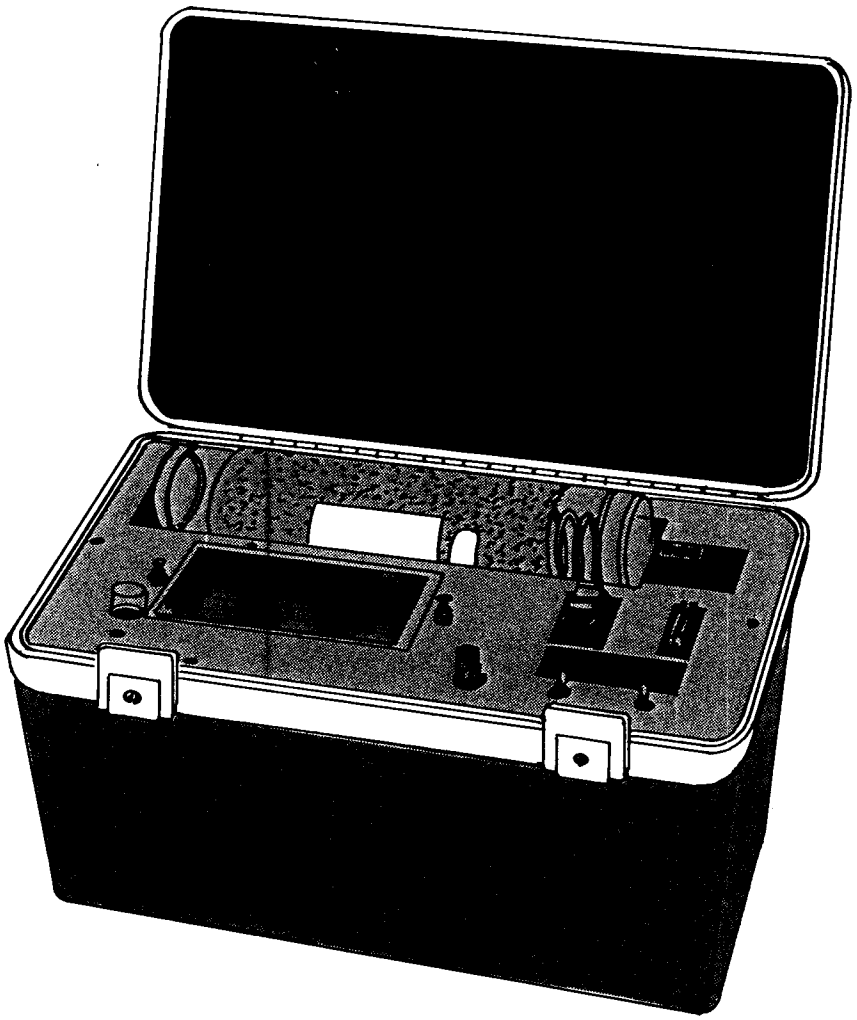
RHCL-1

Relative Humidity Generator



OMEGA®

An OMEGA Technologies Company

Operator's Manual
M1458/0692

TABLE OF CONTENTS
RHCL-1
RELATIVE HUMIDITY TEST CHAMBER

SECTION		PAGE
SECTION 1	**INTRODUCTION**	**1**
1.1	Description	1
1.2	Features	1
1.3	Theory of Operation - Principle Of Divided Flow	2
1.4	Operating Modes	2
1.4.1	Stand Alone	2
1.4.2	Feedback	2
1.4.3	Auto	2
1.4.4	Optional Kit	2
SECTION 2	**UNPACKING**	**3**
SECTION 3	**PARTS OF THE RHCL-1**	**3**
SECTION 4	**INSTALLATION**	**5**
4.1	Start up Operation	5
4.2	Power Connection	5
4.3	Checking the Desiccant Tube Seals	5
SECTION 5	**OPERATION**	**5**
5.1	Introduction	5
5.2	Feedback Operation - Serial Connection	6
5.3	Automatic Operation	6
5.3.1	Loading the Software	7
5.3.2	The Menu Selections	7
5.3.3	Creating a Profile in the Text Mode	7
5.3.4	Downloading a Test Profile to the RHCL-1	9
5.3.5	Using the RHCL-1 in the Auto Mode	10
SECTION 6	**MAINTENANCE**	**10**
6.1	Desiccant Replacement	10
6.2	Adding Distilled Water	11
SECTION 7	**TROUBLESHOOTING**	**11**
7.1	Things to Watch Out for (Do's and Don'ts)	11
7.1.1	Heat the Test Chamber	11
7.1.2	Transporting the RHCL-1	11
7.1.3	Reaching a Setpoint	11
7.2	Audio-Visual Clues	12
7.3	General	12

TABLE OF CONTENTS (Cont'd)

SECTION PAGE

SECTION 8 DESICCANT INFORMATION 12

SECTION 9 RHCL-1MP SAMPLE SYSTEM 13

9.1 Setup 13
9.2 Operation 14

SECTION 10 SPECIFICATIONS 14

10.1 RHCL-1 14
10.2 RHCL-1MP 15

SECTION 11 REPLACEMENT PARTS 16

SECTION 1 INTRODUCTION

1.1 DESCRIPTION

The OMEGA RHCL-1 is a precision relative humidity generator (120VAC standard, 240VAC available on request) designed to be used as an RH calibration test chamber. Any sensor or object that will fit in the RHCL-1 test chamber can be exposed to known humidities from 0 to 99% RH, in 0.1% increments. The RHCL-1 is a universal RH calibration system, which avoids having to use messy and often unstable saturated salt calibration kits designed for specific sensors/equipment.

