ELH

CALIBRATION CHAMBER
OPERATORS MANUAL

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ELH CHAMBER

QUICK STARTUP GUIDE

STARTUP

1. Connect drainage hose to rear of Chamber.

2. Connect source of distilled water to rear water input to Chamber. Or, connect source of tap water to input of demineralizer cartridge on rear.

3. Set up DewMaster on top Chamber surface.

4. Connect dew point sensor cable between sensor and rear of DewMaster.

5. Insert dew point sensor firmly in round opening on top surface of Chamber.

6. Connect analog output cables between DewMaster and Chamber.

7. Connect temperature sensor cable from Chamber to rear of DewMaster.

8. Connect source of AC Power (115VAC, 50/60Hz, 20A) to Chamber and to DewMaster.

9. Turn on AC Power switch on rear of DewMaster.

10. Program desired setpoints using proportional controller.

11. Press POWER button on Chamber to start system operation.

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2.0 EDGETECH'S COMMITMENT TO QUALITY

Thank you for purchasing one of our products. At EdgeTech, it is our policy to provide cost-effective products and support services that meet or exceed you requirements, to deliver them on time, and to continuously look for ways to improve both. We all take great pride in the products we manufacture.

We want you to be entirely satisfied with your instrument. The information contained in this manual will get you started. It tells you what you need to get your equipment up and running, and introduces its many features.

We always enjoy hearing from the people who use our products. Your experience with our products is an invaluable source of information that we can use to continuously improve what we manufacture. We encourage you to contact or visit us to discuss any issues whatsoever that relate to our products or your application.

3.0 INTRODUCTION

3.1 GENERAL DESCRIPTION

The Model ELH Series of environmental test chambers provide an integrated approach to laboratory and industrial applications where a closely controlled environment must be provided. This rugged chamber of 316 stainless steel is controlled by the proven EdgeTech DewMaster NIST-traceable chilled mirror dew point hygrometer. The remotely mounted dew point sensor and platinum RTD temperature sensor measure the chamber conditions at all times, allowing the instrument to display Temperature and Dew Point and Percent Relative Humidity on its front panel.

Note: This chamber uses an environmentally safe non-depleting refrigerant.

Along with the digital display, both analog and digital outputs are available on the rear panel for operator use. These may run a recorder or other device. A chart recorder option is offered by Edgetech. A bi-directional RS-232 serial digital interface is also available on the rear panel. This may be used to remotely test or calibrate the DewMaster if desired.

3.2 CHAMBER SIZES

Three different chamber volumes are available, depending upon the user's requirements.

ELH-1.5	1.5 cubic foot Calibration Chamber
ELH-6	6 cubic foot Calibration Chamber
ELH-10	10 cubic foot Calibration Chamber

3.3 AVAILABLE CHAMBER OPTIONS

A number of options are offered by Edgetech, in order to meet various user requirements.

-SS	Additional Stainless Steel Shelf
-WD	8" X 8" Window in Chamber Door
-IL	Internal Light with External Switch
-DCS	Replacement Demineralization Cartridge System
-SCS	Self-contained 6-gal. Recirculating Humidity System
-ET	Extended Temperature Range to -20°C
-CR	2 Pen 10" Chart Recorder

3.4 SYSTEM CONTROL RANGE

Temperature vs. Humidity Chart

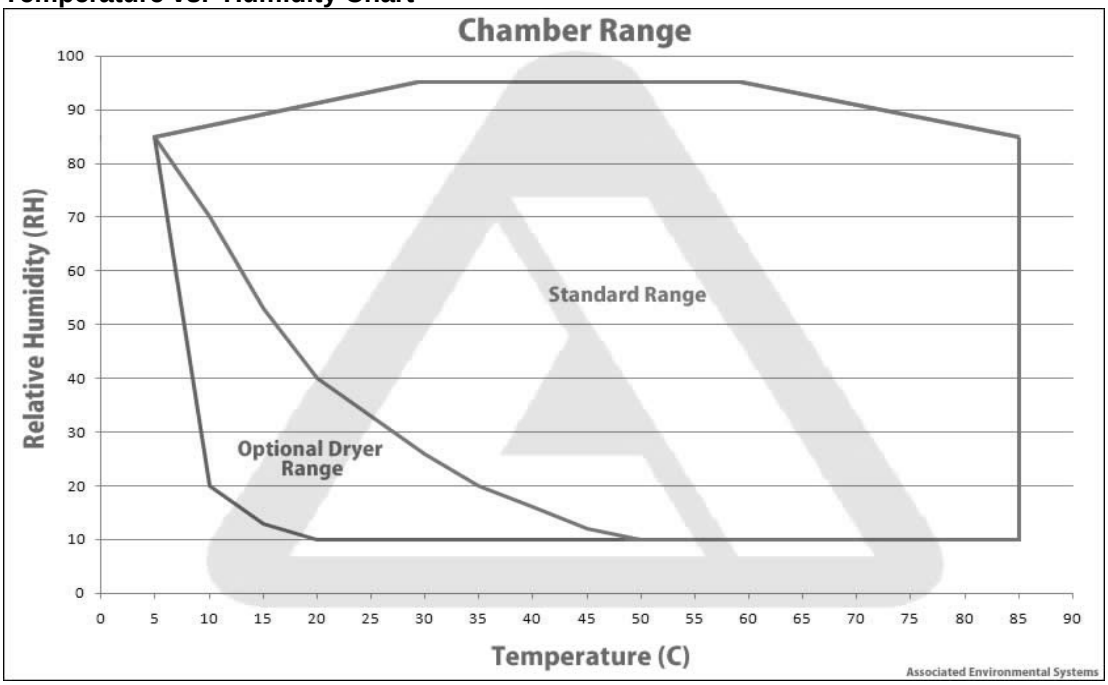


Figure 3-1 ELH Chamber Range

The graph above depicts the actual control range of the ELH Chamber. You can see, for example, that over a Temperature range of from 50 to 85°C, the Relative Humidity range is 10 to 95%. Over a Temperature range of 35 to 50°C, the Relative Humidity range is 20 to 95% or greater.

