1 YEAR WARRANTY

MADE IN USA

User's Guide

RH70 and RH70-AC Handheld Temperature/ Humidity/Dew Point Indicators

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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 which wear are not warranted, including but not limited to contact points, fuses, and triacs.

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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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RH70
TEMPERATURE/HUMIDITY/DEW POINT INDICATOR

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SECTION 1 INTRODUCTION

The OMEGA® RH70 Handheld Temperature / Humidity / Dew Point Indicator is a microprocessor-based digital hygrometer / thermometer with built-in date storage and an RS-232-C interface. The RH70-Ac can be operated using a rechargeable Ni-Cad battery.

The RH70 / RH70-AC Indicator is used for measuring humidity and temperature in heating, ventilation and air conditioning industries. The RH70) / RH70-AC calculates the dew point and displays in either °C or °F. The RH70 / RH70-AC features 2% reading accuracy for humidity and 0.2% reading accuracy for temperature. From the front keyboard, the user can select English or Metric Units, operating mode and data storage controls.

This handheld indicator can store up to 999 lines of data. Each single line of data contains one temperature and one relative humidity reading. The dew point reading can not be saved or transformed (it can only be read on the display).

Figure 1.1 shows the RH70 Indicator.

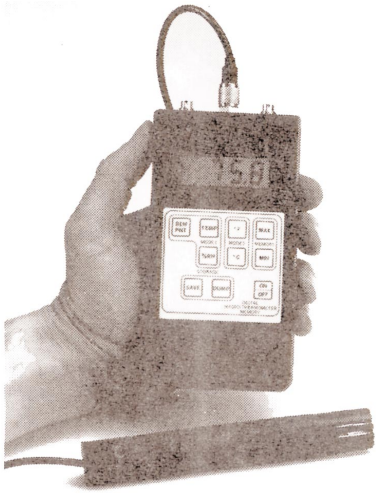


Figure 1.1 RH70 Temperature / Humidity / Dew Point Indicator

Two different models of the RH70 are available from OMEGA Engineering

PART NUMBER	DESCRIPTION
RH70	PORTABLE HYGROMETER/ THERMOMETER WITH 9V BATTERY
RH70-AC	RH70 WITH RECHARGEABLE BATTERY AND CHARGER

For accessories, refer to Section 10.

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 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.

SPECIFICATIONS (Cont'd)

TEMPERATURE

RANGE:	**-5 TO 175°F (-20 to 80°C)**
ACCURACY:	**0.2% reading ± 1 digit**
RESOLUTION:	**0.7°F (0.4°C)**
SENSING ELEMENT:	**100 ohms Pt RTD sensor**
RESPONSE TIME:	**60 seconds**

SEPARATE RTD PROBE

RANGE:	**-148 to 572°F (-10 to 300°C)**
ACCURACY:	**0.2% of reading ± 1 digit**

OPERATING TEMPERATURE

INSTRUMENT:	**32 to 125°F (0 to 50°C)**
RH/ TEMP PROBE:	**-5 to 175°F (-20 to 80°C)**
WITH SEPARATE RTD PROBE:	**-148 to 572°F (-100 to 300°C)**

POWER SUPPLY

RH70:	**One 9V battery**
RH70-AC:	**One 9V Ni-Cad battery with AC charger**

BATTERY LIFE

9V ALKALINE:	**78 hours**
Ni-CAD RECHARGEABLE: (FULLY CHARGED)	**15 hours**

GENERAL

BAUD RATE:	**1200 Baud**
DISPLAY:	**1/2" LCD, 4 digit**
ANALOG OUTPUTS	
RELATIVE HUMIDITY:	**0 to 2 volts**
TEMPERATURE:	**0 to 2 volts**
DIGITAL OUTPUT:	**standard RS-232-C**
DATA STORAGE:	**Store up to 999 measurements for both humidity and temperature.**

DIMENSIONS

INSTRUMENT:	**5.9" H x 3.15" W x 1.2" D**
PROBE:	**6" L x 0.93 diameter**
PROBE CABLE:	**5 feet**

WEIGHT

INSTRUMENT:	**9.49 oz (269 gm)**
PROBE AND CABLE:	**2.75 oz (78 gm)**

9.2 REACHING SATURATION LEVELS

The measuring range for Relative Humidity is from 5% to 95%. The characteristics are not altered when operating in conditions close to saturation; however, exposure to high humidities and the moistening risk of the humidity sensor can momentarily falsify the measurements. For example, a permanent measurement for an extended duration measurement (>1/2 hour) at higher than 90% RH leads to a phenomena of secondary absorption.