The RHCL-1 can be used as a stand-alone system, or to attain NIST traceable accuracy. The RHCL-1 can be interfaced with an RHB-2 monitor via the standard RS-232-C port. When connected to the RHB-2, the RHCL-1 corrects for any deviation from setpoint as measured by the monitor. Automatic test profiles can be loaded into memory from an IBM compatible PC/AT using optional software available.

The RHCL-1 contains a solenoid valve and an air pump. The air pump is quite loud and the entire instrument will make considerable noise in a quiet room. This is normal. When used with the RHCL-1MP, the additional air pump will add somewhat to the noise level.

When operating, the RHCL-1 setpoint display will indicate setpoint in percent RH followed by the letter "H". When properly filled with distilled water, the fill light will be off. When the RHCL-1 is set between 10% and 90% RH, there will be a noticeable rhythmic surge of the water level in the fill tube when viewed from above. This is normal.

The Model RHCL-1MP mounting plate and pump is designed to physically integrate the RHCL-1 with an RHB-2 monitor to make a complete sample test system. The RHCL-1MP also includes a flow restrictor, RS-232 cable and tubing. All hardware necessary for interconnection is included.

1.2 FEATURES

The features of the RHCL-1 include:

✓ Stand-alone RH calibrator/test chamber

✓ Can be used as part of NIST traceable calibration kit

✓ Accurate to ±1.0% RH

✓ 0.2% long term RH stability

✓ RS-232-C standard

✓ 0.1% RH resolution

✓ Rugged, versatile design

1.3 THEORY OF OPERATION - PRINCIPLE OF DIVIDED FLOW

The RHCL-1 uses a divided flow method to generate a relative humidity between 0% and 100% quickly and accurately. Relative humidity is controlled by time proportioning a fraction of a constant flow dry airstream through a saturator and into a mixing chamber. The saturated air rejoins the remaining dry air and mixes to the desired RH value before flowing into the test chamber.

The water vapor pressure relationships that govern the operation of the RHCL-1 are sensitive to a number of parameters, including flow, pressure and temperature. For details on how inconsistencies in these parameters may affect the RHCL-1, refer to Section 7.

1.4 OPERATING MODES

1.4.1 Stand Alone

The RHCL-1 will operate as an independent, open loop factory calibrated device. All that is needed for stand alone operation is appropriate line voltage (see the label on your RHCL-1 for power requirements) and distilled water.

1.4.2 Feedback

The RHCL-1 can be connected to OMEGA's RHB-2 chilled mirror hygrometer to operate as a closed loop system. This is accomplished by connecting the RHCL-1 to the RHB-2 via a null modem cable and configuring an appropriate sensor and sample system, such as OMEGA's RHCL-1MP, to measure the RHCL-1 chamber environment. In this mode, the RHCL-1 corrects for any deviation from setpoint as measured by the RHB-2, and is NIST traceable at all times.

While in the feedback mode, the RHCL-1 is capable of calibrating itself against the RHB-2. See Section 5.2 for details.

1.4.3 Auto

Optional software (part number RHCL-1SW) allows RHCL-1 users to create automatic test profiles (RH vs time) on an IBM AT or compatible computer with serial port. These routines can be saved, stored, and downloaded at will into the RHCL-1. The RHCL-1 will in turn store the routine in its memory until a new routine is loaded. Test routines can be run on the RHCL-1 in either stand alone or feedback operation. See Section 5.3.

1.4.4 Optional Kit

An optional NIST traceable RH and dewpoint calibration kit that can be obtained from OMEGA Engineering has the part number RHCL-KIT. It contains one of each:

RHCL-1, RHCL-1MP kit, RHB-2 meter, RHB-S sensor, and RHB-2 Pt100 temperature sensor.

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 the OMEGA Customer Service Department at 1-800-622-2378 or (203) 359-1660.

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

NOTE

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

Make sure the following is in the packing box:

QTY	DESCRIPTION
1	RHCL-1 relative humidity test chamber, 120VAC
1	Power cord for the test chamber
1	Desiccant/desiccant tube
1	Set of keys for RHCL-1 case (stored in top lid behind foam)
1	Funnel
1	Hand pump (for removing distilled water from RHCL-1)
3	Chamber covers (includes cover currently on RHCL-1)
1	Operator's manual

SECTION 3 PARTS OF THE RHCL-1

Refer to Figure 3-1 for a visual reference to the various parts of the test chamber described below.

