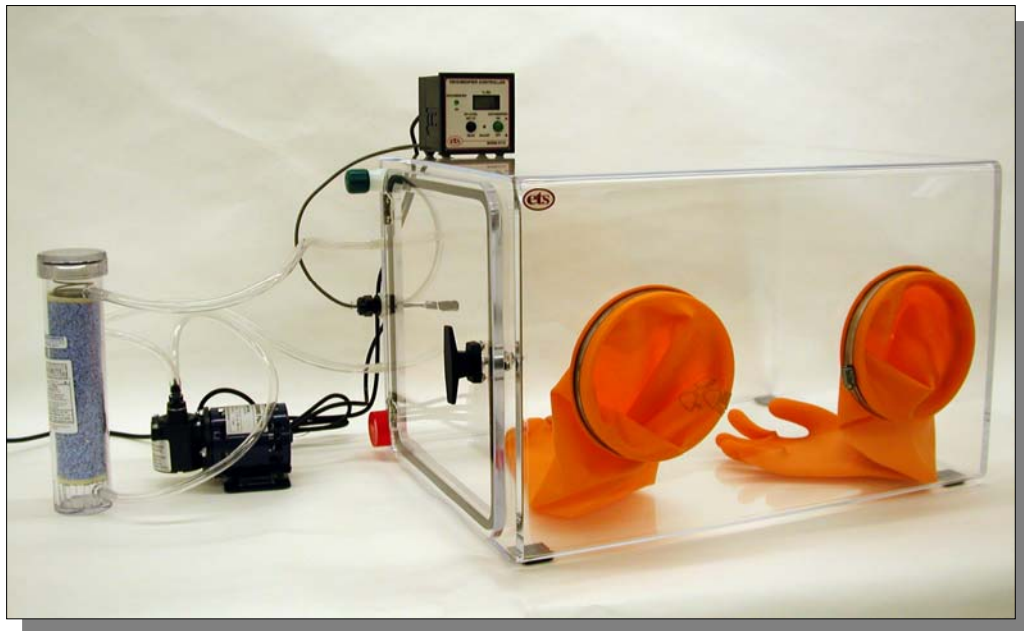


CONTROLLED ENVIRONMENT CHAMBER

Model 5503-00 & 5503-11
Plus
Packages A & B



Operating Manual

1/07



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1.0 GENERAL

Many applications, such as electronics, medical, pharmaceutical and research require a controlled environment for testing, assembly or storage. The Model 5503 is designed to meet these requirements. The Model 5503 is available in standard or custom configurations to meet specific customer requirements.

1.1 Basic Chambers

- Model 5503-00: Enclosure only without glove ports
Model 5503-11: Enclosure only with 6" (150mm) glove ports



Figure 1.1-1a: Model 5503-00

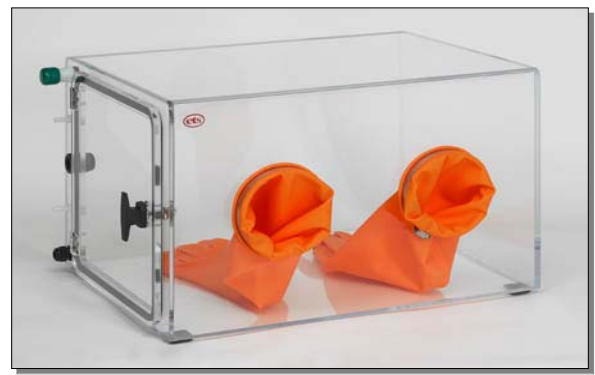
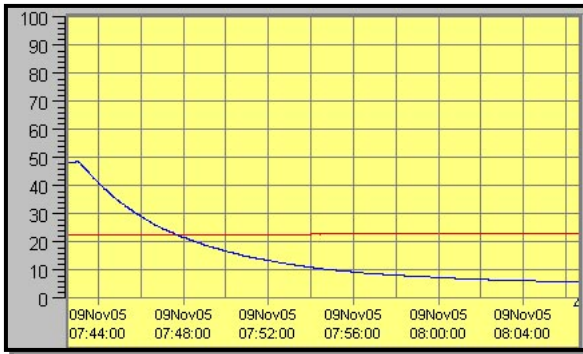


Figure 1.1-1b: Model 5503-11

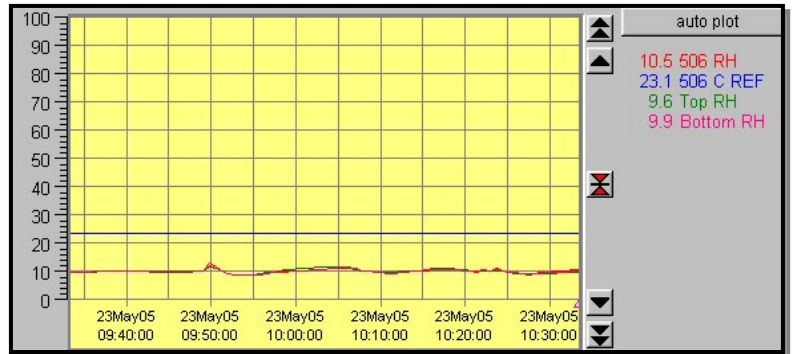
1.2 Standard Packages

The ability of the chamber to reach and then hold a given humidity level along with humidity gradients is a function of the chamber (size, configuration etc.), temperature, operating systems and controllers used. The following packages provide solutions to most dehumidification applications. Chambers can also be custom configured to meet special user requirements.

The following charts show the time typically required to decrease and increase humidity (Blue = RH, Red = T °C) plus humidity gradients using an ETS Controller in conjunction with the Model 5461 Desiccant/Pump Dehumidification System.