4.0 THEORY OF OPERATION

4.1 TEMPERATURE - HUMIDITY CHAMBER BASICS

A source of water is connected to the rear of the chamber. Distilled water is preferred. If distilled water is not available, a demineralizing cartridge filter is provided to allow the use of tap water.

The Edgetech DewMaster Dew Point Hygrometer System, mounted on the chamber, includes two sensors. One is the Chilled Mirror for measuring the chamber dew point, and the other is the platinum RTD probe for measuring the air temperature. Both are inserted inside the chamber, where the air circulation provides good response. These two measured parameters provide analog outputs on the rear panel of the DewMaster. These are in turn connected to the chamber's proportional controller. The controller, on the right front panel of the chamber, may be easily set up for a desired humidity and temperature setting. The system will bring the chamber to the desired settings, and continuously control it at those settings. An opening on the left side of the chamber allows the user to bring in a quantity of sensors to test or to calibrate.

4.2 THE TEMPERATURE – HUMIDITY CHAMBER

4.2.1 CIRCULATION SYSTEM

The circulation system consists of electric motor(s) and fan blade(s). The electric motor is a split phase, TEFC with automatic reset thermal overload. The motor has a stainless steel shaft, which extends into the chamber and then into the fan blade. The bearings are the permanently lubricated type, so no further lubrication is required. Since the motor is single phase there is no need to check for proper rotation after new chamber installation. If motor is replaced or serviced, rotation should be checked since the motor can be wired for standard or opposite rotation.

4.2.2 HEATING SYSTEM

Heating is produced by nichrome wire on ceramic core type heaters, used for their quick response. When the controller senses heat is required, it energizes a series of relays and the pilot light. Should the failsafe circuit be energized, a separate relay will de-energize the chamber heat and illuminate the failsafe pilot.

There are also heat links located in the chamber. Their purpose is for chamber protection only. Once they are opened, replacement is necessary. <u>Never short or jump out heat links</u>.

4.2.3 HUMIDITY SYSTEM

Humidity vapor is created in the external vapor generator using stainless steel heaters and then piped to the chamber for distribution. The water level is maintained by an external tank with a water level valve. Thermal snap disc controls are mounted to the vapor generators to prevent over temperature conditions in the element or a no water condition. When the controller senses humidity is required, it energizes a series of relays, the pilot light, and steam generator heaters.

4.2.4 DEHUMIDITY SYSTEM

Vapor is removed from the work space by an unfinned dehumidity coil located behind the evaporator. When the % RH controller senses too high of a humidity, a solenoid valve, located before the dehumidity coil capillary tube, is energized, letting refrigerant into the coil.

4.2.5 REFRIGERATION SYSTEM

Cooling is accomplished by a single stage mechanical system using one (1) semi hermetic compressor. Compressors utilize polyester oil (POE) for lubrication. The R-404A system removes the heat from the chamber and delivers it to the surroundings using the fan (or water) cooled condenser. An air cooled condenser is utilized.

4.2.6 COOLANT

The coolant provided with this system is R-404A. When the mechanical refrigeration is switched on, the R-404A compressor will start. The R-404A system incorporates a hot gas bypass system to “unload” the compressor during low or no load conditions.

4.3 THE CHILLED MIRROR DEW POINT SENSOR

4.3.1 CHILLED MIRROR THEORY OF OPERATION

Dew Point is defined as *the temperature that moisture <u>just begins</u> to condense on a surface*. The chilled mirror dew point sensor measures this parameter directly. A highly reflective stainless steel plated mirror is mounted to a solid state heat pump, or thermoelectric cooler. A light source (LED) is reflected off the mirr*or* onto an opposing photodetect*or*. The mirror is cooled thermoelectrically to the temperature at which condensation (dew or frost) first begins to form. This condensate causes the light from the light source to be scattered, resulting in a reduction of light as seen by the photodetector. This signal is sent to a servo amplifier which controls power to the thermoelectric cooler, automatically controlling the mirror at whatever temperature is required to maintain a very thin film of water droplets (or frost) on the surface at all times. This is the dew point (frost point when below 0^{o}C) by definition. Since the mirror surface is always at the dew point, measuring the mirror temperature provides actual dew point temperature. Temperature data is received from a PRT (platinum resistance thermometer) embedded directly beneath the chilled mirror surface. The PRT is very tightly thermally coupled to the mirror surface, in order to minimize measurement error.

