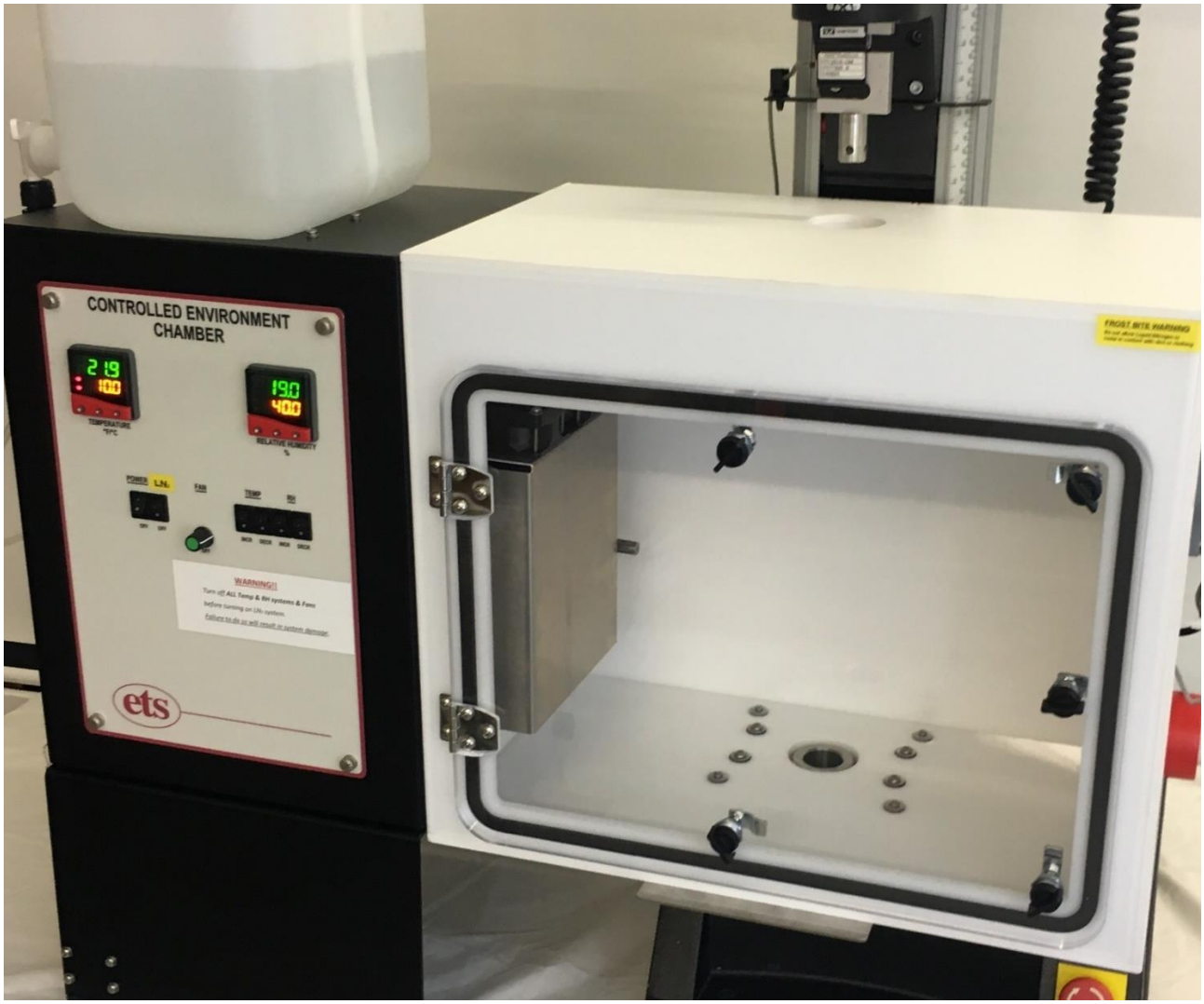
electro-tech systems, inc.



Mini Environmental Chambers for Instron Single Column 3300, 5500, and 5900

ETS Model 5502 Operating Manual

Table of Contents

I. Important Safety Information

SAFETY INSTRUCTIONS

The equipment described in this Manual is designed and manufactured to operate within defined design limits. Any misuse may result in electric shock or fire. To prevent the equipment from being damaged, the following rules should be observed for installation, use and maintenance. **Read the following safety instructions before operating the instrument.**

POWER

POWER CORD: Use only the power cord specified for this equipment and certified for the country of use. If the power (mains) plug is replaced, follow the wiring connections specified for the country of use. When installing or removing the power plug, **hold the plug, not the cord.**

The power cord provided is equipped with a **3-prong grounded plug (a plug with a third grounding pin).** This is both a safety feature to avoid electrical shock and a requirement for correct equipment operation. If the outlet to be used does not accommodate the 3-prong plug, either change the outlet or use a grounding adapter.

FUSES: Replace fuses only with those having the required current rating, voltage and specified type such as normal blow, time delay, etc. **DO NOT** use makeshift fuses or short the fuse holder. This could cause a shock or fire hazard or severely damage the instrument.

OPERATION

CAUTION

DO NOT OPERATE WITH COVERS OR PANELS REMOVED. **Voltages inside the equipment consist of line (mains) that can be anywhere from** 100-240VAC.

DO NOT OPERATE WITH SUSPECTED EQUIPMENT FAILURES. If any odor or smoke becomes apparent turn off the equipment and unplug it immediately. Failure to do so may result in electrical shock, fire or permanent damage to the equipment. Contact the factory for further instructions.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE: Operating the equipment in the presence of flammable gases or fumes **constitutes a definite safety hazard**. For equipment designed to operate in such environments the proper safety devices must be used such as dry air or inert gas purge, intrinsic safe barriers and/or explosion-proof enclosures.

DO NOT IMPEDE THE CHAMBER FROM VENTING EXCESS PRESSURE. The humidification and dehumidification systems are open loop systems that pump external air into the chamber. If the chamber is not allowed to vent, pressure could build up and cause serious damage to the chamber.

