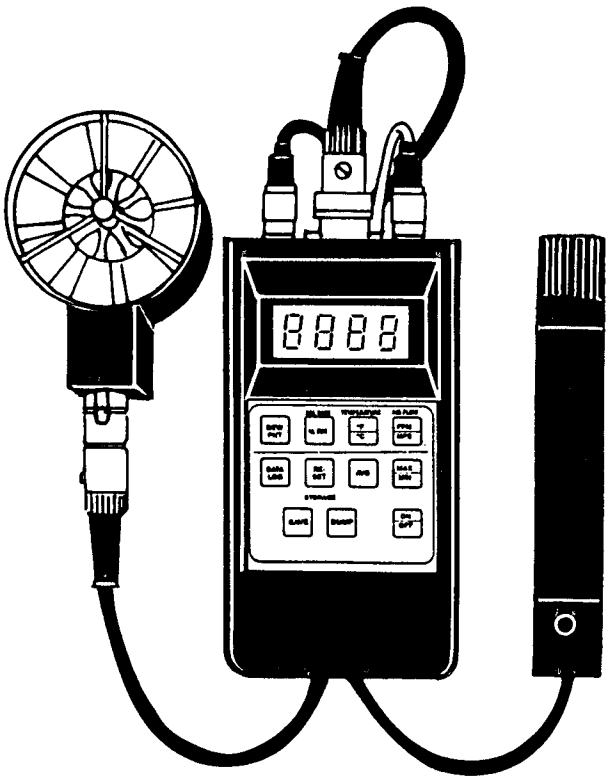
HHF710

Hygro-Thermo Anemometer



OMEGA®
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Operator's Manual
M1126/0792

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
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MODEL HHF710
HYGRO-THERMOMETER ANEMOMETER

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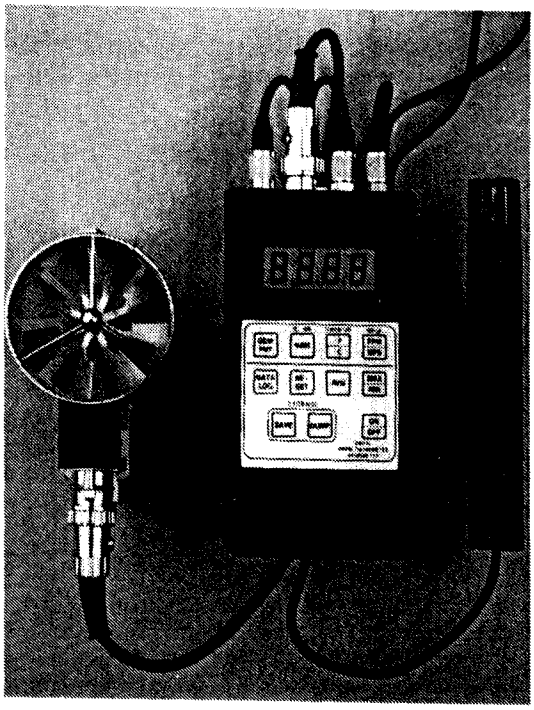
SECTION 1 INTRODUCTION

1.1 GENERAL DESCRIPTION

The OMEGA® HHF710 combines relative humidity, temperature, and air velocity measurement into one highly versatile instrument. This precision instrument is ideal for air conditioning, cooling, heating, and ventilation applications. With the built-in memory, up to 1000 triple measurements (%RH,°F/°C, and FPM/MPS) can be stored, and the collected data can be transferred to a printer or PC via the RS-232C interface. Additional features include three simultaneous analog outputs for applications such as recorder and datalogger interfacing and external RTD input.



HHF710 Meter with HHF7-P2 Probe (left) and Humidity Probe (right)

1.2 FEATURES

- Stores 1000 Combined Readings of Air Flow, RH, and Temperature
- Stores Minimum, Maximum, and Average Values
- Automatically Calculates Dewpoint
- Accepts External 100 Ohm RTD Input
- Includes RS-232C and Three Analog Outputs

1.3 PART NUMBERS

PART NO.	DESCRIPTION
HHF710	Kit including combination instrument, humidity probe, and AC adaptor with rechargeable NiCad battery. Does not include velocity probe.
HHF7-P1	Velocity and Temperature probe, 1" Dia.
HHF7-P2	Velocity and Temperature probe, 2.75" Dia.
HHF7-C1	Adaptor assembly for separate RTD probe with 1" cable, terminates in 3-prong female mini-plug
HHF7-C2	Same as HHF7-C1, with 3-prong female std. plug
HHF7-C3	Same as HHF7-C1, with 2-prong female mini-plug
HHF7-C4	Same as HHF7-C1, with 2-prong female std. plug
RH70-SF	Sintered filter cap for humidity probe

SECTION 2 UNPACKING AND ASSEMBLY

2.1 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 or (203) 359-1660.