This results in an evolution able to reach approximately +6% of a %RH measurement close to saturation. The evolution is memorized by the humidity sensor and it can take up to 24 hours of drying to return the sensor to its original characteristics.

SECTION 10 ACCESSORIES

PART NUMBER	DESCRIPTION
RH70-RP	Replacement Humidity/ temperature probe with 5 ft cable
RH70-SF	Sinter Filter Cap

SECTION 11 SPECIFICATIONS

TEMPERATURE

RANGE:	**5 to 95%RH**
ACCURACY:	**2%RH ± 1 digit**
RESOLUTION:	**0.1%RH**
TEMP DRIFT:	**±0.5% RH per 10° C**
RESPONSE TIME:	**Up to 90% of fluctuations in 10 s**
SENSING ELEMENT:	**Thin film capacitive type sensor**

DEW POINT

RANGE:	**-5 to 175°F (-20 to 80°C)**
SENSING ELEMENT:	**Mathematically calculated from RH and temperature readings (using a look-up table)**

Please note that the following items should be in a box:

MODEL RH70		MODEL RH70-AC	
QTY	DESCRIPTION	QTY	DESCRIPTION
1	RH70 Indicator	1	RH70-AC Indicator
1	Humidity/Temperature Probe with 5 ft cable	1	Humidity/Temperature Probe with 5 ft cable
1	RS-232 Cable (5 ft)	1	RS-232 Cable (5 ft)
1	Analog Output Cable (5 ft)	1	Analog Output Cable (5 ft)
1	9V Battery	1	9V Rechargeable Ni-Cad Battery
1	Rugged Carrying Case	1	Rugged Carrying Case
1	Operator's Manual	1	Operator's Manual