USE DISTILLED OR DEIONIZED WATER SOURCE FOR HUMIDIFICATION. Build-up of contaminates on the transducer will cause stress to the transducer and electronics and resulting in premature failure and invalidate the warranty.

IF YOUR UNIT INCLUDES OPTIONAL LIQUID NITROGEN COOLING CAPABILITES, REVIEW ALL SAFETY INFORMATION IN THE LIQUID NITROGEN SAFETY ADDENDUM.

DO NOT USE IN ANY MANNER NOT SPECIFIED OR APPROVED BY THE MANUFACTURER: Unapproved use may result in damage to the equipment or present an electrical shock or fire hazard.

II. Description of Contents

Included:

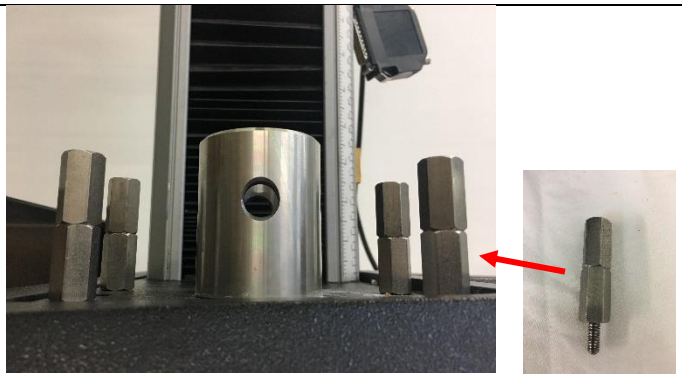
Item	Qty.	Description
Control Unit	1	Control unit houses the primary control and operating systems to support heating, cooling, humidification, and dehumidification.
Control Unit Base	1	Base provides support for the control unit and adjustability to align the control unit with the chamber which will mounted to the Instron unit.
Chamber	1	The Model 5502 includes one chamber as standard. However, chambers are frequently customized to the application and quantity and size may vary.
Water tank	1	One 2.5-gallon water tank is included as standard. Optionally, the humidification system can be connected directly to a DI water supply.
Tubing	1	One 10-foot length of tubing is provided to be used for connecting the water supply, air supply, and water drainage.
Power Cord	1	AC line cord for connecting the control unit to power.
Chamber Support Bracket and Hardware	1	1 bag containing the vertical support bracket and hardware.
Chamber Base Mounting Hardware	1	1 bag containing standoffs and hex bolts for mounting chamber to base of Instron unit.
Cleaning Brush	1	Cleaning brush for preventative maintenance cleaning of the humidification system ultrasonic transducers.
Optional LN2 cooling: DC Power Cable	1	Over pressure safety DC power cable
Optional: LN2 cooling: High pressure hose	1	LN2 High Pressure Hose

III. Setup Guide

Part 1: Mount the Environmental Chamber onto the Instron unit

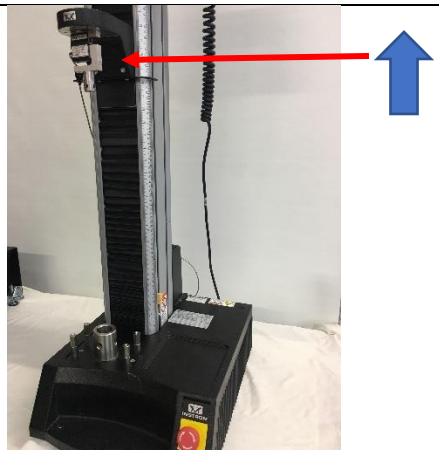
Tools Needed:

- □ Adjustable wrench
- □ 4mm Allen wrench
- □ Phillips screwdriver



Step 1 – Attach Chamber Standoffs

Insert and tighten the four 2” inch tall standoff assemblies into the 4 threaded holes in the Instron platform as shown. An adjustable wrench can be used to tighten the standoffs.



Step 2 – Raise the Instron armature

Make sure the armature of the Instron unit is fully raised to ensure it is not in the way of mounting the environmental chamber.

Step 2 – Set the chamber in place

With 2 people, carefully place the chamber centered from left to right) onto the standoffs and slide the chamber back into place until the hex standoffs and center Instron post align with the holes of the bottom metal support plate. Once in place, have one person hold the chamber steady in place, while the other person completes the next step of attaching using screws.

Step 3 – Insert and tighten screws

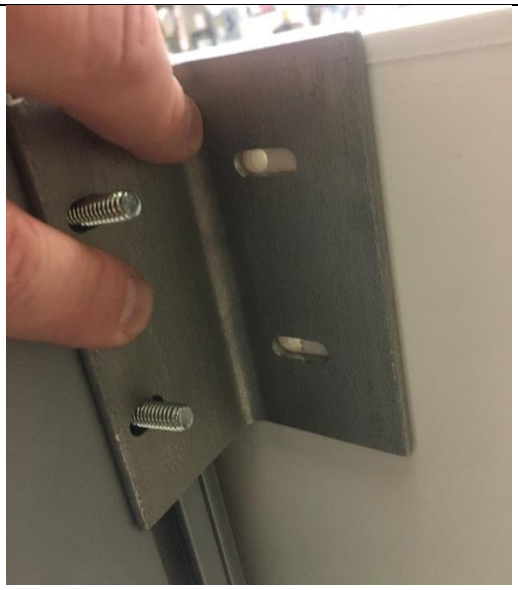
Once the chamber is in place and the mounting holes are aligned, utilize the four M6x25mm screws and shock mount washers (rubber side down) to attach the chamber to the standoffs. Use a 4mm Allen wrench to tighten the screws.

Step 4 – Attach rear support bracket

Attach rear support bracket to the Instron Column utilizing the T-slot nuts.