Rate of humidity decrease



Low humidity gradient

1.2.1 Chamber Specifications

<p>Material: ¼" (6mm) clear acrylic 3/8" (9mm) left end cap</p> <p>Construction: Wrapped, PS30 welded seams</p> <p>Door (left side): ½" (12mm) clear acrylic with ½-turn latch</p> <p>Seal: ¼" (6mm) Poron, non-setting gasket</p> <p>Gloves (when configured): .018" (0.5mm) latex, 6" (14.3cm) ports</p> <p>Operating Range: Humidity: <1 – 100% Temperature: <32 – 135 °F (0-55 °C)</p>	<p>Access Ports (left side): 2x¼" (6mm) hose barbs 1x1" (25.4mm) Hose barb 1x½" (12mm) compression fitting 1x1½" (31.4mm) cable pass through</p> <p>Dimensions: 24"Wx18"Dx15"H (61x46x38cm)</p> <p>Weight: 27 lbs (12.3 kg)</p>
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1.2.2 Package A:

This configuration incorporates a single point controlled valve (factory set to 5% RH; other values available) to regulate the flow of nitrogen, dry air or other dry gas to provide controlled dehumidification in the chamber at a single point. This system, utilizing the ETS Model 5311 Controlled Gas Dehumidification System, shown in Figure 1.2-1, is primarily used for storage or single use applications.

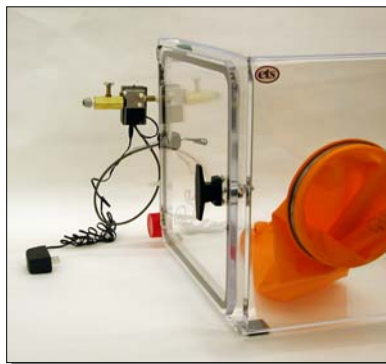


Figure 1.2-1: Package A Controlled Valve System

1.2.3 Package B:

This configuration incorporates an adjustable dehumidification control system, shown in Figure 1.2-2, utilizing the ETS Model 5112 Dehumidifier Controller and the Model 5461 Desiccant/Pump Dehumidification System. The controller can measure and display humidity over the entire range, but controls humidity only from 0 to 55% RH. Optionally, the Model 5465 Dry Gas Dehumidification System can be used. (Ordered separately, not part of Pkg. B.)

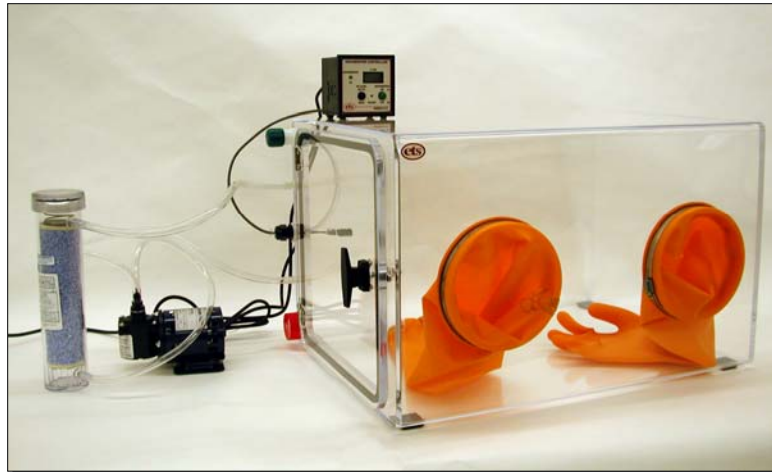


Figure 1.2-2: Package B Dehumidification System

1.2 Unpacking

Figure 1.3-3 shows the chamber in its shipping carton. Unpack the chamber and accessories from the shipping cartons and inspect for any damage. When handling the chamber **DO NOT** use any of the fittings or the door handle as a grip or for leverage. Lift the chamber by placing your hand all the way into the glove port and grabbing hold of the chamber wall or gripping around the outside of the chamber. If an item is missing or broken please contact ETS immediately at 215-887-2196 x226 and photograph the damage to both chamber and shipping carton. **Save all boxes and shipping material until the system is operational!**



Figure 1.3-3: Chamber in shipping carton

Chambers only and with standard Package A or B configurations operating instructions are contained in this Operating Manual. Each chamber system includes the following:

Model 5503-00

1. Chamber without glove ports with 12"x12" (30x30cm) door with gasket seal and inlet/outlet ports for accessories.
2. Pliable sealer
3. Operating Manual

Model 5503-11

1. Chamber with glove ports, 6" (15cm) gloves, 12"x12" (30x30cm) door with gasket seal, inlet/outlet ports for accessories.
2. Pliable sealer
3. Operating Manual

Model 5503-00, Package A

1. Chamber
2. Model 5311 Controlled Valve assembly
3. Pliable sealer
4. Operating Manual

Model 5503-00, Package B

1. Chamber
2. Model 5461 Desiccant/Pump Dehumidification System. Includes pump (110 or 220 VAC), desiccator and 12' (3.7m) of clear plastic tubing.
3. Model 5112 Automatic Humidity Controller. Includes humidity sensor, IEC power cord (North American plug).
4. Operating Manual

2.0 CHAMBER

2.1 Description

The Model 5503 is a 3.75 cubic foot (0.11 cu. m), sealed chamber fabricated from 0.25" (6mm) and 0.375" (9.5mm) clear acrylic and measures 24"Wx18"Dx15"H (61x46x38 cm). Access to the chamber is through a 12" (30.5cm) square opening. A heavy-duty, 0.5" (13mm) clear acrylic door, secured by a single half-turn latch, along with a compression resistant gasket ensures an airtight seal when the door is locked. A 1.25" (32mm) diameter pass-through is provided for passing cables and/or tubing through the chamber wall. A pliable reusable sealer seals the opening. The access door and all fittings are located on the left-hand side

of the chamber as shown in Figure 2.0-1. Additional holes may be positioned elsewhere as an option.