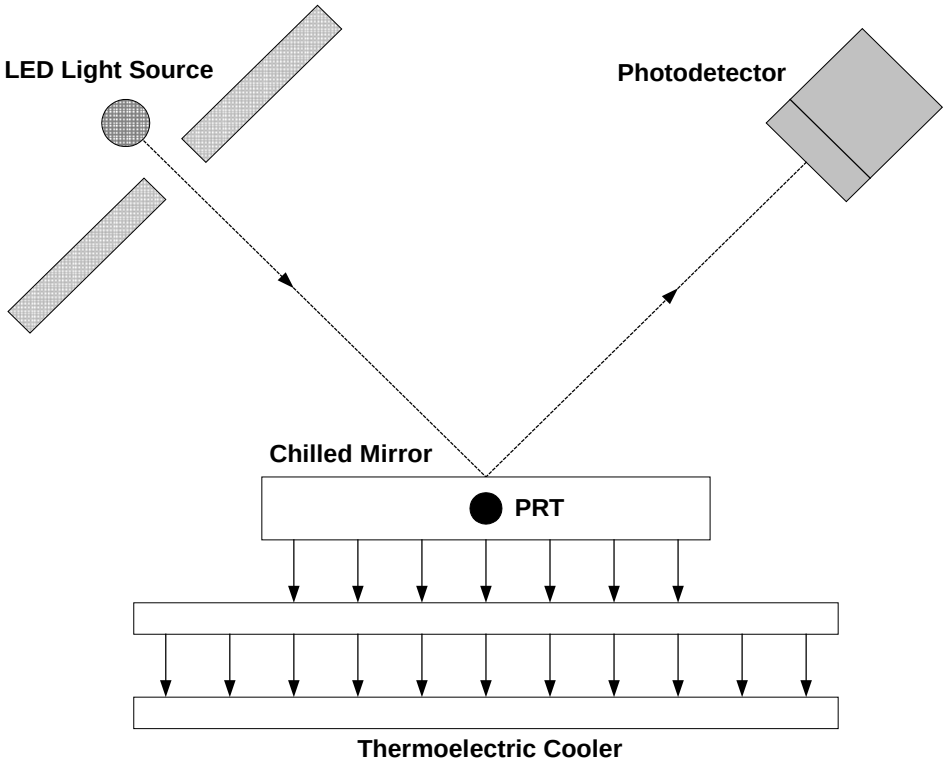


Figure 4-1. Chilled Mirror Block Diagram

The advantages of the Chilled Mirror are:

- It provides a *primary*, as opposed to a *secondary* measurement of dew point.
- Measurement is continuous, accurate and repeatable.
- Results are traceable to N.I.S.T., supporting ISO 9000 and military test requirements.
- No hysteresis.
- No drift.
- Dew point accuracy of +/- 0.2^{o}C

4.3.2 MIRROR AUTOMATIC BALANCE CYCLE (ABC)

The Automatic Balance Cycle is an important electronic feature of the DewMaster that allows much longer operation of the system without any maintenance. At least 90 days is typical. As contamination from the air sample gradually builds up on the mirror surface, an error in the indicated dew point reading could eventually occur. In order to eliminate this potential source of error, the system periodically reprograms itself by correcting for the loss in reflectivity caused by the contaminants on the surface, allowing the mirror to operate at the actual dew point temperature once again. This is called

balancing. The user should always use the ABC feature, because it greatly minimizes mirror cleaning requirements.

When you first turn on the DewMaster, the Automatic Balance Cycle is initiated. It can also be programmed to be initiated automatically with selectable intervals, or initiated manually at any time by depressing the MABC (Manual Automatic Balance Cycle) key on the keypad. It can also be initiated remotely by using the RS-232 port.

The ABC first heats the mirror surface above the dew point, causing the condensate layer to evaporate, leaving only the contamination on the surface. The amount of light received from the dry mirror is then measured, and a correction in the servo loop is made, normalizing the system (balancing) and compensating for the contaminant layer. The balance cycle only takes a few minutes, and at the end of that period the mirror resumes tracking the actual dew point temperature.

TRACK and HOLD: The Analog Output can be programmed with the keypad to provide Humidity, Temperature information. When Dew Point is selected, (or Relative Humidity, which is a function of Dew Point and Temperature), the actual analog value is temporarily incorrect during the ABC. Since the mirror temperature is constantly measured and defined as the dew point, the heating of the mirror described above is the one time when the mirror temperature is intentionally *not* at the dew point. A keypad programming option allows the user to have the Analog Output remember the last dew point value *just before* the ABC started, and *hold* that value constant for the few minutes that the balance cycle requires. It then continues to track the actual real time dew point temperature (or RH) as before. This is the HOLD option, which may be the best choice when driving a strip chart recorder or when using a data acquisition system. If the TRACK option is selected, the resulting positive output pulse on the analog output during the heating portion of the ABC may be recorded and used to tell the operator when the cycle occurred.

4.3.3 CARE AND MAINTENANCE OF THE CHILLED MIRROR SENSOR

Although the ABC greatly minimizes the requirement for mirror cleaning, eventually the system will have to be shut down and the mirror cleaned. A CLEAN MIRROR indication displayed at the end of the ABC tells the user when cleaning is required. See the Maintenance chapter for detailed instructions in mirror cleaning.

5.0 INSTALLATION AND SETUP

5.1 SAFETY INFORMATION

PLEASE READ

Follow all warnings to prevent possible injury or damage. Failure to follow all warnings may void the warranty.

5.1.1 CHAMBER SAFETY

Allow a minimum of 18" clearance in front and rear of chamber for ventilation across air cooled condenser. The internal components and general performance of the chamber will be impaired if it is placed in a corner or boxed in by other equipment. Do not block the air vent on the top or the sides of the chamber because overheating could occur.

The power requirements are 120V 1PH 60HZ. These requirements are noted on the model nameplate located on the back of the chamber. If a contradiction exists, follow the power requirements on the nameplate.

Demineralized or single distilled water with resistance measurement between 50,000 and 100,000 Ohms/cm (20 to 10 Microsiemens/cm) must be used. Untreated tap water should always be fed through a demineralizer cartridge before use by the chamber's humidity system.

Maximum temperature when using humidity is +85°C. Do not test any humidity level above this temperature. Humidity switch must be off.

Humidity system must be drained every week and when not in use.

The Programmer in your chamber has been "set up" and tested at the factory. Aside from programming your set points, do not change any other parameters.