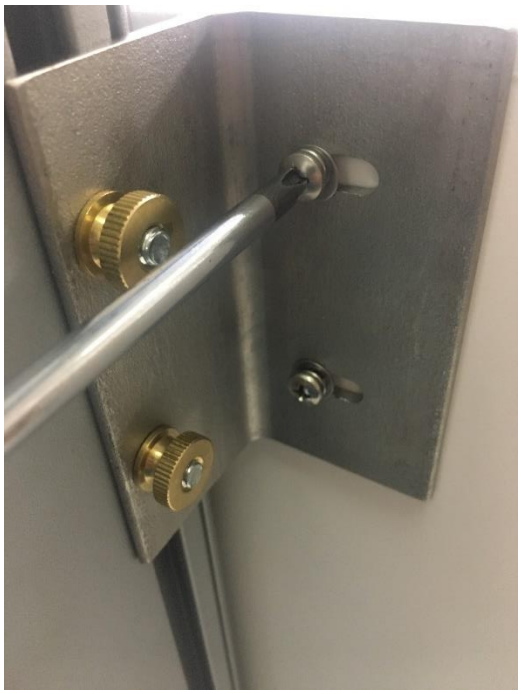
Start by placing the T-slot nuts into the channel on the Instron column and let them fall to the bottom of the channel. Thread the ¼”-20 1-inch studs loosely into the T-slot nuts. Do not tighten; the t-slot nuts still need to be able to slide in the channel.

Slide the top stud up and place the bracket onto the studs with one stud in each of the slots in the bracket. The bracket should be oriented with the side having the shorter slots placed against the column [and the side with the longer slots placed against the chamber].



Next, slide the entire bracket upward until the long slots on the bracket align with the holes in the chamber. Loosely attach the bracket to the ETS chamber using the 10-24x3/4" pan head screws, #10 split washer, and #10 washer. Do not tighten pan head screws.

You can now finger tighten the studs on the Instron column to lock the T-slot nuts into place.



Next thread the ¼"-20 thumb nuts loosely onto the studs on the Instron column. Do not tighten.

With the bracket in place flush against both the Instron column and ETS chamber, proceed to tighten the screws and thumbnuts. Utilize a Phillips screwdriver to tighten the 10-24x3/4" pan head screws.

Be careful to avoid placing any strain on the chamber that could cause stress/cracking. If necessary, STOP, and loosen the hardware and readjust the position of the bracket to eliminate any physical stress and then tighten.

Refer to documentation from Instron for your model of single column Instron unit.

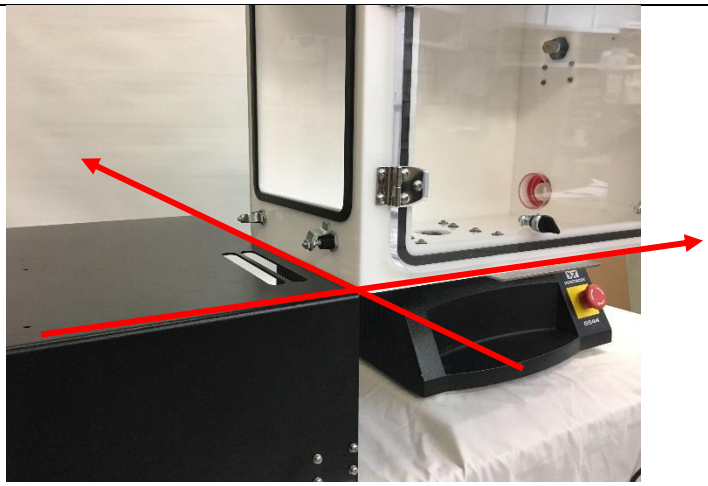
Step 5 – Set limits on Instron column

To avoid the Instron unit armature from destroying the chamber accidently, set your lower physical stop limit on your Instron armature to a safe level to avoid physical contact with the chamber.

Part 2: Place the Control Unit on the Base and attach to the Chamber

Tools Needed:

- □ 3/16” Allen wrench
- □ Adjustable wrench
- □ Ruler or tape measure
- □ Phillips screwdriver



Step 1 – Place the base in position

Set the control unit base on the work surface to the left of the Instron unit with the front of the base [the long vent slots in the top of the base should be to the front].

The front face of the base should be aligned approximately with the front edge of the chamber steel support plate and the right edge of the base should align with the left edge of the chamber. Ensure the feet of the base are fully and securely on the work surface. If necessary, adjust the position of the Instron unit to allow the proper positioning of the base.

Step 2 – Adjust the height of the base

Adjust the 4 feet on the bottom of the base such that the top of the base is level with the bottom of the chamber. Rotate the feet clockwise (raise) or counterclockwise (lower) as needed. You can turn the feet with your fingers or utilize a 3/16” Allen wrench.

Step 3 – Place the control unit on the base

The control unit should be positioned on the front half of the base with the front of the control unit approximately aligned with front of the base. Set the control unit on the left 3/4 of the base. Initially, about 1/3 of the control unit may be overhanging the base.

Once placed on the base, gently slide the control unit towards the opening in the chamber. As the control unit is placed into position, the heating/cooling unit extending from the right side of the control unit should be inserted through the large opening on the left side of the chamber. If ANY physical blockage/resistance occurs, STOP and carefully adjust the positioning of the control chamber front to back or raise/lower the feet on the base to better align the control unit vertically with the chamber.

