

DUSTTRAK™ AEROSOL MONITOR ENVIRONMENTAL ENCLOSURE MODEL 8535

(FOR DUSTTRAK™ II AND DRX AEROSOL MONITOR
MODELS 8530 AND 8533)

OPERATION AND MAINTENANCE MANUAL

P/N 6002097, REVISION H
SEPTEMBER 2014



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USA
UK
France
Germany

Tel: +1 800 874 2811
Tel: +44 149 4 459200
Tel: +33 4 91 11 87 64
Tel: +49 241 523030

India
China
Singapore

Tel: +91 80 67877200
Tel: +86 10 8219 7688
Tel: +65 6595 6388

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Address

TSI Incorporated / 500 Cardigan Road / Shoreview, MN 55126 / USA

Fax No.

(651) 490-3824

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Seller warrants the goods, excluding software sold hereunder, under normal use and service as described in the operator's manual, shall be free from defects in workmanship and material for twenty-four (24) months, or if less, the length of time specified in the operator's manual, from the date of shipment to the customer. This warranty period is inclusive of any statutory warranty. This limited warranty is subject to the following exclusions and exceptions:

- a. Hot-wire or hot-film sensors used with research anemometers, and certain other components when indicated in specifications, are warranted for 90 days from the date of shipment;
- b. DustTrak internal pump for Models 8530 and 8533 is warranted for two (2) years or 4000 hours, whichever comes first;
- c. DustTrak external pump for Models 8530EP and 8533EP is warranted for two (2) years or 8760 hours, whichever comes first;
- d. DustTrak internal pump for Models 8530 and 8533 is warranted for operation within ambient temperatures between 5–45°C. Warranty is void when the internal pump is operating outside of this temperature range;
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- h. This warranty is **VOID** if the instrument is opened by anyone other than a factory authorized service center with the one exception where requirements set forth in the manual allow an operator to replace consumables or perform recommended cleaning;
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Service Policy

Knowing that inoperative or defective instruments are as detrimental to TSI as they are to our customers, our service policy is designed to give prompt attention to any problems. If any malfunction is discovered, please contact your nearest sales office or representative, or call TSI's Customer Service department at (800) 874-2811 (USA) or (001 651) 490-2811 (International) or visit www.tsi.com.

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Safety Information



WARNING

The DustTrak™ II/DRX aerosol monitor is not rated for intrinsic safety. The DustTrak monitor, with the Environmental Enclosure, must **never** be operated under conditions where there is a risk of fire or explosion.



WARNING

Use of components other than those specified by TSI may impair the safety features provided by the equipment.



WARNING

The instrument has been design to be used with batteries supplied by TSI. Do **not** use a substitute.

The TSI charger (P/N 801809) has been designed to be used with the battery packs supplied by TSI. Do **not** use a substitute charger to charge TSI battery packs.

Old batteries must be properly recycled in accordance with the local environmental regulations.



WARNING

Do **not** use non-rechargeable batteries in this instrument. Fire, explosions, or other hazards may result.



Caution

The enclosure is designed to be water resistant to rain or spray. It is not designed to be waterproof when immersed. Setting it in a pool of water will result in flooding the inner compartment with water. This will severely damage both your DustTrak II/DRX aerosol monitor and battery pack. Do **NOT** set the Environmental Enclosure in **water!**

The enclosure has no IP rating or NEMA rating for dust or water ingress.

Note

Prior to using the Battery Pack for the first time, a full recharge is recommended. **Recharging Battery Pack(s) immediately after use (within one hour maximum) is critical to obtaining optimal recharge time, battery health, and battery life.**

Laser Safety

- The Model 8533/8534 DustTrak DRX monitor is a Class I laser-based instrument
- During normal operation, you will **not** be exposed to laser radiation
- Precaution should be taken to avoid exposure to hazardous radiation in the form of intense, focused, visible light
- Exposure to this light may cause blindness

Take these precautions:

- **DO NOT** remove any parts from the DustTrak DRX monitor unless you are specifically told to do so in this manual
- **DO NOT** remove the housing or covers. There are no serviceable components inside the housing



WARNING

The use of controls, adjustments, or procedures other than those specified in this manual may result in exposure to hazardous optical radiation.



WARNING

There are no user-serviceable parts inside this instrument. The instrument should only be opened by TSI or a TSI approved service technician.







WARNING

If the DustTrak monitor is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

When operated according to the manufacturer’s instruction, this device is a Class I laser product as defined by U.S. Department of Health and Human Services standards under the Radiation Control for Health and Safety Act of 1968. A certification and identification label like the one shown below is affixed to each instrument.

Labels

Advisory labels and identification labels are attached to the instrument.

<p>1. Serial Number Label (bottom)</p>	<p style="text-align: center;">DUSTTRAK™ DRX – Model 8533</p> <p>SN 8533080401 </p> <p>MFD JANUARY 2012</p> <p>CLASS I LASER PRODUCT COMPLIES WITH 21 CFR 1040.10 AND 1040.11</p> <p>TSI Inc. 500 Cordigan Road Shoreview, MN 55128 U.S.A. www.tsi.com</p> <p> </p> <p style="text-align: right;">⎓ 24V – 2.5A Made in USA</p>
<p>2. Laser Radiation Label (internal)</p>	<p style="text-align: center;">DANGER! VISIBLE LASER RADIATION WHEN OPEN. AVOID DIRECT EXPOSURE TO BEAM WARNING: NO USER SERVICABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED PERSONNEL</p>
<p>1. Battery label</p>	<div style="display: flex; align-items: center; justify-content: space-around;"> <div style="border: 1px solid black; padding: 10px; background-color: yellow; text-align: center;"> <p>!!WARNING!! THIS INSTRUMENT WAS DESIGNED TO USE ONLY TSI SUPPLIED BATTERIES, PN 801680</p> </div> <p><i>or</i></p> <div style="border: 1px solid black; padding: 10px; background-color: yellow; text-align: center;"> <p>!!WARNING!! THIS INSTRUMENT WAS DESIGNED TO USE ONLY TSI SUPPLIED BATTERY, PN 801681</p> </div> </div>
<p>4. European symbol for non-disposable item. Item must be recycled.</p>	

Description of Caution/Warning Symbols

Appropriate caution/warning statements are used throughout the manual and on the instrument that require you to take cautionary measures when working with the instrument.

Caution



Caution

Failure to follow the procedures prescribed in this manual might result in irreparable equipment damage. Important information about the operation and maintenance of this instrument is included in this manual.

Warning






WARNING

Warning means that unsafe use of the instrument could result in serious injury to you or cause damage to the instrument. Follow the procedures prescribed.

Caution and Warning Symbols

The following symbols may accompany cautions and warnings to indicate the nature and consequences of hazards:

	Warns that the instrument contains a laser and that important information about its safe operation and maintenance is included in the manual.
	Warns that the instrument is susceptible to electrostatic discharge (ESD) and ESD protection should be followed to avoid damage.
	Indicates the connector is connected to earth ground and cabinet ground.

Reusing and Recycling



As part of TSI Incorporated's effort to have a minimal negative impact on the communities in which its products are manufactured and used:

- ♻️ Do **not** dispose of used batteries in the trash. Follow local environmental requirements for battery recycling.
- ♻️ If instrument becomes obsolete, return to TSI for disassembly and recycling.

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Chapter 1

Parts Identification and Unpacking

Carefully unpack the Model 8535 DustTrak™ Aerosol Monitor Environmental Enclosure from the shipping container. Use the tables and illustrations below to make certain that there are no missing components. Contact TSI immediately if anything is missing or damaged.

Parts Identification: Environmental Enclosure

Identify the parts of the Model 8535 DustTrak Aerosol Monitor Environmental Enclosure (Figure 1 and Figure 2). Please become familiar with these components before proceeding.

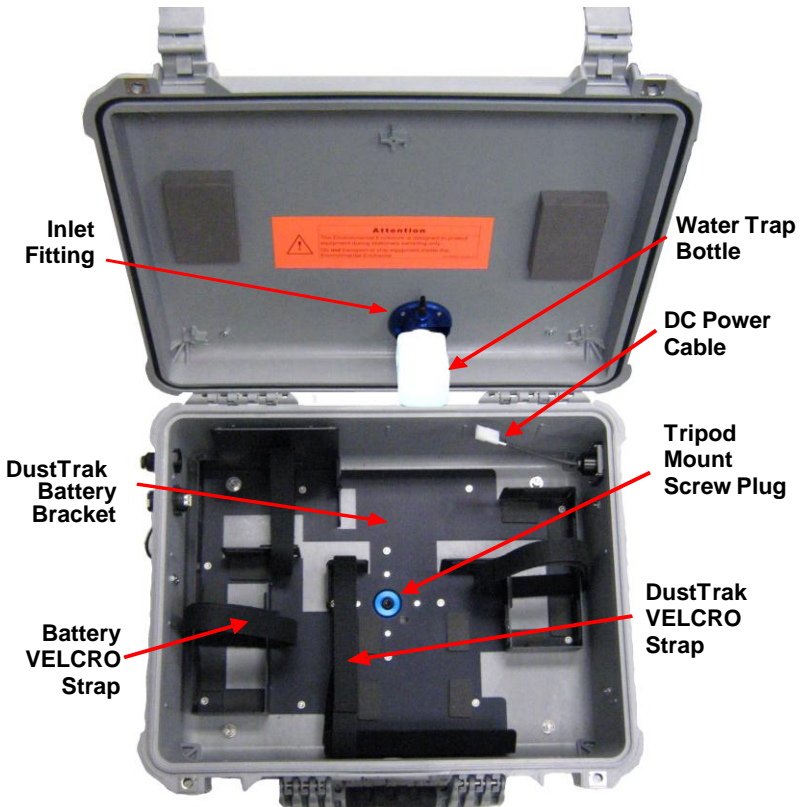


Figure 1: Inside View of Environmental Enclosure

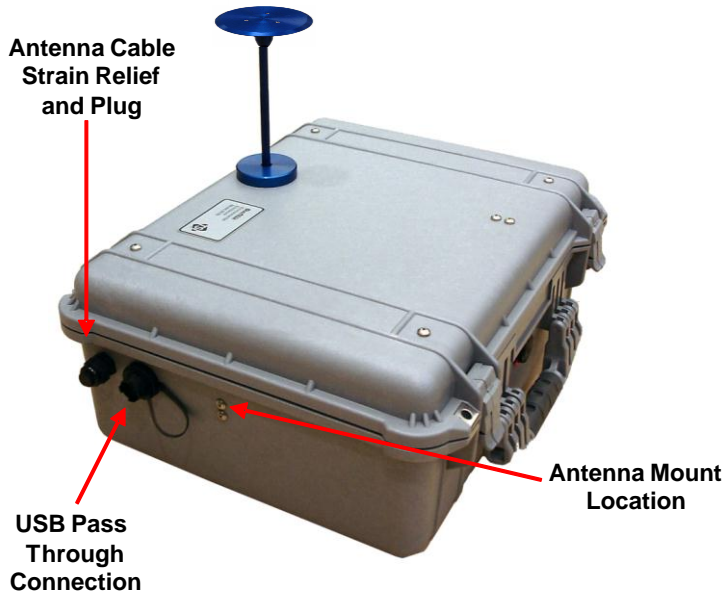









Figure 2: Outside Views of Environmental Enclosure

Unpacking the Model 8535 DustTrak Aerosol Monitor Environmental Enclosure






Compare all the components you received with those listed in the table below. If any parts are missing, contact TSI.

Item	Qty	Part Number	Description
	1	801567	Environmental Enclosure Omni-Direct Inlet with Extended Rain Cap
	1	<i>Refer to 801830 accessory kit.</i>	Sample Inlet Tubing
	1	<i>Refer to 801830 accessory kit.</i>	Inlet Fitting for Sample Tubing
	1	<i>Refer to 801830 accessory kit.</i>	Water Trap Bottle
	4	<i>Refer to 801830 accessory kit.</i>	VELCRO® Straps
	1	<i>Refer to 801830 accessory kit.</i>	Internal DC Power Cable
	1	801843	12 VDC Weatherproof Power Adapter (90 to 130 VAC)

Item	Qty	Part Number	Description
	1	801842	12 VDC Weatherproof Power Adapter (170 to 250 VAC, CE compliant)
	3	6002196 6002197 6002198	Universal AC Plug Adapters
	1	<i>Refer to 801830 accessory kit.</i>	Transport Inlet Plug
	1	<i>Refer to 801830 accessory kit.</i>	Tripod Mount Screw Plug
	1	<i>Refer to 801830 accessory kit.</i>	Tripod Mount Screw Plug Wrench
	1	<i>Refer to 801830 accessory kit.</i>	Antenna Cable Fitting Plug
	1	6002097	Model 8535 DustTrak™ Aerosol Monitor Environmental Enclosure Operation and Maintenance Manual

Model 8535 DustTrak Aerosol Monitor Environmental Enclosure Optional Accessories

Listed below are optional accessory items for the Model 8535 DustTrak Aerosol Monitor Environmental Enclosure. Contact TSI for purchase info.