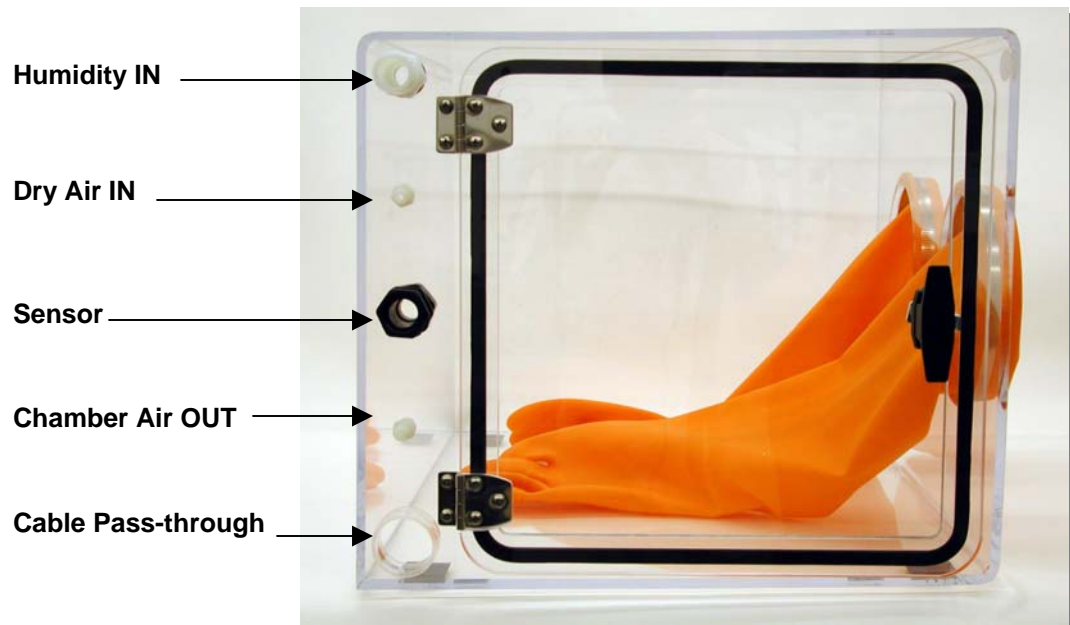


Figure 2.0-1: Chamber access door and fittings

The humidity level within the chamber is reduced using either dry gas (usually dry nitrogen or dry air) injected into the chamber or a desiccant/pump drying system. The desiccator contains a self-indicating, renewable drying agent (Anhydrous CaSO_4) and is mounted externally to the chamber. A small pump draws air from the chamber and forces it through the desiccator back into the chamber. This circulating system is capable of producing humidity levels below 5% RH within the chamber (Actual lower humidity limit may be determined by the object placed in the chamber).

2.2 Installation

Place the chamber on an appropriate support surface such as a bench or desk. Open the latch by turning the handle counterclockwise until the cam turns away from the chamber wall and then open the access door. Place the object(s) to be stored or tested inside the chamber and feed any cables through the cable pass-through located at the rear of the left panel. Seal the opening using the supplied pliable sealer.

3.0 PACKAGE SYSTEMS

Model 5503 Chambers configured as Package A or Package B feature automatic dehumidification control.

The Model 5311 and 5112 Dehumidification Controllers used in these packages operate in a similar manner. When the measured humidity exceeds the set point

by more than 0.5% RH (Model 5112), a solid-state control circuit turns on a solenoid valve or pump. When the valve is activated, dry gas is injected into the chamber, or the pump is turned on to circulate chamber air through the desiccator, absorbing moisture and lowering the humidity level and then back into the chamber. When the humidity level set point is reached, the controller turns off the valve or pump. The valve or pump then cycles on and off automatically as required by the controller to maintain the humidity level at the desired set point.

3.1 Package A

Many applications require the accurate control of relative humidity at a specific point below ambient for long-term storage or test applications. Package A incorporates the Model 5311 Controlled Dry Gas System to meet these requirements. The controlled solenoid activated valve regulates the amount of dry gas required to both maintain a dry environment and conserve the amount of dry gas used in the Model 5503 chamber.

The Model 5311 is self-contained and comes complete with a controlled solenoid valve, adjustable flow control valve, universal input voltage 12 VDC power module (90-260 VAC, 50/60 Hz), 5% RH sensor with ½" NPT compression fitting plus a ¼" NPT quick disconnect fitting for ¼" polyflo tubing.

The standard sensor supplied with the Dry Gas System has a fixed set point of 5%. Sensors with other humidity set points are available as an option. Supplied sensors cannot be reprogrammed to other set points. The Model 5311 is capable of maintaining the humidity level to better than $\pm 3\%$ of the fixed controller set point with a measurement accuracy of $\pm 2\%$ R.H.

3.1.1 Description

The Model 5311 Controlled Dry Gas System consists of two (2) basic components: a humidity sensor and a controlled solenoid valve with adjustable flow regulator.

The standard humidity sensor is an integrated unit measuring approximately 1"Lx.44"Wx.375"D (25x12x10mm) that plugs into a 24" (61cm) multi-conductor cable that is hard-wired to the control module. Longer cable lengths are available as an option. A temperature compensated capacitive sensing element where capacitance is proportional to humidity is used to detect the relative humidity level. This sensor is programmed at the factory to produce a digital output around a pre-selected set point. The standard factory setting is 5% RH. Other fixed RH set points are available as an option. Contact ETS to order.

The sensor is mounted to the wall of the chamber using the ½” NPT compression fitting, shown in Figure 3.1-1. Other mounting configurations can also be used to meet the user’s specific requirement.

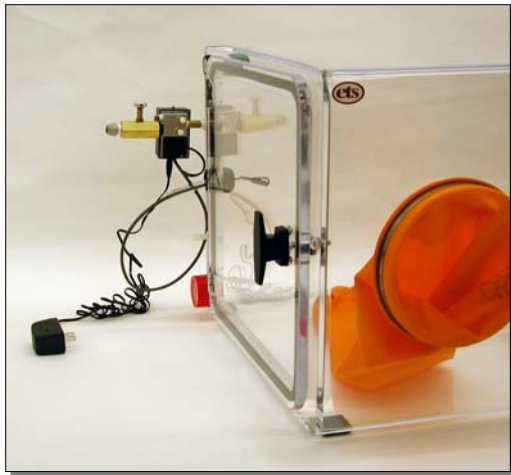


Figure 3.1-1: Sensor mounted in compression fitting

The 36” (91cm) hard wired cable provides the input/output interconnect between the Control unit and the Humidity Sensor. The sensor end is fitted with a flat, 4-pin female receptacle with the following pin-out configuration:

The Control/Solenoid/Flow Regulator unit is shown in Figure 3.1-2. It will be referred to as just the Control Unit.



Figure 3.1-2: Control/Solenoid/Flow Regulator unit

The Control Unit is designed as a complete assembly. There are no user controls except the flow regulator adjust knob. The only indicator is a Green LED that indicates the solenoid is on and supplying gas to the chamber.