5.1.2 DEWMASTER SAFETY

Removing the DewMaster Control Unit cover exposes the user to line operating voltages when the unit is connected to line power. Only experienced persons should attempt to make adjustments or tests with the cover removed. If the instrument is plugged in when performing any circuit adjustments or tests, take extreme care not to come in contact with the high voltage present around the power supply, the AC line filter, or the rear panel power switch.

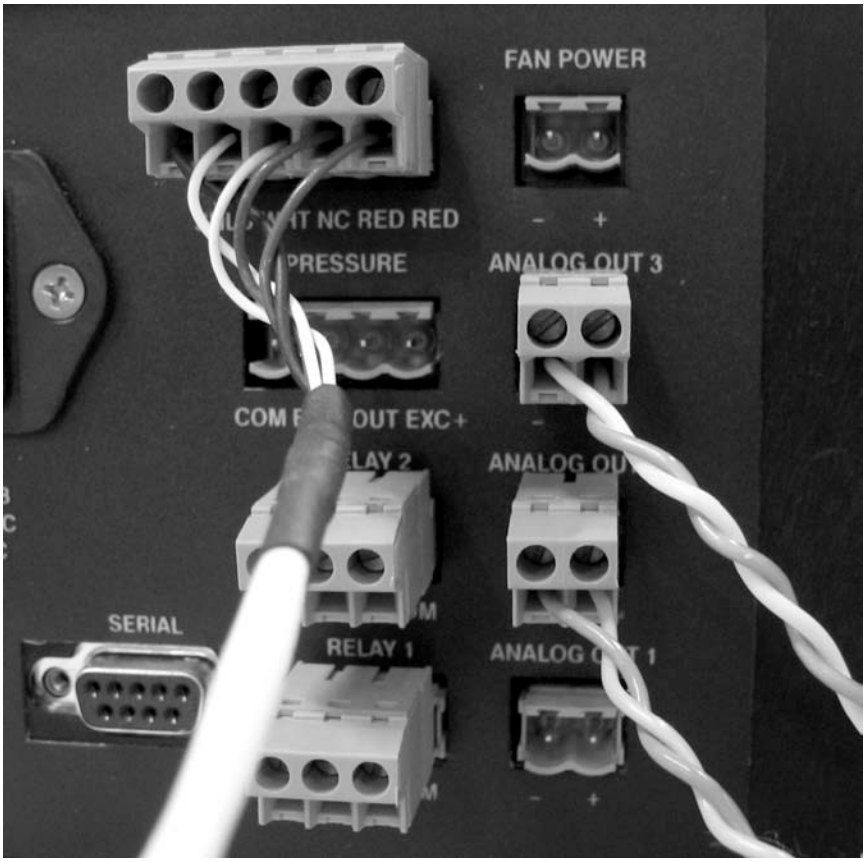
5.2 DEW POINT HYGROMETER SETUP

The DewMaster chilled mirror dew point hygrometer system is supplied with two sensors and two sensor cables. The larger one is the dew point sensor. Connect it's cable between the sensor and the rear panel of the instrument. Firmly insert the sensor vertically into the hole provided on the top of the chamber. The smaller probe is the air temperature sensor. Connect it's cable between the sensor and the instrument also. If not already mounted inside the chamber, this sensor is mounted near the fan for best air circulation.

Figure 5-1 DewMaster Rear Panel Wiring

Plug the remainder of the supplied rear panel cables into their correct connectors as shown in Figure 5-1. They are:

1. AC Power Cable
2. Temperature Sensor
3. Analog Out 3
4. Analog Out 2



The Analog Outputs are wired to the Controller on the right front panel of the humidity chamber. They provide the Humidity and Temperature control inputs for the chamber.

Color coding is as shown below.

Analog Out 3	Yellow and Violet
Analog Out 2	Gray and Orange

Note: Be careful to insert these connectors the correct way. There is only one correct way. Do not force them in if they seem not to fit correctly, as they may be inverted. See Figure 5-1 for the correct installation.

5.3 CHAMBER SETUP

5.3.1 PLACEMENT

Place the chamber on a level, hard surface. Allow a minimum of 18" clearance in front and rear of chamber for ventilation across air cooled condenser. The internal components and general performance of the chamber will be impaired if it is placed in a corner or boxed in by other equipment. Do not block the air vent on the top or the sides of the chamber because overheating could occur.

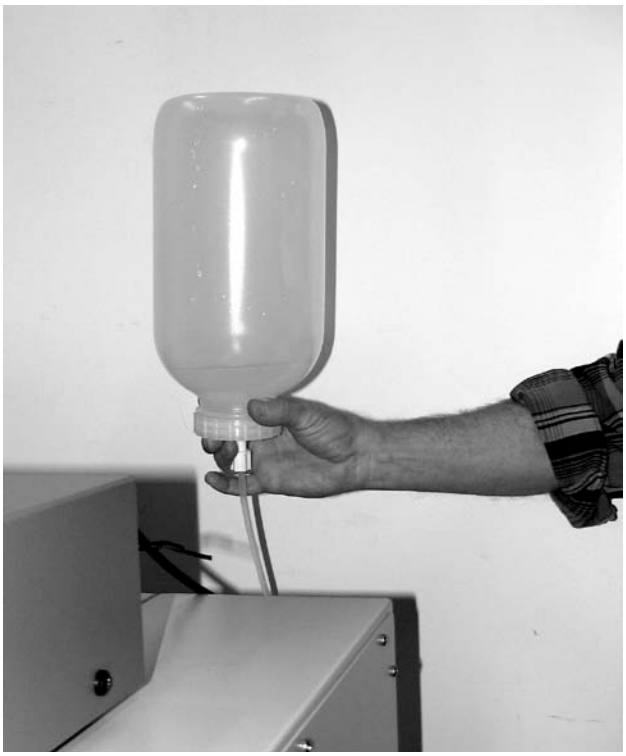
5.3.2 POWER REQUIREMENTS

Connect the ELH system to a source of proper voltage and current, following all local electrical codes as required.