Item	Part Number	Description
	801808	12 VDC Battery Pack
	801817	Dual Battery Wiring Harness (Optional, requires two TSI P/N 801808. See Chapter 3 for details)
	801809	12 VDC Battery Pack Charger
	801810	Heat Shield Assembly
	801820 801821	922 MHz Radio Modem Kit with antenna mount (for enclosure) 922 MHz Radio Modem Kit (for base station)

Chapter 2

Setting Up

The setup of the Environmental Enclosure is an important part in allowing reliable and accurate sampling of aerosols in a wide range of conditions. TSI cannot ensure accurate measurements if any of the components are set up incorrectly. Failure to follow these procedures could result in damage to the enclosure or its components.

Install the Aerosol or Respirable Aerosol Inlet

The inlet assembly allows ambient aerosols to be sampled efficiently in a wide range of conditions. Proper installation into its sampling position ensures that the DustTrak II/DRX aerosol monitor measures an accurate ambient aerosol mass concentration. Follow these instructions to install either of the aerosol inlets:

1. Remove the Inlet Transport Plug from bubble pack.



Caution

Always hold the inlet assembly by the knurled portion of the tube. **Do not** twist on the inlet assembly cap.

2. Thread the inlet assembly into upper inlet ring found on the top of the Environmental Enclosure (see Figure 3).



Figure 3: Thread the Inlet into the Inlet Ring

Notes

Make sure that a thin film of vacuum grease is coating both O-rings on the inlet tube to ensure a good seal before installing it.

Do **not** use the Respirable Aerosol Inlet in the rain. As it will aspirate rainwater into the cyclone body

If a Heat Shield is used, you need to install the inlet after you install the Heat Shield (see Figure 6).

Install Heat Shield Assembly *(optional accessory)*

The optional Heat Shield Assembly is designed to protect the DustTrak monitor from excessive heating inside the Environmental Enclosure due to direct sunlight.

Note

Be sure to remove the Inlet Transport Plug from the top of the Enclosure prior to attaching the Heat Shield Assembly.

1. Remove the 4 waterproof bolt assemblies from the Heat Shield mount locations (Figure 4). Save these nuts and bolts for future usage when the Heat Shield is not used.



Figure 4: Remove Waterproof Bolt Assemblies from Heat Shield Mount Locations

2. Remove the Inlet Transport Plug from the top of the Enclosure at the Inlet Ring.

3. Attach the Heat Shield Assembly to the top of the Enclosure, ensuring that the sealing washers are in place, and tighten the lock washers to secure it in place (Figure 5).



Figure 5: Attach Heat Shield to the top of the Enclosure

4. Now thread the Inlet Assembly into the Inlet Ring as shown in Figure 6.



Figure 6: Thread the Inlet into the Inlet Ring after Heat Shield is Installed

Install Water Trap Bottle

The translucent bottle that attaches to the bottom of the inner inlet is used to collect any water that is drawn into the sampled flow. This prevents water from reaching the DustTrak II/DRX aerosol monitor and damaging it. The bottle is installed on the Environmental Enclosure when it is shipped. If the bottle is removed for cleaning, follow these precautions when re-installing:

1. Before screwing the bottle into inner inlet ring, be sure that the O-ring found in the bottom of the threaded hole is greased. This ensures an air-tight seal.
2. When threading the bottle into the inlet, be careful not to damage its threads.
3. Make sure the bottle has been securely tightened, and that it is in the correct orientation as shown in Figure 7.



Figure 7: Install the Water Trap Bottle

Install Sample Inlet Tubing

The Sample Inlet Tubing directs the sample aerosol flow from the Sample Inlet to the DustTrak monitor.

1. Make sure that the Inlet Fitting is inserted into the Inner Inlet Ring as shown in Figure 8.
2. Attach the Sample Inlet Tubing to the Inlet Fitting.
3. The other end of the Sample Inlet Tubing connects directly to the DustTrak monitor.



Figure 8: Install the Barbed Inlet Fitting and Sample Inlet Tubing

Install Impactor in the Sample Flow *(optional accessory)*

Optional Impactors are available as accessories to the DustTrak II/DRX aerosol monitor. These Impactors can be placed in the Sample Flow in the Environmental Enclosure system as detailed below.

Note

Refer to the DustTrak II/DRX aerosol monitor manual for Impactor usage and maintenance information.

1. Remove the Inlet Fitting from the water bottle mount.
2. Insert the Impactor in the water bottle mount in its place.
3. Then insert the Inlet Fitting in the other end of the Impactor as shown in Figure 9.

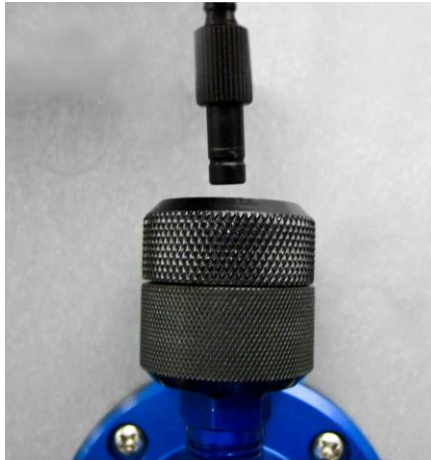


Figure 9: Install Impactor in the Sample Flow

Install GSM/GPS Communication Modem

(optional accessory)

Installation documentation found in the quick start document shipped with each optional accessory (P/N 6007817).

Contains FCC ID: RI7HE910

Contains IC: 5131A-HE910

The GSM/GPS accessory complies with Part 15 of the FCC Rules. Operation is subject to the following conditions. This device may not cause harmful interference and this device must accept any interference received, including interference that may cause undesired operation. The antennas used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons. Use only the supplied antenna.

Install Heated Inlet Sample Conditioning Module

(optional accessory)

Installation documentation found in the quick start document shipped with each optional accessory (P/N 6007667).

Install Wireless Radio Modem *(optional accessory)*

Wireless Radio Modems are available for remote logging and data acquisition. These kits include a Radio Modem, SMA Antenna Cable, Antenna, Configuration Software, and Antenna Mount kits for the Enclosure.



Attention

Read the XStream-PKG-U USB RF User's Guide for the radio modem prior to setup or operation of the radio modem.



WARNING

The TSI model 8535 with optional XStream-PKG-U USB RF wireless radio modem has been tested to be CE compliant only to CLASS A equipment and as such is only intended for use in an industrial environment. Any operation of this equipment in other environments may result in difficulties in ensuring electromagnetic compatibility due to conducted as well as radiated disturbances.



WARNING

The TSI model 8535 with optional XStream-PKG-U USB RF wireless radio modem was tested to comply with part 15 of FCC rules using the antenna provided with the radio modem shipped from TSI Incorporated.

Use only the antenna included with TSI part numbers 801820, 801821, 801825, and 801826 for radio communication.



WARNING

This equipment is approved only for mobile and base station transmitting devices, separation distances of 20 centimeters or more for the antenna provided with the radio modem should be maintained between the antenna of this radio modem and nearby persons during operation. To ensure FCC RF Exposure compliance, operation at distances closer than this is not recommended.

Note

Data logging and data acquisition procedures for the Environmental Sampling Platform using the Wireless Radio Modems are located in the TrakPro™ software User's Guide.

1. Loosen the strain relief on the outer left side of the Enclosure and remove the antenna cable fitting plug as shown in Figure 10.



Figure 10: Remove the Antenna Cable Fitting Plug

2. If installing a DustTrak 8530 EP or 8533 EP monitor with the external pump, place the external pump on its bracket as shown below and secure it with Velcro tape around it.

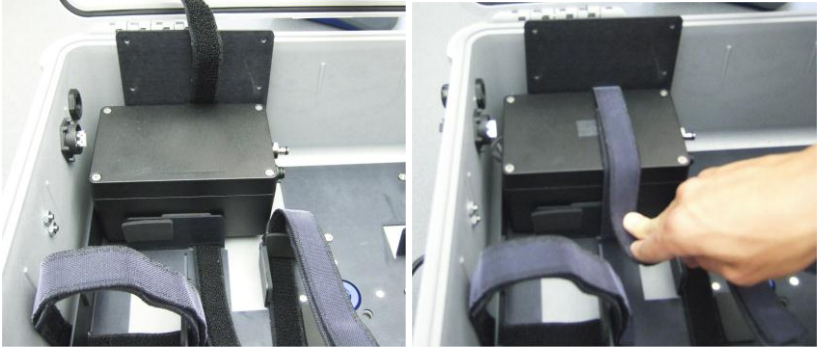


Figure 11: Place the External Pump in its bracket and secure using the Velcro tape

3. Remove the Radio Modem from its packaging and attach the provided SMA antenna cable to the Radio Modem. Pass the unconnected end of the antenna cable through to the outside of the Enclosure. Then attach the Antenna to the unconnected end of the cable as shown in Figure 12.



Figure 12: Attach Antenna and Cable to Radio Modem

4. Orient the Radio Modem as shown in Figure 13 (antenna connector on the left, USB and power connections on the right) and attach to the bracket using the four 4-40 x 1/4" supplied screws.



Figure 13: Attach Radio Modem to Bracket

5. Before attaching the Antenna Mounting Bracket to the side of the Enclosure, make sure that the sealing O-ring is in place, as shown in Figure 14.



Figure 14: Antenna Mounting Bracket O-Ring

6. Remove the two screws used to secure the antenna as shown below.



Figure 15: Remove Two Screws to Secure Antenna

7. Now install the Antenna Mounting Bracket to the outside of the Enclosure as shown in Figure 16.



Figure 16: Attach Antenna Mounting Bracket to Enclosure

- Slide the Antenna up through the bracket and secure in place with the setscrews at the top of the bracket, as shown in Figure 17. Now tighten the strain relief on the antenna cable to provide a waterproof seal.

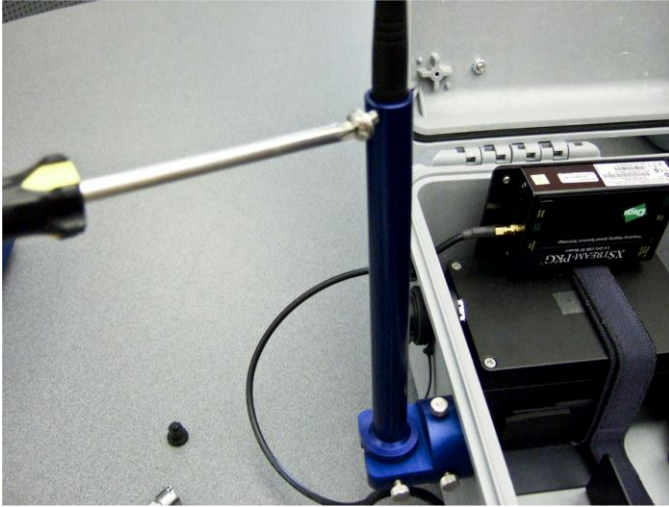


Figure 17: Secure Antenna to Bracket

- To adjust the position of the antenna mount, use the thumbscrews on the base of the bracket, as shown in Figure 18.

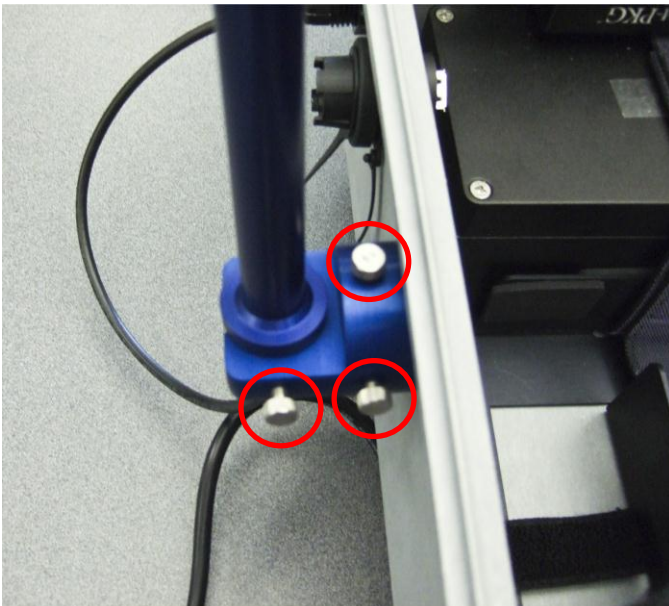


Figure 18: Adjustable Antenna Mount

10. Supply power to the Radio Modem through the DC power jack on the right end of the Radio Modem, as shown in Figure 19.