3.1.2 System Function

The Humidity Sensor measures the relative humidity inside the chamber. If the humidity measured in the chamber exceeds 7% RH the solenoid valve is powered and dry gas is injected. When the humidity inside the chamber drops to 4% RH the solenoid valve is deactivated, shutting off the flow of dry gas. The valve will then cycle on and off automatically as required by the Controller to maintain the specified humidity level.

A 12V DC universal power module is used to power the Model 5311. It operates from 90-260 VAC, 50/60 Hz. For international applications the user will have to provide the appropriate adapter plug to convert the standard North American 2-prong plug to mate with the available power (MAINS) outlet.

3.1.3 Installation

3.1.3.1 Initial Check Out

Inspect the Control unit and Sensor and inspect for any visible damage. If no damage is observed then check out the system as follows:

1. The Humidity Sensor is pre-wired to the control unit when shipped.
2. Plug the low voltage connector from the power module into the power jack located on the bottom of the Control unit. Then plug the power module into the appropriate power outlet (MAINS). This will automatically power up the Control unit. There is no power ON/OFF switch.
3. Wait 3 minutes and check the Green LED mounted on top of the unit. If the ambient humidity is above the fixed set point the solenoid will be activated and the LED should light.

3.1.3.2 Installation

The sensor mounts in the ½" NPT compression fitting installed on the left chamber wall.

CAUTION:

The sensing element is sealed within the sensor assembly, protected against mechanical damage by a slotted housing cover. Under no circumstances should the sensing element be touched. The sensor should never be cleaned using compressed air. Dust and dirt

particles can be removed by blowing gently. There are no user serviceable parts in the Model 5311 sensor.

The Control Unit may be installed either directly onto the chamber wall using the fitted 2" (5cm) long, ¼" NPT threaded tube with ¼" NPT nylon adapter or located remotely and connected to the chamber using the ¼" polyflo tubing and the quick disconnect fitting supplied. A small relief hole is required to prevent pressure build-up in the chamber. The extra quick disconnect is used for this application.

3.1.3.3 Dry Gas Requirements

Typical dry gases are nitrogen, CO₂ and dry air. Usually these gases are under high pressure at the source. An appropriate pressure reducer should be installed between the source and the Dry Gas Control System.

Gas flow to the chamber is controlled by the Flow Regulator. It is connected to the solenoid valve gas input. It should be adjusted for a flow rate between 10 and 50 cfm. If the chamber door is to be opened frequently then a higher flow rate will reduce the humidity quicker. If the door is to be opened occasionally then a lower flow rate will better conserve the dry gas. If the flow rate is to be monitored then a flow gauge can be installed between the valve output and the chamber inlet. Ultimately, it is up to the user to determine the optimum flow rate for the particular application.

3.1.4 Operation

The Model 5311 Dry Gas Control System is self-sustaining and does not need any operator function to maintain the required humidity level. Once the unit is operating and the proper flow rate established no further user action is required.

Frequent on/off cycling of the solenoid valve may be indicative of a poor chamber seal. The chamber should be thoroughly inspected to determine where the leak(s) are occurring and the problem corrected.

3.1.5 Calibration

The Model 5311 Controller is calibrated prior to leaving the factory. There are no user adjustable controls. Calibration can be checked by placing a calibrated humidity indicator in the chamber next to the sensor to observe that the Controller is maintaining the humidity within the specified range. If significantly out of tolerance or it just

does not work then the unit will have to be returned to the factory for service.

NOTE:

If returning to the factory for repair or replacement, first obtain a RMA number from ETS by calling 215-887-2196 Ext. 220.

3.1.6 Troubleshooting

The Model 5311 should provide trouble-free service. If a problem with the system is suspected, it is recommended the fault be initially isolated to either the Sensor, Control Unit or solenoid.

The following troubleshooting guide will assist the user in identifying various possible problems:

1. No Power - Check power at the wall outlet.
2. Green LED does not come on even though the humidity level inside the chamber is known to be at least several percent above the fixed set point of the Model 5311. Return unit to factory.
3. Obviously incorrect humidity control – If sensor was removed from its connector, check to see that it has been replaced properly. The arrow (▲) should line up with the left hand side of the sensor with the sensing grill facing up. If it was reversed, reinstall properly. The sensor will not be damaged if plugged in backwards.

Next, if the ambient humidity is near the fixed set point, check sensor operation by blowing gently onto sensor for several seconds and observe the Green LED. If the LED turns on, the humidity sensor and control electronics are working.

4. No dry gas flow, Green LED remains on constantly – Check to see if there is dry gas at the source. If so, the valve may be contaminated preventing it from opening or closing. Return the unit to the factory for replacement.
5. Difficulty maintaining low humidity within the chamber – The chamber may either be leaking, ambient humidity may be very high or the flow rate is too low. Generally, with a dry gas system the humidity within the chamber should recover and stabilize within a few minutes. If this is not happening, try increasing the flow rate. Also, check to ensure that dry gas is being injected. If dry air is being used, there may be condensation in the line.

3.1.7 Specifications

<p>Sensor type: Temp compensated, capacitive film Range: Fixed point, 5%RH, standard Accuracy: ±3% RH Lo/Hi band: 4% RH off / 7% RH on Set pt adjust: None Manual control: None Control Out: 12VDC, Solenoid Valve Power req.: 90-260 VAC, 50/60Hz, 30W max Gas In/Out: ¼" Quick Disconnect</p>
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3.2 Package B

Package B is for those applications that require the accurate measurement and control of relative humidity at various set points below ambient for long-term applications in a seal environment. The Model 5112 Dehumidifier Controller is used to control dehumidification in the Model 5503 Chamber to any user selectable set point up to 55% RH. The standard Package B utilizes the ETS Model 5461 Desiccant/Pump Dehumidification System to dry the chamber.

As an option, the ETS Model 5465 Dry Gas Dehumidification System may be substituted for the Model 5461. This system uses a solenoid valve to control the flow of dry gas

The Model 5112 can measure relative humidity over the entire 0 to 100% range, but only controls levels below 55% RH. The standard sensor supplied with the Controller has a response time satisfactory for maintaining long-term humidity stability. For applications requiring a fast recovery time the optional ETS Model 554 Humidity Sensor should be used.