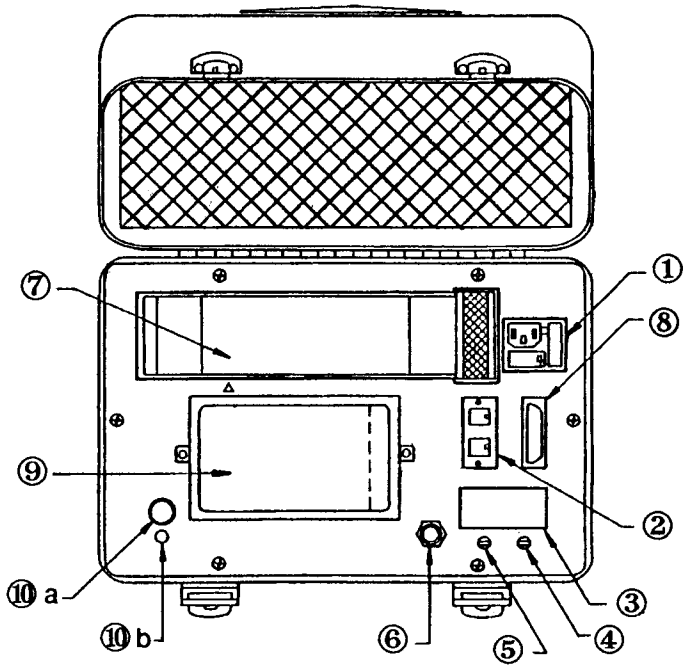


Figure 3-1. Front of the RHCL-1

KEY	ITEM	DESCRIPTION
1	POWER SWITCH, FUSE HOLDER, LINE CORD RECEPTACLE	Provides power input and fuse protection for the RHCL-1
2	POWER SUPPLY TERMINALS	A convenient source of 24VDC (unregulated) to power instruments under test.
3	SETPOINT DISPLAY	LED indicator that displays the RH value the RHCL-1 is generating.
4	INCREMENT/DECREMENT SWITCH	Adjusts setpoint up or down; hold in position to scroll to desired setpoint
5	AUTO/CAL SWITCH	While the RHCL-1 is operating, use of this switch will start the self-calibration routine or the last routine downloaded into the RHCL-1. The only way to interrupt either routine is to shut off the RHCL-1 and power up again.
6	DRY GAS INLET	Allows optional use of dry gas to prolong desiccant life. Dry gas introduced through this port passes through the desiccant, so there is no particular dryness requirement for the gas used. Flow into the dry gas inlet should not be more than 8 standard cubic feet/hour (scfh).
7	DESICCANT TUBE	All incoming air/gas passes through the desiccant to form the dry air stream. The desiccant tube is removable; its gasketed connectors mate to the receptor tubes in the RHCL-1.
8	SERIAL PORT	Standard RS-232 interface for connection to RHB-2, IBM-AT, or other devices.
9	CAPTIVE CHAMBER COVER	Each RHCL-1 comes with 3 chamber covers that can be drilled or slotted to allow for wires, screwdrivers, etc. The cover hold-down devices provide the proper seal for the cover, as well as lending structural support for large or awkward instruments.
10a & 10b	FILL TUBE AND FILL LIGHT	Distilled water is poured into the fill tube to fill the saturator and chamber bath assembly. The proper volume of water is 800ml; or just fill slowly until the fill light goes out. If the fill light comes on during operation, slowly add water until the light goes out.

SECTION 4 INSTALLATION

4.1 START UP OPERATION

The RHCL-1 is fully calibrated as shipped from OMEGA. To begin operation, place the RHCL-1 on a level surface and add 800 ml of distilled water to the water chamber through the fill tube.

4.2 POWER CONNECTION

Plug the RHCL-1 into an outlet supplying 120VAC or 240VAC, 50/60 Hz according to the proper voltage and frequency marked on the instrument.

4.3 CHECKING THE DESICCANT TUBE SEALS

Check that the desiccant tube is properly seated with its rubber gaskets inserted into the receptor tubes, and turn the unit on. After a three second initialization routine the RHCL-1 will begin the generate the humidity displayed on the setpoint indicator.

SECTION 5 OPERATION

5.1 INTRODUCTION

After start up, set the RHCL-1 to 25% RH and allow the unit to run for 15 to 20 minutes. This clears ambient air from the internal plumbing of the RHCL-1. The generated humidity may now be raised or lowered by operating the increment/decrement switch. When the switch is released it will return to the operate position and the new displayed humidity will be generated. The RHCL-1 chamber will settle to equilibrium in less than five minutes.

In normal stand-alone operation (no RHB-2 attached) the auto/cal switch should not be activated. If it is switched to the calibrate position the unit will immediately start a self calibration routine. With no serial port connection, the RHCL-1 will lock onto a 10% RH setting and disable the increment/decrement switch. To reset the RHCL-1 back to normal operation, turn the RHCL-1 off and then back on again. All data generated during a calibration run is held until the end of the run and only then dumped to the main memory. Therefore calibration runs which are interrupted before completion are not used. Operation of the "Cal" switch with no RHB-2 attached will not result in any loss of calibration data, as the calibration procedure cannot be completed.

If an automatic test is inadvertently started, the test can be terminated by turning the power off and then back on. The RHCL-1 is shipped from the factory with a standard test routine in memory.

To use the RHCL-1 to test the behavior of humidity dependent objects, circuits or sensors it may be necessary to create holes or feed through the cover in order to provide access for wires, screwdrivers, etc. Remember that the generated humidity is only accurate inside the test chamber below the indentation which runs about an inch below the cover. Three spare covers are provided with the RHCL-1 when shipped from the factory.

Drilled holes should be relatively tight to the devices which will pass through them and should be sealed when not in use. The cover should sit flat when in use so that there are no gaps around the edge. Use of the cover hold down devices will provide correct positioning and sealing of the chamber. **Under no circumstances should the chamber or the edges of the cover be sealed, as the resulting back pressure will push water out of the chamber and all over the RHCL-1.**

5.2 FEEDBACK OPERATION - SERIAL CONNECTION

When used in conjunction with a precision humidity measurement device with serial communications capability, the RHCL-1 can be driven to agree with RHB-2 within 0.1% RH. When the serial port on the RHCL-1 is connected to the serial port on the RHB-2, the RHCL-1 will communicate with the instrument and continuously correct itself so that the instrument always agrees with the setting on the RHCL-1.

