour.
3. Refer to Figure 9-1 for the location of the humidity calibration pots. Adjust the potentiometer P3 until the display reads 11.0 RH. If it is not possible to adjust the display to 11.0, contact the Customer Service Department at OMEGA Engineering.

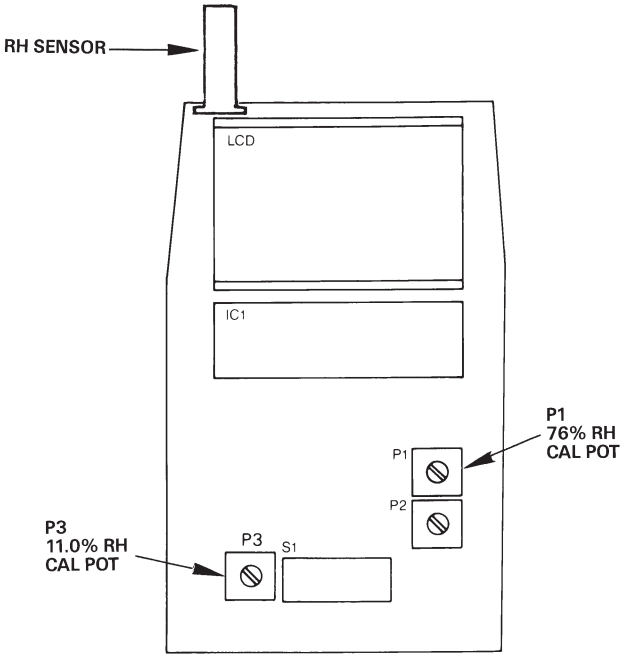

Figure 9-1 RH-10 Humidity Calibration Pots

4. When the display reads correctly, carefully remove the sensor from the container and reseal the solution.

Repeat steps #2, #3, #4 above, this time using the 76% salt solution container (sodium chloride). Adjust potentiometer P1 until the display reads 76.0 RH. (Refer to Figure 9-1 for pot location).

Alternately repeat the above two calibration procedures again with each of the two salt solutions until the readings of 11% and 76% can be achieved without resetting either P3 or P1.

Reassemble the RH-10 when finished with the calibration procedure.

— Use a small amount of white glue to secure the RH sensor and silicone paste back in place. DO NOT use a permanent glue, doing so will hinder future calibrations.

— Lay the wires and printed circuit board into the bottom half of the case. Be sure not to pinch the wires. Fit the top cover in place over the whole assembly and snap shut.

— Secure case assembly with the four screws, being careful not to strip the case when tightening.

— Finally, put a SMALL dab of white glue on the tip of the slide switch shaft. Place the slide knob back on the shaft, taking notice to make sure that the tiny pointer on the knob is facing the letters.

9.2 RH-20 AND RH-21 HUMIDITY CALIBRATION AND CHECK

1. Prepare the probe for calibration as described in Section 8.2. Pop holes in the warranty label only if the meter is out of spec. Go through the steps below to verify the accuracy.
2. Fit the tip of the probe into the 11% lithium chloride salt solution container described in Section 7.2. Be sure not to immerse the sensor in the liquid. Let the assembly stabilize for at least an hour.
3. Refer to Figure 8-1 for the location of the humidity calibration pots in the probe. Adjust the potentiometer P4 until the display reads 11.0 RH. If it is not possible to adjust the display to be 11.0 using P4, contact the OMEGA Engineering Customer Service Department.
4. When the display reads correctly, remove the sensor from the container and close it again.

Repeat steps #2, #3, and #4 above, this time using the 76% salt solution container (sodium chloride). Adjust potentiometer P3 until the display reads 76.0 RH.

Alternately repeat the above two calibration procedures again with each of the two salt solutions until the readings of 11% and 76% can be achieved without resetting either P4 or P3.

SECTION 10 TEMPERATURE CALIBRATION FOR THE RH-20/RH-21

The following equipment is needed when calibrating the temperature portion of the RH-20/RH-21 meters.

