



DX™ Insertion Sensor

OPERATORS MANUAL

DX Chilled Mirror Sensor



Technical subject to change without notice

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The DX Insertion chilled mirror sensor can be found on many of the Edgetech Instrument platforms.

KEY ATTRIBUTES

1. The DX has a modular heat exchanger system allowing the use of forced air cooling to enhance the depression range and stability
2. The DX Sensor has been designed with an integral on board temperature sensor thus reducing installation costs
3. The DX utilizes a range of mirror surface coatings to allow it to operate across a broad spectrum of applications.
4. The DX sensor has the option for integral barometric pressure sensor
5. The DX sensor has the option for internal aspirator for quiescent environments
6. The DX Sensor design includes automatic temperature compensation of the optical components further improving the stability of the measured reading over long periods.
7. The DX sensor has a low profile compact design
8. Pipe and duct thread boss is incorporated in basic design
9. Ideal for applications with high external ambient temperatures
10. DX Sensor has in board particulate filters as an option to prevent fouling of the mirror surface



DX Start up

The DX chilled mirror water vapor sensor is a first principle precision instrument which is traceable to NIST. Its range of sensitivity spans more than 4 orders of magnitude from 125 PPMv to 500,000 PPMv or more. The DX sensor can be applied to different applications and needs to be correctly configured to ensure the best performance. For further description, please consult Section 5.0, “DX Probe Configurations” to utilize the sensor’s full capabilities regarding accuracy and response time.

Follow the steps, below for optimal operation.

1. Sample flow rate should be 0.5 to 1.5 l/min or higher depending on how much residual moisture is in the system. Use higher flow rates when lower frost points are to be measured. An optional micro aspirator is fitted internally within the sensor for applications that have static or low flow rates.
2. The sensor’s cover has an adjustable aperture so that the sample flow rate can be adjusted. As a general rule, the higher the sample flow rate the smaller the cover aperture needs to be. If the sample flow is too high, the sensor output can be unstable.
3. Guard against condensation of water or ice onto the housing of the sensor. Condensation may cause positive errors at low frost points. Condensation will occur if the housing temperature falls below the ambient dew point.
4. Allow enough time for the instrument to find the frost/dew point of the gas sample. The lower the frost point, the longer time is required to reach measurement equilibrium.
5. Once the dew/frost point has been achieved, one can verify the measurement by reactivating the *ABC* mode and waiting for the subsequent measurement to stabilize.

The DX Probe is a platform insertion chilled mirror sensor and it is utilized across our product lines. Please consult Appendix (B) for a deployment summary.



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2.0 EDGETECH INSTRUMENTS INC.'S COMMITMENT TO QUALITY

To Our Customers:

Thank you for purchasing one of our products. At Edgetech Instruments Inc., it is our policy to provide cost-effective products and support services that meet or exceed your 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.

Edgetech Instruments Inc products are 100% made in the USA in our Massachusetts factory.

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.

The Employees of Edgetech Instruments Inc.



3.0 INTRODUCTION

3.1 GENERAL DESCRIPTION

The DX insertion sensor is an optical chilled mirror hygrometer, designed to continuously measure the moisture content of gases. It uses the chilled mirror dew point temperature condensation principle to determine the water vapor concentration in gas mixtures, and a platinum resistance thermometer to accurately measure that temperature.

The DX sensor has been designed from customer feedback of the Edgetech Instrument D and DS insertion probe based sensors.

The DX sensor uses active air flow heat exchanger design to ensure a wider operating range and better stability. The DX sensor is ideal for use in applications where the sensor is in high ambient conditions or is in a wall mounted, duct, or glove box configuration.

The DX sensor has an innovative optical temperature compensation processor. This ensures that as the measurement gas sample temperature changes during operation, the optical system does not need to run an ABC. This allows the sensor to have longer and more stable measurement periods.

The DX sensor also has integral to the sensor a Platinum Resistance Thermometer that continuously measures the sample gas temperature at the same point as the Dew point measurement is made. This will give the highest accuracy in calculating RH conditions.

It also reduces first installation costs as there is no need for an additional temperature sensor, cable and mounting procedure.

The DX sensor has a duct or pipe mounting thread built into the unit as standard simplifying and reducing installation costs. It has a low-profile design to allow ease of installation and smaller external projection. The sensor electrical connections have been redesigned for simple plug and play use. A range of innovative options further extend the applications where chilled mirror accuracy and stability are desired but until now have not been possible.