3.2.1 Description

3.2.1.1 Model 5112 Dehumidifier Controller

The Model 5112 Dehumidifier Controller shown in Figure 3.2-1 consists of two (2) basic components: a Humidity Sensor and a Control Unit.



Figure 3.2-1: Model 5112 Dehumidifier Controller

The standard Humidity Sensor is an integrated unit measuring approximately 1" L x .44" W x .375" D (25x11x10mm) that plugs into a 24" (61cm) multi-conductor cable that is hard-wired to the Control unit. Longer cable lengths are available as an option. A temperature compensated capacitive sensing element where capacitance is proportional to humidity is used to detect the relative humidity level. This type of sensor can measure over the entire range of 0 to 100% R.H. with accuracy better than $\pm 2\%$ R.H. at a temperature of 20-40°C. The sensor has a slew rate (response time) of 0.35% R.H./sec.

The sensor is mounted to the wall of the chamber using a $\frac{1}{2}$ " NPT compression fitting installed in the chamber wall. Other mounting configurations can also be used to meet the user's specific requirement. The Control Unit provides the necessary indicators and controls to set the desired humidity level and to measure the actual humidity level in the chamber.

The front panel of the Control Unit shown in Figure 3.2-2 contains a 0.375", $3\frac{1}{2}$ -digit LCD readout for both setting the desired set point and for reading the relative humidity with a resolution of $\pm 0.1\%$ R.H. A black, momentary RH LEVEL, SET PT/READ switch selects the information to be displayed. In the normal (Button out) position the readout displays the measured relative humidity level. In the depressed position, the readout displays the desired humidity set point. When released, it automatically returns to the READ position. A 10-turn screwdriver adjustable potentiometer is used to adjust the set point from 0 to 100% R.H.



Figure 3.2-2: Control Unit front panel

The Green DEHUMIDIFIER switch, when in the ON position (in), places the system in the DEHUMIDIFY mode. When the measured humidity is above the set point level, a control signal activates the DEHUMIDIFY relay circuit and 115/230 VAC is applied to the DEHUMIDIFY AC outlet on the rear panel. This turns on the Dehumidification System. When this switch is in the OFF position (out) the Dehumidification System will remain off irrespective of the RH level measured.

When this switch is in the OFF position, the Model 5112 operates as a precision electronic hygrometer.

The system Power switch and the controlled North American 3-prong grounded outlet are located on the rear panel as shown in Figure 3.2-3.



Figure 3.2-3: Control Unit rear panel

The Power switch, Fuse and AC line cord are separate components that control the power input to the Model 5112 Controller. The AC line cord is a standard North American 3-prong grounded type, 8" (2.5m). The Model 5112 contains a universal power supply that operates from 90-260VAC, 50/60Hz. Optional line cords are available to conform to the requirements of other countries when ordered with the Controller. Otherwise, the user must use either an adapter or cut off the plug and install the appropriate type.

The ON/OFF switch located on the rear panel, controls the ON/OFF status of the Controller. The AC line fuse is located internally on the PC board and protects both the controller electronics, and the solid-state relay. It is a 3AG Slo Blo type rated at 250 Volts, 2 Amps. The solid-state relay is not voltage dependent and is capable of switching a maximum of 3 Amps at either voltage, however, for extra protection a 2 Amp fuse is installed.

This AC output receptacle accepts the standard 3-prong North American grounded plug. When the measured humidity exceeds the humidity level set point by about 1% R.H., 115/230 VAC power is applied to the receptacle.

NOTE:

A 115 VAC pump or solenoid must be used when operating at 115 VAC and a 230 VAC pump or solenoid must be used when operating at 230 VAC.

This 18" (46cm) hard wired cable provides the input/output interconnect between the Controller and the Humidity Sensor. The sensor end is fitted with a flat, 4-pin female receptacle with the following pin-out configuration:

Pin-1	Temp Signal In (0-5V)
Pin-2	Power (2-5.5VDC)
Pin-3	RH Out (0-5V)
Pin-4	Ground

The Control unit is housed in a flame resistant Noryl, SE1 GFN1 housing that conforms to the dimensional standard DIN 43700. The case measures 3.78"Wx3.78"Hx3.35"D (96x96x85mm). To install the control module into a panel a 3.62"x3.62" (92x92mm) cutout and the optional panel mount kit are required.

3.2.1.2 Model 5461 Dehumidification System

The Model 5461 Dehumidification System can reduce the relative humidity level in the Model 5503 Chamber to less than 10% RH. Calcium Sulfate; however, is capable of reducing the humidity to <5%RH, but mechanical considerations of the chamber, load and operating system limit the specified lower limit to <10% RH.

This Dehumidification System utilizes a pump to draw air from the chamber and circulate it through a plastic cylinder that contains Calcium Sulfate. The desiccant absorbs any moisture that is in the air. This dried air is then forced back into the chamber. The Calcium Sulfate contains an indicator that turns the normally blue colored desiccant pink as it absorbs moisture. When the entire cylinder turns pink, the desiccant must either be replaced or renewed by removing it from the column and placing in an oven at 400°F (200°C) for one hour.

The complete Model 5461 Dehumidification System consists of a desiccant column containing 1 lb (.45kg) of renewable, calcium sulfate (CaSO_4) desiccant, a 0.6cfm pump, and 12' (4m) of 5/16" (8mm) ID of flexible plastic tubing for connecting the pump, desiccator and chamber together.

The desiccant can be renewed approximately ten (10) times before having to be replaced. The granules should be removed from the drying column and spread evenly, one granule deep on a tray. The desiccant should then be heated for approximately one (1) hour at about 400°F (200° C). It should be allowed to cool in an airtight container before refilling the acrylic drying column. The felt filters should also be pre-dried at 200° F (100° C) for about 30 minutes before assembly.

3.2.2 System Function

Figure 3.2-4 is a block diagram illustrating the Dehumidifier Controller and Dehumidification System connected to the Model 5503 Chamber.