Upon receipt of the 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.

The following items are included in the HHF710 Kit:

QUANTITY	DESCRIPTION
1	HHF710 Instrument
1	Humidity/Temperature Probe
1	Analog Output Cable, 5.5 ft. long
1	RS-232C Adaptor Cable
1	Extension Cable, 5 ft. long
3	Extension Rods, 9" each
1	Flexible Rod
1	Carrying Case

2.2 PROBE CONNECTIONS

The HHF710 consists of three parts: the indicating unit, probe head with connecting cable, and the humidity/temperature probe with connecting cable. Before operating the HHF710, connect the probe head, and/or humidity/temperature probe to the appropriate connector on the top of the instrument. Tighten the knurled threaded fitting to secure the cable to the instrument. Refer to Figures 2-1 and 2-2 for wiring and Figure 3-1 for location of the probe connector.

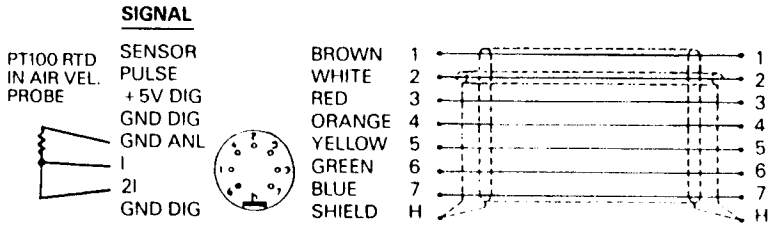


Figure 2-1. Air Velocity Probe Cable and Connector

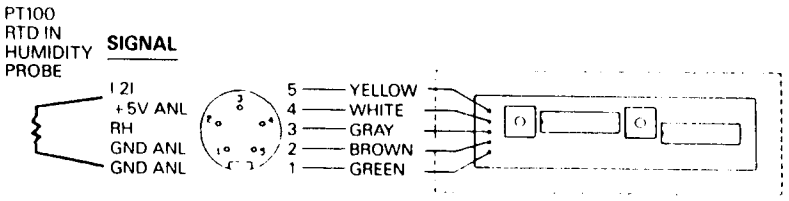


Figure 2-2. RH Probe Cable and Connector

2.3 BATTERY INSTALLATION

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 close the battery cover.

2.4 AC CHARGING ADAPTOR

1. Install the rechargeable Ni-Cad battery as described in Section 2.3.
2. Plug in one side of the AC Charging Adaptor into the socket on the side of the HHF710 and the other end to a 110VAC wall socket. Refer to Figure 3-1 for the location of the socket on the meter.

The HHF710 will NOT work with the AC charging adaptor alone. The rechargeable Ni-Cad battery must be installed in order to operate the unit.

The HHF710 is fully operational while the Ni-Cad battery is recharging. After one hour the battery is fully recharged.

If it is desired to operate the unit with the AC charging adaptor continuously plugged into the unit, install a 16 volt, 100 microfarad, tantalum or electrolytic (watch the polarity ±) capacitor across the ± terminals of the NiCad battery installed in the unit. The NiCad battery must be installed for proper operation.

WARNING

DO NOT OPERATE THE HHF710 WITH A NON-RECHARGEABLE BATTERY AND THE AC CHARGING ADAPTOR TOGETHER. USE OF A NON-RECHARGEABLE BATTERY AND THE RECHARGER CAN CAUSE THE BATTERY TO EXPLODE!

2.5 TEMPERATURE SIGNAL SELECTION

On the top of the HHF710, between the connector posts for the air velocity probe and the RH probe, there is a slide switch. Refer to Figure 3-1. Moving the slide switch towards the air velocity probe connector tells the unit to accept the RTD input from the air velocity probe. Moving the switch towards the RH probe connector measures temperature with the RH probe.