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Safety

To prevent injury to personnel and/or damage to property, always follow your workplace's safety procedures

4.0 Installation

The DX Sensor is energized by two different instrument platforms, the DewTrak II, and the DewMaster product lines. See Appendix B for a summary.

1. As a remote mounted unit on a cable this would be on DewMaster or DewTrak II.
2. A direct coupled sensor is on the DewTrak II chassis. The sensor position can be field adjusted to suit a change of application.



DX on remote from control unit



DX Integrated with control unit



The sensor placement should allow for free and unrestricted air flow into the sensor



4.1 Insertion Sensor

When used as an insertion sensor:

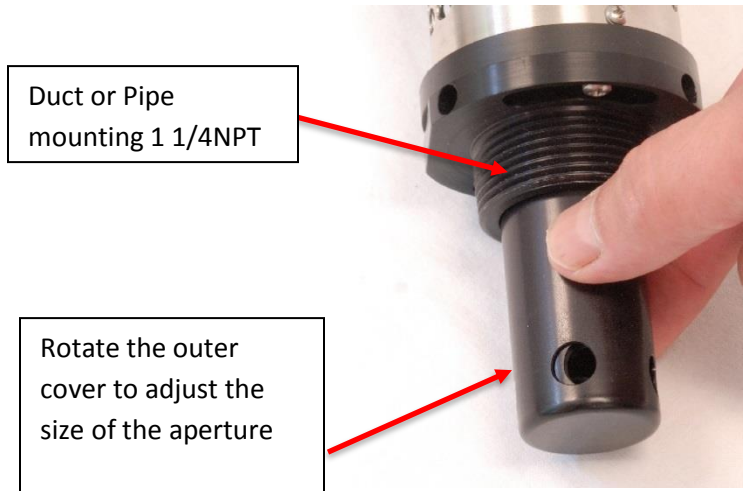


Figure 1



CAUTION!

When operating with a pressurized sampling system, be sure vent the pressure before starting any work. Do not vent sample before confirming flammability, toxicity, or any other risk factors. Always use personal protective measures

The DX sensor has an integrated mounting boss with a 1¼ NPT thread. This ensures that the sensor will not be ejected out of the high pressure environment under pressure. It also ensures that the sensor can be positively sealed into the process allowing no leakage. This requires that the customer fits a female threaded boss in the pipe or duct. If this is not available, Edgetech Instruments has available the option of a PVC flange mounting kit. Note when screwing the sensor into a fitting, the connecting umbilical cable should be disconnected to avoid excessive twisting of the cable.

The DX sensor must be mounted so that the sensor tip section is inside the process gas flow, at least ½ inch away from the inner pipe or duct wall to ensure laminar sample flow.

The outer sleeve cover on the sensor tip can be rotated to open and close the sample aperture. In low volume flow conditions, the aperture should be open and in high

sample gas volume flows, it is ideal to reduce the aperture size to reduce turbulence inside the sensor. See Fig 1.



4.2 When Used with Sample chamber



Fig 2 DX probe shown as remote sensor in sample chamber configuration

If the DX probe is used in a sample chamber set up either as a remote or integral sensor care must be taken to ensure that the sensor is firmly secured into the sample chamber. Edgetech Instruments offers optional sample chamber with matching 1¼ threaded section. Note when screwing the sensor into a fitting, the connecting umbilical cable should be disconnected to avoid excessive twisting of the cable.

4.3 DX Integrated

When used with a DewTrak II unit, the DX sensor is directly attached to the display. In this application, the sensor can be screwed into the pipe or duct directly using the integral threaded section on the sensor body. Follow paragraph 4.1, above for this installation process.

The DX Sensor can also be suspended in an open environment such as a room or glove box application. In these applications if there is a very low air flow or it is a static environment Edgetech Instruments has the option of the internal micro aspirator. This pulls sample from the external environmental and forces it over the chilled mirror ensuring that the sensor is seeing the active space conditions



Note air cooled sensors do not require any additional connections and are supplied fully operational from the factory.



5.0 DX PROBE CONFIGURATIONS

The DX probe was designed as a fully contained chilled mirror instrument capable of serving a wide range of applications. The probe is fully compatible with the Dew Master and Dew Trak II instrument systems. For optimal performance, the DX Sensor can be configured for specific applications. These applications are listed below. A summary of these configurations appears in Appendix (A).