The connection must be made using a NULL MODEM CABLE DB-25 male <-> male. Communication is at 1200 baud RS-232-C and the RHCL-1 listens for the character string "RH = ###.###xx" ("R" "H" space "=" space floating point number between 0 and 100 of arbitrary precision) which it takes to be the correct relative humidity. The format of the data word is as follows: 8 data bits, 1 stop bit, no parity. If there is a disagreement between the RHCL-1 setting and the number read in by the serial port, the RHCL-1 will make a minute adjustment to the timing on the proportioning valve and compare the new information on the serial port to the set point. This procedure will continue until the two instruments agree. The RHB-2 will take care of all the details of communication. The user requirement is to ensure a proper sampling system (see Section 9).

When operating in the feedback mode (or "handshake mode") all features of the RHCL-1 are available. The increment and decrement switches will raise and lower the humidity setpoint and the error corrections will begin at the new setpoint immediately. If you press "Auto" the RHCL-1 will run through the automatic test routine in the handshake mode with continuous error correction. If you press "Cal" the RHCL-1 will recalibrate itself to agree with the instrument and will retain this calibration in memory even when disconnected. The new calibration data will supersede all existing calibration data, which will be dumped from memory.

NOTE: Field recalibration of your RHCL-1 should not be necessary. If you undertake this procedure, be sure that all supporting instrumentation and equipment is in good working order. Allow at least 3 hours for the calibration routine, and be sure that there is adequate desiccant/dry gas supply. Errors in the calibration procedure will adversely affect stand-alone operation and unsupported automatic operation.

If you inadvertently press "CAL" and you do not want to recalibrate the RHCL-1, turn the power off before the end of the calibration routine and restart as desired. During a calibration routine all switches except the power switch are disabled.

5.3 AUTOMATIC OPERATION

Automatic test profiles (RH vs time with ramps and step changes) can be loaded into the RHCL-1 memory from an IBM compatible PC/AT computer using the optional software provided by OMEGA.

Automatic operation requires a computer system as follows: IBM 286 machine, RS-232 serial port, Hercules GB102 Monochrome Graphics Adaptor, null modem cable (one end DB-25 male, other end your computer). If your null modem cable does not have pins 4 & 5, 6 & 20 jumpered, you will not be able to download test profiles to your RHCL-1. See Section 5.2 for serial interface setup.

5.3.1 Loading the Software

OMEGA provides as an accessory RHCL-1 test software (part number RHCL-1SW) on low density 5-1/4" and 3-1/2" floppy disks (one of each). To start the software, place the program disk in the A: drive of your computer. Type "A:". At the prompt, type "C1TEXT". The main menu will appear:

Q.QUIT
0.SELECT TIME SCALE
1.RETRIEVE FILE
2.CREATE NEW FILE
3.DOWNLOAD FILE
4.SAVE CURRENT FILE
5.SELECT MODE

SELECTION:

If your computer has a hard drive, you can load the RHCL-1 test software onto that drive. To do so, place your program disk in the A: drive of your computer. Type "A:". At the prompt, type "INSTALL". Follow the instructions as they appear on the screen. The install command creates a subdirectory under your C: drive's root directory call C1GENA, and places a batch file called C2.BAT in the root directory. You can now start the program at the "C:\>" prompt by typing "C2". The main menu will appear.

Please note that if your computer is part of a Local Area Network (LAN), the RHCL-1 test software may not operate properly if there are any Terminate Stay Resident (TSR) programs in your computer.

5.3.2 The Menu Selections

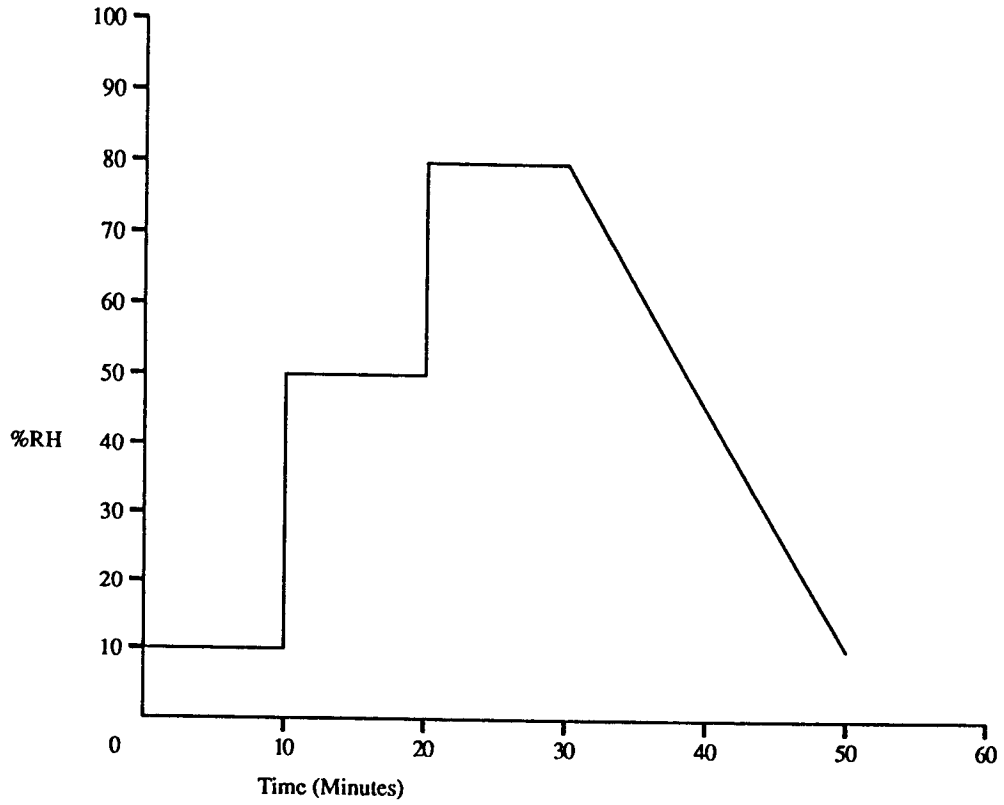
QUIT	is used to escape from the program and return to DOS.
SELECT TIME SCALE	allows you to specify the length of the automatic test run in hours (decimal hours are used, i.e. 1.5, or 0.25). This applies only to profiles created in the graphic mode.
RETRIEVE FILE	allows you to retrieve a previously saved file by name.
CREATE NEW FILE	allows you to create a new test profile in text profile.
DOWNLOAD FILE	will transfer the current file over your data cable into the RHCL-1.
SAVE CURRENT FILE	will save the file you are working on under the name of your choice.