- High precision resistors (see Table 10-1 for values)
- Low temperature soldering iron and solder
- Small long nose pliers (optional)
- Small screw driver

1. Disassemble the case of the RH-20/RH-21 as described in Section 8.1.
2. Remove the screw in the probe handle and remove the sensor cap. DO NOT take apart the probe case. Leave the rubber gasket in place.
3. Open the probe case just wide enough to get in there and unsolder the cable from the printed circuit board (the long nose pliers might help here).
4. Connect a 100.00 ohm precision resistor across the yellow and green wires on the cable (tack them with solder, if necessary).
5. Turn the unit on to read temperature. Adjust P1 (see Figure 10-1) until the display reads 31.6°F (0°C). Disconnect resistor.

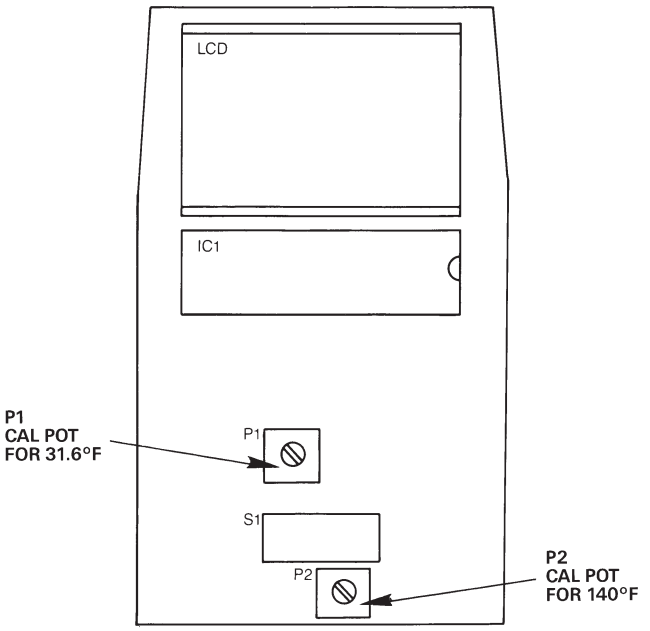

Figure 10-1 RH-20/RH-21 Temperature Calibration Pots

6. Connect a 123.24 ohm precision resistor across the yellow and green wires on the cable.
7. Adjust P2 until the display reads 140.0°F (60.0°C). Disconnect resistor.
8. Repeat steps #4 through #7 until 31.6°F and 140.0°F can be achieved without resetting the pots.
9. If desired, check linearity with the precision resistors listed in Table 10-1. Allow cooling time between readings—even precision resistors change with heat.

TEMPERATURE CALIBRATION GUIDE			
RESISTANCE ACROSS YELLOW & GREEN WIRE	°C	°F	NORM. DISPLAYED VALUE
100.00	0	32	31.6
103.90	10	50	50.0
107.79	20	68	68.2
111.67	30	86	86.3
115.54	40	104	104.4
119.40	50	122	122.3
123.24	60	140	140.0
130.89	80	176	175.2

Table 10-1: Precision Resistor For Temperature Simulation

10. Reassemble the RH-20/RH-21 when finished with the calibration.
    - —Solder the cable onto the printed circuit board. (See Figure 8-1). Reassemble the probe case and sensor cap.
    - —Lay the wires and printed circuit board into the bottom half of the case. Be sure not to pinch the wires. Fit the top cover in place over the whole assembly and hold closed.
    - —Secure case assembly with the four screws, being careful not to strip the case when tightening.
    - —Finally, put a SMALL dab of white glue on the tip of the slide switch shaft. Place the slide knob back on the shaft, taking notice to make sure that the tiny pointer on the knob is facing the letters. DO NOT use a permanent glue, doing so will hinder future calibrations.

SECTION 11 LOW BATTERY INDICATION

The RH-10, RH-20 and RH-21 each have an automatic low battery indication when the supply voltage drops below 7 volts. A low battery condition will be indicated by ''LO BAT'' appearing on the display. When this condition occurs, replace the battery with a 9 volt battery.