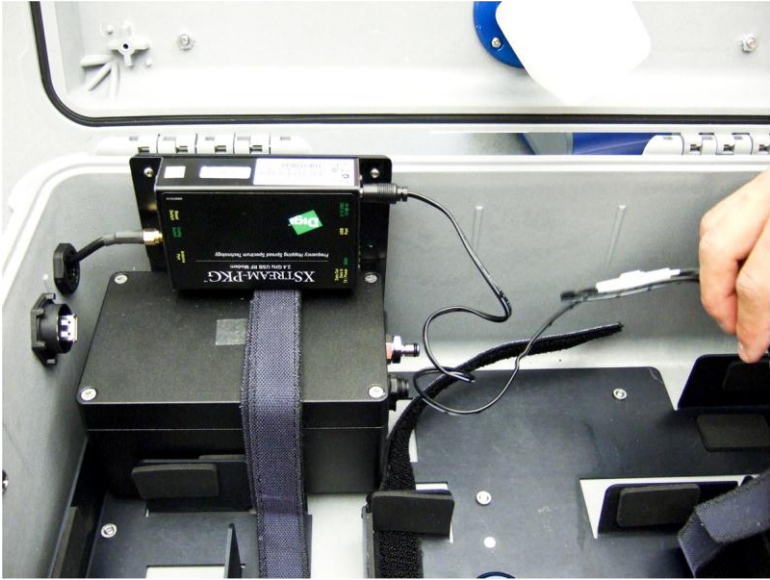


Figure 19: Power Connection to Radio Modem

11. When using a Radio Modem inside the Enclosure, always supply power to it through this power connection using the provided internal DC power cable.

Install Battery Pack System *(optional accessory)*

An optional 12 VDC Battery Pack provides power to the DustTrak monitor (and optional Radio Modem).



WARNING

Use only TSI supplied Battery Packs, P/N 801808.

1. VELCRO® straps are provided to secure the Battery Pack System to the Enclosure. Make sure the VELCRO® straps are present in the Enclosure bracket as shown in Figure 20.

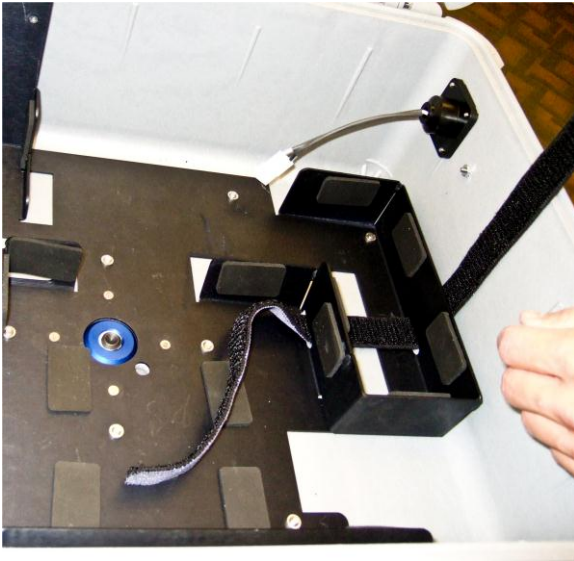


Figure 20: Battery Pack VELCRO® Straps

2. Lift the Battery Pack using the lifting strap and place in the Enclosure bracket as shown in Figure 21, keeping the battery output connector facing away from you.

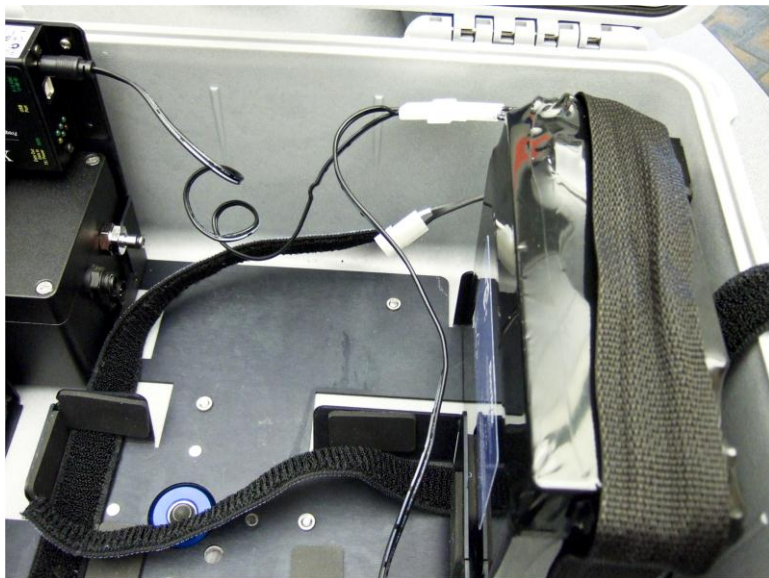


Figure 21: Install the Battery Pack System

3. Tightly secure the Battery Pack System in place using the VELCRO[®] straps.

4. If installing an additional Battery Pack for increased run-time, follow the same process as illustrated in steps 1 through 3 above. Simply add a second Battery Pack inside the enclosure using the same process. Once installed, use the Dual Battery Wiring Harness to connect the two Battery Packs together as shown below in Figure 22.



Figure 22: Install the Dual Battery Pack System

Install External Weatherproof AC Adapter *(if desired)*

Use the external weatherproof AC/DC adapter when dedicated AC power is available for powering the instrument.

Note

Two 12 VDC output weatherproof AC/DC adapters are provided with the 8535 Environmental Enclosure System—one rated for 90 to 130 VAC input and one rated for 170 to 250 VAC input. Make sure you use the adapter rated for your input AC voltage.

1. Remove the external AC adapter mounting screws from the right side of the Enclosure as shown in Figure 23.

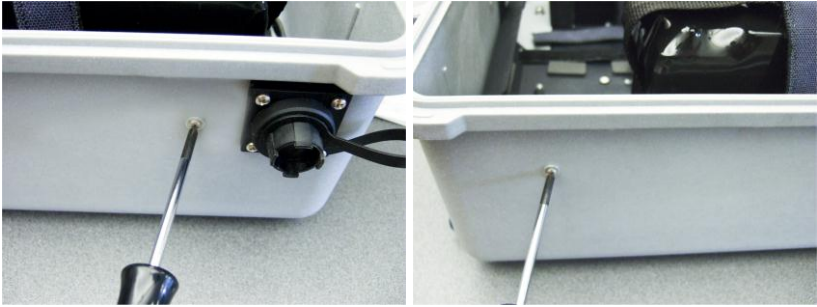


Figure 23: Remove the Adapter Mounting Screws

2. Attach the AC adapter to the Enclosure as shown in Figure 24, using the existing mounting screws and sealing washers.



Figure 24: Attach the Adapter to the Enclosure

3. Connect the DC power output cable from the adapter to the Enclosure DC input connector as shown in Figure 25.



Figure 25: Connect Adapter DC Cable to Enclosure

Install DustTrak Monitor in the Environmental Enclosure

The internal bracket of the Environmental Enclosure is designed to hold the DustTrak monitor securely in place, using the provided VELCRO® straps.

1. VELCRO® straps are provided to secure the DustTrak to the Enclosure. Make sure the VELCRO® straps are present in the Enclosure bracket as shown in Figure 26.

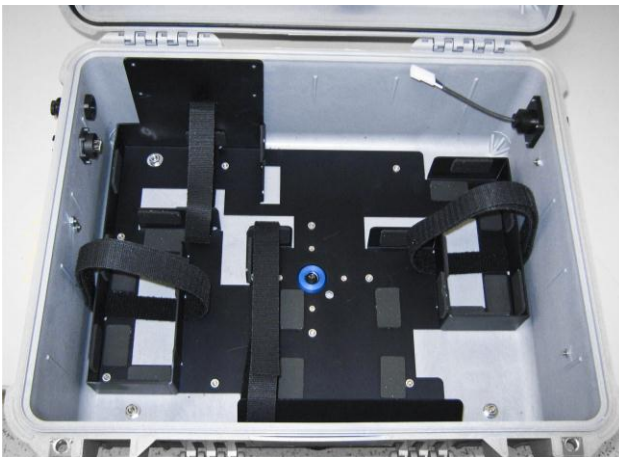


Figure 26: DustTrak Aerosol Monitor VELCRO® Straps

2. Install the DustTrak monitor into the bracket as shown in Figure 27 and tightly secure in place with the VELCRO® straps.



Figure 27: Install DustTrak Monitor in the Bracket

Connecting Internal USB Cables

Two USB A/B cable connections to the DustTrak monitor are required, depending on your intended usage. The first is a connection from the DustTrak monitor to the optional Radio Modem; the second is a connection from the DustTrak monitor to the external USB pass-through connector.

1. If using Model 8530 EP or 8533 EP with external pump, make sure you install the exhaust adapter on the exhaust of the DustTrak monitor as shown below.



Figure 28: Install Exhaust Adapter

2. Connect the DustTrak External Pump Power Cable (Part #801797) to the DustTrak monitor and the pump as shown below in Figure 29 and Figure 30.



Figure 29: Connect Monitor Power Cable to DustTrak Monitor



Figure 30: Connect Monitor Power Cable to Pump

- Likewise, connect the External Pump Flow Tube (Part# 801798) between the DustTrak monitor and the External Pump Module (Part #801675) as shown below in Figure 31.



Figure 31: Connect External Pump Flow Tube

- If a Radio Modem is to be used, connect the square (B-type) end of the USB cable to the Radio Modem, and the flat (A-type) end to the DustTrak monitor as shown in Figure 32 and Figure 33. This provides a communication link between the DustTrak monitor and the Radio Modem.



Figure 32: Connect Square (B-type) USB Cable to Radio Modem

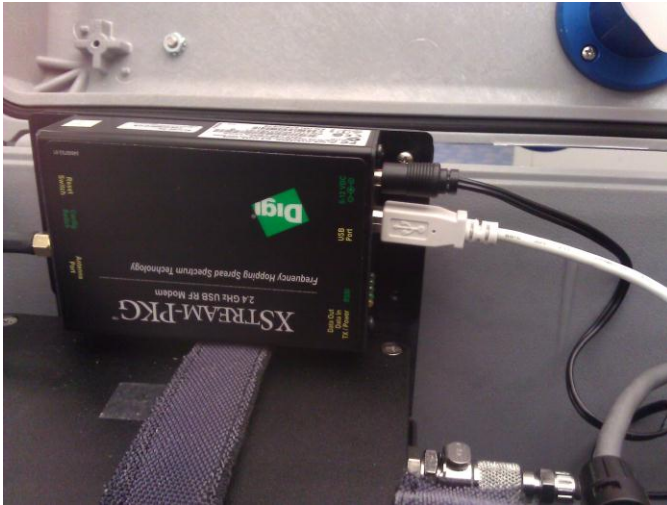


Figure 33: Connect Flat (A-type) USB Cable to DustTrak Monitor

5. Connect the flat (A-type) end of the USB cable to the USB pass-through connector on the inside left of the Enclosure and connect the square (B-type) end to the DustTrak monitor as shown in Figure 34. With this connection in place, a computer can be connected to the DustTrak monitor by plugging into the external USB connector interface on the outside of the Enclosure.



Figure 34: Connect USB Cable for Pass-through

Connecting Sample Tubing

A length of tubing is provided to transport the aerosol from the external inlet to the DustTrak II/DRX aerosol monitor inlet. Before attempting to sample, make sure that this tubing is securely fastened to the barbs from both of the inlets. When closing the enclosure, make sure that this tube **does not** get kinked, as shown in Figure 35.



Figure 35: Connect Sample Tubing

Supplying Power to the DustTrak II/DRX Aerosol Monitor (and optional Radio Modem)

The DustTrak II/DRX Aerosol Monitor and optional Radio Modem may be powered in one of three ways when used with the Model 8535 Environmental Enclosure:

1. Use external weatherproof AC adapter, when AC power is desired.
2. Use the optional Battery Pack(s) (Single or Dual).
3. Use the optional Solar Cell Power System.

4. The internal DC power split cable is used to connect power from any of the above-mentioned sources to the DustTrak monitor and Radio Modem. Simply connect the 3-pin connector end of the cable to either the Battery Pack output or to the Enclosure DC connector. The other end of the cable has two DC power plugs—one which only fits the DustTrak power jack, and another which only fits the Radio Modem (see Figure 36).