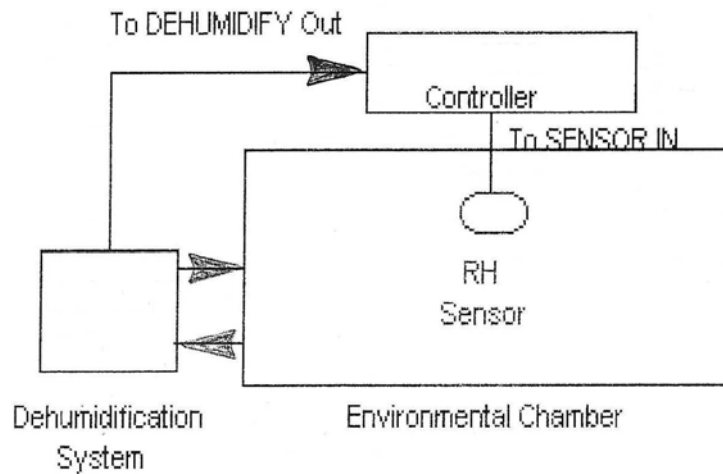


Figure 3.2-4 Controlled humidity chamber block diagram

The Humidity Sensor measures the relative humidity inside the chamber. The Sensor output signal is then compared to the set point. When the humidity measured in the chamber exceeds the set point the Controller turns on the pump circulating the test chamber air through the desiccator or injecting dry gas through a solenoid valve. For the desiccator system the desiccant absorbs moisture, thereby lowering the humidity level inside the chamber. For the dry gas system the dry gas replaces the wet air that is ejected into the atmosphere or through a vent. When the humidity level drops below the set point, the Controller turns off the pump. The pump will then cycle on and off automatically as required by the Controller to maintain the desired humidity level.

Power to operate the Dehumidification System is controlled by a 3 amp solid-state relay. When the measured humidity deviates from the R.H. set point the Controller turns on the relay which then supplies the necessary 115/230 VAC power to the system.

3.2.3 Installation

3.2.3.1 Initial Check Out

Unpack the Control Unit and Sensor and inspect for visible damage. If no damage is observed then proceed to check out the system as follows:

1. The Humidity Sensor is already connected to the Control Unit when shipped.
2. Connect the line cord into the appropriate power outlet (MAINS). Be sure the POWER switch is in the OFF position and the DEHUMIDIFIER switch is in the OFF

(out) position. Plug the Dehumidification System into the AC outlet.

NOTE:

All ETS operating systems utilize the standard 3-prong North American plug. A 230V/50Hz system will be marked as 230V, but will still have the same 3-prong plug.

3. Turn on the Controller (the POWER switch is located on the rear panel). The LCD readout will initially read a humidity level much lower than ambient and the Green DEHUMIDIFIER indicator should be OFF.
4. The LCD reading will slowly start to increase until it reaches the ambient RH level. This may take as long as 5 minutes if the ambient humidity is very high.
5. Depress the READ RH/SET RH Switch to the SET PT position. The Display will read some level. While holding the switch down in the SET PT position, rotate the ADJUST Control to the desired RH level set point using a small (1/8"/3mm) screwdriver.
6. Release the switch so that it returns to the READ RH (out) position and note the humidity level reading on the display. Turn on the DEHUMIDIFIER switch (Green button out). If the set point is below ambient, the Green DEHUMIDIFIER ON light will turn on and power will be applied to the Dehumidifier outlet, activating the dehumidification system. If the SET PT is above the ambient RH reading, the Green LED indicator light will be off.
7. The dehumidification process will start. The Dehumidification System will remain on until the set point is reached. It will continue to cycle to maintain the set point level.

3.2.3.2 Installation

The Humidity Sensor is normally mounted in the bulkhead using the compression fitting. However, other mounting locations may be used to meet user requirements.

CAUTION:

The sensing element is sealed within the sensor assembly protected against mechanical damage by a slotted housing cover. Under no circumstances should the sensing element be touched. The sensor should

never be cleaned using compressed air. Dust and dirt particles can be removed by blowing gently. There are no user serviceable parts in the Model 5112 sensor.

The Control Unit may be placed on any surface near the test chamber or installed into a panel 3.62"x3.6" (92x92mm cutout) using the optional mounting clips.

Installation of the Dehumidification System is as follows:

1. Locate the desiccator at a convenient location near the left-hand side of the chamber. Place the pump at a convenient location near the desiccator or on the floor as shown in Figure 3.2-5.

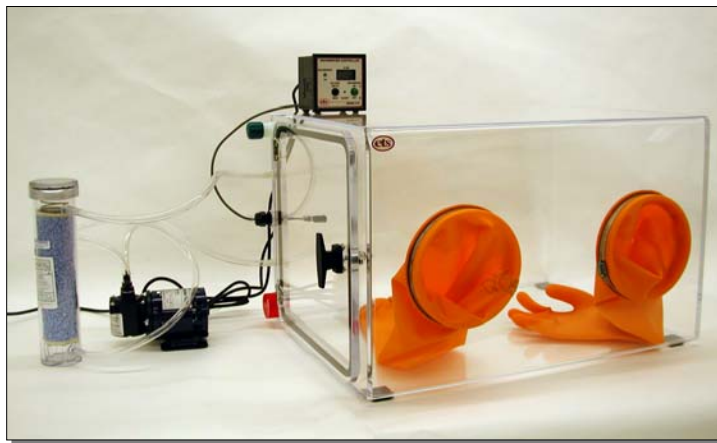


Figure 3.2-5: Model 5503 Package B installation

2. Insert one end of the length of supplied plastic tube into the lower hose barb on the chamber.
3. Cut the tube and insert the other end into the INLET or vacuum side of the pump.
4. Insert the remaining section of tube into the OUTLET or pressure side of the pump.
5. Cut the tube and insert the other end into the lower hose barb on the desiccator.
6. Cut an appropriate length of tubing and connect the desiccator upper hose barb to the upper hose barb on the chamber.
7. Plug the line cord from the pump into the "DECREASE" outlet on the rear of the controller.

8. Plug the Dehumidifier into the AC Output receptacle on the rear of the Controller. Plug the Controller line cord into the appropriate power outlet (115 or 230 VAC).

NOTE

A 230 VAC pump must be used with a Controller configured for 230 Volts. The pump will be fitted with a standard North American 3-prong plug to fit into the DEHUMIDIFY outlet on the rear panel

The System is now ready to dehumidify the test chamber.