SECTION 3 DISPLAY AND KEYPADS OPERATION

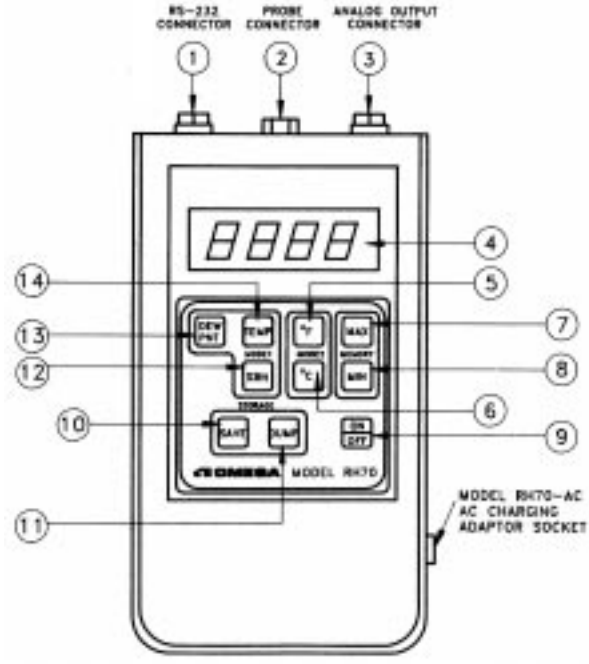


Figure 3-1. RH70/RH70-AC

ITEM	KEY	DESCRIPTION(refer to Figure 3
1	--	Connector for the RS-232 Cable
2	--	Connector for the Humidity / Temperature Probe
3	--	Connector for the Analog Output Cable (0-2V)
4	--	Instrument LCD Display (4 Digits)
5	°F	Pressing the "°F" key displays a temperature reading in degrees Fahrenheit. The reading is updated 2.5 times per second.
6	°C	Pressing the "°C" key displays a temperature reading in degrees Celsius. The reading is updated 2.5 times per second.
7	MAX	Pressing the "MAX" key displays the highest value in either Temperature or Relative Humidity. This feature is not applicable to the Dew Point values. The maximum value (since turning on the RH70) alternates with the flashing"H". To exit from the MIN / MAX mode, and continue to monitor temperature, press the "TEMP" key. To exit from the MIN / MAX mode and continue to monitor humidity, press the "%RH" key.
8	MIN	Pressing the "MIN" key displays the highest value in either Temperature or Relative Humidity. This feature is not applicable to the Dew Point values. The maximum value (since turning on the RH70) alternates with the flashing"L". To exit from the MIN / MAX mode, and continue to monitor temperature, press the "TEMP" key. To exit from the MIN / MAX mode and continue to monitor humidity, press the "%RH" key.
9	ON OFF	The RH70 is turned ON by pressing the"ON / OFF" key. Pressing it again turns the RH70 off.
10	SAVE	Pressing the "SAVE" key stores the current temperature and relative humidity readings at the instant the key is pressed, i.e. 98.0°F and 33.2% RH. Dew Point values are NOT saved. See NOTES on next page

PROBLEM	CONDITION	SOLUTION
"E-04" on display	No communication through the RS-232 data link with a	Check RS-232 connection and peripherals
"E-06" on display	Relative Humidity lower than measuring	----
"E-07" on display	Relative Humidity higher than measuring	----
"E-08" on display	Temperature lower	
"E-09" on display	Temperature higher than measuring range.	Connect probe
"E-10" on display	Relative Humidity not within range for calculating the Dew Point (3.0% to 97.0% RH)	----
"E-11" on display	Temperature not within range for calculating the Dew Point (-5 to 175°F or -20 to 80*C)	----
"E-XX" on display	Error code for 50 or higher (shows internal errors)	Contact OMEGA
"E-51" on display	Some hardware has come loose internally.	Contact OMEGA

SECTION 8 POWER SOURCE INFORMATION

8.1 BATTERY REPLACEMENT

To replace the battery, gently open the battery cover on the back of the unit (use a small screwdriver, if necessary). Plug in the 9V battery observing polarity, place in compartment and gently close the cover.

8.2 RH70-AC POWER INFORMATION

Check to see that a Ni-Cad battery is in the RH70-AC. Plug in one side of the AC Charging Adapter into the socket on the side of the RH70-AC and the other end to a 110VAC outlet.

The RH70-AC will NOT work with the AC charging adapter alone. The rechargeable Ni-Cad battery must be installed in order to operate the unit.

PROBLEM	CONDITION	SOLUTION
"L" on display	**Weak battery (less than 6V)**	**Replace battery (refer to Section 8.1 on how to replace battery)**
"E-02" on display	**Instrument has reached max. allowable number of stored data points (at 999).**	**Clear memory using "DUMP" key (See Section 5.3.3).**
"E-03" on display	**Storage memory is empty**	**Press "SAVE" key to store measurements.**

ITEM	KEY	DESCRIPTION(refer to Figure 3

NOTE

The stored values are retained, even when the unit is turned off.
Pressing the "SAVE" key while viewing a temperature reading automatically saves the corresponding humidity reading at that moment and vice versa.

11 DUMP Pressing the "DUMP" key down-loads the stored measurements to a connected printer or computer (IBM XT, AT, or compatible) through the RS-232 cable.

TO CLEAR STORED DATA: Data is maintained in the RH70 memory for a minimum of 1 year or until it is cleared. Clearing the memory is done by pressing and holding down the "DUMP" key while turning ON the RH70.

12 %RH Pressing the "5RH" key displays the humidity reading in % Relative Humidity (5 to 95% RH). The reading is updated 2.5 times per second. Refer to Section 9.2, Reaching Saturation, if the sensor becomes saturated.

NOTE

Notice that the RH reading is left always displayed by the LEFT most digits of the meter display.

13 DEW PNT Pressing the "DEW PNT" key displays a calculated Dew Point reading. The user can toggle the Dew Point value between °F and °C. Pressing the "DEW PNT" key and then the "°F" key will display the Dew Point in degrees Fahrenheit. Pressing the "DEW PNT" key and then the "°C" key will display the Dew Point in degrees Celsius.