Figure 36: Internal DC Power Connections

Using the External Weatherproof AC Adapter

Make sure that the external weatherproof AC adapter is securely mounted to the outside of the Enclosure and that its DC output cable is connected to the DC input connector on the outside of the Enclosure (as described earlier in this manual). After the adapter is plugged into an AC voltage source, DC voltage is then available on the inside of the case at the 3-pin connector interface, and the internal DC power split cable is used to route that power to the DustTrak (and optional Radio Modem).

Notes

Two 12 VDC output weatherproof AC/DC adapters are provided with the 8535 Environmental Enclosure System—one rated for 90 to 130 VAC input and one rated for 170 to 250 VAC input. Be sure to use the adapter rated for your input AC voltage.

Universal input AC plug adapters are included with the 8535 Environmental Enclosure for changing to a different AC plug style.

Using the Internal Battery Pack *(optional accessory)*

The battery packs supplied with the Environmental Enclosure allow for extended use of the DustTrak monitor. The battery pack enables the DustTrak monitor and optional Radio Modem to operate for at least 34 hours (even in cold conditions). If an External Pump is used with the DustTrak monitor and Radio Modem, then operation will last at least 23 hours. If longer operation time is desired, the Dual Battery Wiring Harness is available to increase operation time by roughly twice the numbers quoted above for a single battery pack. To ensure a minimal battery recharge time and a prolonged lifetime, rotate and properly charge the battery packs immediately after each use (see [Maintenance](#) section for further information). Make sure that fully-charged internal batteries are installed correctly within the DustTrak monitor to make it possible to continue sampling when swapping-out one external Battery Pack with a charged Battery Pack.

Connect the one end of the DC power split cable to the battery pack output, and the other end to the DustTrak monitor (and optional Radio Modem). If using the optional Dual Battery Wiring Harness, simply connect each battery pack output to either male plug connector available, then connect the female connector to one end of the DC power split cable. Now, connect the other end of the DC power split cable to the DustTrak monitor (and optional Radio Modem).

Note

Prior to using the Battery Pack for the first time, a full recharge is recommended. **Recharging Battery Pack(s) immediately after use (within one hour maximum) is critical to obtaining optimal recharge time, battery health, and battery life.**

Note

Use of components other than those specified by TSI may impair the safety features provided by the equipment.

Using the Solar Cell Power System *(optional accessory)*

The DC power output of the Solar Cell Power System connects to the DC input connector on the right side of the Enclosure. Internal power connections are made on the inside of the Enclosure at the 3-pin connector interface, and the internal DC power split cable is used to route that power to the DustTrak monitor (and optional Radio Modem). See "[Setting-up Solar Cell Power System](#)" section of this document for additional details on the Solar Cell Power System setup.

Note

Prior to using the Solar Cell Power System for the first time, a full recharge of the Solar Battery is recommended.

Mounting the Environmental Enclosure to a Surveyor Tripod

The Environmental Enclosure may be mounted to a standard surveyor tripod equipped with a $\frac{5}{8}$ "-11 threaded stud. Mounting the Enclosure on a tripod is useful when doing outdoor site monitoring. Figure 37 shows the Environmental Enclosure mounted on a surveyor tripod. Use the supplied tripod screw plug wrench to remove the plug, and then attach the Enclosure to the tripod.



Figure 37: Enclosure Mounted on a Tripod



Caution

Do not place the Environmental Enclosure in direct contact with the ground. The bottom of the Environmental Enclosure contains an exhaust port that may allow water to enter the enclosure, resulting in damage to the DustTrak II and DRX aerosol monitors.

Transporting the Environmental Enclosure

When transporting the Environmental Enclosure it is important to store its components correctly. To ensure that no damage is done to the enclosure or its components during transportation, the following steps should be taken:



Attention

The Environmental Enclosure is designed to protect equipment during stationary sampling only.

Do not transport or ship equipment inside the Environmental Enclosure.

1. Unscrew the aerosol inlet from the top of the case.
2. Insert the Inlet Transport Plug into the opening in the inlet ring in the top of the box.
3. Empty any water from the water trap.
4. Remove temperature/relative humidity probe for heated inlet accessory if attached.
5. Remove GSM/GPS Communication Modem antenna if attached.
6. Remove DustTrak II/DRX aerosol monitor and battery pack.
7. If mounted on a tripod, take the enclosure off the tripod and screw in the tripod mount plug.

Setting-up the Solar Cell Power System

(optional accessory)

The full Solar Cell Power System is shown in Figure 38. The following section details the setup of this system.

Important

Make all Solar Cell Power System electrical connections in the order outlined below. Damage to the system can occur if connections are not made in this order.



Figure 38: Solar Cell Power System

1. Remove the Solar Battery from its packaging and place it in the Solar Battery Enclosure box. Make sure that the battery positive (+) terminal is on the left (the positive terminal is noted on the battery with a RED marking). Remove the battery terminals using an adjustable wrench and connect the ring terminal ended wires from the solar charge controller to the battery terminals (see Figure 39).

Note

There are two wires coming from the charge controller: one is **BLACK** and is labeled **(+)**; the other is **WHITE** and is labeled **(-)**.

The **BLACK (+)** wire should be connected to the battery positive **(+)** terminal, which has a red marking on the top of the battery.

The **WHITE (-)** wire should be connected to the battery negative **(-)** terminal.



Figure 39: Install the Solar Battery and Connect to Controller

2. The next step is to attach the provided power cables with waterproof connectors to each Solar Cell.

Remove the Solar Cell from its packaging and access the junction box on the end of the panel. Remove the screws and sealing strip from inside the box and set aside. Remove the center of one of the access holes which is labeled $\frac{1}{2}$ ". Pass the power cable through that access hole while attaching the individual pieces of the cable strain relief, as shown in Figure 40.

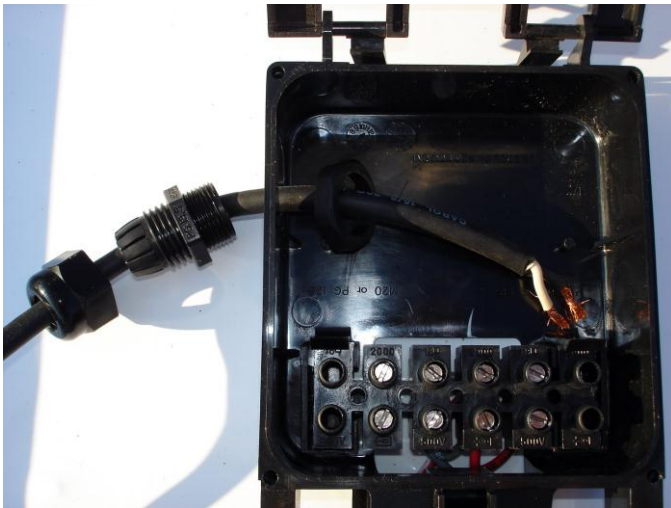


Figure 40: Strain Relief and Power Cable through Access Hole

- Next, attach the power cable to the Solar Cell screw terminals as shown in Figure 41 or Figure 42.

Note

Make sure the wires are connected as shown below. Connecting the wires incorrectly can cause severe damage to the Solar Power System. Refer to the Solar Cell manufacturer's specification sheet for additional details.

BLACK power cable wire connected to **RED** Solar Term. This is the **POSITIVE (+)** connection.

WHITE power cable wire connected to **GREY** Solar Term. This is the **NEGATIVE (-)** connection.

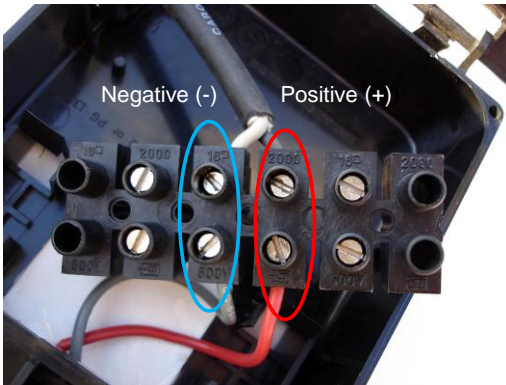


Figure 41: Power Cable Connection to Solar Cell Terminals (Supplier part number 485J and 490J. See solar panel instructions for details.)

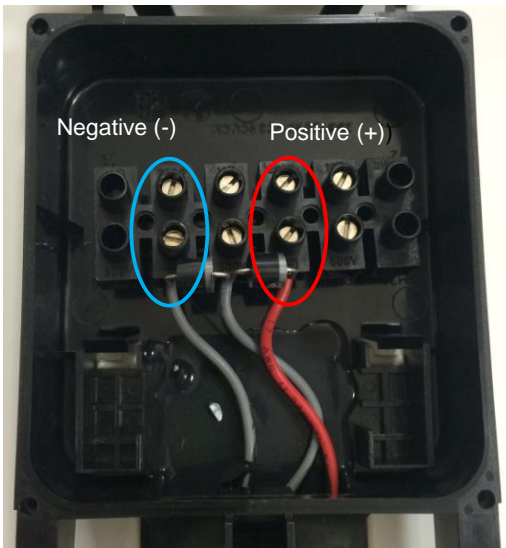


Figure 42: Power Cable Connection to Solar Cell Terminals. (Supplier part number 90J. See solar panel instructions for details).

4. With the wires tightened, secure the terminal block in its retaining clips, and tighten the strain relief connections to the power cable as shown in Figure 43.

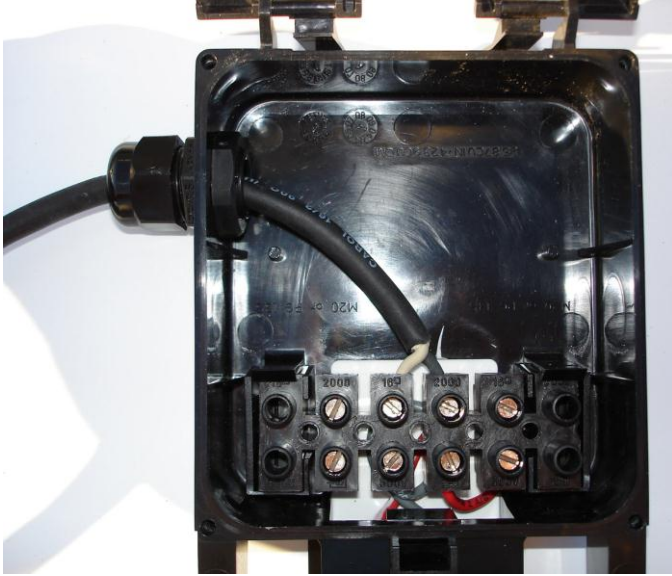


Figure 43: Secure Terminal Block and Tighten Strain Relief

5. Next, attach the sealing strip to the inside of the junction box cover, as shown in Figure 44.



Figure 44: Apply Sealing Strip to Junction Box Cover

6. Then attach the cover to the junction box using the supplied screws, as shown in Figure 45.

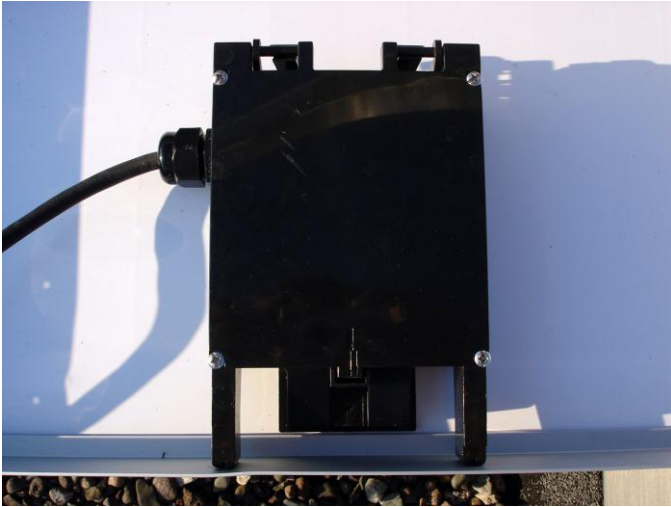


Figure 45: Attach Junction Box Cover

7. Now attach the two Solar Cells to the adjustable angle Mounting Frame using the supplied bolts, as shown in Figure 46.