Even gap top to bottom

Latch aligned with slot
(Viewed from inside control unit)

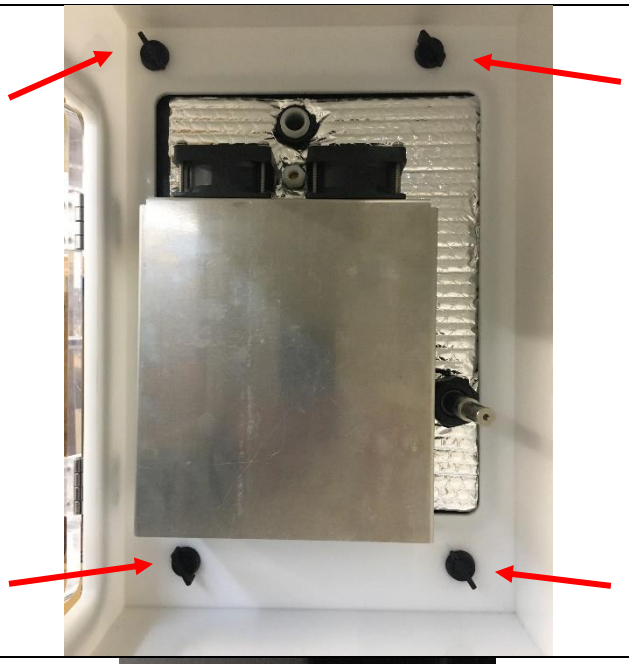
Step 4 – Fine tune position to latch

The final height of the base, positioning of the control unit from front to back, and levelness from left to right will all need to be adjusted until the 4 keyhole slots on the right side of the control unit align with the 4 latches on the chamber. In addition, ensure the gap between the chamber and the control unit is even from top to bottom.

Adjust the feet on the base and shift the position of the control unit as appropriate.

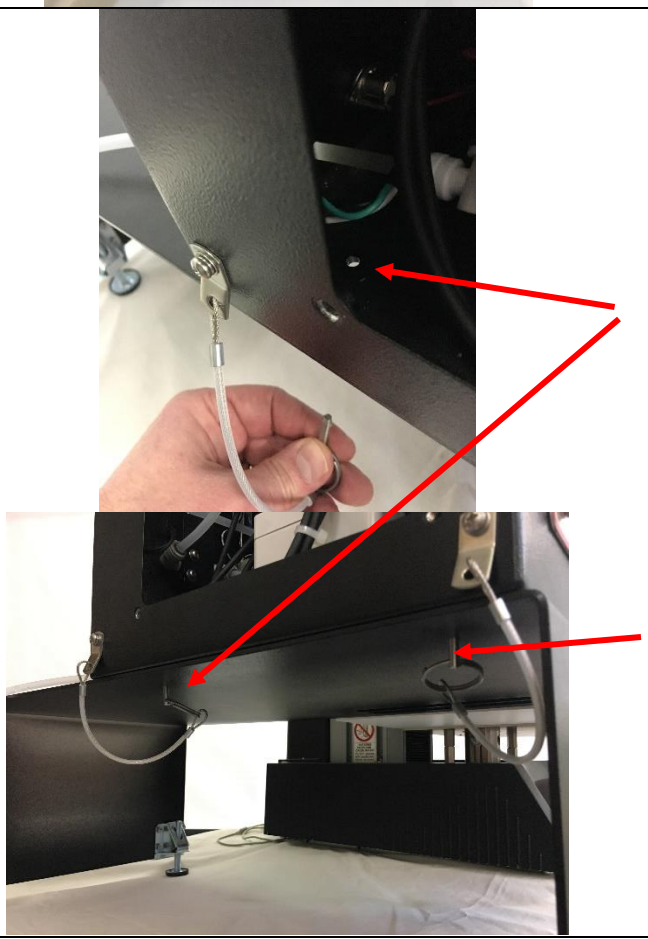
Once the gap is even and the latches are properly aligned, push the control unit flush with the chamber. If you note any obstruction, make final adjustments as needed to eliminate the obstruction.

NOTE: The access panel on the left side of the control unit can be removed to better view the alignment of the latches from inside the control unit.



Step 5 – Close the latches

To complete the attachment of the control unit to the chamber and provide a tight seal, turn each of the latches clockwise from inside the chamber. If any significant resistance is encountered, do not force the latch. Any significant resistance may indicate misalignment of the latch mechanism with the slot; revisit step 4. If the latches are difficult to reach by hand, use a pair of needle nose pliers to gently turn the latches.

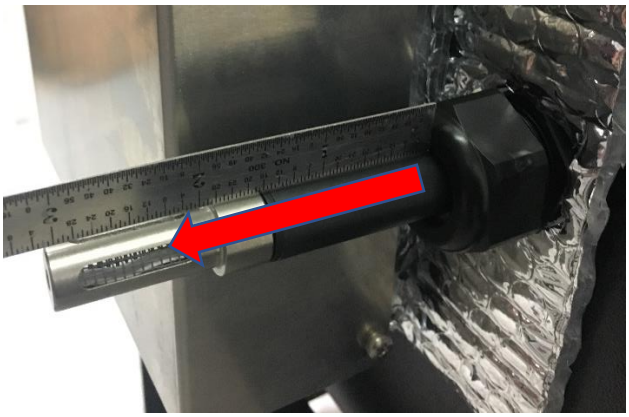


Step 6 – Insert retainer pins (recommended)

The system includes two safety locater pins which connect the base to the control unit. These locator pins help ensure the control unit remains properly located on the base.

The base may need to be shifted around underneath the control unit to align the holes in the base and control unit.

Once the holes are aligned, insert the two locator pins.



Step 7 – Plug in the control unit sensor

The temperature/humidity sensor separate from the chamber. Loosen the nut on the fitting (by hand or with an adjustable wrench) and push the sensor into the chamber. Retighten the nut.

Part 3: Connect all Operating Systems

Tools Needed:

- □ Scissors (to cut ¼" tubing to length)

Step 1 – Connect the DI Water Supply

¼" tubing and a 2.5-gallon water tank have been provided to provide a water supply to the ultrasonic humidifier.

Fill the water tank with at least 1 gallon of water and place the water tank on top of the control unit. Loosen or entirely remove the air release cap on top of the water tank to allow water to flow.

Use approximately 2 feet of hose (use scissors to cut to length) to connect the water tank to the water intake. Insert one end of the hose into the quick connect on the water tank and insert the other end into the water intake on the control unit.