SECTION 12 SPECIFICATIONS

12.1 SPECIFICATIONS FOR RH-10

MEASURING RANGE: 10%-95% RH

OPERATING TEMPERATURE: 32°F to 122°F (0°C to 50°C)

SENSOR: Dielectric Humidity Sensor

RESOLUTION: 0.1% RH

ACCURACY: ±2.0% RH

RH RESPONSE TIME: (Up to 90% of measuring value)

Circulating Air: 2 to 3 min. from 10% to 50% RH
3 to 5 min. from 50% to 90% RH

Still Air: 20 to 30 minutes

SAMPLING RATE: 2 readings per second

TEMPERATURE DRIFT: ±0.5% per 10°C

DIMENSIONS:

Instrument: H: 4.875″ (123.8 mm) x W: 2.875″ (73.0 mm);
D: 1.000″ (25.4 mm) to 1.375″ (34.9 mm)

WEIGHT: 5.5 oz. (160 gr) including battery

DISPLAY: 3½ digit, ½″ LCD

POWER SUPPLY: 9 Volt battery

BATTERY LIFE: 100 hours continuous
6 months for typical use

BATTERY CHECK: Automatic low battery indication

12.2 SPECIFICATIONS FOR RH-20

MEASURING RANGES:	
RH/Temp Probe—Humidity:	10%-95% RH
Temperature:	32°F-175°F (0°C-80°C)
INSTRUMENT OPERATING TEMPERATURE:	32°F-120°F (0°C-50°C)
SENSORS:	Humidity-Dielectric Temperature-100 ohm RTD
RESOLUTION:	
Humidity:	0.1% RH
Temperature:	0.1°F (0.1°C)
ACCURACY:	
Humidity:	±2.0% RH
Temperature:	±1°F or °C
RH RESPONSE TIME: (Up to 90% of measuring value)	
Circulating Air:	2 to 3 min. from 10% to 50% RH 3 to 5 min. from 50% to 90% RH
Still Air:	20 to 30 minutes
TEMPERATURE RESPONSE TIME:	1 minute
SAMPLING RATE:	2.5 times per second
DIMENSIONS:	
Instrument:	H: 4.875″ (123.8 mm) x W: 2.875″ (73.0 mm); D: 1.000″ (25.4 mm) to 1.375″ (34.9 mm)
Probe:	0.925″ diameter (23.5 mm) 6.0″ long (152.4 mm)
Cable:	4½ feet
WEIGHT:	8.75 ox. (250 gr) including battery
DISPLAY:	3½ Digit, ½″ LCD
POWER SUPPLY:	9 Volt battery
BATTERY LIFE:	100 hours continuous 6 months for typical use
BATTERY CHECK:	Automatic low battery indication

12.3 SPECIFICATIONS FOR RH-21

MEASURING RANGES:	
RH/Temp Probe—Humidity:	5%-95% RH
Temperature:	−5°F-175°F (−20°C-80°C)
With Separate RTD Probe:	−150°F -200°F (−100°C-200°C)
INSTRUMENT OPERATING TEMPERATURE:	32°F-120°F (0°C-50°C)
SENSORS:	Humidity-Thin Film Dielectric Temperature-100 ohm RTD
RESOLUTION:	
Humidity:	0.1% RH
Temperature:	0.1°F (0.1°C)
ACCURACY:	
Humidity:	±2.0% RH
Temperature:	±1°F or °C
RH RESPONSE TIME: (Up to 90% of measuring value)	
Circulating Air:	15 seconds
TEMPERATURE RESPONSE TIME:	1 minute
SAMPLING RATE:	2.5 times per second
TEMPERATURE RATE:	±0.5% RH per 10°C
DIMENSIONS:	
Instrument:	H: 4.875″ (123.8 mm) x W: 2.875″ (73.0 mm); D: 1.000″ (25.4 mm) to 1.375″ (34.9 mm)
Probe:	0.925″ diameter (23.5 mm) 6.0″ long (152.4 mm)
Cable:	4½ feet
WEIGHT:	8.75 oz. (250 gr) including battery
DISPLAY:	3½ Digit, ½″ LCD
POWER SUPPLY:	9 Volt battery
BATTERY LIFE:	100 hours continuous 6 months for typical use
BATTERY CHECK:	Automatic low battery indication

MADE IN THE USA

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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