14 TEMP Pressing the "TEMP" key displays the temperature. When the RH70 is first turned on, it defaults to degrees Fahrenheit. Press "°F or °C" to select the desired units for displaying temperature.

SECTION 4 ASSEMBLY

4.1 PROBE ASSEMBLY

Connect the Humidity/Temperature Probe to the middle connector on top of the RH70. Refer to item #2 in Figure 3-1 for the location of the probe connector. The male connector on the cable and the female connector on the instrument are keyed, so make sure they are lined up before connecting to each other. Tighten knurled threaded fitting to secure the cable to the instrument.

4.2 BATTERY ASSEMBLY

Gently open the battery cover on the back of the unit (use a small screwdriver, if necessary). Plug in the 9V battery observing polarity, place in compartment and gently close the cover.

4.3 AC CHARGING ADAPTER (RH70-AC ONLY)

1. Install the rechargeable Ni-Cad battery as described in Section 4.2

2. Plug in one side of the AC Charging Adapter into the socket on the side of the RH70-AC and the other end to a 110VAC wall socket. Refer to 3-1 for the location of the socket on the meter.

NOTE

The RH70-AC will NOT work with the AC charging adapter alone. The rechargeable Ni-Cad battery must be installed in order to operate the unit

WARNING

DO NOT OPERATE THE RH70-AC WITH A NON-RECHARGEABLE BATTERY AND THE AC CHARGING ADAPTER TOGETHER. USE OF A NONRECHARGEABLE BATTERY AND THE RECHARGER CAN CAUSE THE BATTERY TO EXPLODE!!

2. Carefully fit the probe tip in the closed glass container with the solution simulating 11% relative humidity. Make sure the assembly is sealed. Let it sit for approximately one (1) hour. Adjust the pot P4 until the display reads 11.0. Refer to Section 7.2

3. Repeat step 2 with the sodium chloride solution. Carefully fit the probe tip in the closed container with the solution simulating 76% RH for approximately one (1) hour. Adjust P3 until the display reads 76.0.

4. Repeat steps 2 and 3 until 11% and 76% relative humidity can be achieved without resetting pots P3 or P4.

5. Different relative humidities can be simulated by using any of the following saturated solutions.

TEMPERATURE VS RELATIVE HUMIDITY

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

7.4 TEMPERATURE CALIBRATION

Temperature is measured using a precision RTD sensor which is very stable by nature. The sensor electronics generally do not go out of calibration.

Periodic checks can be performed to determine the equipment accuracy in the temperature range. This is done by comparing the RH70 readings to known temperature values.

In the event that the RH70 is out of specification, contact OMEGA. Temperature calibration can not be performed by the user. Due to the complexity of the procedure, it is required that the RH70 be returned to OMEGA Engineering for recalibration. **Do not attempt to recalibrate the RH70 yourself.**

7.3 HUMIDITY CALIBRATION

All calibrations should be made at room temperature (68°F to 77°F (20°C to 25°C)). Refer to Figure 7-1 for the location of the calibration potentiometers (pots).