SECTION 3 OPERATION

3.1 FRONT PANEL CONTROLS

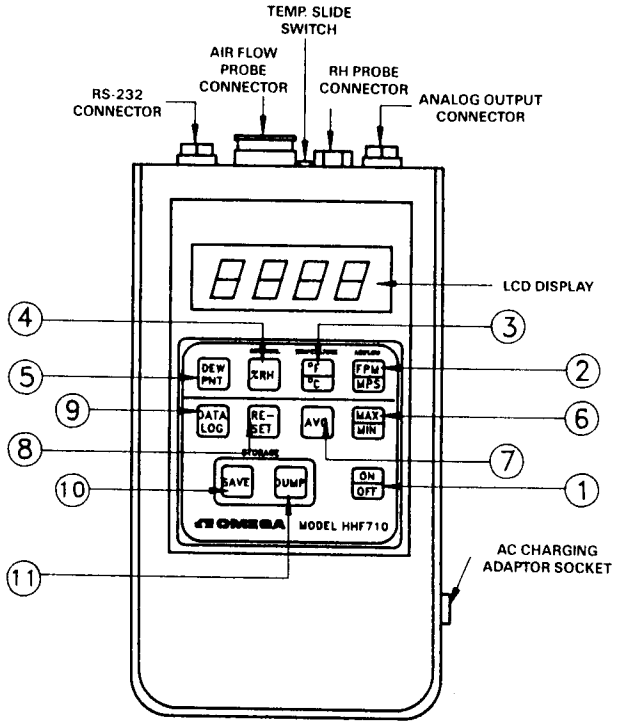


Figure 3-1. HHF710 Front Panel

1. **ON/OFF**

   The HHF710 is turned ON by pressing the ON/OFF key. Pressing it again turns the HHF710 off.

2. **FPM/MPS**

   Pressing the FPM/MPS key once displays an air flow value in feet per minute. Pressing FPM/MPS again displays an air flow value in meters per second with a 0.01 m/s resolution. The measuring time is 2 seconds.

3. **°F/°C**

   Pressing this key once displays a temperature reading in degrees Fahrenheit. Pressing the key again displays a temperature reading in degrees Celsius. Temperature readings are updated 2.5 times per second.

FRONT PANEL CONTROLS (Cont'd)

4. **% RH**

   Pressing the %RH key displays the humidity reading in % Relative Humidity (5 to 95% RH). The reading is updated 2.5 times per second.

5. **DEW PNT**

   Pressing the DEW PNT key displays a calculated Dew Point temperature reading. To switch the Dew Point reading from °F to °C, or vice versa, press the °F/°C key. To switch the reading from Dew Point directly to Temperature, press the RESET key first, then the °F/°C key.

6. **MAX/MIN**

   Pressing the MAX/MIN key once displays the highest value (since switching on the instrument) for Relative Humidity (press %RH key); for Air Flow (press FPM/MPS key); or for Temperature (press °F/°C key).

   Pressing this key a second time displays the lowest value since switching on the instrument. Use the same procedure to obtain the minimum value.

   Press the RESET key to return to normal measurements.

7. **AVG**

   Pressing the AVG key will instruct the HHF710 to make 8 air flow measurements of 2 seconds each, and display the calculated average value after 16 seconds.

   After pressing the AVG key, the keyboard is locked and a 16 second measuring integration time will start. During the integration time, the HHF710 will display "16S". After the average measuring value is indicated, this value will be updated every 2 seconds. The AVG measurement key functions on Air Velocity measurements only. Press the RESET key to return to normal measurements.

8. **RESET**

   The RESET key is used to switch back to normal measurements after "MAX/MIN" and "AVG" readings.

9. **DATA LOG**

   Pressing the DATA LOG key displays the highest (MAX) and the lowest (MIN) value of all stored measurements. After pressing the key, the display will show "H" (MAX) or "L" (MIN) for two seconds, then a measuring value for two seconds, then a "P" display (P038, for example).

   EXAMPLE: "H 1056 P038" shows that of all the stored air flow measurements, the 38th measurement was the highest with 1056 FPM.