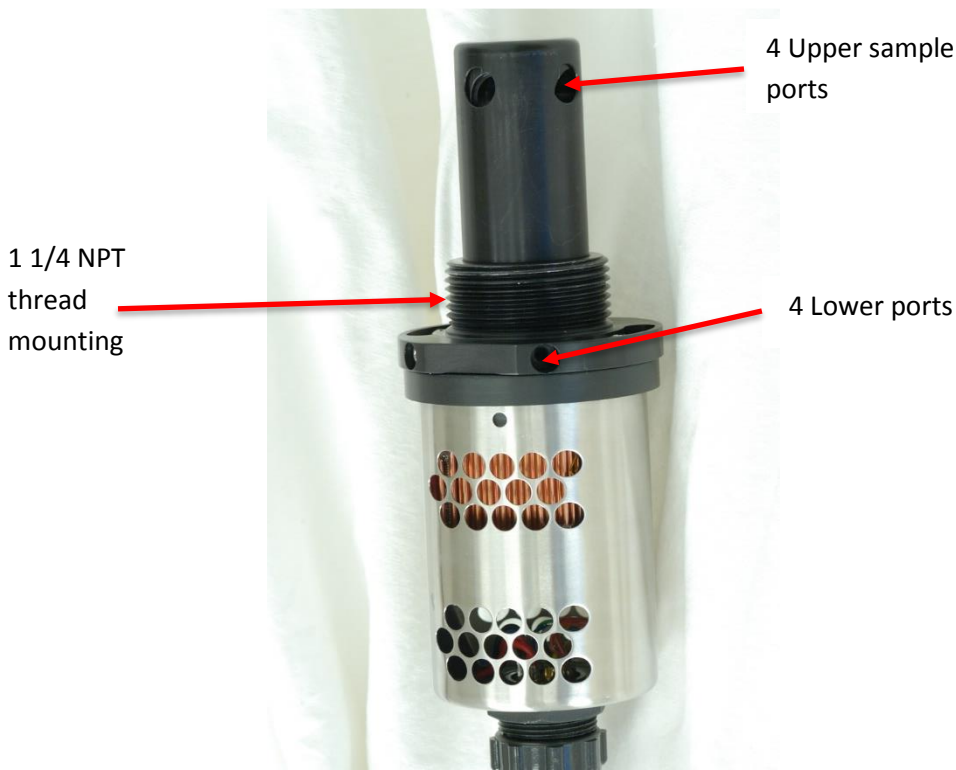
5.1 HVAC

In the HVAC configuration, the probe breathes through four lower side ports that are co-planar with the mirror, as well as four non-coplanar to the mirror top ports. The opening of the eight ports, and therefore sample access to the mirror is controlled by rotating the sensor cover. For the HVAC configuration, remove all 4 screws in the bottom ports. Adjust sample flow to mirror sensing chamber by rotating cover. Maximum sample flow is achieved when all 4 lower ports are completely opened to mirror and all 4 top ports are opened to some degree. See figure 3, below.



When the lower port sealing screws are removed, a small amount of the sample gas will vent into the ambient environment.

If active ventilation is required, the optional internal micro aspirator can be added and is permanently activated whenever the DX Probe is energized.





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Figure 3



Figure 4. HVAC and Duct configurations. Image shows one lower port opened, and the other closed.

The probe can be protected from particulates in the environment that cause measurement errors by the use of stainless steel mesh filters which trap dirt, dust, and other small particles. The standard filter is 40 microns.



Figure 5: Optional replaceable filters can be built into probe to protect the mirror from particulates. Filter porosity can be selected to balance out mirror protection with measurement response time. For most filter applications, particularly when filter porosity is smaller than 40 microns, the optional micro aspirator should be selected.



5.2 DUCT

In the duct configuration, the four lower ports are left sealed with four screws fitted with gaskets to make a sure seal. This is the standard configuration on new units. The probe is inserted into the duct by the use of the former' integral NPT thread. In order for the mirror of the probe to be open to the sample, the probe top cover is rotated. The cover is adjusted for the correct flow. Excessive flow is avoided as it will affect the dew point measurement. See Figure 4, above

5.3 GLOVE BOX

There are three options for use in a glove box.