Figure 46: Assemble the Solar Cells on the Mounting Frame

8. The support bar may also be attached to each side of the Mounting Frame, as shown in Figure 47.

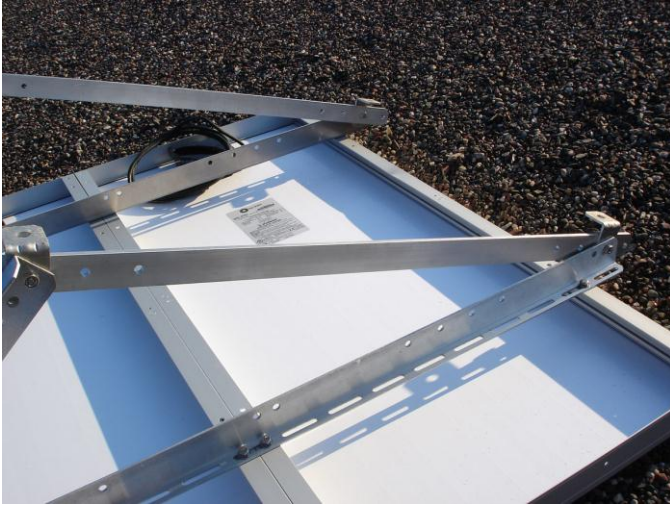


Figure 47: Assemble the Support Bar to the Mounting Frame

For best results, mount the Solar Cells at an angle directly pointed at the path of the sun, allowing the maximum power to be collected by the Solar Cells.

To secure the Mounting Frame to the ground, use the bolt locations at the end of each frame arm, or add sandbags or other weights to the support bar.

9. Connect the Solar Cell cables to the Solar Battery Enclosure box as shown in Figure 48. The Green LED on the Solar Charge Controller will illuminate when sunlight power is available, and the Solar Battery is charging.

Note

Do **not** connect the Solar Cells **directly** to the 8535 Environmental Enclosure as this may result in damage to the DustTrak Aerosol Monitor. The Solar Cells **must** be connected to the Solar Battery Enclosure Box so they can be regulated by the Solar Charge Controller.

Prior to using the Solar Cell Power System for the first time, a full recharge of the Solar Battery is recommended. Simply allow the Solar Battery to charge for a day with sunlight power from the connected Solar Cells.



Figure 48: Connect Solar Cells to Battery Enclosure Box

10. Now connect the Solar Battery Enclosure to the 8535 Environmental Enclosure using the provided outdoor DC power cable with weatherproof connectors, as shown in Figure 49. DC power is now available at the Environmental Enclosure, and the internal DC power split cable is used to power the DustTrak monitor and the optional Radio Modem.

Note

The Solar Charge Controller has built-in low voltage cutout protection for the Solar Battery. If extended non-sunlight conditions occur, causing the Solar Battery to become deeply discharged, the Solar Charge Controller temporarily cuts off output power. The Red LED on the Solar Charge Controller will illuminate when this condition occurs. Once sunlight returns, and the Solar Battery has been recharged to an appropriate level, the Red LED will turn off and the Solar Charge Controller will re-enable the power output.

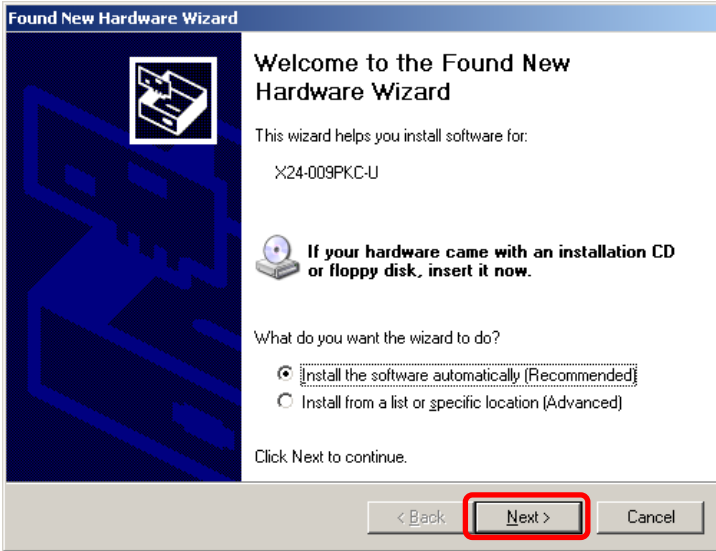


Figure 49: Connect Power from the Solar Cell Power System to the Environmental Enclosure

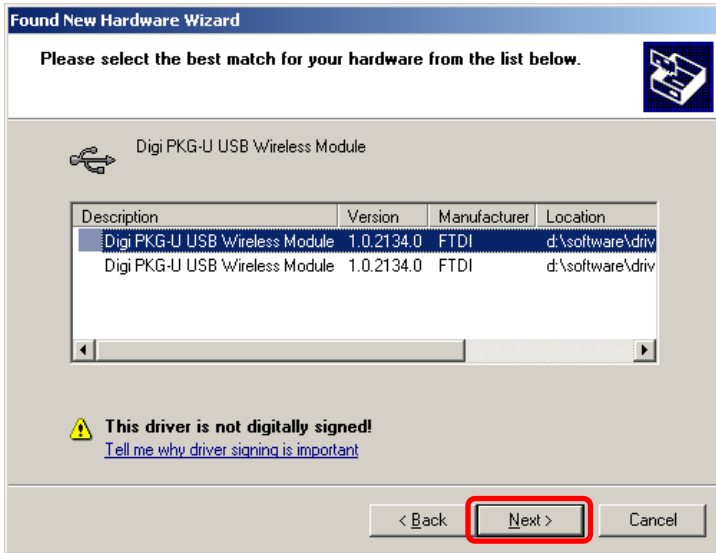
Setup Radio Modems *(optional accessory)*

Wireless Radio Modems are available for remote logging and data acquisition. One Radio Modem is connected to the DustTrak monitor in the Environmental Enclosure (Instrument Radio Modem), and the other is connected to the user's computer (Base Station Radio Modem). Follow these software installation steps for each radio modem.

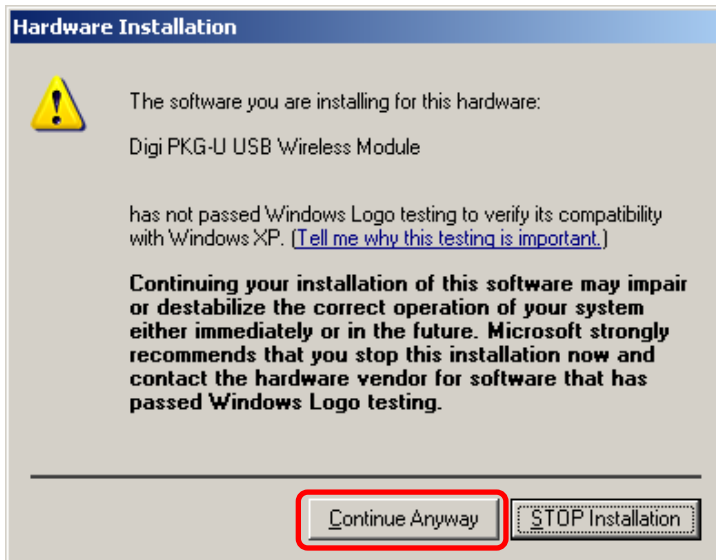
1. Insert the Radio Modem CD into your CD-ROM. Connect the Radio Modem to your PC through a USB cable.



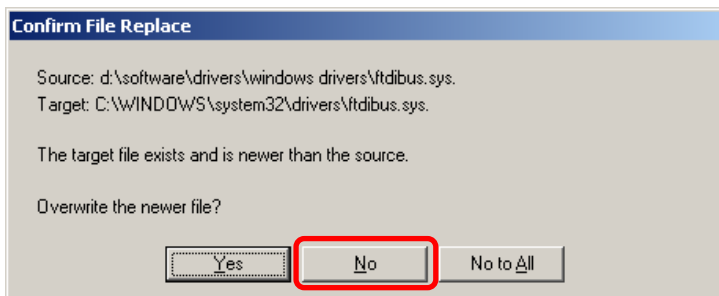
2. Click **Next** on the popup screen.



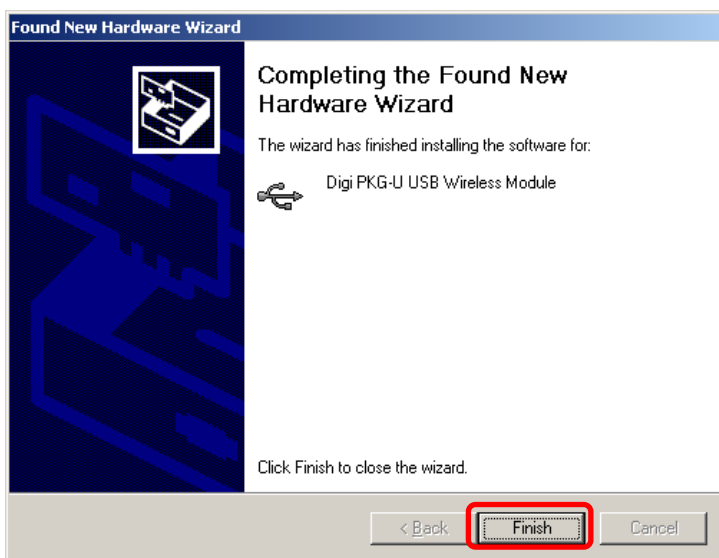
3. Select the first device and click **Next** when prompted. When Windows prompts for driver installation, click **Continue Anyway**.



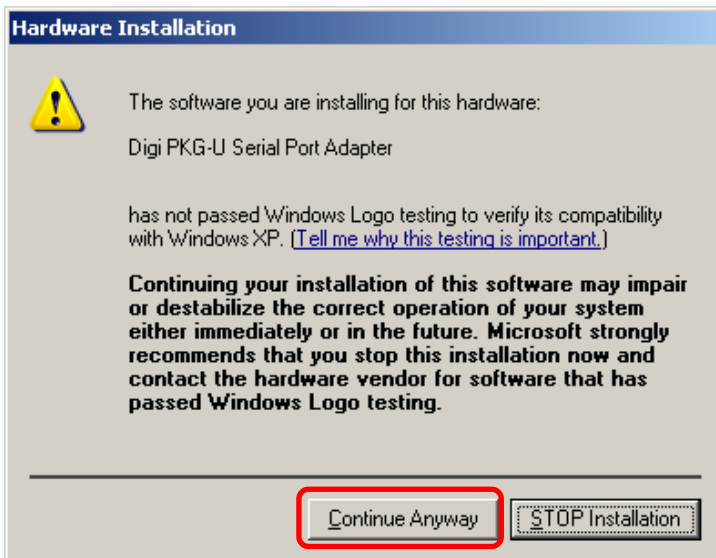
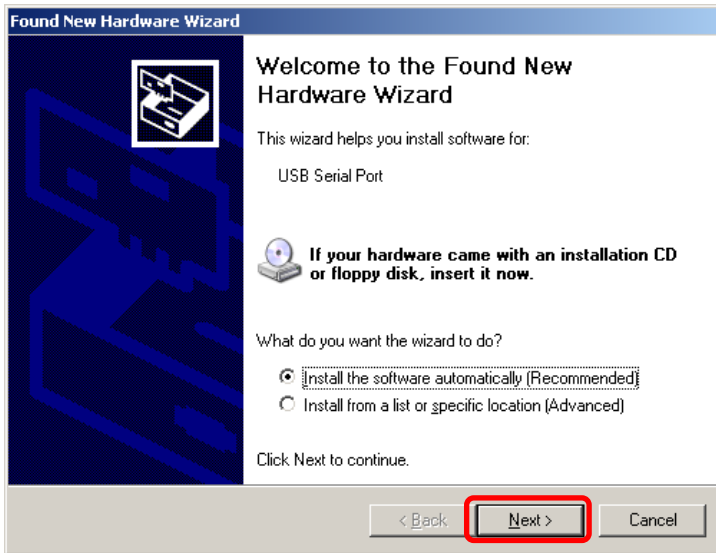
- Click **No** if prompted to overwrite any newer FTDI files.



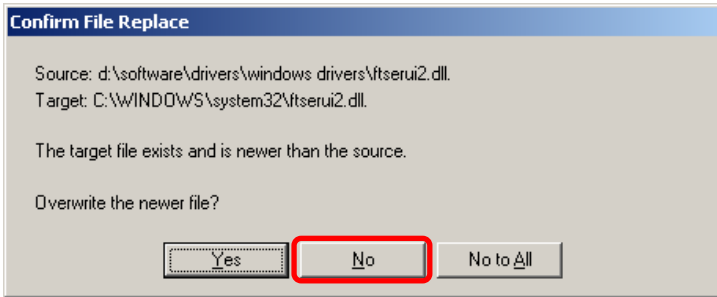
- Click **Finish** when you finish installation.