10. **SAVE**

    Pressing the SAVE key stores the present reading into memory. When pressing the SAVE key during a temperature measurement, the Relative Humidity and Air Flow at time of pressing the key will be stored also. Dew Point values are NOT stored. The stored values are retained even when the unit is turned off.

11. **DUMP**

    Pressing the DUMP key down-loads the stored measurements to a connected printer or computer through the RS-232 cable.

TO CLEAR STORED DATA: Data is maintained in the HHF710 memory for a minimum of one year or until it is cleared. Clearing the memory is done by pressing and holding down the DUMP key while turning on the HHF710.

3.2 MEASUREMENT PROCEDURES

1. Connect the probe and battery as described in Section 2.
2. Turn on the HHF710 by pressing the "ON/OFF" key.

   The unit will display "88.8.8" for two seconds; this is an internal test. After the internal test, the unit will display the battery voltage for two seconds. For example, "8.2" means 8.2 volts. Then the unit will display a "P" with a 3-digit number. This number shows how many positions in storage are occupied: P025 means 24 storage positions are occupied, and 25 is the next available position.
3. Now you must instruct the HHF710 what measurement to display.

   For AIR VELOCITY: Press the "FPM/MPS" key—once for FPM indication; press again for MPS indication.

   For TEMPERATURE: Press the "°F/°C" key—once for the temperature reading in degrees Fahrenheit; press again for the temperature reading in degrees Celsius.

   For %RH: Press the "%RH" key.

   For DEW POINT: Press the "DEW PNT" key. To switch the reading from °F to °C, press the "°F/°C" key.

3.3 SAVE/DUMP/CLEAR MEMORY

3.3.1 The Save Feature

Pressing the "SAVE" key will store the present reading into the Data Logger. When pressing the SAVE key during a temperature measurement, the Relative Humidity and air flow reading at time of pressing the "SAVE" key will be stored also.

Notice that when the "SAVE" key is pressed, the display will flash the letter "P" followed by a 3-digit number. For example, when the first data point is saved, "P002" will flash on the display. This indicates that the HHF710 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 labelled "001". All the rest of the points will follow in sequence. Refer to Section 3.5, "Sample RS-232 Data Format".

Data is maintained in the HHF710 memory for a minimum of one year or until it is cleared. Refer to Clear Memory section for instructions to clear the memory.

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.

3.3.2 The Dump Feature

Pressing the "DUMP" key will down-load (or dump) the measurements stored to a connected serial printer or computer. These points are still retained in memory, however, even after being dumped through the RS-232 connector. Refer to Section 3.5 for complete details on the RS-232 feature.

NOTE

If the display reads "E-04" when the "DUMP" key is pressed, the HHF710 is indicating that nothing is connected to the RS-232 port, or that there is a possible transmission failure. Check all connections from the HHF710 to the printer/computer.

3.3.3 Clear Memory

To clear the memory, press and hold down the "DUMP" key while turning ON the HHF710. This will erase the "saved" data points and get the instrument ready for new readings. The erased data can not be retrieved once it is cleared.

3.4 ANALOG OUTPUTS

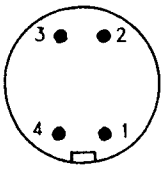
The HHF710 features three 0-2 volt analog output signals on demand. These signals correspond to the displayed temperature, humidity, and air velocity readings. All analog outputs have 256 bit resolution; thus, the analog outputs increase and decrease in steps of 7.8125 mV (2 Volts divided by 256 steps).

These three analog signals can be connected to a variety of equipment, including chart recorders, remote displays and an analog input card (with single ended or differential inputs) in a personal computer. The four wires in the cable allow for continuous monitoring of relative humidity, air velocity, and temperature simultaneously.

Analog outputs for Relative Humidity and Temperature are available at all times (after switching on the HHF710). Analog output for airflow is normally turned off, and can be switched ON by holding the "SAVE" key down while switching on the HHF710.

The analog outputs for temperature and humidity are transmitted via single-end outputs with a common ground. Locate the five-foot cable with four exposed wires at one end (one grey, one white, one green and one brown) and a connector at the other end. To access the analog signals on the HHF710, plug the connector side of the cable into the analog output connector on the top of the HHF710. Referring to Figure 3-2, connect the four exposed wires to the instruments/recorder that will accept a 0-2 volt analog signal.