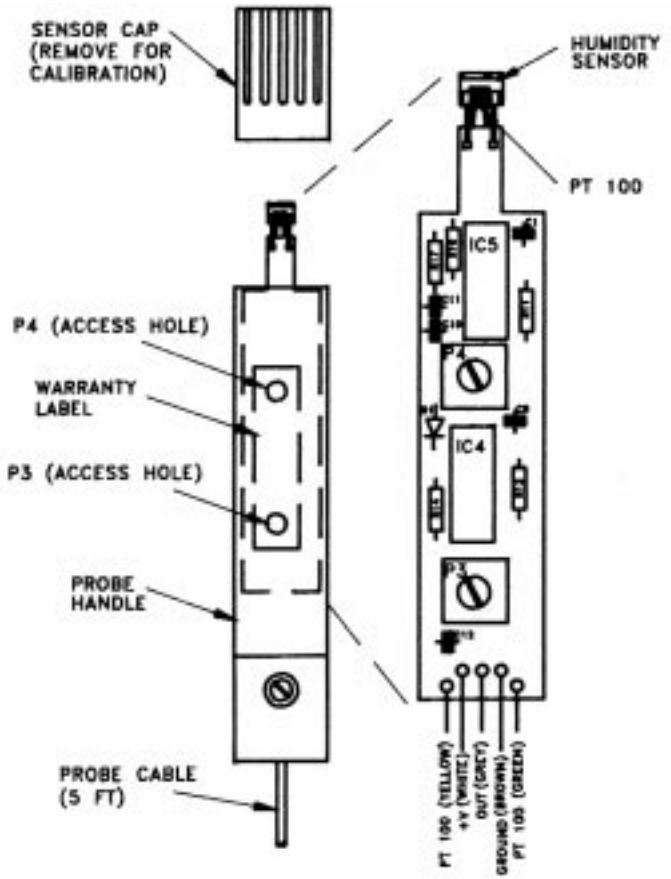


Figure 7-1. RH70 Probe: Potentiometer Locations

1. Carefully remove the sensor cap from the probe handle. This is done by grasping the sensor cap and the lower end of the probe enclosure firmly. 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.

NOTE

The RH70-AC is fully operational while the Ni-Cad battery is recharging. After 0ne (1) hour the bat-

SECTION 5 OPERATING INSTRUCTIONS

5.1 PRINCIPLES OF OPERATION

RELATIVE HUMIDITY (%RH): This relates to the ratio of actual water vapor pressure in the air to the vapor pressure in saturated air at the same temperature. This unit measures from 5% to 95%. Refer to Section 8 if saturation occurs. Typical applications: monitoring computer rooms, test chambers, pharmaceutical and food packaging places.

DEW POINT/FROST POINT: The dew point is the temperature at which water vapor begins to condense. If the dew point occurs below 32°F, it is called the frost point. Typical applications: Heat treating, annealing atmospheres, dryer control, instrument air monitoring, meteorological / environmental measurements, and external paintwork.

5.2 MEASUREMENT PROCEDURES

NOTE

Refer to Section 3 for complete operating details of each key on

1. Connect the probe and the battery as described in Section 4.

2. Turn on the RH70-AC by pressing the “ON / OFF” key. The unit will display for two seconds each of the following. “88.8.8” (this is an internal test) then, the battery voltage, then “P” followed by three numbers where the 3-digit number indicates how many data points have been “saved” in the memory, +1. For example, when 3 readings are stored in memory, the display will show “P004”. These three stored values are retained in memory, even after shut-off.

3. Now you must instruct the RH70 what measurement to display.

   For TEMPERATURE: Press the "TEMP" key. Pressing the "°F" or "°C" key will cause the display to show the Temperature in the desired units.

   For %RH: Press the %RH key.

   For DEW POINT: Press the "DEW PNT" key. Pressing the "°F" or "°C" key will cause the display to show the Dew Point in the desired units.

4. Press the "ON / OFF" key to turn off the RH70.

5.3 SAVE/DUMP/CLEAR MEMORY

5.3.1 The Save Feature

Pressing the "SAVE" key will store BOTH the humidity AND the temperature values the moment the key is pressed. The two are simultaneously saved as one line of data. This means that pressing the "SAVE" key while viewing the temperature reading automatically saves the corresponding humidity reading AT THE SAME INSTANT.

Notice that when the "SAVE" key is pressed, the display will flash the letter "P" followed by a 3-digit number (i.e. P204). This number indicates how many data points have been saved in the memory, plus 1.

For example, when the FIRST data point is saved, "P002" will flash on the display. This indicates that the RH70 has saved the reading and the memory is ready and pointing to the next available address. However, when the saved data is later down-loaded through the RS-232 connector, that first point will be labeled as "P001". All the rest of the points will follow in sequence. Refer to Section 5.5, "Sample RS-232 Data Format".

Data is maintained in the RH70 memory for a minimum of 1 year or until it is cleared. Refer to Memory section below for instructions to clear the memory. A maximum of 999 temperature / humidity readings can be saved.

Note that the Dew Point reading CAN NOT be saved or output to a computer. The Dew Point can only be read on the display.

It is important that the solutions must remain saturated for those 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.