1. The probe is inserted into the glove box through a threaded hole in the wall using the NPT threaded feature on the probe with the four side ports sealed as described above in the duct configuration. When glove box has more or less quiescent gas, the internal micro aspirator which is optional is fitted in the probe to ensure that adequate sample makes its way to the mirror. The cover is rotated to open the 4 top ports of the probe. This is especially important when frost points below -20°C are involved.
2. The probe is placed entirely suspended inside the glove box with all 4 gasketed screws removed from the probe. With screws removed, the micro aspirator is usually not required even in somewhat still environments within the glove box.
3. The probe is inserted into a sampling chamber which is in the glove box environment, and aspirated by an exterior gas pump in a closed loop configuration with three of the four side ports sealed with the above described set screws with integral gaskets. Make sure that the probe cover is in the open position within the sampling chamber. Make sure that daylight can be seen through the opened bottom port. To do this, the opposite screw needs to be removed, and then reinserted. When the internal humidity of the glove box is less than -20°C frost point, sample flow rates into the sampling chamber need to be at least 1 - 2L/min. See Figure 6, below.



If the lower port sealing screws are removed a small amount of the sample gas will vent into the ambient environment.

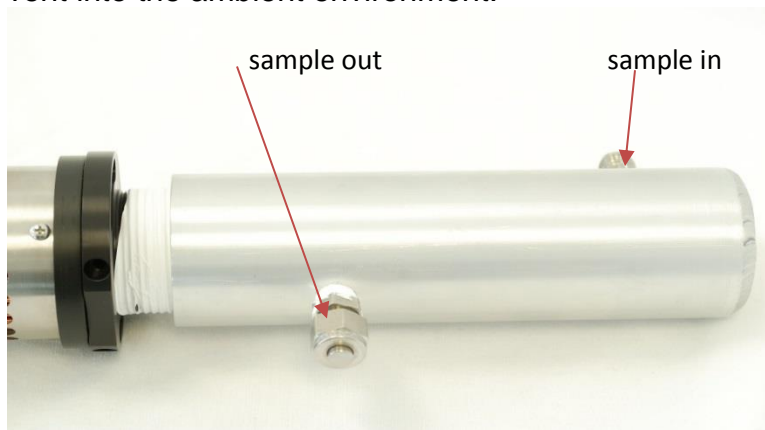


Figure 6. Probe in sampling chamber configuration for low frost points.

6.0 Maintenance

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 to reduce dry mirror reflectivity which results in 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.



CAUTION!

When operating with a pressurized sampling system, be sure to remove pressure from the Sensor prior to removing the Sensor cover.
Shut off the 24VDC power supply.
allow the mirror to equilibrate to room temperature, evaporating the dew layer

6.1 Accessing the Mirror

In order to clean the mirror surface of the DX Probe, the NPT threaded collar must be first removed. This is done by loosening the two set screws with associated internal tooth washer, and rotate the collar until the collar can be slipped off the probe. The collar is sealed to the probe body by means of an O ring. After this is accomplished, the probe cover is lifted exposing the mirror for cleaning.

After cleaning, the cover then the collar is re-applied. The series of photos in figures 7, 8, and 9, below describe this process.



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Fig 7. The collar is removed by first loosening the two set screws and rotating the collar until the heads of the set screws can be slipped through the collar slots. Keep the O ring in site as it needs to be repositioned after cleaning and reassembly of the NPT collar.

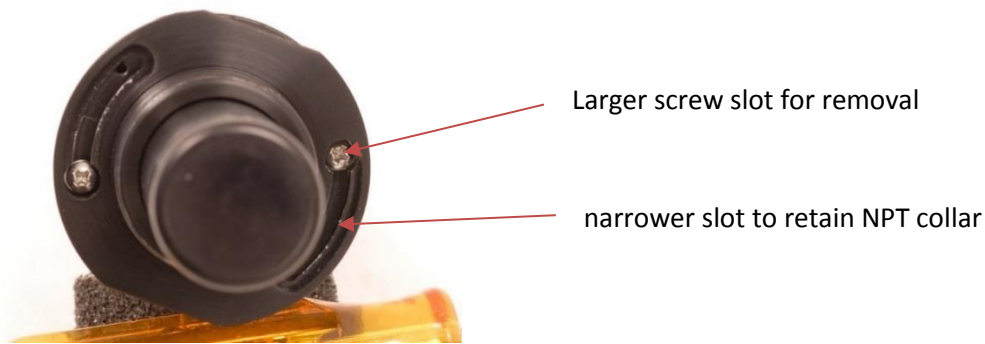


Figure 8. Once the two set screws are loosened, the collar can be rotated until the screw heads line up with the larger screw head slot.