ANALOG OUTPUT CONNECTOR LAYOUT



(HHF710 TOP VIEW)

ANALOG CABLE		
PIN NO.	WIRE COLOR	WIRE SIGNAL
1	GREEN	GROUND
2	BROWN	TEMPERATURE VALUE
3	GREY	RH VALUE
4	WHITE	AIR FLOW VALUE

Figure 3-2. Analog Connector Wiring

3.4.1 Temperature Analog Signal

The 0-2 volt analog output signal on the HHF710 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).

Moving the temperature slide switch on top of the unit towards the air velocity probe connector tells the unit to accept the RTD input from the air velocity probe. Moving the switch towards the RH probe connector measures temperature with the RH probe.

WARNING

DO NOT EXPOSE THE STANDARD HHF710 HUMIDITY/ TEMPERATURE PROBE TO TEMPERATURES OVER 175°F (80°C) OR BELOW −5°F. DOING SO WILL DESTROY THE HUMIDITY SENSOR!

DO NOT EXPOSE THE HHF7-P1 OR HHF7-P2 TO TEMPERATURES BEYOND THE RANGE OF −22 to 212°F, OR SERIOUS DAMAGE WILL RESULT!

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

3.4.2 Humidity Analog Signal

The 0-2 volt analog output signal on the HHF710 is accessed by the white 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 x analog voltage

3.5 RS-232 OUTPUTS

The HHF710 can be used as a portable datalogger to store air velocity, temperature, and relative humidity values. This feature is very simple to use. Press the "SAVE" key to store the 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 is shown below.

001	34.7% RH	76.9 dgF	2385 FPM
002	45.2% RH	24.9 dgC	12.59 MPS

Sample Data Format

The string is sent as follows:

001__34.7__%RH__100.9__dgF__2385 FPM [Carriage Return] [Line Feed]

Note: Each__(underscore) is a space.

There are 4 characters sent back for RH (up to 99.9), and 5 each for Temperature and Velocity. A decimal point uses up 1 character position. Thus, the unit can indicate 100.1 MPS. The characters are right justified; thus, in the above example, the velocity reading is received as __2385. At the end of the dump, an "EOF" character is sent to indicate the end of the file.

3.5.1 RS-232 Set-Up Details

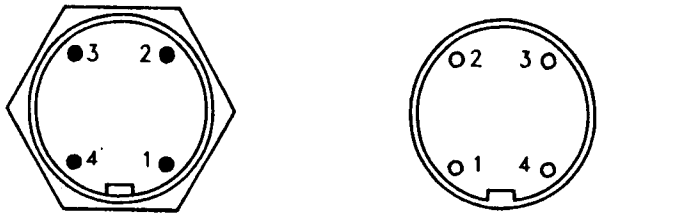
To use the RS-232 feature, first "SAVE" a number of data points into the HHF710 memory. Refer to Section 3.3, Save Feature. Next, connect the RS-232 cable to an RS-232 port. Plug one end of the RS-232 cable into the left-most connector on top of the HHF710. (Refer to Figure 3-1 for the RS-232 connector location). Connect the other end of the cable to a serial printer or computer.

Refer to Figure 3-3 for the pin-outs on the RS-232 connector.

Refer to Tables 3-1 and 3-2 for the RS-232 cable connection details.

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

TOP VIEWS



RS-232 CONNECTOR ON HHF710

RS-232 CABLE CONNECTOR

Figure 3-3. RS-232 Connector Layout

TABLE 3-1
RS-232 CABLE COLOR AND SIGNALS

HHF710 RS-232 CONNECTOR	CABLE WIRE COLOR	RS-232 CABLE SIGNAL
Pin 1	Green	Ground
Pin 2	Brown	Transmit Data (TXD)
Pin 3	Grey	Clear to Send (CTS)
Pin 4	White	Ready to Send (RTS)

TABLE 3-2
RS-232 CABLE CONNECTOR PIN-OUTS

HHF710 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

3.5.2 Down-Loading to a Serial Printer

1. To output data to a serial RS-232 printer, connect the RS-232 cable between the HHF710 and the printer port. (Refer to Table 3-2 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 3.5.