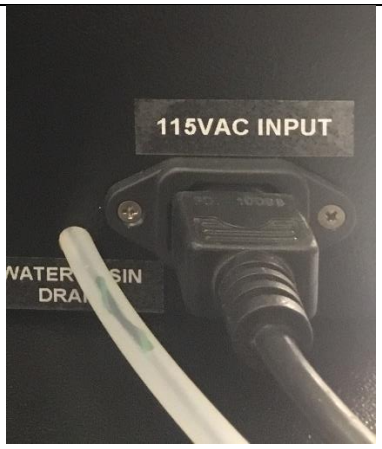
As an alternative, the unit can be connected directly to a laboratory deionized (DI) water supply. Utilize the length of hose necessary to connect directly to the DI water supply.

IMPORTANT NOTES:
Water will not properly flow out of the water tank if you do not loosen or remove the air release cap.

Step 2 – Connect the Air Supply

The Model 5502 utilizes a self-regenerating dehumidification system that is powered by air pressure. The system requires approximately **50 psi** of air pressure which can be provided by a self-contained portable compressor or house air. Utilize the length of ¼" OD tubing that is long enough to make the connection to the air system being utilized.

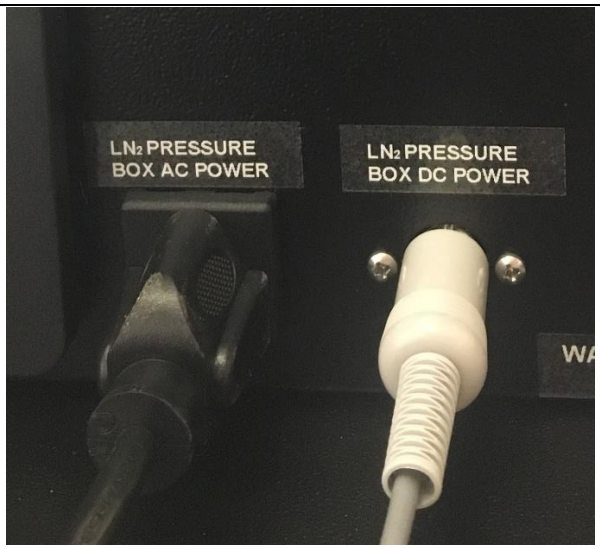
To connect the tubing to the rear of the control unit, push the tube into the fitting orifice as far as possible.



Step 3 – Connect Main Power

Connect the power line cord to the rear power 115VAC Input plug on the back of the control unit.

IMPORTANT NOTES:
Since the unit utilizes a water supply, avoid connecting power if there is a water spill or your hands are wet.



Step 4 – Optional LN2 Cooling System

Connect the optional LN2 cooling system power cables as follows:

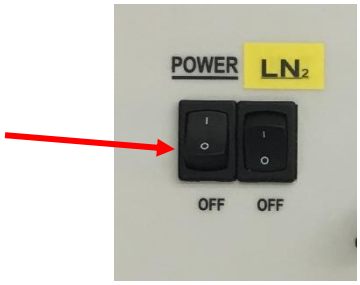
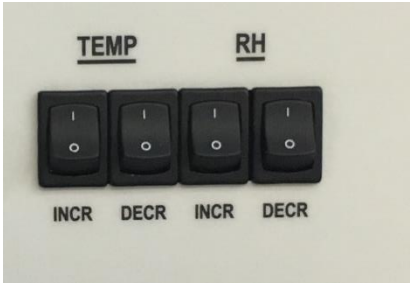
- Attach the black power cord coming from the black pressure box attached to the right side of the chamber to the LN2 Pressure Box AC Box plug on the back of the control unit.
- Connect the LN2 pressure box DC power cord to the pressure box DC power jack and then connect to the LN2 Pressure Box DC Power connection on the back of the control unit.

Step 5 – Connecting to LN2 Supply

- **See supplemental addendum.**

WARNING:
- **Exercise extreme caution in connecting Liquid Cooled Nitrogen.**

IV. Quick Start Guide

Quick Start Guide	
	**Step 1 – Turn on Power** Turn on Power (I = on). Do NOT turn on LN2 power.
	**Step 2 – Set Temperature** Set your set point by pressing and holding the * key and using increase/decrease buttons to adjust to your desired temperature.
	**Step 3 – Set Humidity** Set your set point by pressing and holding the * key and using increase/decrease buttons to adjust to your desired temperature.
	**Step 4 – Turn on Operating Systems** Flip all four operating system switches to the on position (I = on). If operating at edge conditions (<30% RH, >80% RH, <15C, >35C) only the corresponding systems need to be used (ex: 20%RH 45C only needs Temp Incr and RH Decr).

IMPORTANT! REVIEW ALL SAFETY PRECAUTIONS AND INSTRUCTIONS ○ Liquid Nitrogen Safety Addendum ○ Liquid Nitrogen Cooling System Set-Up Addendum	**Step 5 – Optional LN2 System** If the LN2 cooling system is going to be used, it is **IMPORTANT** to turn off all of the other temperature and humidity systems (reverse Steps 2 and 4 – Turn **OFF** the fan and turn **OFF** all 4 operating system switches). See LN2 Addendum for safety precautions and instructions on setting up the LN2 system.

IV. Operation Guide

Control Panel

Button	Description	Functionality
1	POWER	This switch disconnects all power going to the Chamber Systems. “I” is “ON”, “O” is “OFF”.
2	LN2 (optional)	Turns on power to the liquid nitrogen (LN2) cooling system (if installed).
3	FAN	No longer used
4	TEMP - INCR	Allows the user to manually disable the Temperature Heating System. Pushing this switch to the (‘0’) is “Off”
5	TEMP - DECR	Allows the user to manually disable the Temperature Cooling System. Pushing this switch to the (‘0’) is “Off”
6	RH - INCR	Allows the user to manually disable the Humidification System. Pushing this switch to the (‘0’) is “Off”
7	RH - DECR	Allows the user to manually disable the Dehumidification System. Pushing this switch to the (‘0’) is “Off”
8, 9, 10	TEMPERATURE CONTROLLER	The temperature controller includes a * button along with down and up arrows to allow selecting and changing settings.
11, 12, 13	HUMIDITY CONTROLLER	The humidity controller includes a * button along with down and up arrows to allow selecting and changing settings.