5.3.3 WATER REQUIREMENTS

If you have distilled or demineralized water, it may be connected directly to the rear panel water input ¼" compression fitting. See Figure 5-2.

Figure 5-2 Connecting the Distilled Water Source



If tap water is to be used, it must be connected through a demineralization cartridge, because plant water contains minerals which could impregnate the stainless steel interior of the chamber. This action would cause rust to form on the inner liner and on exposed electrical components. Untreated water will also cause sediment to build up in the vapor generator tank, which can damage the heater.

NOTES:

1. If a replaceable demineralizer cartridge is used, water pressure must be less than 30 psi.

2. Do not use double or triple distilled water.

3. **Do not run demineralized, deionized, double or triple distilled water through a demineralizer cartridge.**
4. **If "white" deposits show up inside the chamber, your water is not demineralized and you need to use the demineralizer cartridge.**

If a demineralizer cartridge is used with a reservoir and pump assembly, the demineralizer cartridge must be downstream of the pump. Gravity alone cannot provide enough pressure to push a sufficient quantity of water for the vapor generator through the cartridge.

If appreciable amounts of organic, free chlorine and chloramines, phosphate complexes, and turbidity are present, a rough filter (US filter model: absorber) should be used. This may be in addition to the ion exchanger cartridge. All filters described are available from the factory.

Check your water supply periodically for resistivity, as well as organic and inorganic content. Make it a habit to check you water supply frequently.

5.3.4 CONNECT THE CHAMBER DRAIN

Connect the copper chamber drain in accordance with local codes. It is located on the bottom rear of the chamber.

5.3.5 INITIAL CHAMBER CHECKOUT

See Figure 5-3 below.

The test chamber has been thoroughly inspected and tested prior to leaving the factory. To ensure that it is in proper working order after receipt, you may perform the following initial checkout steps:

Step 1: Place the Power (Circulation) switch ON and with the door opened, confirm that there is airflow from the circulation blower.

Step 2:

a. Set the digital failsafe control to a setting above the desired test temperature.
b. Close the door and turn the power and heat switches on.
c. Set the primary controller temperature set point at the desired test temperature.
d. Allow the chamber to reach the set point and then wait 15 minutes for the system to stabilize itself at that temperature.
e. Reset the digital failsafe control at the temperature above the set point temperature where you want the chamber to go into “safety mode.”
f. Open door, turn heat switch off, let cool down to room ambient.

Close the chamber door and set chamber temperature controller to your desired high setting. Push heat and cool (mechanical refrigeration) switches on. Confirm an increase in chamber temperature by observing the digital display. As the chamber temperature approaches the set point, the Heat pilot light will begin to flash, indicating proper operation of the temperature control instrument at high temperatures.

Step 3: The power, heat, and cool switches should all be on. Set chamber temperature to a low temperature. Confirm a decrease in chamber temperature by observing the digital display. As the chamber temperature approaches the low set temperature, the cool pilot light will begin to flash indicating proper operation of the temperature control instrument at low temperatures. Set the chamber temperature controller to your lowest testing temperature (within chamber specifications.) Let the unit run to verify proper operation of the refrigeration system.

5.3.6 PILOT LIGHTS

The switch and pilot light are integrated into one unit. Light will illuminate when switch is actuated. From top to bottom:

POWER - (Circulation) When the power light is ON, the chamber circulation fan is activated and the primary power for the chamber is ON.

HUMIDITY - When the humidity pilot is steady ON, the vapor generator heater circuits are energized, flashing of the humidity pilot light indicates chamber humidity is at or near set humidity. Each time the humidity is switched on, there will be a delay of approximately five (5) minutes before an increase in humidity is observed, this is due to the thermal mass of the vapor generator.

LIGHT - When the pilot light is steady ON, this indicates that the light is on in the chamber.

Figure 5-3 Controller and Pilot Lights

5.3.7 HUMIDITY TESTING

This unit is equipped with a chilled mirror sensor to sense and control humidity.

1. Connect demineralized water to the inlet connection on the external wet wick tank to fill humidity steam generator tank. Level is controlled automatically.
2. You will notice that the chamber is sloped slightly to the rear. This is for water drainage.

5.3.8 HUMIDITY SYSTEM/STEAM GENERATOR

Humidity is created in this unit by a steam generator. The steam generator tank(s) has safeties on it to prevent the heater from operating in case there is no water in the tank.

Very often at the initial startup of the machine, the humidity system is started before water is placed in the system. This activates the safety to protect the heater(s). A common complaint to our service department is “our humidity doesn’t work.”

When there is no water in the tank, the humidity system will not operate.

You must reset the manual reset switch located on the steam generator tank(s).

Make sure water is in the tank, push the reset safety button and the steam generator will operate.

6.0 OPERATION

6.1 OPERATING THE ELH SYSTEM

6.1.1 BASIC OPERATION

Once the DewMaster and the Calibration Chamber has been connected together as described in Chapter 5, and a proper source of water has been connected, you are ready to operate. See Figure 6-1.

Figure 6-1 The DewMaster and the Proportional Controller

The DewMaster displays three pertinent pieces of information about the Humidity Chamber; the actual Dew Point, Percent Relative Humidity, and the Air Temperature. It has been programmed at the Factory specifically for operating with the Humidity Chamber, and it should only be necessary to turn on the rear panel Power switch.