3.5.3 Down-Loading to a Computer

The stored data points in the HHF710 can be down-loaded to the RS-232C port of a personal computer. (Note that communication is one-way only!) The RS-232C cable included with the HHF710 includes a mating connector for the RS-232C port on an IBM XT, AT, or compatible computer. If you are using another computer, simply clip off the connector and rewire the cable, using a connector compatible with the RS-232C port on your computer.

1. Make sure there is a program in your computer to allow data to be sent by the HHF710 and received by the computer. A simple emulator program is shown in Section 3.5.4.

   Line 80 of the program shown sets up the baud rate, parity, number of data and stop bits for com1, as well as disabling the handshake lines. This line should be modified when operating with different parameters.
2. Connect the RS-232 cable between the HHF710 and the computer. (Refer to Table 3-2 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. The printout will essentially look the same as shown in Section 3.5.

NOTE

Refer to the OMEGA Data Acquisition Handbook for software that has advanced data analysis capabilities. An example could be Slide Write Plus™ software for graphing.

3.5.4 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 "COM1:1200,0,
   7,1,CS,DS"AS #1                       'Set up com 1
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 GOTO90
170 CLOSE                                'Close com port
180 CLS
190 END
```

3.5.5 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.

Data is transmitted at a rate of 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 is possible, and will terminate the dump mode.

Once the handshaking is established, the ASCII data is transferred at 1200 baud. Each line (record) of data is terminated with a "carriage return and line feed". At the end of the data transmission, the HHF710 will generate an End of File ("EOF") character. The PC program can detect the EOF character and return to the operating system.

SECTION 4 SENSOR INFORMATION AND MAINTENANCE

4.1 TEMPERATURE SENSOR

The temperature sensor in the Humidity/Temperature probe consists of a Platinum RTD sensor (100 ohm). It conforms to the European 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.

4.2 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 (> ½ hour) higher than 90% RH leads to a phenomena of "secondary absorption" which results in inaccurate readings. If this occurs, return the sensor to ambient conditions (40% up to 50% RH) for 24 hours and recheck the calibration to confirm that no permanent damage has occurred to the sensor.

4.3 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 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 HHF710 HUMIDITY SENSOR TO TEMPERATURES OVER 175°F (80°C) OR BELOW −5°F. DOING SO WILL DESTROY THE SENSOR.

4.4 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 5 CALIBRATION

The HHF710 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.

5.1 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.

It is important to note 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.

5.2 PREPARING A SALT REFERENCE

To calibrate the humidity portion of the HHF710, 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).

The following equipment is required:

1. Two glass containers (fitted to probe end without cap) and lids with a good seal
2. Distilled water
3. Lithium Chloride (LiCl) for 11% RH
4. Sodium Chloride (NaCl) for 76% RH

To simulate 11% RH, fill the bottom of the glass container approximately ¼ 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 from changing (68°F or 20°C).