VI. Maintenance and Calibration

Calibration

For consistency of performance Annual manufacturer conducted calibration is required.

ETS recommends the Model 5502 system be calibrated annually. Only the control unit needs to be returned for calibration. Be sure to drain the water out of the humidification system prior to returning. Do NOT return the chamber or the control unit support base.

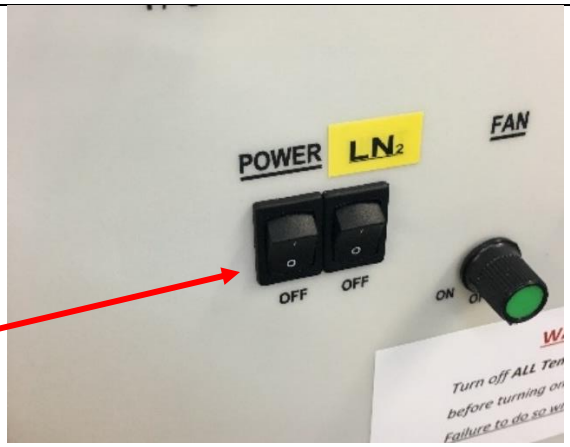
To return equipment to ETS for calibration or repair it is first necessary to obtain a RMA number, please call 215-887-2196 or email service@ets2.com

Preventive Maintenance

Humidification System

The humidification system utilizes an ultrasonic transducer that has an estimated lifespan of 3000 hours after which it may need to be replaced. The ultrasonic transducer is not user replaceable. Please contact ETS for assistance with repair/replacement. To maximize the life of the transducer, utilize an appropriate water supply (deionized water or distilled water) and perform regular preventative maintenance after every **300 hours** of operational use.

Humidification System Maintenance



OFF

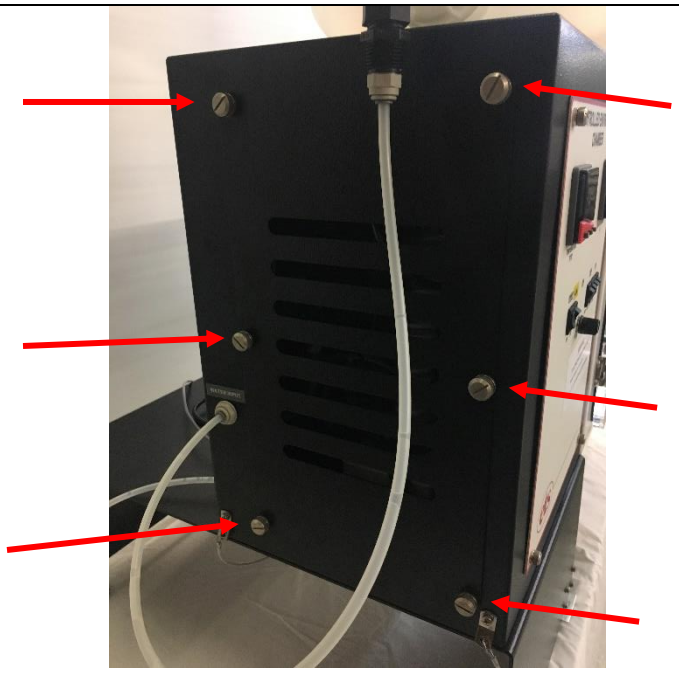
Step 1 – Turn off power and unplug

Turn off the power switch on the control panel AND unplug the Control Unit power cord before cleaning the humidifier to avoid any possibility of electrical shock.

OFF

Step 2 – Turn off water supply

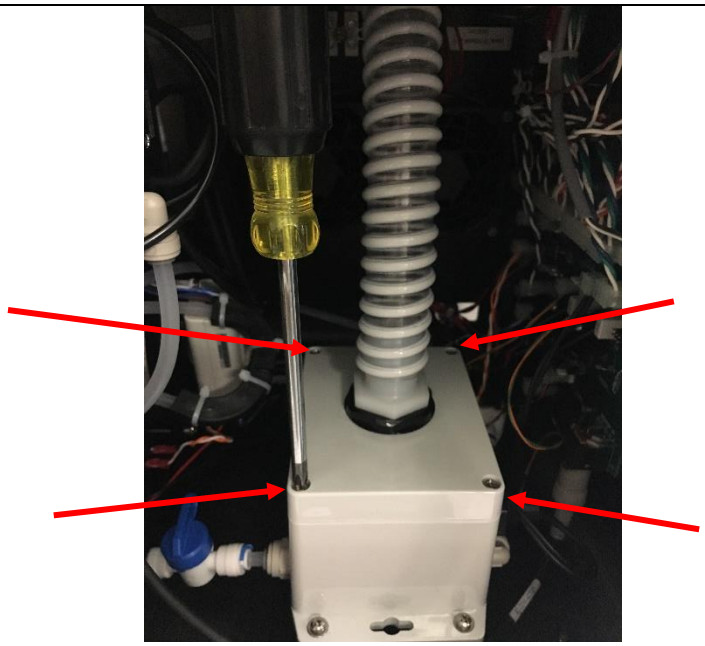
Turn off the water source. If utilizing the 2.5-gallon water tank, turn the valve position to OFF.



Step 3 – Remove side panel

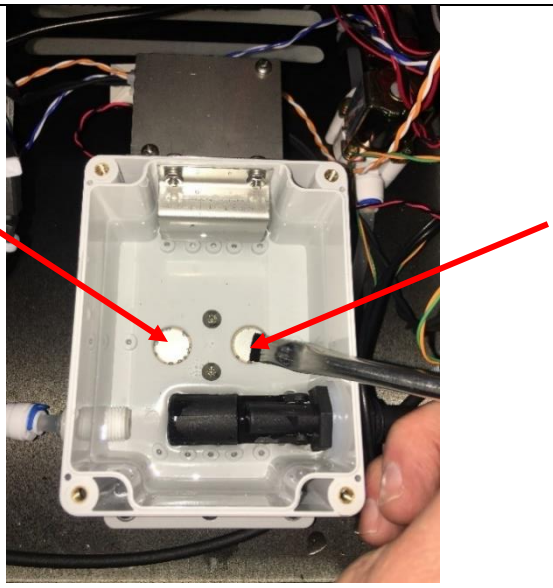
Remove the side access panel on the control unit by loosening the 6 large thumbscrews and set the cover aside.