5.3.3 Creating a Profile in the Text Mode

At the main menu, type "5" to select the screen mode. Type "0" and then "Return" to choose text mode and return to the main menu. Now type "2" to create a new file.

A box will appear with a menu bar at the top. The three choices on the menu bar are EDIT, SAVE and QUIT. Use the arrow keys to highlight the different choices. Now highlight EDIT and press "Return". Two columns will appear in the box. The left column is % RH and the right column is TIME-LENGTH (MINUTES). Follow the instructions at the bottom of the screen to move the highlighted box. Enter a value in the %RH column, press "Return", and then use the arrow keys to move to the right to enter a time segment. Continue in this way until your profile is complete.

When working with profiles in the text mode, remember that you are defining individual segments of a graph. Refer to Figure 5-1 to see what the text version of a graphic profile looks like. The first two lines of the text version define the first line segment of the graph. The text version instructs the RHCL-1 to be at 10% RH at time 0 and to be 10% RH at time 10 minutes. The third line of text tells the RHCL-1 to be 50% RH at time 0. Remember that each new segment starts at time 0, not the cumulative time of the entire profile. The fourth line tells the RHCL-1 to be at 50% at time 10 minutes, thus completing the second step in the graph.



% RH	Time Length (Minutes)
10	0
10	10
50	0
50	10
80	0
80	10
10	20

Figure 5-1. Text Version of a Graphic Profile

To save a profile in the text mode, press "ESC", then use the arrow keys to highlight SAVE on the menu bar. Press "Return". You will be prompted to enter a name. Enter a name, press "Return", and you are free to move around in the program.

5.3.4 Downloading a Test Profile to the RHCL-1

To download a test profile to the RHCL-1, you will to connect your RHCL-1 to the serial port of your computer with an appropriate cable (see Figure 5-2 which shows cable configurations for communication and downloading from computer to RHCL-1). If your computer has more than one serial port, use the COM1 port, or the primary port. Turn your RHCL-1 on and type "3" to download a test profile. If you have just booted the RHCL-1 test software, you will be prompted to name the program you want to download. Follow the prompts. If you have been using the software, the profile you have worked on most recently will download automatically. The word "DOWNLOADING" will appear on the screen until the download is complete. After you have completed the downloading, you can disconnect your data cable.

The RHCL-1 will store only one profile at a time. The program is kept in nonvolatile memory, so it will not be lost when the RHCL-1 is turned off. When a new profile is downloaded, the existing profile is dumped from memory.