3.2.4 Operation

1. Turn on the Controller and allow it to warm up for approximately 5 minutes for the sensor to stabilize.
2. Depress the black momentary READ/SET PT pushbutton and adjust the ADJUST control for the desired R.H. set point as indicated on the LCD display. A small (1/8"/3mm wide blade) screwdriver is required. When the correct reading is obtained, release the switch. The display will then read the measured humidity level.
3. If the desired humidity is lower than the ambient humidity measured, turn on the DEHUMIDIFY function by depressing the Green push-on-push off switch to the ON position. The Green DEHUMIDIFIER light will come on indicating that the Dehumidification System has been activated.
4. As the humidity level in the test chamber begins to drop it will be detected by the Humidity Sensor and displayed on the LCD meter. When the humidity level in the chamber has been reduced below the set point, the Green LED light will go out indicating the Dehumidification System has been turned off. As the humidity level in the chamber gradually begins to increase above the set-point level, the Dehumidification System will turn back on until the humidity level drops back to slightly below the set point. The System will continue to cycle to maintain the desired humidity to within $\pm 3\%$ RH of the set point.
5. If the Model 5112 Controller is to be used as a humidity indicator only (no humidity control), place the DEHUMIDIFIER switch to OFF. The system now becomes a humidity level meter (hygrometer) only.
6. Frequent on/off cycling of the dehumidifier may be indicative of a poor test chamber seal or defective gloves. The chamber

should be thoroughly inspected to determine where the leak(s) are located and the problem corrected.

3.2.5 Calibration

The Model 5112 Controller is calibrated prior to leaving the factory. However, as with all temperature and humidity measuring instruments, they must be calibrated periodically to maintain specified performance levels. Calibration should be checked at least one or two times a year depending on the operating conditions and the required measurement accuracy. The Model 5461 does not require calibration.

NOTE:

If returning to the factory for recalibration or repair, first obtain a RMA number from ETS by calling 215-887-2196 Ext. 220.

Calibration of the Model 5112 is performed as a complete unit.

Turn on the power and allow at least 5 minutes for the instrument to warm up. Place the DEHUMIDIFY switch in the OFF position then follow the procedure described below.

Calibration of the Controller requires a known calibrated reference sensor for comparison. As an alternative, certified calibration salt solution cells can also be used.

The Model 5112 is calibrated by comparing the relative humidity reading with the reading of a known calibrated reference. The reference sensor should be placed next to the Model 5112 sensor and allowed to stabilize for at least 30 minutes before making any adjustments to the sensor electronics.

Calibration can be performed either in the test chamber or in a separate calibration cell.

1. Remove the Sensor from its mounted position. If the Sensor is to be calibrated in the chamber, place the reference sensor next to it. If the Sensor is to be calibrated outside the chamber, remove the Sensor from its installed position.
2. Turn on the power. Allow at least 5 minutes for the system to warm up. The Sensor and reference unit must be in a constant temperature environment of 73°F/23°C, $\pm 5^\circ\text{F}/3^\circ\text{C}$ and humidity environment for at least 30 minutes to obtain humidity/temperature equilibrium prior to calibration.
3. Establish a required relative humidity level in the chamber.
4. Read the temperature and relative humidity. Compare the reference unit reading with the level displayed on the

Dehumidifier Controller display. They should be within $\pm 2\%$ R.H. of each other. If not, adjust the “1-point RH-calibration” control, located through an access hole on the right-hand side of the control unit as shown in Figure 3.2-4 until the correct reading is obtained. A small blade screwdriver is required to perform this adjustment.



Figure 3.2-4 Calibration adjust potentiometer

This completes calibration of the Model 5112 Dehumidifier Controller.

Other calibration techniques include the use of wet bulb/dry bulb and chilled plate measurement. Wet bulb/dry bulb instruments should not be used in the test chamber because the wet bulb adds humidity to the chamber making it extremely difficult to calibrate at low humidity levels. However, there are wet bulb/dry bulb calibrators with a small test cell for the sensor that can be used.

3.2.6 Troubleshooting

The Model 5112 is all solid state and should provide many years of trouble-free service. If a problem with the system is suspected, it is recommended that the fault be initially isolated to either the Sensor or the Control Unit.

The following troubleshooting guide will assist the user in identifying various possible problems:

1. No Power. - Check power at the wall outlet.
2. No indication on LCD display, but Green Dehumidifier LED is on. - LCD display defective. Return unit to factory.
3. Obviously incorrect humidity reading – If sensor was removed from its connector, check to see that it has been replaced properly. The arrow (▲) should line up with the left hand side of

the sensor with the sensing grill facing up. If it was reversed reinstall properly. The sensor will not be damaged if plugged in backwards.

Next, check sensor operation by blowing gently onto sensor for several seconds and observe the reading. If the humidity increases, the humidity sensor is working. Depress the READ/SET PT switch and adjust the ADJUST control fully CCW and then rotate it fully CW. The display should show readings approximately 0 to 100% RH. If not, return the unit to the factory.

4. Incorrect RH set point readings – Return the unit to the factory.
5. No DEHUMIDIFY AC control voltage – Turn on the DEHUMIDIFIER switch. Read the humidity level on the LCD display. Adjust the set point to that level. Rotate the control at least $\pm 5\%$ R.H. about this point. The Green DEHUMIDIFIER indicator should come on when the set point is below the measured humidity. When the set point is above the measured humidity the Green indicator should be off. If the light cycles, but the dehumidifier still fails to operate, either the 2 Amp internal fuse or the solid-state relay may be blown or the Dehumidification System may have failed. The fuse and relay can be replaced by the user.

Access to the PC board requires removing the front panel. Snap off the front bezel as shown in Figure 3.2-5 and remove the 4 screws. It may also be necessary to remove the rear panel to provide enough slack in the internal wiring to reach the fuse or U1. Reverse the procedure to reassemble.



Figure 3.2-5: Front panel removal

If the fuse/relay procedure does not fix the problem then replace U1 (MC1458) and recheck the system. If the system still fails to operate, return the unit to the factory for repair.

6. Unit reads either 0 or over 100% with sensor installed. - Sensor is defective. Replace sensor.

If any components are replaced the system should be recalibrated as set forth in Section 3.2.5.