Be careful to hold the cover with one hand while loosening the last two screws with your other hand, to avoid losing control of the cover and having it fall off in an uncontrolled manner.



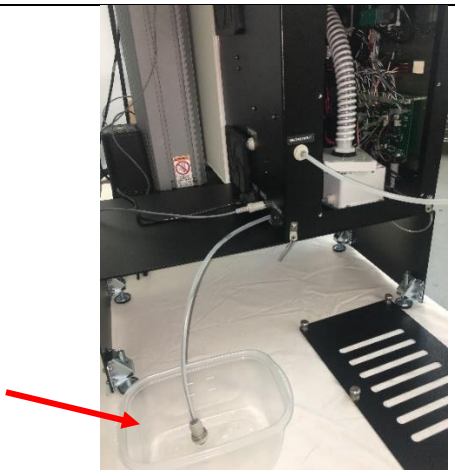
Step 4 – Remove the humidifier cover

Once the side access panel has been removed, next remove the humidifier top cover by loosening the 4 screws in the cover using a Philips screwdriver.



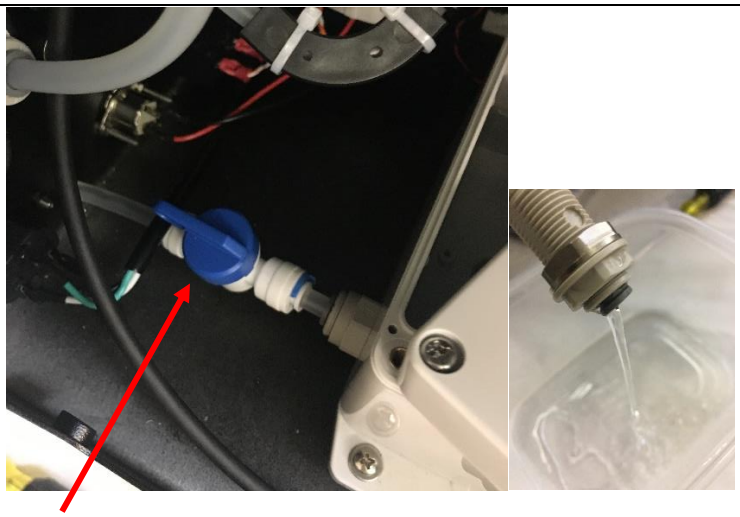
Step 5 – Clean the transducer

Clean the surface of the two transducers (located at the bottom center of the basin using the cleaning brush provided by ETS. If not available or lost, utilize a soft clean cloth or small soft brush (e.g. toothbrush) to clean the surface of the transducer. Do not use any tools with sharp edges – scratching the transducer could damage it.



Step 6 – Prepare to drain the basin

After cleaning both transducers with the brush, the contaminated water will need to be drained out of the basin. In preparation, place a small container at the end of the drain hose to collect the water that flows out of the hose. The container must allow the hose to flow downward so the water can gravity feed and drain out of the basin.

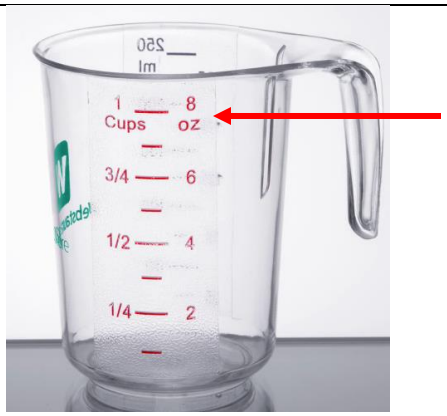


Drain Valve (shown in the "Open" position)

Step 6 –Drain the basin

Open the drain valve by turning it to the open position as shown in the picture.

If the water does not flow, move or gently bend the hose to help break any air pockets/bubbles that may have formed that could prevent the free flow of water.

	**Step 6 – Flush the basin** Once the basin has drained, flush out the basin twice with an 8-ounce cup of deionized or distilled water each time. Do not exceed 8 ounces of water at a time.
Reference pictures in the previous steps.	**Step 7 – Return the System to operation** Return the system to operation by: • Close the basin drain valve so water won't pour out the drain hose. • Replace the humidifier basin cover and tighten the screws with the screwdriver. • Replace the control unit side access panel and tighten the thumbscrews • Turn on the water supply on the 2.5 gallon water tank • Restore power to the control unit by plugging it in. • Turn on the power switch on the control panel

VII. Warranty

Limited Warranties. Seller warrants that all goods manufactured and delivered hereunder shall (a) conform to any samples, drawings, specifications or other written documents provided to Seller by Buyer, or approved by Buyer to Seller and (b) be free from all defects in workmanship and material. Buyer's sole remedy against Seller for breach of either of the specifically mentioned warranty shall be the repair or replacement, at Seller's sole option, of the defective workmanship or material. Seller expressly disclaims all other warranties, express and/or implied, including but not limited to those of merchantability and fitness for a particular purpose. In no event shall Seller be liable, under either warranty or otherwise, to Buyer in excess of the purchase price of the products paid to Seller by Buyer. In no event shall Seller be liable for any loss or damage arising directly or indirectly from the use of the product or for consequential or incidental damages. Seller's specified warranties will expire and lapse (i) for renewable items (such as gloves, iris ports and desiccants), sixty (60) days from date of shipment and (ii) for all standard equipment and otherwise nonrenewable items, one year from date of shipment.