Note: In case you wish to understand more about the unique DewMaster features such as the AutoBalance (ABC) cycle, or if further optional programming is desired, such as changing the Alarm Relay setpoints, additional information is provided in the Appendix portion of this manual.

The Proportional Controller, shown at the right in figure 6-1, allows you to do several things.

1. The large digital display at the top monitors the **actual chamber temperature.**

2. Input 2 in the window shows the **actual chamber relative humidity.**

3. SP1 allows you to program the **required temperature setpoint.**

4. SP2 allows you to program the **required relative humidity setpoint.**

Use the arrow buttons on the controller panel to navigate to the desired parameter and program it as needed. After a little experimentation, you will see that it is straight-forward and easy.

6.1.2 SYSTEM STARTUP

To begin operation, press the **POWER** button on the right front of the chamber, located below the Proportional Controller. After a short period of self-testing, the DewMaster will begin to measure the dew point and air temperature in the chamber. The analog outputs will then control the chamber operating conditions, and will bring them to the set points you have programmed. You can monitor the actual conditions on the displays, and observe when the chamber is under proper control.

Below the **POWER** button are two other buttons. The **HUMIDITY** indicator light flashes ON when the chamber calls for additional humidity. There may be a delay before the effects of the increase are seen. The **LIGHT** indicator shows the operator that the light is ON inside the chamber. Press the button to turn it off.

Figure 6-2 Calibrating Sensors

6.1.3 TESTING AND CALIBRATING OTHER SENSORS

In order for you to insert other sensors in the chamber for testing and/or calibrating them, there is a removable plug on the left-hand side of the chamber. See Figure 6-2. Insert the sensors under test, and close up as much of the opening as you can around the sensor cables to keep the chamber atmosphere

isolated from the outside atmosphere. Whenever you program the chamber to a new calibration point, be sure to wait long enough for the sensors to completely equilibrate to the chamber conditions before attempting to performing a calibration.

6.1.4 LONG TERM OPERATION

For long term operation, you only need be concerned with maintenance items. These are covered in Chapter 7, the Maintenance chapter. They include:

1. Periodic Sensor Mirror Cleaning

2. Periodic replacement of the deionizing water filter, if used.

3. Cleaning the chamber cavity and the condenser fins when dirty.

4. Periodic draining of the chamber.

6.1.5 FREQUENTLY ASKED CHAMBER QUESTIONS

Why does the chamber heat/cool slower than specified?

The heating and cooling performance of the chamber is significantly affected by characteristics of your test sample such as mass, material, size, shape, and load. The test sample should be placed in the unit in a manner that allows for air circulation. The test sample should not occupy more than a third of the total working volume of the chamber. You should not place the test sample directly on the chamber floor. It should be placed on a shelf to ensure conditioning on all sides. Multiple test samples should be positioned throughout the chamber to ensure even airflow. If necessary, additional shelves should be used to evenly distribute the load.

Should I put a filter in front of the air intake?

No, the performance of the chamber will be reduced if there is restricted airflow across the condenser. We do not recommend putting a filter in front of the air intake; instead regularly clean the condenser fins.

Why is there ice or “snow” buildup in the chamber?

At low temperatures moisture will condense out of the air and freeze. When the chamber is heated, the ice or frost will turn into water.

7.0 MAINTENANCE

7.1 CHAMBER MAINTENANCE

7.1.1 KEEPING IT CLEAN

It is a good idea to periodically clean the chamber cavity, because dirt is hygroscopic; that is, it retains moisture. Wash the interior regularly with mild soap, particularly following exposure to acid or other highly corrosive compounds. Do not clean with steel wool or permit ferrous materials to rub on stainless surfaces, because particles of iron will imbed in the stainless and rust. Gummy deposits, if allowed to remain, may result in electrolytic action and pitting. Check the back of the chamber for dust occasionally. If dirty, the condenser can be cleaned with a vacuum.

7.1.2 HUMIDITY SYSTEM

If you are using ordinary tap water, and therefore using the demineralizer cartridge mounted to the rear, the filter will have to be replaced periodically. The frequency of replacement will depend entirely on your rate of chamber usage, in addition to the level of contamination of your water source. Generally this contamination may be seen through the clear filter wall.

The cartridge should be replaced when 80% of the pellets have changed to an amber color. Remove the protective end caps from the cartridge. Detach the two washers that are taped to the cartridge and place one washer on the top of the cartridge and then push the washer and cartridge into the upper pressure fitting. While holding the cartridge in position, place the second washer in the lower receiving block and slide the bottom of the cartridge into place. Tighten the adjusting nut on the lower receiving block to firmly hold the cartridge in the bracket. Only moderate tightening should be necessary to prevent leakage.

7.1.3 GENERAL CHAMBER MAINTENANCE

Some general maintenance suggestions and operating precautions are offered below.

1. Always disconnect the chamber from all sources of power before attempting any form of maintenance or service to the chamber electrical circuits.

2. Avoid connecting the chamber to a power source which exhibits wide voltage or frequency fluctuation. Such a power source may seriously hamper the performance of the temperature control instrument.

3. Avoid using lengthy line cords for supplying electrical power to the chamber since they often cause undesired voltage drops. For best results connect the chamber to a power line which is free of any other electrical equipment.

4. Bearings of circulation motor are permanently lubricated. No oiling is required.

7.1.4 DRAINING THE GENERATOR

The generator should be drained regularly to remove any mineral buildup that might have accumulated even though the water is treated. The frequency of draining depends on whether the water is treated and how often the humidity system is used. With constant usage, once a month is recommended. If humidity is only generated occasionally or not at all for some period, the generator should be drained weekly.