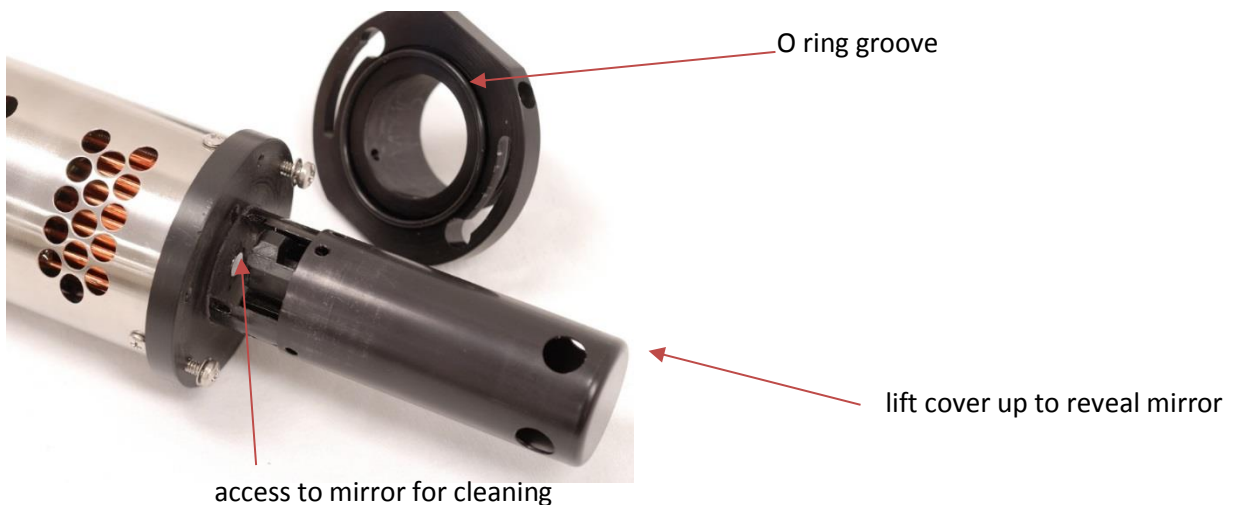


Figure 9. After NPT collar is removed, the mirror is made to be accessible for cleaning. Note the O ring groove on the underside of the NPT collar for purposes of sealing the sensing cavity.



6.2 Cleaning The mirror

1. Shut off the 24VDC power supply (in the case of Dew Trak II system), allowing the mirror to equilibrate to room temperature, evaporating the dew layer.
2. Moisten a clean cotton swab with isopropyl alcohol. Cotton swabs and cleaning bottle are provided in the Cleaning Kit supplied.
3. Wipe the mirror surface and the optics surface in a circular motion.
4. Dry the surface with a clean cotton swab.
5. Next, moisten a clean swab with clean, distilled or de-ionized water and lightly wipe the mirror and optics areas.
6. Dry these areas thoroughly with a clean, dry swab. Make sure no fibers from the swab are left on the mirror.
7. During the cleaning process, the sensor will have absorbed moisture from the ambient air. It will take time after restarting the unit to dry out this moisture and allow the mirror to come back to control point. The lower the Dew Point, the longer this dry down process will take.



Figure 10. Mirror is exposed for cleaning with a clean swab.



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6.3 Re-assembly Of DX Probe After Cleaning

To re-assemble the DX Probe after cleaning, take the NPT threaded collar plate and install the O ring, taking care to seat the O ring in the retaining groove all the way around the circumference. See figures 11 & 12.



Fig 11



Fig 12

Slide the collar plate onto the sensor and carefully slide down the sensor tip taking care not to dislodge the O ring.. Once the collar is at the base of the sensor slide the screws into the slotted ring and then rotate the collar ring till it locks into place. **MAKE SURE THE PROBE COVER IS IN PLACE AS IT WILL SERVE TO POSITION THE SLOTTED COLLAR BETTER.** Once in place, the screws can be tightened to permanently lock the collar into position Fig 14



Fig 13



Fig 14

6.4 Spare Parts.

O-Ring service kit

Consist of 3 sets of O ring seals, for the sensor tip cover and NPT thread collar plate



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7.0 OPTIONS

7.1 Internal Micro Aspirator Fan

Edgetech Instruments has developed a micro aspirator fan that mounts internally in the sensor tip. The design allows the sample to be flowed to the mirror without effecting the dew point or frost point. This option is ideal where the DX sensor is used in an environment with little to no flow. A clean room, testing chamber or glove box are typical examples where this option would be selected.