To simulate 76% RH, follow the same procedure as above. In the second glass container, add sodium chloride to the distilled water until saturated. Keep the chamber closed for at least one hour.

5.3 HUMIDITY CALIBRATION

All calibrations should be made at room temperature (68 to 77°F; 20 to 25°C). Refer to Figure 5-1 for the location of the calibration potentiometers.

1. Carefully remove the sensor cap from the probe handle, by grasping the sensor cap and the lower end of the probe enclosure firmly. Carefully twist them in opposite directions, and pull. Do not bend the assembly as this may damage it. Be careful not to touch the sensors.
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 stand for approximately one hour. Adjust potentiometer P4 until the display reads 11.0.
3. Repeat step 2 with the sodium chloride (76% RH) solution. Adjust potentiometer 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.

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

5.4 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 HHF710 readings to known temperature values.

In the event that the HHF710 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 HHF710 be returned to OMEGA Engineering for recalibration. **Do not attempt to recalibrate the HHF710 yourself.**

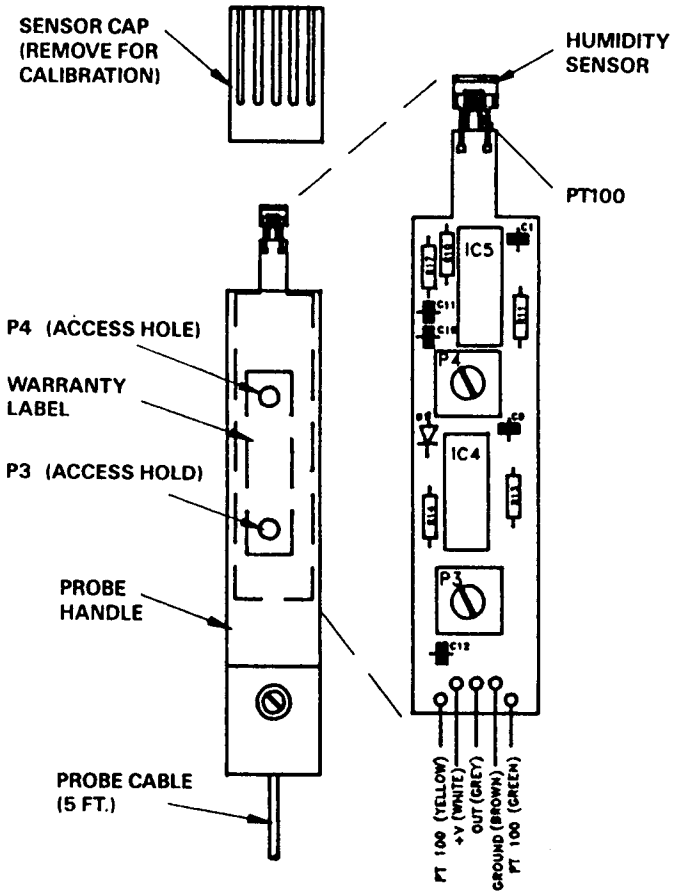


Figure 5-1. HHF710 Probe Potentiometer Locations

SECTION 6 TROUBLESHOOTING GUIDE

6.1 ERROR CODES

CODE	CONDITION	SOLUTION
"L" on display	Weak battery (less than 6V).	Replace battery (refer to Section 2.3 on replacing battery)
"E-02" on display	Instrument has reached maximum allowable number of stored data points.	Clear memory using "DUMP" key (See Section 3.3.3)
"E-03" on display	Storage memory is empty.	Press "SAVE" key to store measurements.
"E-04" on display	No communication through the RS-232 data link with a printer or computer.	Check RS-232 connections and peripherals.
"E-06" on display	Relative Humidity lower than measuring range (< 5.0% RH).	———
"E-07" on display	Relative Humidity higher than measuring range (> 95.0% RH).	———
"E-08" on display	Temperature lower than measuring range (< −99.99°C or °F)	———
"E-09" on display	Temperature higher than measuring range, or probe not connected.	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-50" or higher on display	Internal error.	Contact OMEGA.

SECTION 7 SPECIFICATIONS

RELATIVE HUMIDITY

Sensing Element:	Thin film capacitive type
Range:	5% to 95% RH
Accuracy:	±2.1% RH
Resolution:	0.1% RH
Temperature Drift:	±0.5% RH per 18°F/10°C
Response Time:	Up to 90% of fluctuation in 10 seconds

TEMPERATURE FROM VELOCITY OR HUMIDITY PROBE

Sensing Element:	RTD sensor (Pt100)
Range:	Full range of humidity or velocity probe
Accuracy:	±0.2% of reading ±0.4°F or °C
Resolution:	0.4°F or °C
Response Time:	Approximately 60 seconds

AIR FLOW

Range:	HHF7-P2: 40 to 7800 FPM, 0.2 to 40.00 MPS HHF7-P1: 60 to 6800 FPM, 0.3 to 35.00 MPS
Accuracy:	±1% of reading, ±1 digit (both probes)
Resolution:	0.01 m/s or 1 ft/min.

TEMPERATURE WITH SEPARATE RTD PROBE

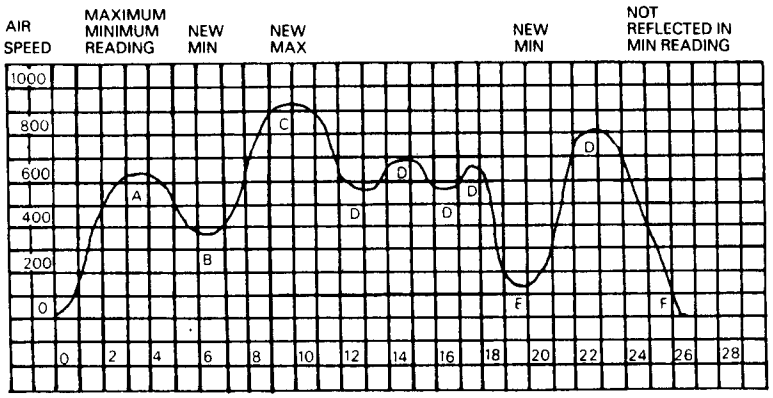
Range:	−100 to 575°F (−100 to 300°C)
Accuracy:	±0.2% of reading ± 0.4°F or °C
Resolution:	0.4°F or °C

SPECIFICATIONS (Cont'd)

GENERAL SPECIFICATIONS

Display:	½" LCD, 9999 digits
Data Acquisition:	Storage capacity up to 1000 triple measurements (Humidity, temperature, and air flow)
Data Link:	Std. RS-232C, including handshake signals CTS and RTS
Baud Rate:	1200 bps std.
Analog Outputs:	3 separate simultaneous outputs, 0-2 V over full span
Analog Output: (for Velocity)	0-2 VDC from 0 to 7935 FPM or 0 to 40.31 MRS