3.2.7 Specifications

3.2.7.1 Model 5112

Sensor type: Temp compensated, capacitive film
Range: Adjustable: 0-100% RH
Accuracy: $\pm 3\%$ RH
Lo/Hi band: 2% RH below set pt / 2% RH above set pt
Set pt adjust: 22-turn screw driver adjust potentiometer
Manual control: Dehumidify ON/OFF pushbutton switch
Display: 3½-digit LCD
Resolution: 0.1% RH (± 1 digit)
Control Out: 3 Amp solid state relay
Power req.: 90-260 VAC, 50/60Hz, 700W max
Dimensions: 3.78"Wx3.78"Hx3.35"D (DIN 43700, 9.6x9.6x8.5 cm)

3.2.7.2 Pump

Capacity (free air): 1200 cubic inch/minute
RPM: 1550
Power: 115 VAC/60 Hz, 1.5 Amps
230 VAC/50 Hz, 0.75 Amps

3.2.7.3 Drying Unit

Column: Molded acrylic plastic.
Dimensions: 2 5/8" O.D. x 11 3/8".
Anodized aluminum cap: Fitted with "O-Ring" gasket.
Safe working pressures: 90 psig max.
Desiccant supports and coil spring: Cadmium plated steel.
DRIERITE (Calcium Sulfate): Held firmly in place between felt filters.
Connections: Plastic or rubber flexible tubing.
(Hose clamps must be used when used under pressure.)
Contents: 1¼ lbs. of #8 mesh Indicating DRIERITE.
Water vapor capacity: 50 grams max.
Flow rate: 200 liters per hour or 0.1 scfm for maximum efficiency.
Air and gases drying: -100° F dew point max.

Indicating DRIERITE is non-toxic and non-explosive.

3.2.8 Optional Model 5465 Dry Gas Dehumidification System

This system consists of a solenoid valve with an attached power cord and pressure regulator plus 6' (2m) of ¼" (6mm) OD high-pressure polyflo tubing, terminated with quick disconnect fittings. The regulator is used to fine tune the gas flow into the chamber and is in addition to the regulator that is normally attached to either a user supplied gas tank or a central dry gas or air supply outlet. **The pressure from the dry gas source must be limited to 50psi.** The valve assembly is packed separately during shipping and is installed onto the chamber by the user.

This is a one-way system where gas is injected into the chamber to purge out the wet air. The hose barb fitting on the chamber must be left open or be used to vent the nitrogen to prevent pressure build-up.

Dry nitrogen is capable of reducing the humidity in the chamber to less than 1% RH, but due to mechanical considerations the lower limit of the chamber is specified at <5%.

This system is similar in operation to the controlled valve described in Package A. The only operational difference being that it has an AC (specified 115 or 230VAC required) instead of a DC operated solenoid and is controlled by the Model 5112 Controller instead of the built-in fixed-point control.

3.3 Replacement Parts

The Series 5400 Operating Systems should operate reliably for many years if maintained properly. Typical service includes gloves and desiccant. Listed are common replacement parts for the various operating systems and control units along with the corresponding ETS part number.

<u>ITEM</u>	<u>ETS Part #</u>
1. 6" (15cm) Gloves	0140-00056
2. Pliable Sealer	
3. Replacement Door Gasket (roll)	
4. 5 lb Jar of Indicating Calcium Sulfate Desiccant	0122-00002
5. 1 lb Desiccant Column	0122-00001
6. Replacement Felt Pad for column	
7. 2.5 lb Desiccant column (high capacity option)	
8. Model 5561 Pump Repair Kit	
9. Digital Humidity Sensor (Model 5311)	
10. Analog Humidity Sensor (Model 5112)	
11. 18"Lx4"W (46x15cm) Stackable Sample Rack (optional accessory)	

4.0 WARRANTY

Electro-Tech Systems, Inc. warrants its equipment, accessories and parts of its manufacture to be and remain free from defects in material and workmanship for a period of one (1) year from date of invoice and will, at the discretion of Seller, either replace or repair without charge, F.O.B. Glenside, similar equipment or a similar part to replace any equipment or part of its manufacture which, within the above stated time, is proved to have been defective at the time it was sold. All equipment claimed defective must be returned properly identified to the Seller (or presented to one of its agents for inspection). This warranty only applies to equipment operated in accordance with Seller's operating instructions.

Seller's warranty with respect to those parts of the equipment purchased from other manufacturers shall be subject only to that manufacturer's warranty.

The Seller's liability hereunder is expressly limited to repairing or replacing any parts of the equipment manufactured by the manufacturer and found to have been defective. The Seller shall not be liable for damage resulting or claimed to result from any cause whatsoever.

This warranty becomes null and void should the equipment, or any part thereof, be abused or modified by the customer or if used in any application other than that for which it was intended. This warranty to replace or repair is the only warranty, either expressed or implied or provided by law, and is in lieu of all other warranties and the Seller denies any other promise, guarantee, or warranty with respect to the equipment or accessories and, in particular, as to its or their suitability for the purposes of the buyer or its or their performance, either quantitatively or qualitatively or as to the products which it may produce and the buyer is expected to expressly waive rights to any warranty other than that stated herein.

An RMA (Return Material Authorization) must be obtained from ETS prior to return of equipment.

Equipment should be shipped prepaid and insured in the original packaging. If the original packaging is not available, the equipment must be packed in a sufficiently large box (or boxes if applicable) of double wall construction with substantial packing around all sides. The RMA number, description of the problem along with the contact name and telephone number must be included in formal paperwork and enclosed with the instrument. Round trip freight and related charges are the owner's responsibility.

WARNING: WOODEN CRATES MUST NOT BE USED. PACKAGING OF DELICATE INSTRUMENTS IN WOODEN CRATES SUBSTANTIALLY INCREASES THE CONTENT'S SUSCEPTIBILITY TO SHOCK DAMAGE. DO NOT PLACE INSTRUMENTS OR ACCESSORIES INSIDE OTHER INSTRUMENTS OR CHAMBERS. ELECTRO-TECH SYSTEMS, INC. WILL NOT ASSUME RESPONSIBILITY FOR ADDITIONAL COST OF REPAIR DUE TO DAMAGE INCURRED DURING SHIPMENT AS A RESULT OF POOR PACKAGING.