IX. Liquid Nitrogen Safety Addendum

Reference: http://engineering.dartmouth.edu/microengineering/ln2.html

Properties of Liquid Nitrogen (LN2)

1. It is extremely cold: 77.3K = -196C = -320F at atmospheric pressure. This can cause **severe frost bite**.
2. On vaporization, it expands by a factor of 700; one liter of liquid nitrogen becomes 24.6 cubic feet of nitrogen gas. This can cause **explosion** of a sealed container, or it can displace oxygen in the room and cause **suffocation without warning**.
3. It can become oxygen enriched and cause ordinarily noncombustible materials to burn rapidly.

Precautions when handling liquid nitrogen

1. Treat liquid nitrogen and any object cooled with liquid nitrogen with respect.
2. Take care not to allow liquid nitrogen to be trapped in clothing near the skin.
3. Wear safety glasses or a face shield when transferring liquid nitrogen.
4. Wear gloves when touching any object cooled by liquid nitrogen. Gloves should be loose fitting, so they could be thrown off if liquid were to pour inside them
5. Use only approved unsealed containers. Never pour it into a coffee thermos. Never seal it in any container (it will explode).
6. Never dip a hollow tube into liquid nitrogen; it may spurt liquid.
7. Never use in a small poorly ventilated room, and never dispose of liquid nitrogen by pouring it on the floor. It could displace enough oxygen to cause suffocation. Nitrogen gas is colorless and odorless--the cloud that forms when you pour liquid nitrogen is condensed water vapor from the air, not nitrogen gas.
8. Do not store liquid nitrogen for long periods in an uncovered container (on the other hand, never totally seal a container). Because the boiling point of oxygen, 90.1K, is above that of nitrogen, oxygen can condense from the air into the liquid nitrogen. If the air over the nitrogen circulates, this liquid oxygen can build up to levels which may cause violent reactions with organic materials; even materials which are ordinarily nonflammable. For example, a severe clothing fire could result from ignition in the presence of liquid oxygen.

First Aid

- Suffocation: If person seems to become dizzy or loses consciousness while working with liquid nitrogen, move to a well-ventilated area immediately. If breathing has stopped, apply artificial respiration. If breathing is difficult, give oxygen. Call a physician. Keep warm and at rest.
- Frost bite: If exposed to liquid or cold gas, restore tissue to normal body temperature, 98.6F (37C), followed by protection of the injured tissue from further damage and infection. Remove or loosen clothing that may constrict blood circulation to the frozen area. Call a physician. Rapid warming of the affected part is best achieved by using water at 106F (42C). Under no circumstances should the water be over 112F (44C), nor should the frozen part be rubbed either before or after rewarming. The patient should neither smoke, nor drink alcohol.

The above is first aid information is from the publication "Handle With Care", C 1996 Harsco Corporation, Factory code 7950-8052.

X. Liquid Nitrogen Cooling System Set-Up Addendum

The Nitrogen Cooling System cools a chamber by converting liquid nitrogen into a gas. In the conversion process the gas is cooled to nearly -100°F. Liquid is passed directly from the dewar to the cryogenic solenoid valve through a stainless steel cryogenic transfer hose. The output of the valve has a cap with a small orifice drilled through it. This cap acts as the pressure regulator for the system. As the liquid nitrogen passes through the orifice, it is converted into a cold gas.

A low-pressure Dewar is required. This is determined by the Dewar pressure relief valve which can range from below 22 PSI to above 235 PSI. For this system, a 22 PSI Dewar is required. When the system is first turned on, there will be a small amount of nitrogen gas in the liquid nitrogen stream. The nitrogen gas must be allowed to pass before any cooling will take place. Typically, this should happen within the first 3-5 minutes, some may take longer. Adequate venting is a necessity.

PROCEDURE

1. ***Review proper safety procedures for Liquid Nitrogen and Dewar tank use before starting!!***
2. Attach the stainless steel cryogenic transfer hose to the liquid nitrogen output from the Dewar or source.
3. ***Check the pressure gauge*** on the Dewar or Liquid Nitrogen Source. Pressure should be below 22 PSI. Be aware that as the valve cycles on and off, the pressure will increase in the Dewar when the valve is off. The Dewar will relieve pressure at a specific pressure set by the auto relief on the Dewar which is supposed to be 22 PSI for this application. This will cause the tank to vent most of the time creating a hissing sound which is normal.
4. Holding the transfer hose with insulated gloves and pointing it away from anything, open the liquid nitrogen output valve on the Dewar to bleed the tank until a solid thick cloud of gas comes out. Once a cloud of gas is visible close the liquid nitrogen output valve on the Dewar.
5. Attach the open end of the transfer hose to the ETS Control Valve input.
6. Open the liquid nitrogen output valve on the Dewar.
7. Turn on the LN2 switch on the control panel to operate the valve.
8. ***Monitor the pressure.*** Periodically check the Dewar pressure to insure the pressure relief valve is functioning properly and manually vent the Dewar if necessary.

EXPLOSION WARNING!! Do not block or seal the Dewar pressure relief valve or the tank will explode. Monitor the pressure of the Dewar to insure the pressure relief valve is functioning properly. Never completely seal liquid nitrogen in any container.

WARNING!! To avoid risk of bursting of the hose, always bleed liquid nitrogen from the stainless steel transfer hose when the system is not in use. If the liquid nitrogen valve on the dewar is open, pressure from the hose will be relieved normally through the dewar vent. If the Dewar valve is closed, the liquid nitrogen must be bled from the line otherwise the hose will explode. The vaporization expands by a factor of 700. One liter of liquid becomes 24.6 cubic feet of nitrogen gas.

SUFFOCATION WARNING – Due to the high evaporation rate of liquid nitrogen, never use unless in a well ventilated area. If a person seems to become dizzy or looses consciousness, move to a well-ventilated area immediately.
FROST BITE WARNING – Do not allow liquid nitrogen to come in contact with skin or clothing.