Operating Temperature:	Instrument: 32 to 125°F Humidity probe: −5 to +175°F; Velocity probe: −22 to +212°F
Battery Check:	Automatic at 6V
Power Supply:	NiCad battery with AC adaptor with 5 ft. cable. (Instrument can be used while re-charging)
Battery Life:	10 hours before re-charge
Dimensions:	Instrument: 5.9" H x 3.2" W x 1.2" D Humidity Probe: 7" L x 1" dia. HHF7-P2: 2.75" dia. HHF7-P1: 1" dia.

OPERATIONAL GRAPH



ELAPSED TIME

A. First maximum reading. Also first minimum reading until B occurs.

B. The new Min will register after the air speed starts to increase.

C. The new higher Max will register after the air speed starts to decrease.

D. This speed is between the earlier Max and Min and will not be reflected.

E. This speed is slower than the previous Min and will now be the new Min after the air speed starts to increase.

F. This speed will not be reflected in the Min reading because it goes directly to zero without increasing speed in the process. This protects against false Min readings when the probe is withdrawn from the air stream.

MANUAL ADDENDUM M1126B/0293
FOR
OMEGA ENGINEERING, INC.
HHF710
Hygro-Thermo Anemometer

USING THIS ADDENDUM

Use this addendum with your HHF710 Hygro-Thermo Anemometer Operator's Manual (M1126/0792).

SPECIFICATIONS

On page 19, replace the **Range** and **Accuracy** specifications in the **AIR FLOW** section with the following information:

Range:	HHF7-P2: 40 to 7800 FPM, 0.3 to 40.00 MPS
	HHF7-P1: 60 to 6800 FPM, 0.3 to 35.00 MPS
Accuracy:	HHF7-P2: ±0.25% of full scale, ±0.75% of reading ±1 least significant digit
	HHF7-P1: ±0.5% of full scale, ±1.0% of reading ±1 least significant digit

WARRANTY

OMEGA warrants this unit to be free of defects in materials and workmanship and to give satisfactory service for a period of **13 months** from date of purchase. OMEGA 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 our customers receive maximum coverage on each product. If the unit should malfunction, it must be returned to the factory for evaluation. Our 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. However, this WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being 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 or which are damaged by misuse are not warranted. These include contact points, fuses, and triacs.

We are glad to offer suggestions on the use of our various products. Nevertheless OMEGA only warrants that the parts manufactured by it 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 buyer 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.

Every precaution for accuracy has been taken in the preparation of this manual, however, OMEGA ENGINEERING, INC. neither assumes responsibility for any omissions or errors that may appear nor assumes liability for any damages that result from the use of the products in accordance with the information contained in the manual.

RETURN REQUESTS / INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA ENGINEERING Customer Service Department. Call toll free in the USA and Canada:1-800-622-2378, FAX: 203-359-7811; International: 203-359-1660, FAX: 203-359-7807.

BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, YOU MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OUR 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. Please have the following information available BEFORE contacting OMEGA:

1. P.O. number under which the product was purchased,
2. Model and serial number of product, and
3. Repair instructions and/or specific problems you are having with the product.

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

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