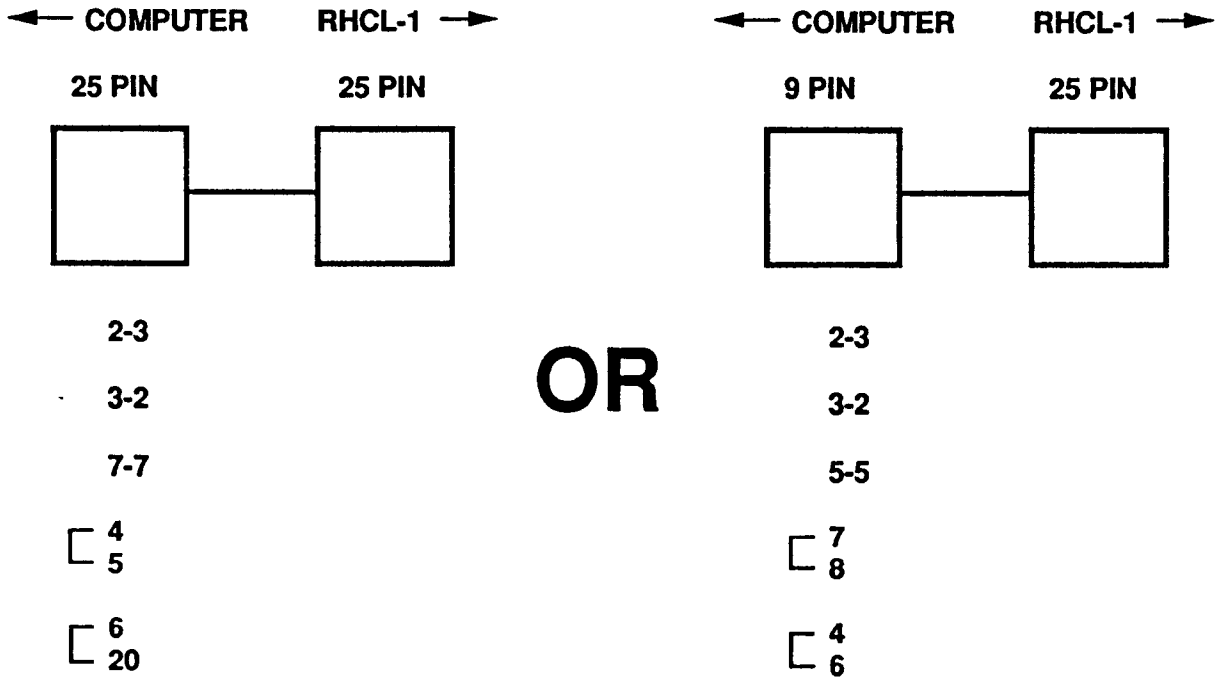


Figure 5-2. Cable Configurations

5.3.5 Using the RHCL-1 in the Auto Mode

To initiate an automatic test profile, turn on the RHCL-1 and follow the operating procedure in Section 5.1. When you are ready to begin the profile, flip the Auto/Cal switch to the auto position. The test profile will start immediately. If you leave the switch in the auto position, the test profile will repeat itself continuously. Once a test profile is started it can only be interrupted by turning the RHCL-1 off and then on again. While a profile is running, the RHCL-1 display will indicate the %RH being generated at the time. In the case of ramp changes , the display will scroll through discrete steps.

Remember when you create a test profile that there are certain limitations to what you can do based on the response time of the RHCL-1, as well as any sensor that may be under test. Because the RHCL-1 requires five minutes to reach a new setpoint, step changes of less than five minutes duration (or steep ramps) will do little to generate useful data.

SECTION 6 MAINTENANCE

6.1 DESICCANT REPLACEMENT

Regular use of the RHCL-1 will require routine maintenance of the desiccant and the distilled water. The desiccant should be changed when the indication label turns pink in color (at the "CHANGE WHEN PINK" mark). The desiccant, which is anhydrous $CaSO_4$ may be rejuvenated by baking on a cookie sheet in a single layer for 2 hours at 400° to 450°F. Replacement desiccant is available from OMEGA Engineering.

To replace the desiccant, turn the RHCL-1 off, grasp the desiccant tube with both hands, and pull upward slowly. The tube should come out slowly, and easily with a lightly greased feel. If it does not, work it slowly from each end, rocking it lightly from side to side. The seals on the tube are delicate; do not apply excessive force.

Once the desiccant tube is removed, unscrew the cover and remove the spring plate. Remove the pad and empty the used desiccant. If the desiccant sticks, tap the tube lightly. Fill the tube with fresh desiccant up the indication mark which is immediately below the intake nozzle, and tap lightly to settle the desiccant. Replace the pad and spring plate, carefully check the position of the O-ring, and screw the cover on snugly. Make sure the rubber gaskets are well lubricated with O-ring grease. Line up the gasketed connectors with the receptor tubes and ensure that even contact occurs on both tubes, then press down slowly and firmly until the tube is seated. Follow the start up procedure in Section 4 after replacing the desiccant.

Desiccant life is determined by ambient humidity, since all air entering the RHCL-1 passes through the desiccant. Desiccant life can be extended indefinitely by connecting a source of dry gas to the dry gas port. Set the flow from your gas source to 8 scfh. Higher flow rates are acceptable, however, anything beyond 8 scfh will be vented to atmosphere and therefore wasted. A gas entering the dry gas inlet passes through the desiccant, so any source drier than ambient will extend the life of the desiccant. More information on desiccant may be found in Section 8.

6.2 ADDING DISTILLED WATER

Distilled water should be added to the RHCL-1 before start up or whenever the fill light comes on during operation. Do not overfill. **USE ONLY DISTILLED WATER.**

The RHCL-1 should be completely emptied of water before any transporting is done. Pump water from the chamber by inserting the hand pump into the fill tube and pumping dry. Always keep the RHCL-1 in the upright position.

Replacement desiccant tubes, power cords, chamber covers and fuses are available from OMEGA Engineering. Contact the factory for information on parts or repairs.

SECTION 7 TROUBLESHOOTING

7.1 THINGS TO WATCH OUT FOR (DO'S AND DON'TS)

7.1.1 Heat the Test Chamber

The proportionality of wet and dry air mixing to relative humidity can be affected by the generation of heat in the test chamber. Therefore, when testing electronic devices which generate heat, the generated humidity will not be the same as the humidity in the air around the device. This problem can only be corrected by feedback operation (sensors from an RHB-2 monitor actual chamber dew point and temperature; the RHCL-1 is prompted to adjust its output accordingly).

7.1.2 Transporting the RHCL-1

When transporting the RHCL-1, changes in temperature can temporarily affect the accuracy of the unit. This is due to the varying thermal constants of the components in the RHCL-1. Proper operation of the RHCL-1 requires that the RHCL-1, water bath, and instruments in the test chamber be at the same temperature. If the RHCL-1 or the water to be used in the RHCL-1 has experienced a temperature change of 15°F or more, allow at least 1 hour for temperature equilibration. If the RHCL-1 is colder than ambient temperature, be especially cautious of generating high humidities where the dew point of the generated humidity may be higher than the temperature of the internal parts of the RHCL-1. In this case, condensation will occur and may take hours to dry out.