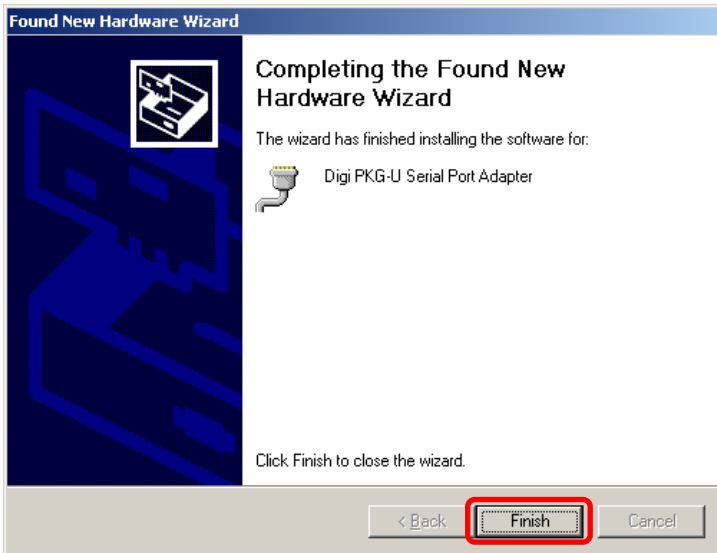
6. After the first round of installation, a new Hardware Wizard screen will popup. Follow these steps to install the COM port driver.



7. Click **Next** and **Continue Anyway** to continue.



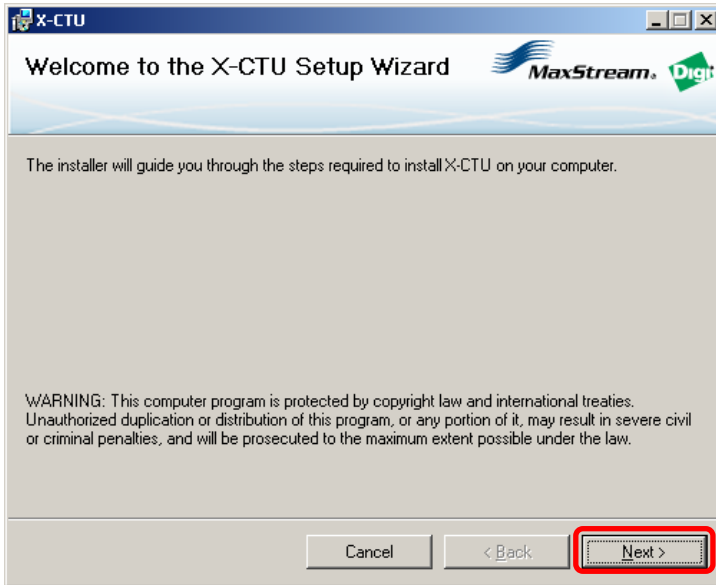
8. Click **No** if prompted to overwrite any newer FTDI files.



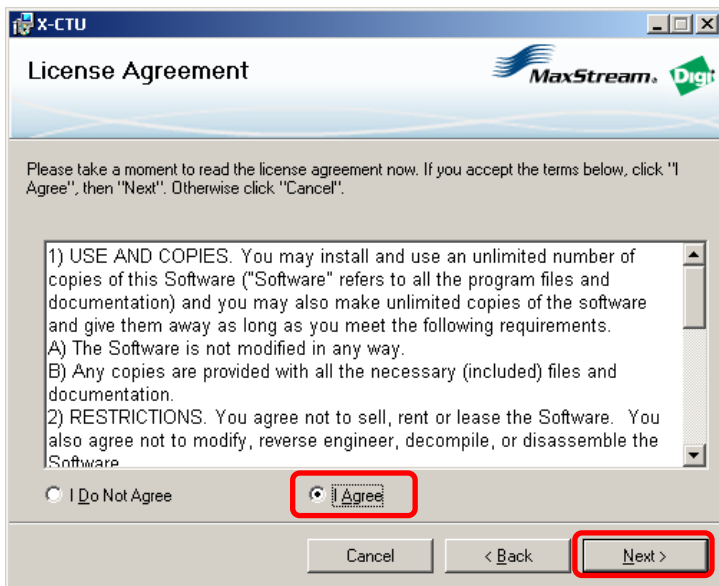
9. Click **Finish** after the serial port adapter has installed.

Setup Radio Modem Configuration Software

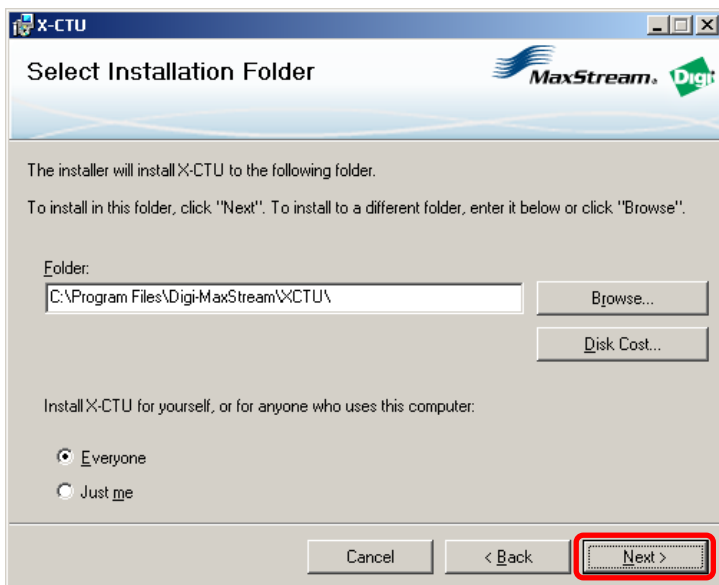
1. Insert the Radio Modem CD into your CD-ROM, the Digi X-CTU software startup screen will come up automatically, click **Install X-CTU software** button on the startup screen.



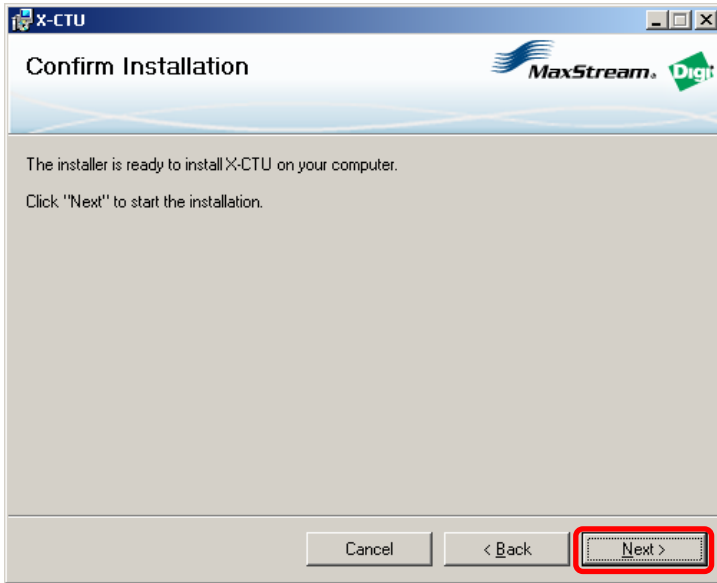
2. Click **Next** on the popup screen.



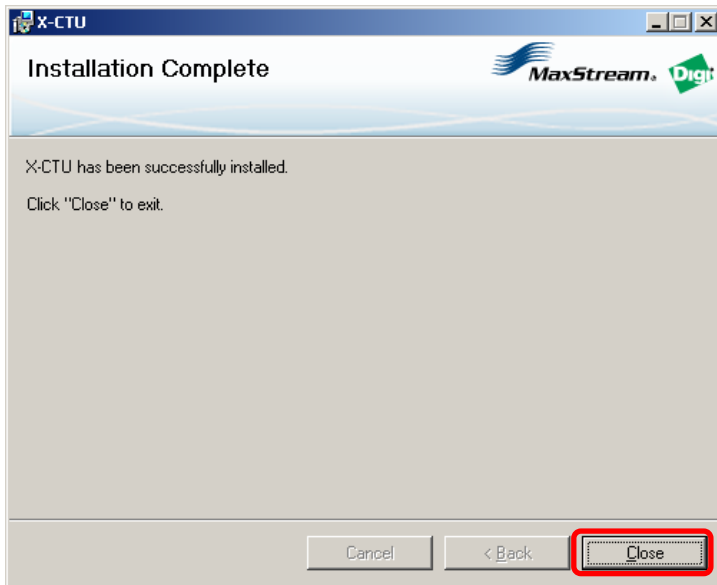
3. Select **I Agree** and click **Next**.



4. To install in default folder, click **Next**. To install in a different folder, enter folder path or click **Browse**, click **Next**.



5. Confirm installation and click **Next** to start the installation.



6. Click **Close** when installation is finished.

Configure Radio Modem Settings

The following Radio Modem settings must be updated from the factory defaults (or verified to match the settings outlined below) to ensure that TrakPro software and/or the DustTrak II/DRX monitor communicate properly to the Radio Modems, and to improve the robustness of communication over the Radio Modem wireless link.

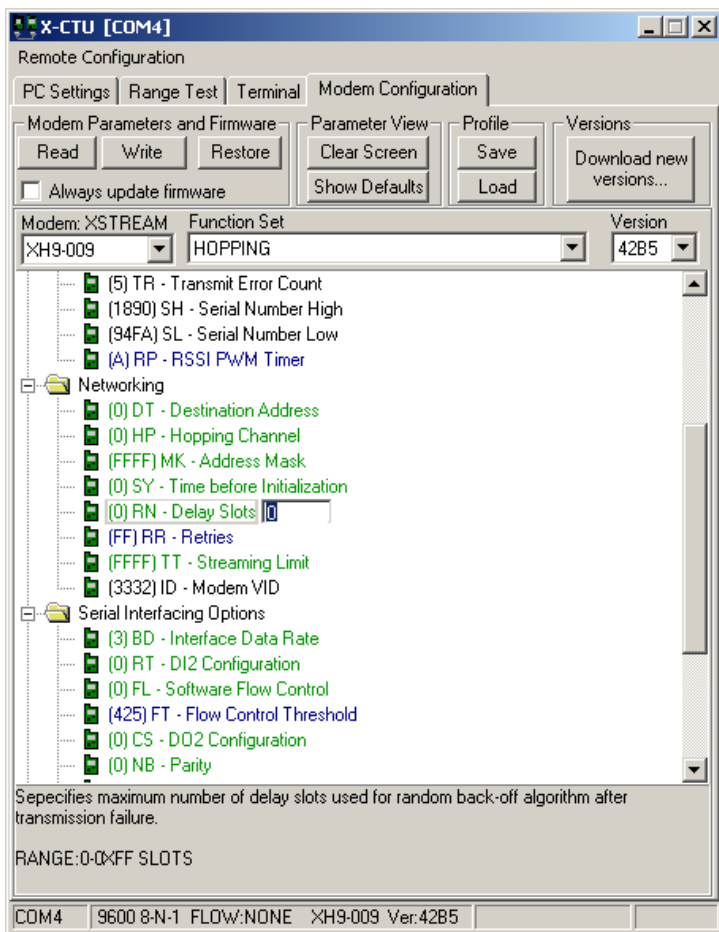
These settings *must* be identical in all Radio Modems in the wireless link—so make sure to update both the remote and base station Radio Modems with these settings prior to connecting to a DustTrak II/DRX monitor or TrakPro software.

1. Connect the Radio Modem to the USB port of a PC.
2. Run the X-CTU software and select the COM port for the Radio that is connected.
3. Click **Modem Configuration** tab.
4. Click **Read** to display the current settings stored in the Modem.
5. Update each of the following Radio Modem settings by clicking on the setting and making an entry in the box provided, or selecting the proper setting from the drop-down list.

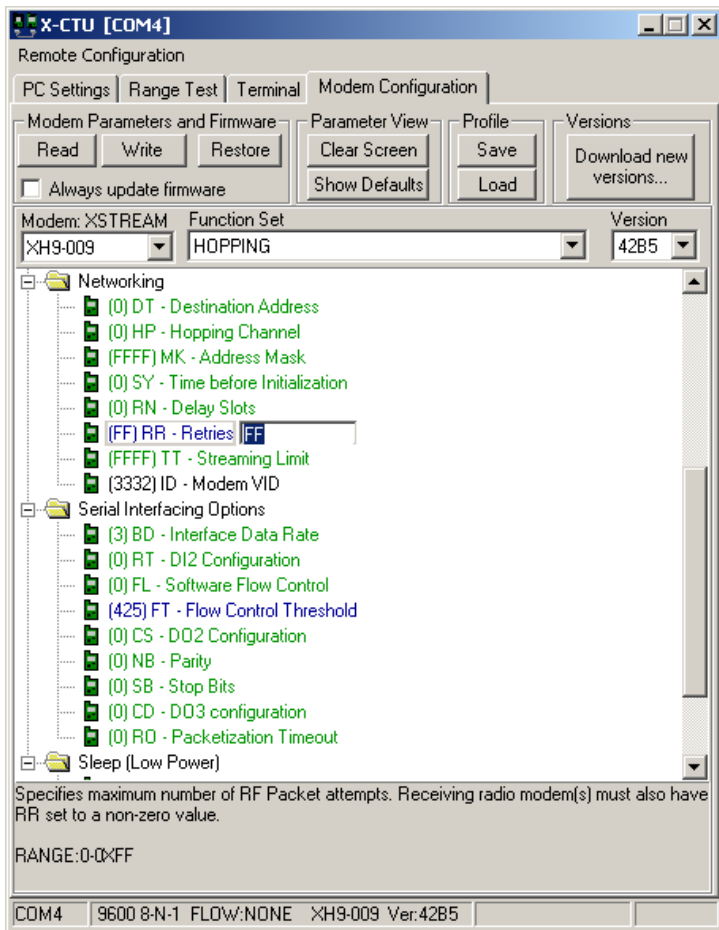
Note

Changing settings other than those listed below may result in loss of communication. Leave all other Radio Modem settings at their default values during the configuration process.