Figure 7-1 Drain Valve (Gray with Blue Handle)

To drain the generator, the humidity system must have been off for one (1) hour to allow for cooling of water.

1. Disconnect power.
2. Shut off water inlet valve.
3. Open drain valve until all water is drained.
4. Shut drain valve.
5. Re-open water inlet valve.
6. Connect power.

7.2 DEW POINT SENSOR MAINTENANCE

7.2.1 ROUTINE SENSOR MAINTENANCE

To ensure the maximum in accurate and reliable operation of any optical chilled mirror system, a periodic maintenance program should be established.

7.2.2 MIRROR CLEANING SCHEDULE

The buildup of contamination on the mirror surface normally occurs very slowly. Over time, particulates and other matter present in the sample gas and not captured by filters, build up on the mirror. The result of the buildup of contaminants on the mirror surface is reduced dry mirror reflectivity and a change in the optical reference point. The Automatic Balance Cycle (ABC) will automatically readjust the reference point periodically, but eventually the adjustment range will be exceeded and a manual cleaning of the mirror may be necessary. When the contamination becomes too severe to be adjusted automatically, an error will be displayed at the end of the ABC. Normally, intervals of 90 days between routine mirror cleanings can be easily achieved. However, if the sample contaminants are particularly high, more frequent mirror cleanings may be required. When cleaning is required, clean the mirror surface and the adjacent optical parts.

7.2.3 MIRROR CLEANING

To clean the mirror surface in the Sensor:

1. Pull the Dew Point Sensor straight up, removing it from the hole in the top of the chamber.

2. Remove the pull-off cover from the Sensor to expose the reflective mirror.

3. Press the HEAT key on the front panel to heat the mirror and evaporate any condensate.

4. Cotton swabs and an empty cleaner bottle are provided in the Cleaning Kit shipped with the system. Fill the bottle with isopropyl alcohol, purchased locally. (We are not allowed to ship it). Moisten a clean cotton swab with the alcohol. Wipe the mirror surface and the optics surface in a circular motion.

5. After cleaning the mirror surface, wipe the surfaces dry with a clean cotton swab.

6. Next, moisten a clean cotton swab with clean, preferably distilled water and wipe the mirror and optics areas Dry these areas thoroughly with a clean, dry cotton swab.

7. Replace the sensor cover and reinsert the sensor firmly in the chamber.

8. Press the HEAT key again to shut off the heat and allow the mirror to cool.

9. Press the MABC key to balance the optics and return to normal operation.

See Figure 7-2 below for Mirror Location.

Figure 7-2. Cleaning the Mirror

7.3 THE DEWMASTER/SENSOR SYSTEM

7.3.1 UNDERSTANDING THE ABC AND MIRROR MESSAGES

The Automatic Balance Cycle (ABC) is initiated upon instrument turn-on. In addition, the ABC can be initiated automatically at programmable intervals, or initiated manually at any time by depressing the MABC (Manual Automatic Balance Cycle) key on the keypad, or remotely via the RS-232 port.

The ABC begins by heating the mirror to a temperature well above the dew point to evaporate any dew on the surface. The computer determines that the mirror is dry and ready to be re-balanced based on a pre-set time interval AND the stability of the mirror reflectance. The pre-set time interval is determined by the mirror temperature at the beginning of the cycle. At low temperatures, greater time is needed to heat the mirror and evaporate the condensate. If the mirror temperature at the beginning of the cycle is greater than -20°C, the heat time is a minimum of 1.0 minute. If the temperature is below -20°C, the heat time is a minimum of 3.0 minutes.

At the end of the heat phase, the computer balances the optical bridge and control loop and returns to normal operation. If, at the end of an ABC, the amount of balance

adjustment is too large, a flashing “CLEAN MIRROR” message will appear on the display and the serial output. See 7.2.3 above for detailed mirror cleaning instructions. If the computer finds any other abnormality in sensor performance during an ABC, a flashing “CHECK SENSOR” message will appear, in which case the factory should be contacted.

7.3.2 REPLACING THE DEWMASTER FUSE

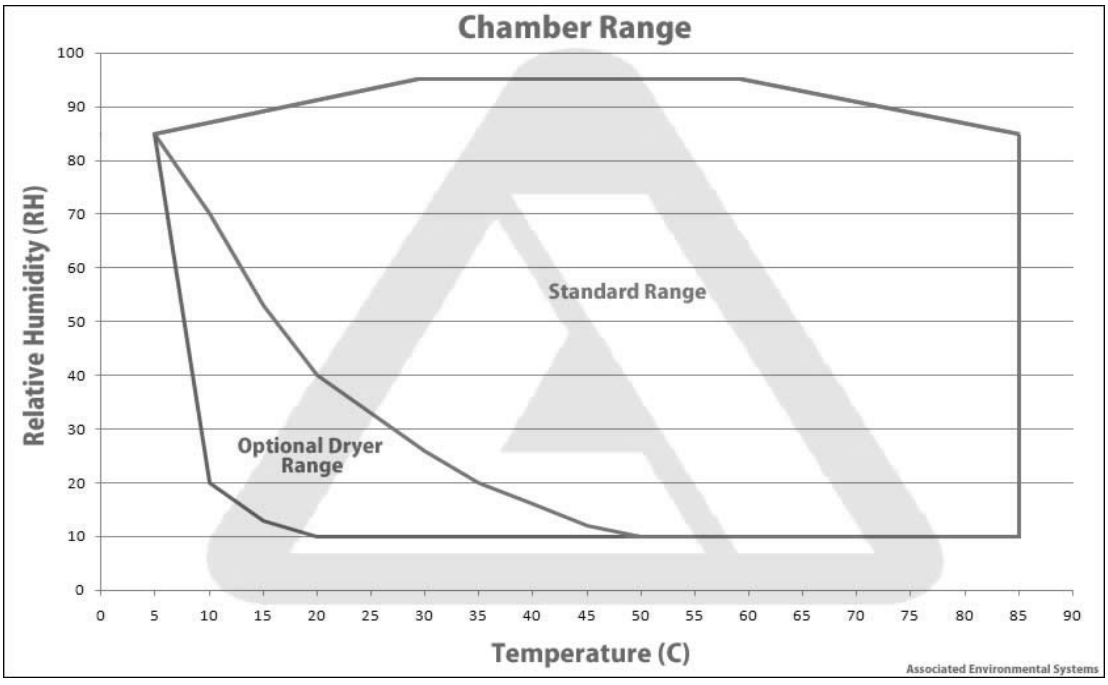
The AC power line fuse is located inside the right-hand portion of the AC Power socket assembly, in the upper left corner of the rear panel. For access, insert a small, flat screwdriver into the left side of the fuse holder, and pry the panel open. Then, pull the inner fuse holder assembly straight out. To close, reinsert the fuse holder assembly and snap the cover closed.