7.1.3 Reaching a Setpoint

In stand alone operation, the RHCL-1 will reach setpoint in under five minutes. When the setpoint is changed, the RHCL-1 immediately begins to generate a gas mixture of the new value. Ten minutes are required to displace the existing chamber environment with the new gas. Instruments in the chamber will lag considerably behind the RHCL-1. This is a function of that instrument, not of the RHCL-1. All sensors should be allowed to reach equilibrium after the RHCL-1 has had five minutes to reach setpoint.

7.2 AUDIO-VISUAL CLUES

The RHCL-1 should hum loudly when running. This is the sound of the internal pump. With humidity set between 10% and 90% RH there should also be a quiet pulsating hissing noise audible from the fill tube. If either sound is missing there is a problem with the air delivery system of the RHCL-1. Contact OMEGA.

If the RHCL-1 does not power up when turned on, unplug the power cord and check the fuse. Use a small screwdriver to pry out the fuse holder that is built into the line cord receptacle. If the fuse is blown, replace with a spare from the holder next to it and reinstall. If the RHCL-1 still won't power up, contact OMEGA.

The RHCL-1 should not gurgle. If it gurgles then it has been over filled, or tipped when full. Drain and re-fill the RHCL-1. Operate at 25% RH for 1 to 2 hours to dry out internal systems, then test for proper operation.

Overfilling or tipping when full may cause water to enter the test chamber. Wipe any water from the chamber and operate following the above procedure.

As the RHCL-1 runs, the blue desiccant should slowly turn pink, and the line between the pink and blue should slowly move from right to left (assuming no use of dry gas inlet). If this line fails to move over the course of a few hours of operation, turn off the RHCL-1 and inspect the desiccant tube for proper seating and gasket seals to the receptor tubes. In a typical room environment, the tube of desiccant will last for about 24 hours of continuous use.

7.3 GENERAL

Best performance from the RHCL-1 will result when the unit is operated in a temperature stable environment. Attention to detail and procedure when setting up your instrument will help to eliminate problems and produce useful test results. If everything seems to be operating fine and your results are not as expected, check your assumptions! If still in doubt, contact OMEGA.

SECTION 8 DESICCANT INFORMATION

The following information is provided to give brief details about Desiccant (Anhydrous $CaSo_4$). More information is contained in the MSDS sheet available from OMEGA Engineering.

CONTENTS:	Calcium sulfate 97%, Cobalt Chloride 3%
STABILITY:	Stable
INCOMPATIBILITY (MATERIALS TO AVOID):	Strong oxidizing agents
HAZARDOUS DECOMPOSITION OR BY-PRODUCTS:	Thermal decomposition may produce chlorine
HAZARDOUS POLYMERIZATION:	Will not occur
ROUTES OF ENTRY:	Inhalation

Continued

DESICCANT INFORMATION (Cont'd)

HEALTH HAZARDS:	This product contains 3% cobalt chloride which causes eye irritation and may cause skin and upper respiratory tract irritation. Overexposure to cobalt compounds may cause nose and throat irritation and an allergic skin rash. They are mildly irritating to the eyes and if ingested, may cause vomiting, diarrhea and affect the kidneys, lungs and thyroid.
MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE:	Respiratory system conditions and skin diseases
EMERGENCY AND FIRST AID PROCEDURES:	If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. If breathing is difficult, give oxygen. Call a physician. If swallowed, give two glasses of water and induce vomiting immediately. Call a physician. Never give anything by mouth to an unconscious person. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Call a physician.
STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:	Ventilate area of spill. Collect material into appropriate containers for reuse or disposal. Material may also be flushed with water to a wastewater treatment system.
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING:	Keep in closed containers. Avoid generating dust.
OTHER PRECAUTIONS:	Avoid contact with eyes, skin and clothing. Avoid breathing dust. Wash thoroughly after handling.

SECTION 9 RHCL-1MP SAMPLE SYSTEM

To enable the user to interface the RHCL-1 to the RHB-2 chilled mirror dew point hygrometer, one needs to order an RHCL-1MP kit. The kit includes a mounting plate, air pump, flow restrictor, pre-configured RHCL-1 chamber cover, RS-232-C data cable, and all of the hardware and tubing necessary to create a complete system.

It is advisable to read all of Section 9 if you have purchased an RHCL-1MP.

Before setting up your system, it is recommended that you read the appropriate operator's manual for your dew point hygrometer and sensor. Also, re-read Section 5.2, Feedback Operation, of this manual. This will help you to assure proper RHCL-1 and instrument operation.

9.1 SETUP

The RHCL-1MP mounting plate is designed to hang off the left side of the RHCL-1, providing for a short sample line. It comes with the air pump attached and provisions for mounting a RHB-S optical dew point sensor. Mount your dew point sensor on the plate with the sensor cable connection facing away from the air pump. Connect one end of the clear plastic tubing with the flow restrictor in the middle to the air pump (to the nipple labeled "vac"), and the other end to the gas port on the sensor that faces down. Be sure that the arrow on the flow restrictor points from the sensor toward the air pump (the direction of air flow).