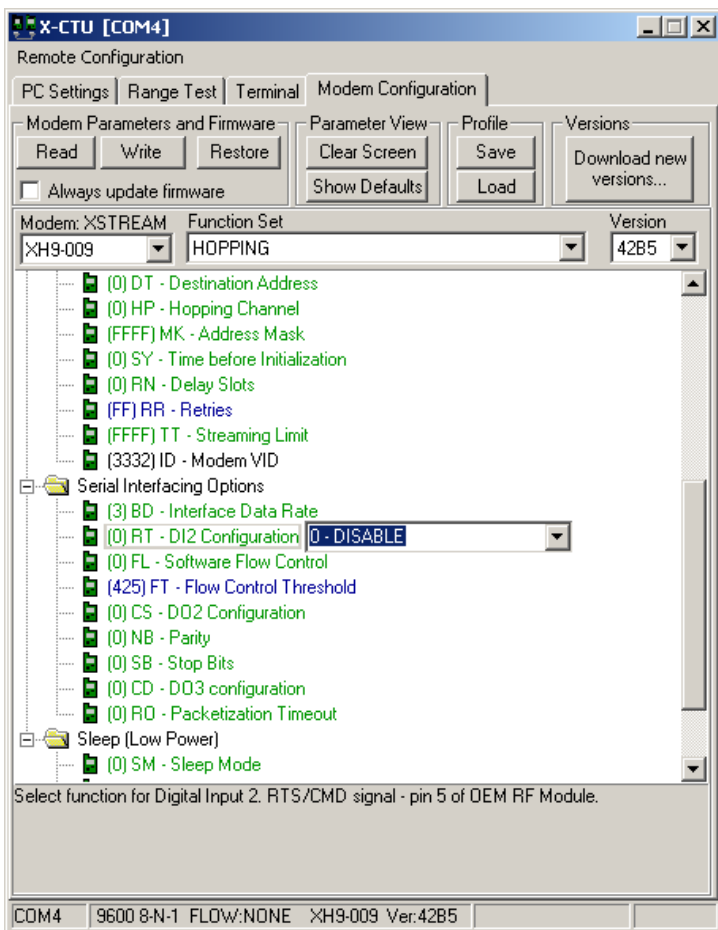
RN-Delay Slots: Set this to “0”.



FF-Retries: Set this to “FF”.



RT-DI2 Configuration: Set this to “0 – DISABLE”.



- Once all settings have been updated, click **Write** so the new settings are saved to the Radio Modem.

Configure Radio Modem Address *(if necessary)*

In order for Radio Modems to communicate to each other, they must have matching Destination Addresses. For a simple point-to-point configuration, where there is one Radio Modem at the base station and one at the instrument site, the default Destination Address value in the Modem allows communication automatically. The Radio Modems have a default address of 0 from the factory. Verify that the addresses match prior to deployment and usage.

In a point-to-multipoint setup, where multiple remote Radios are to be accessed by a single base station Radio, each remote must have a unique Destination Address setting. To communicate to one of the remotes, the base station Radio address is changed to match the remote Radio address of interest. This switching can easily be done using TrakPro, as described in the TrakPro software User's Guide.

The Destination Address value can be set as a hexadecimal (base-16) value between 0000 and FFFF. Set the modem address using the Digi X-CTU software on your PC.

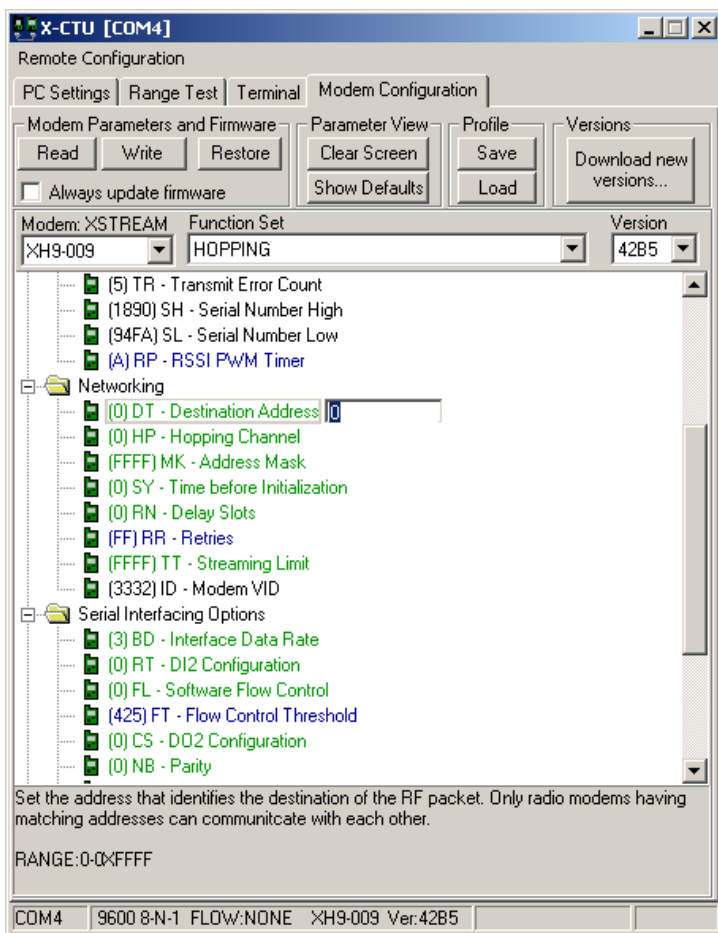
1. Connect the Radio Modem to the USB port of a PC.
2. Run the X-CTU software and select the COM port for the Radio that is connected.
3. Click **Modem Configuration** tab.
4. Click **Read** to read current status of modem.
5. Select the **Destination Address** entry box, and enter the desired address for that Radio Modem.
6. Click **Write** so the new settings are saved in the Radio Modem.

Note

Leave all other Radio Modem settings at their default values during the configuration process. Changing the default settings may result in loss of communication.

Any time Radio Modem settings are written, make sure that the RT-DI2 Configuration is set to "0". Any other setting will result in a loss of communication to a Modem connected to a DustTrak II/DRX monitor or TrakPro software.

When attempting to communicate to a particular instrument using TrakPro software, simply enter the desired Destination Address in the TrakPro Radio Address entry box, and click **Set Radio Address**. This step will change the Destination Address in the base station Radio Modem, and allow it to communicate to the Instrument Radio Modem which has the same Destination Address. These TrakPro screens are described in more detail in the TrakPro software User's Guide.



Setting-up TrakPro™ Data Analysis Software

Information on setting-up and using TrakPro software can be found in the DustTrak II or DustTrak DRX Aerosol Monitor or the TrakPro software User's Guide.

Chapter 3

Operation

Overview

The DustTrak™ Environmental Enclosure can be used in conjunction with the DustTrak II and DustTrak DRX aerosol monitor for many different applications. Its primary use is in outdoor applications to give the DustTrak monitor protection from the elements and the ability to sample efficiently in different wind speeds. The enclosure and extended-life battery may also be advantageous in indoor industrial applications, to provide additional security and protection to the DustTrak monitor.

How to Properly Orient the Environmental Enclosure

Set up the Environmental Enclosure in a location where it can sample the particles of interest. It should be placed “out in the open,” away from obstructions which may affect wind currents. For example, do not place it at the corner of a building, which would cause swirling wind currents and result in poor particle sampling.

Use the Environmental Enclosure in wind conditions with speeds of 22 mph or less to obtain the most accurate readings. An increase in wind speed over 22 mph can decrease the sampling efficiency of the inlet to under the efficiency specified by PM-10 standards. If wind gusts of over 22 mph are present, the data collected is still valid, but be aware that the readings will be slightly lower than the actual mass concentration of aerosol present.

If the Environmental Enclosure is exposed to direct sunlight, causing the temperature inside to approach the operating limit of 50°C, the Heat Shield Assembly should be used. The Heat Shield Assembly blocks the direct sunlight, keeping the temperature inside the Environmental Enclosure cooler than it would otherwise be. Orient the Environmental Enclosure with Heat Shield Assembly such that the Heat Shield faces the sun directly when the sun is at its highest point in the sky. This will maximize the effectiveness of the Heat Shield.

Changing and Re-charging the Battery Packs

If using a DustTrak monitor, change the battery packs within the Environmental Enclosure at least every 34 hours of use. However, if using a DustTrak monitor with External Pump, change the battery packs within the Environmental Enclosure every 23 hours of use. TSI recommends replacing the battery pack(s) during the daily maintenance check described in the [Maintenance](#) Section.

A voltage cutoff switch will cut the power to the DustTrak II/DRX aerosol monitor when the battery voltage reaches 10.5 V. This ensures that the battery does not become too deeply discharged to recover, and also prevents the DustTrak monitor from operating below its rated voltage input. Preventing this condition will prolong the life of the battery.

If storage is required, battery packs should be fully charged prior to storage to prolong the life of the battery and be left off of charge for no longer than 3 months maximum. However, it is NOT recommended to store battery packs off of charge. Battery packs stored off charge may result in shorter than average life.

Battery packs will age over time per usage and care. The battery packs will last 180 to 200 cycles on average. One cycle being defined as one battery pack discharge and one recharge process. With optimal use and care, the life of a battery pack may possibly increase beyond 200 cycles. For optimal battery health, keep battery packs on charge in a cool, dry, and well-ventilated area while **NOT** in use, and recharge battery packs immediately after use.

If battery packs are stored off of charge for durations longer than 30 days then longer charge times and shorter run-times may result due to degraded battery health. Battery pack health will diminish at a much more rapid pace if **NOT** recharged immediately (within one hour maximum) after use.

It is important to remove a battery pack from service if signs of diminished run-time or longer charge time are observed. These are signs of battery pack aging and poor general battery health. **To identify unhealthy battery packs, it is important to review and adhere to the maintenance recommendations listed within Chapter 4.** A battery pack in good health will take near 8 to 9 hours to fully charge. A battery pack that provides 30% less product run-time than expected is ready to be removed from service. If a given battery pack provides a run-time of 24 hours or less for the DustTrak monitor (and optional Radio Modem) or a run-time of 17 hours or less for the DustTrak monitor with External Pump, the battery pack should be

removed from service and properly recycled in accordance with local environmental regulations.

Note

Prior to using the Battery Pack for the first time, a full recharge is recommended. **Recharging Battery Pack(s) immediately after use (within one hour maximum) is critical to obtaining optimal recharge time, battery health, and battery life.**



WARNING

The instrument has been designed to be used with batteries supplied by TSI. Do **not** use a substitute.

The TSI charger (P/N 801809) has been designed to be used with the battery packs supplied by TSI. Do **not** use a substitute charger to charge TSI battery packs.

Old batteries must be properly recycled in accordance with the local environmental regulations.



WARNING

Do **not** use non-rechargeable batteries in this instrument. Fire, explosions, or other hazards may result.

Charging Battery Pack

1. Disconnect the battery pack from the DustTrak II/DRX aerosol monitor and remove it from the Environmental Enclosure. Take it to a protected area where it can be charged undisturbed for 8 to 9 hours. Before charging any battery pack, please completely read the "Battery Charger Owner's Manual" that was provided along with your charger. Do **NOT** attempt to charge Battery Packs using the Dual Battery Wiring Harness (P/N 801817). The Dual Battery Wiring Harness is designed to be used to power the 8530, 8531, 8533, 8530EP, or 8533EP and the wireless radio modem during instrument operation only.

The information below is **NOT** intended as a substitute to the charger manual. The charger manual will cover all important warnings and operating instructions for using the charger. The steps below will guide you through the battery pack charging process steps.