If selected, the micro aspirator is activated when the sensor is powered up and remains on as long as the DX Probe is being energized.



Figure 15. Image of the micro aspirating fan.

7.2 40 MICRON Filter

The optional for filtration on the sample gas inlet at the sensor tip allows for the installation of a replaceable 40 Micron filter grid in the internal sample path. The filter element is field replaceable



Figure 16. Image of filters retained in the top orifices of the sensor probe.

7.3 BAROMETRIC PRESSURE SENSOR

An optional Barometric pressure sensor can be added to the DX unit to allow measurement in PPMv units. When used with a DewMaster controller, the Barometric sensor is inside the DX sensor body directly in the sample gas. When used with a DewTrak II controller, the Barometric sensor is mounted in the controller body and measures the Ambient Barometric pressure. The display will read PPMv, Gr/lb and pressure in PSIA or Inches of Mercury.



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8.0 SPECIFICATIONS

Measurement Range:

Dew Point: -40°C to 60°C (-40°F to 140°F)

Temperature: -40°C to 95°C (-40°F to 203°F)

Equivalent %RH: 1% to 95%

Pressure 0 to 15 PSIA (0-30.5"Hg)

Depression Range: 60°C (108°F)

Accuracy:

Dew Point $\pm 0.2^{\circ}\text{C}$ ($\pm 0.36^{\circ}\text{F}$)

Temperature $\pm 0.2^{\circ}\text{C}$ ($\pm 0.36^{\circ}\text{F}$)

Pressure $\pm 0.5\text{gr/lb Dew Point}$ 0.044"Hg Barometric

Operating Ambient:

Sensor -40°C to 95°C (-40°F to 203°F)

Pressure: 50 PSIG maximum
(Higher pressures available on special order)

Flow Rate: Static to 3,000 linear ft/min.

Standard Output Ranges: Dew Point: -40°F to 140°F (-40°C to 60°C)
Temperature: -40°F to 140°F (-40°C to 60°C)
Percent RH: 0 to 100%
Pressure 0- 15 PSIA

Remote Cables:

Single cable 6 ft. standard, 100 ft. maximum

Power Supply: 24VDC $\pm 20\%$, 1A maximum



9.0 WARRANTY STATEMENT

All equipment manufactured by Edgetech Instruments Inc. is warranted against defective components and workmanship for repair at their plant in Massachusetts, free of charge, for a period of twelve months. Malfunction due to improper use is not covered in this warranty and Edgetech Instruments Inc. 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 Instruments Inc. and the directions received for properly identifying items returned under warranty are followed; and (iv) the return notice authorizes Edgetech Instruments Inc. to examine and disassemble returned products to the extent Edgetech Instruments Inc. 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 Instruments Inc. does not assume any other obligation or liability in connection with the sale or use of said products.

Equipment not manufactured by Edgetech Instruments Inc. is supported only to the extent of the original manufacturer's warranties



Appendix (A)

Application	Probe Configuration	Micro Aspirator	NPT Sampling Chamber
HVAC; Entire Probe Immersed in Environment	All 4 side bolts out	usually not required	not required
Glove Box Thru NPT Fitting	side bolts engaged	if air flow is too low	may be required at fp <-20C in closed loop with 3 bolts engaged, and 1 entirely out
Glove Box Entire Probe Suspended	All 4 side bolts out	if air flow is too low	usually not required
Duct Thru NPT Fitting	side bolts engaged	usually not required	usually not required
Bench Top <-20C Fp	3 side bolts engaged	usually not required	may be required with 3 bolts engaged, and 1 entirely out; sample flow at 1.5 to 2 L/min

Appendix (B)

DX Probe System Options		
	DS Probe	DX Probe/DewTrak Probe
Instrument Used	Dewmaster based (RH Cal, PDM-75, DewMaster)	DX Probe/DewTrak Probe
Visible Optics No Temp Compensation	NA	NA
IR Optics 137 board for temp Compensation	A	NA
In board AT Sensor	A	A
In Board Pressure Sensor	A	NA
>100 PSIA Pressure capability	A	NA
Clean Free Mirror	A	A



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Notes