Attach the pre-configured chamber cover to the RHCL-1 with the fittings on the left side. The final piece of tubing should be attached to the dew point sensor and run through the fitting on the chamber cover. The ferrule should be crimped so that the tubing extends two inches (2") into the RHCL-1 chamber. The second fitting is for the RHB-2 Pt100 temperature probe from the RHB-2. The tip of the RHB-2 Pt100 should be close to the bottom of the chamber, but not touching. Connect the RHB-2 Pt100 and the dew point sensor to the RHB-2.

9.2 OPERATION

With the RHB-2 and RHCL-1 running, simply plug in the sample pump (115VAC, 60Hz). The pump provides gas flow over the chilled mirror sensor at a rate between 1 and 2 scfh. The RHB-2 will calculate and display the relative humidity in the RHCL-1 chamber by measuring the chamber temperature and dew point. If feedback operation is desired, connect the data cable between the RHCL-1 and RHB-2.

SECTION 10 SPECIFICATIONS

10.1 RHCL-1

OPERATING RANGE: 0% to 99% RH

AMBIENT TEMPERATURE RANGE: 35° to 100°F (2° to 38°C)

REPEATABILITY: 0.2% RH

ACCURACY:

RANGE	ACCURACY
0 to 10%	±4.0% RH
10 to 20%	±2.0% RH
20 to 80%	±1.0% RH
80 to 90%	±2.0% RH
90 to 99.9%	±4.0% RH

±2% RH agreement with Model RHB-2 Monitor in feedback mode

STABILITY: 0.2% RH

RESPONSE TIME: less than 10 minutes to within 1% of RH setting

RESOLUTION: 0.1% RH

POWER: 120VAC, 60 Hz (standard)
240VAC, 50 Hz available on request
(not field convertible)

INTEGRAL POWER SUPPLY: 24VDC unregulated

CHAMBER DIMENSIONS: 3.2"H x 5.8"W x 3.7"D (81 x 147 x 94mm)

SPECIFICATIONS (Cont'd)

OVERALL DIMENSIONS: 10.5"H x 16"W x 10"D (167 x 406 x 254mm)
Refer to Figure 10-1.

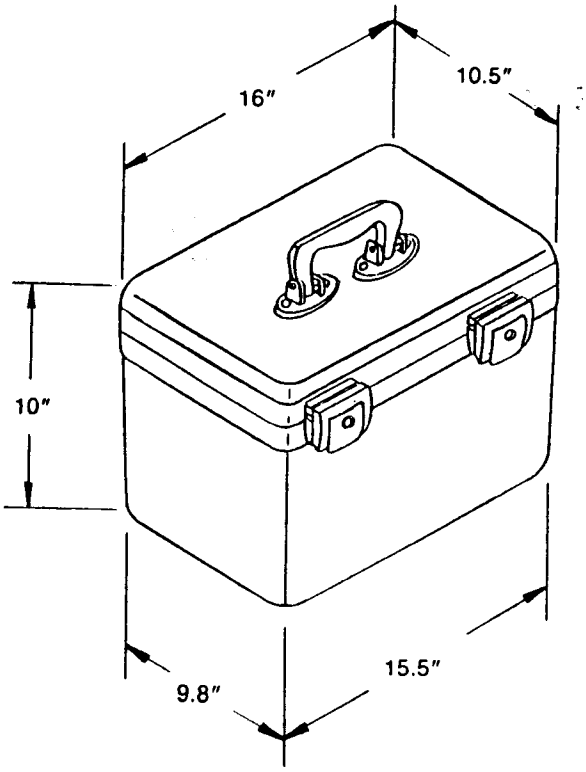


Figure 10-1. Dimensions

DRY GAS INLET: 1/4" tube fitting with a gas flow of no more than 8 standard cubic feet per hour (scfh)

STORAGE TEMPERATURE
(FULL): 33° to 100°F (1° to 38°C)
(DRAINED): -65° to 120°F (-54° to 49°C)

WEIGHT: 12 lb (5.5 kg)

DESICCANT INFORMATION: 24 hours of continuous use in ambient temperature

LIQUID TYPE: Distilled water only

10.2 RHCL-1MP

POWER: 120VAC, 60Hz

FLOW RATE: 1 to 2 scfh

NOTE: The mounting plate will accommodate the RHB-S chilled mirror sensor.

SPECIFICATIONS (Cont'd)

RHB-2-PT100 RTD TEMPERATURE PROBE

OPERATING RANGE (METER & SENSOR):	-146° to 199°F (-99° to 93°C)
CONSTRUCTION:	316SS sheath; comes with 10 feet of lead wire
DIMENSIONS:	7.5" long, 0.25" outside diameter, 1/4" NPT fitting 190.5 mm long, 6.35 mm outside diameter, 1/4" NPT fitting

SECTION 11 REPLACEMENT PARTS

The following parts are available from OMEGA.

DESCRIPTION	PART NUMBER
Replacement Desiccant Tube	RHCL-1-DT
Power Cord	RHCL-1-PC
Chamber Cover	RHCL-1-COVER
Power Line Fuse	RHCL-1-FUSE

NOTES

NOTES

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.

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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.

FOR WARRANTY RETURNS, 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 the product under warranty, and
3. Repair instructions and/or specific problems you are having with the product.

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

1. Your P.O. number to cover the COST of the repair/calibration,
2. Model and serial number of product,
3. Repair instructions and/or specific problems you are having with the product.

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TEMPERATURE

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

PRESSURE/STRAIN FORCE

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

FLOW/LEVEL

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

pH/CONDUCTIVITY

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

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

HEATERS

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