7.2 PREPARING A SALT REFERENCE

To calibrate the humidity portion of the RH70, it is necessary for the user to prepare two saturated salt solutions - one to simulate 11% RH and one to simulate 76% RH (at 68°F).

Equipment Needed:

1. 2 glass containers (fitted to probe end without endcap) and lid with a good seal.

2. Distilled water

3. Lithium Chloride (LiCl) (for 11% RH) and

4. Sodium Chloride (NaCl) (for 76% RH).

To simulate 11% RH, fill the bottom of two glass containers approximately 1/4 full of distilled water. Add lithium chloride until the solution is saturated (solution is saturated when an additional crystal of solute which is added to the solution does not enter into the solution). Keep the chamber closed for at least one hour, with the temperature of the solution constant to prevent the concentration of the salt solution form changing (68°F or 20°C).

To simulate 76% RH, follow the same procedure as above. But in this case, in the second glass container, add sodium chloride to the distilled water (until saturated). Let the solution sit for at least one hour.

6.3 HUMIDITY SENSOR HANDLING

Due to its design, and the ease of access, the humidity sensor must be handles with care. AVOID ANY CONTACT with fingers or with products which could be harmful to the good permeability of the electrode and dielectric. The sensor must not come in contact with dirt or other foreign material. Incorrect readings can be caused by build-up of material, which can increase or decrease the RH reading.

WARNING

DO NOT EXPOSE THE RH70 HUMIDITY SENSOR TO TEMPERATURES OVER 175°F (80°C) !

DOING SO , WILL DESTROY THE SENSOR.

6.4 HUMIDITY SENSOR CLEANING

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 7 CALIBRATION

NOTE

The RH70 is calibrated at the factory. The warranty is void if the label on the probe handle is 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.

7.1 SALT 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.

There is no internal clock in the RH70 or RH70-AC for record keeping purposes. It is up to you to keep track of the time when the readings are saved.

5.3.2 The Dump Feature

Pressing the "DUMP" key will down-load (or dump) the measurements stored to a connected serial printer or computer (IBM XT, AT, or compatible). These points are still retained in memory, however, even after being dumped through the RS-232 connector. Refer to Section 5.5 for complete details on the RS-232 feature, including more "DUMP" details.

NOTE

If the display reads "E-04", when the "DUMP" key is pressed, the RH70 is indicating that nothing is connected to the RS-232 port or that there is a possible transmission failure. Check all the connections from the RH70 to the printer/computer.

5.3.3 Clear Memory

To clear the memory, press and hold down the "DUMP" key while turning ON the RH70. Doing this will erase all the "saved" data points and get the instrument ready for new readings. The erased data can not be retrieved once it is cleared.

5.4 ANALOG OUTPUTS

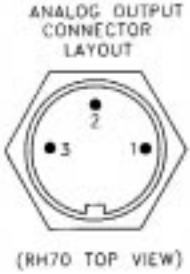
The RH70 features two 0-2 volt analog output signals on demand. Both voltages are present at the analog output connector at all times. These two signals correspond to the displayed temperature and humidity readings and can be observed as analog voltages on a printout or on the computer screen. A typical printout looks like the following:

```
 0.670 0.579
 0.671 0.588
 0.676 1.011
0.682  1.047
0.677  1.877
```

The first column represents temperature. The second column represents relative humidity.

These two analog signals can be connected to a variety of equipment, including chart recorders, remote displays and an analog input card in a personal computer. The three wires in the cable allow for continuous monitoring of relative humidity and temperature simultaneously.

The RH70 analog outputs for temperature and humidity are transmitted via single-end outputs with a common ground. Locate the five-foot cable with 3 exposed wires (one grey, one green, and one brown) at one end and a connector at the other end. To access both analog output signals on the RH70, plug the connector side of the cable into the analog output connector on top of the RH70 (right hand connector #3 in Figure 3-1). Referring to Figure 5-1, connect the tree exposed wires to the instrument / recorded that will accept a 0-2 volt analog signal.