Figure 7-3a. Opening the Cover

Figure 7-3b. Fuse Holder Removed

8.0 SPECIFICATIONS

Measurement Accuracy:	Relative Humidity- ±0.5% Temperature- ±0.1°C Dew Point- ±0.2°C
Measurement Traceability:	N.I.S.T. Traceable
Chamber Control Range: (See Graph Below)	Temperature- 7 to 85°C
R.H. Examples:	Relative Humidity- 10 to 95% over temperature range of 50 to 85°C Relative Humidity- 20 to 95% or better over temperature range of 35 to 50°C



Chamber Volume:

Option ELH-1.5	1.5 cubic feet (42.5 liters)
Option ELH-6	6 cubic feet (170 liters)
Option ELH-10	10 cubic feet (283 liters)

Chamber Dimensions: (H x W x D) (Note: Hygrometer included)	Internal	External
Option ELH-1.5	13 x 14 x 13 inches (33 x 36 x 33 cm)	38 x 27 x 26 inches (97 x 69 x 66 cm)
Option ELH-6	24 x 20 x 18 inches (61 x 51 x 46 cm)	51 x 33 x 31 inches (130 x 84 x 79 cm)
Option ELH-10	30 x 24 x 24 inches (76 x 61 x 61 cm)	57 x 36 x 37 inches 145 x 91 x 94 cm)

Power Requirements: 115VAC, 50/60Hz, 20A

9.0 APPENDIX

9.1 WARRANTY STATEMENT

9.2 N.I.S.T. TRACEABILITY

9.3 DEWMASTER OPERATING MANUAL

9.4 HUMIDITY CHAMBER OPERATING MANUAL

9.5 BASIC HUMIDITY DEFINITIONS

9.1 WARRANTY INFORMATION

All equipment manufactured by EdgeTech is warranted against defective components and workmanship for repair at their plant in Massachusetts, USA, free of charge, for a period of twelve months. Malfunction due to improper use is not covered in this warranty and EdgeTech disclaims any liability for consequential damage resulting from defects in the performance of the equipment. No product is warranted as being fit for a particular purpose and there is no warranty of merchantability. This warranty applies only if (i) the items are used solely under the operating conditions and in the manner recommended in the instruction manual, specifications, or other literature; (ii) the items have not been misused or abused in any manner or repairs attempted thereon; (iii) written notice of the failure within the warranty period is forwarded to EdgeTech and the directions received for properly identifying items returned under warranty are followed; and (iv) the return notice authorizes EdgeTech to examine and disassemble returned products to the extent EdgeTech deems necessary to ascertain the cause for failure. The warranties expressed herein are exclusive. There are no other warranties, either expressed or implied, beyond those set forth herein, and EdgeTech does not assume any other obligation or liability in connection with the sale or use of said products.

Equipment not manufactured by EdgeTech is supported only to the extent of the original manufacturer’s warranties.

9.2 N.I.S.T. TRACEABILITY – WHAT DOES IT MEAN?

This humidity measurement system is certified by Edgetech to be traceable to N.I.S.T., the National Institute of Standards and Technology (formerly known as the National Bureau of Standards, or NBS), in Gaithersburg, Maryland, U.S.A. You have received a Certificate of Calibration from our calibration laboratory. What does N.I.S.T. Traceability mean in terms of this system?

The instrument measures Dew Point using the Optical Chilled Mirror (OCM) technique, which provides a primary rather then a secondary measurement of Dew Point temperature. In addition, Dew Point is a fundamental measurement of humidity. It is not affected by temperature.

Both the Dew Point temperature and the Air Temperature are measured using Platinum Resistance Thermometers (PRTs). These devices are coils of nearly pure platinum, where the rate of change of resistance with temperature is precisely known. Resistance is accurately measured and is automatically converted to temperature information within the instrument.

Other parameters, such as Percent Relative Humidity, are microprocessor-calculated from the directly measured Dew Point and Temperature information.

TRACEABILITY:

- 1. The precise platinum resistance thermometers are N.I.S.T. traceable by the traceable resistance standards maintained by the PRT manufacturers.

- 2. A multi-point Dew Point calibration is performed on every chilled mirror sensor, using EdgeTech's traceable secondary dew point standard. This instrument, a precise chilled mirror hygrometer, is periodically sent directly to N.I.S.T. for certification against the USA's Dew Point transfer standard, a Two-Pressure Generator.

NOTES