ANALOG CABLE		
PIN NO.	WIRE COLOR	WIRE SIGNAL
1	Black	GROUND
2	Green	TEMPERATURE VALUE
3	GREY	R. H. VALUE

Figure 5-1. Analog Connector Wiring

5.4.1 Temperature Analog Signal

The 0-2 volt analog output signal on the RH70 is accessed by the BROWN wire (green is ground) of the analog output cable. The 0-2 volt range of the analog output corresponds to the full temperature range of the instrument itself (when used with a separate RTD probe). This equivalent temperature range is -148°F to 572° F (-100° C to 300°C).

WARNING

DO NOT EXPOSE THE STANDARD RH70 HUMIDITY / TEMPERATURE PROBE TO TEMPERATURES OVER 175°F (80°C) !

DOING SO , WILL DESTROY THE HUMIDITY SENSOR!!

Once the handshaking is established, the ASCII data is transferred at 12 baud. Each line (record) of data is terminated with a “carriage return and line feed”. At the end of the data transmission, the RH70 will generate an End of File (“EOF”) character. The PC program can detect the EOF character and return to the operating system.

SECTION 6 SENSOR INFORMATION AND MAINTENANCE

6.1 TEMPERATURE SENSOR

The temperature sensor in the Humidity / Temperature probe consists of a Platinum RTD sensor (100 ohm). It conforms to the European (E) curve where $\alpha = 0.00385$ 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.

6.2 HUMIDITY SENSOR

The relative humidity sensor is a thin film capacitance sensor. It consists 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 the moistening risk of the sensitive element can momentarily falsify the measurements.

A permanent measurement or an extended duration measurement (>1 / 2 hour) higher than 90% leads to a phenomena of “secondary absorption” which results in an evolution able to reach about ±6% of a relative humidity close to saturation. This evolution is memorized by the sensor and a return to ambient conditions (40% up to 50% RH) of 24 hours might be necessary to find again the origin characteristics.

5.5.4 Basic Emulator Program

PROGRAM	COMMENT
10 CLS: KEY OFF	'Clear screen and soft keys
20 KEY 1, " "	'Disable F1 soft key
30 LOCATE 25, 30	
40 PRINT "<<STRIKE F1 KEY TO EXIT>>"	Instructions to exit
50 LOCATE 1,1,1	'Home cursor
60 ON KEY (1) GOSUB 170	'Enable trapping of F1 key
70 KEY (1) ON	
80 OPEN "COM1:1200,O,7,1,CS,DS" AS #1	'Set up com 1 (letter O, not number 0)
90 A$=INKEY$	'Read character from keyboard
100 IF A$ = " "GOTO 130	
110 PRINT A$;	'Write character to screen
120 PRINT #1,A$;	'Send character out com port
130 IF LOC(1)<1 GOTO 90	'Has data come in com port
140 X$=INPUT$(LOC(1),#1)	'Write data to screen
150 PRINT X$;	
160 GOTO 90	
170 CLOSE	'Close com port
180 CLS	
190 END	

5.5.5 RS-232 Signal Details

The RS-232 signal voltage levels are +9 volts and -9 volts. A signal of +9 volts represents a space (logical “0”). A signal of -9 volts represents a mark (logical “1”).

Protocol is 1 start bit, 7 data bits, 1 parity bit, 1 stop bit Data.

Format is ASCII.

Parity is odd parity

Baud Rate is 1200 baud.

When the “DUMP” key is pressed on the instrument a RTS signal becomes available on the RS-232 plug (logical “1”). The PC program or printer must respond with a CTS signal (logical “0”). If this CTS signal does not come within 1 second, the instrument will display “E-04” (error 4) meaning no data communication possible and terminates the dump mode.

The following formula is then used to convert the analog output voltage signal to an equivalent temperature value:

Temp (°F) = (360 x analog voltage) - 148
Temp (°C) = (200 x analog voltage) - 100

5.4.2 Humidity Analog Signal

The 0-2 volt analog output signal on the RH70 is accessed by the grey wire (green is ground) of the analog output cable. The 0-2 volt range of the analog output corresponds to the humidity range of the electronics of the instrument itself: 0% RH to 100% RH

The following formula is used to convert the humidity analog signal to the equivalent humidity value:

Humidity (%RH) = 50 analog voltage

5.5 RS-232 Outputs

The RH70 can be used as a portable "data logger" to store as many as 999 temperature and relative humidity values. This feature is very simple to use. Press the "SAVE" key to store current readings. When it is time to down-load the information, simply connect the RS-232 cable and press the "DUMP" key. A sample printout you can expect to see on a computer screen or printer is shown below:

001	72.5 dgF	35.1 %RH
002	73.2 dgF	71.9 %RH
003	78.7 dgF	92.4 %RH
004	81.5 dgF	94.1 %RH

SAMPLE RS-232 PRINTOUT

5.5.1 RS-232 Set-up Details

To use the RS-232 feature, first "SAVE" a number of data points into the RH&) memory. Refer to Section 5.3.1, Save Feature. Next, connect the RS-232 cable to an RS-232 port. Plug one end of the RS-232 cable into the left-most connector on top of the RH70. (Refer to Figure 3-1 for the RS-232 connector location - #1). Connect the other end of the cable to a serial printer or computer (IBM XT, AT or compatible).

Refer to Figure 5-2 for the pin-outs on the RS-232 connector

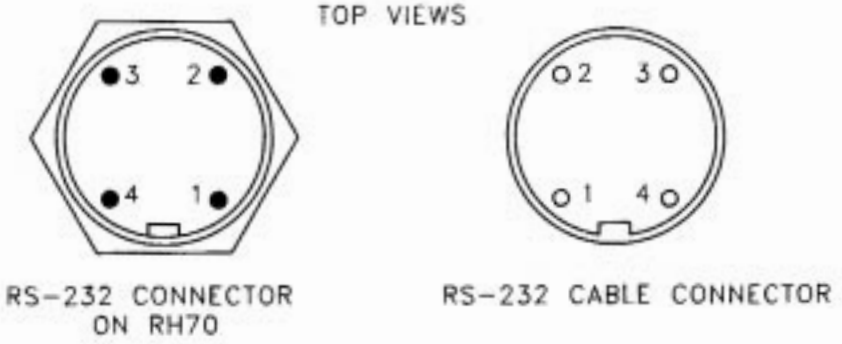


Figure 5-2. RS-232 Connector Layout

Refer to Tables 5-1 and 5-2 for the RS-232 cable connection details.

TABLE 5-1
RS-232 CABLE COLOR AND SIGNALS

RH70 RS-232 CONNECTOR	CABLE WIRE COLOR	RS-232 CABLE SIGNAL
Pin 1	Black	Ground
Pin 2	Green	Transmit Data (TXD)
Pin 3	Grey	Clear to Send (CTS)
Pin 4	White	Ready to Send (RTS)

TABLE 5-2
RS-232 CABLE CONNECTOR PIN-OUTS

RH70 RS-232 CONNECTOR	COMPUTER 25-PIN CONNECTOR	COMPUTER 9-PIN CONNECTOR	SERIAL PRINTER CONNECTOR
Pin 1	Pin 7	Pin 5	Pin 7
Pin 2	Pin 3	Pin 2	Pin 2
Pin 3	Pin 4	Pin 7	Pin 5
Pin 4	Pin 5	Pin 8	Pin 4

When everything is connect, programmed and ready to go, simply press the "DUMP" key to down-load the stored information.

5.5.2 Down-Loading to a Serial Printer

1. To output data to a serial RS-232 printer, connect the RS-232 cable between the RH70 and the printer port. (Refer to Table 5-2 for wiring information).

2. Once connected, simply press the “DUMP” key and the data will print out essentially the same way as shown in Section 5.5

5.5.3 Down-Loading to a Computer

The stored data points in the RH70 can be down-loaded to an IBM XT, AT, or compatible personal computer. (Communication is one-way only!!!)

1. Make sure there is a program in your computer to allow data to be sent by the RH70 and received by the computer. A simple emulator program is shown in Section 5.5.4.

2. Connect the RS-232 cable between the RH-232 and the computer. (Refer to TAble 5-2 for wiring information.

3. Once the communication is established and the RS-232 cable is connected, simply press the “DUMP” key and the data will transfer through the cable to the computer and the printout will essentially look the same way as shown in Section 5.5

NOTE

Refer to the OMEGA Data Acquisition Handbook for software that has advanced data analysis capabilities. An example could be Labtech® Notebook software.

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