2. Select the manual switch setting on the back of the charger to the setting that matches the correct power distribution present in your local area (i.e., 115 VAC or 240 VAC).
3. Connect the charger to the battery pack by connecting the battery pack output connector to the mating charger connector.
4. Plug the battery charger's power AC plug (Red colored) into an AC outlet. The "ON" LED will light red momentarily then the "ON" LED will turn off and the "CHARGE" LED will light solid yellow. This indicates that the charging process has started.
5. The "CHARGE" LED will remain lit solid yellow until the battery pack is charged to a state of charge of 80% then the "CHARGE" LED will start to flash yellow for the remainder of the charging process until the battery pack reaches a fully charged state. The duration of time the charger will remain in charging mode depends upon state of discharge of the battery. It is important to allow the charger to go through a complete charging routine in order to charge each battery pack to an optimum level. Even if a battery pack is already charged, the charging process will take a minimum of one hour.

Note

Do **NOT** stop charging a battery before it is completely charged.

Battery packs should be completely charged before using. Once the battery pack is completely charged, the yellow "CHARGE" LED light will turn off and then the "READY" LED will light green to indicate that the battery pack is ready for use. The battery is fully charged at this point. The charger can remain connected in this state indefinitely—it will continue to float charge the battery at a very low level with no risk of overcharging the battery.

Leaving the battery pack connected to the charger while not in use is highly recommended, and doing so will maintain the battery at a fully charged state and support optimum battery pack health while it is not in use.

6. **ALWAYS DISCONNECT THE CHARGER FROM THE AC POWER SUPPLY (REMOVE AC PLUG FROM WALL SOCKET) BEFORE REMOVING THE BATTERY PACK FROM THE CHARGER AFTER CHARGING HAS COMPLETED.** This will prevent the possibility of arcing during the battery disconnect process.

7. The charger is equipped with a time-out feature. The time-out feature is designed to prevent over-charging aging battery packs or battery packs having poor health due to abuse. The time-out feature may also protect against charger faults. The time-out feature does **NOT** trigger during normal operation of charging healthy battery packs. This feature is triggered if a battery pack does not reach the correct state of charge within a defined time period. When the time-out feature is triggered, the charger will simply shut-down charging the battery and is indicated by a continuous flashing of the green “READY” LED.

In the event that the time out feature is triggered, remove the battery pack from service immediately and recycle the battery pack appropriately. When a time-out event occurs, the charger must be reset before being used again. To reset the charger simply disconnect the battery from the charger, or disconnect the AC plug from the charger momentarily then reconnect the charger to AC power. If the time-out feature should trigger multiple times on different battery packs, contact TSI Incorporated for assistance.

Using the Dual Battery Wiring Harness

The Dual Battery Wiring Harness (P/N 801817) is a product option used to connect two battery packs together to provide roughly twice the run-time provided with a single battery pack. You can expect at least 42 hours run-time if powering a TSI P/N 8530EP/8533EP, and 68 hours run-time if powering a TSI P/N 8530/8531/8533 (this includes operation of the wireless radio modem option).

To use the Dual Battery Wiring Harness, simply connect two battery packs to the Dual Battery Wiring Harness at the male connectors and then connect the female connector to the Internal DC Power Cable connector. Once the cable is connected, power will be delivered to the DustTrak Aerosol Monitor and optional radio modem in manner which supports even power distribution.

The Dual Battery Wiring Harness is **NOT** intended for use to charge battery packs. The cable is designed specifically to prevent the use of the cable to charge battery packs through the cable interface. Be careful to **NOT** put unnecessary strain on the cable or connectors.

Only connect the Dual Battery Wiring Harness after installing battery packs into the environmental enclosure case. Moreover, be sure to disconnect the Dual Battery Wiring Harness prior to removing battery packs from the environmental enclosure case. Only use the cable internal to the environmental enclosure case.

The Dual Battery Wiring Harness is water-resistant, but **NOT** water-proof, the cable may fail if subjected to abundant water exposure including submersion in water.

Zeroing the DustTrak II/DRX Aerosol Monitor

Always zero the DustTrak II and DustTrak DRX monitor before beginning a sample. See the instructions in the DustTrak II or DustTrak DRX user manual for more information. If possible, zero the instrument under stable ambient temperature conditions (since variations in temperature will have a small impact upon the DustTrak monitor readings). If this is not possible (for example, 24-hour outdoor sampling, with wide temperature swings) the instrument should be kept closed inside the Environmental Enclosure. The thermal mass of the Enclosure will dampen out the effect of temperature swings, radiant heat, etc.

In nearly all cases, the temperature impact upon the DustTrak II/DRX aerosol monitor reading is very small in comparison to the ambient particle concentration.

Setting the Flow Rate for the Respirable Aerosol Inlet *(optional accessory)*

The optional Respirable Aerosol Inlet is designed to operate at a 1.7 L/min flow rate to achieve the proper particle cut-off size. When using a Respirable Aerosol Inlet, the flow rate should be verified and/or adjusted as described in the DustTrak II or DustTrak DRX user manual to 1.7 L/min.

Locking the Environmental Enclosure

To avoid theft of the DustTrak II/DRX aerosol monitor, when left inside the Environmental Enclosure, use a padlock to lock the box. There are two holes on the front of the box that allow for a standard padlock to be attached. A padlock is **not** supplied with the Model 8535.

Checklist for Sampling with the Environmental Enclosure

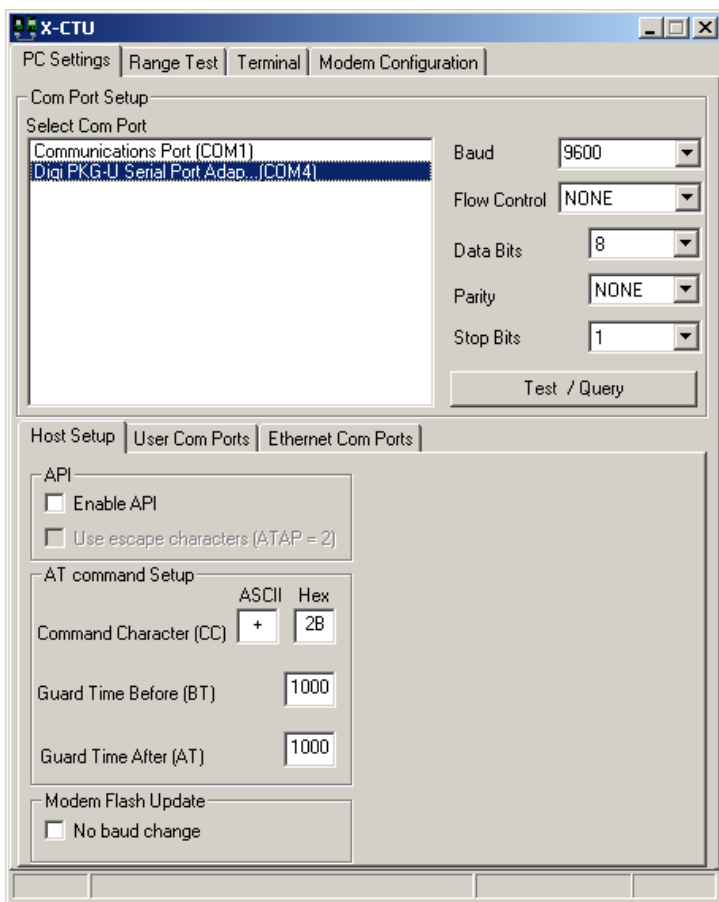
Before beginning a sample, check to see that all of the following conditions are satisfied:

- ✓ All components are properly installed into the enclosure as described in the Setup section.
- ✓ The DustTrak II/DRX monitor has been zeroed at the temperature at which it will be sampling (if possible).
- ✓ The Environmental Enclosure has been put in a place clear of any obstructions that will affect the flow around the enclosure (putting it on a tripod is optional).
- ✓ The Enclosure is not resting directly on the ground (no standing water).
- ✓ The DustTrak II/DRX monitor has been set to the appropriate logging mode.
- ✓ The Enclosure is locked shut to prevent theft or vandalism to instrument.
- ✓ Plans have been made to check for maintenance and data collection every 24 hours after initial set up, if necessary.

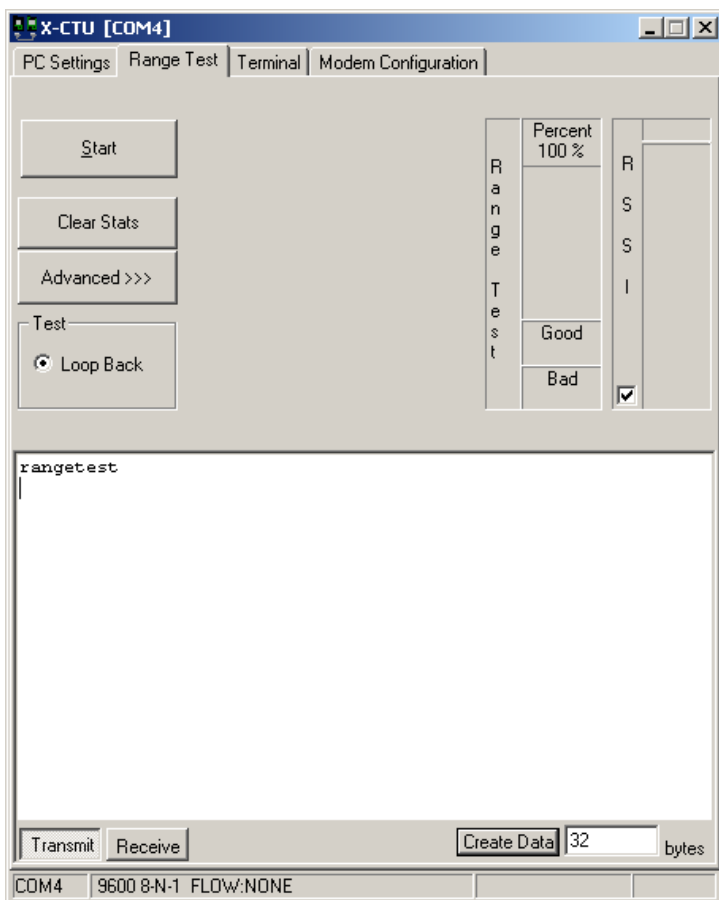
After the completion of monitoring, follow the procedures for transporting the Environmental Enclosure in the [Setting Up](#) section of this manual. This prevents the instrument from becoming damaged.

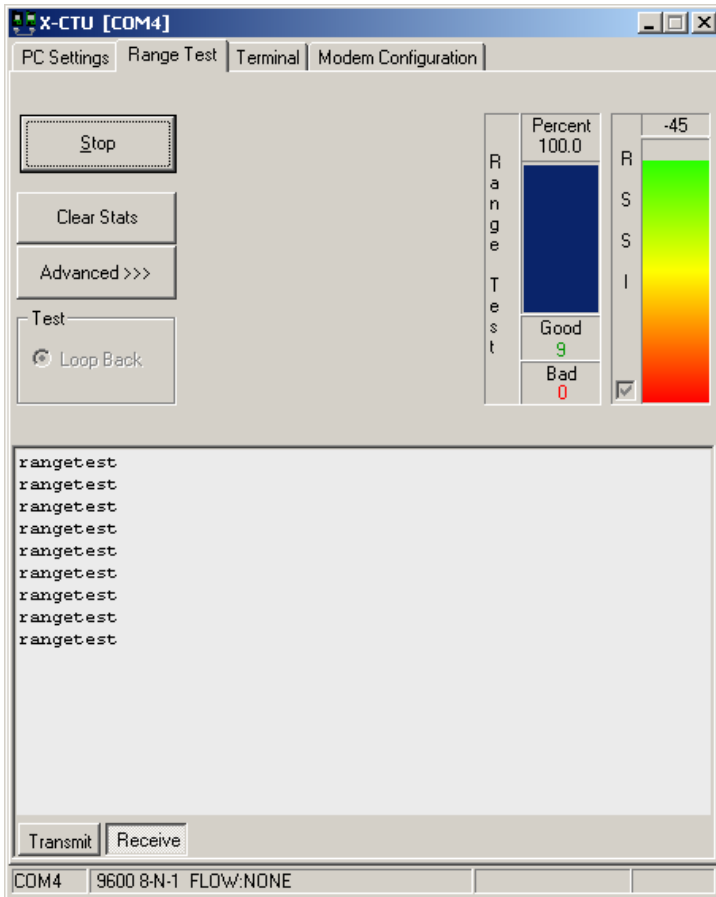
Radio Modem Range Test

Connect a Radio Modem to a USB port on your PC. Make sure both the DustTrak II/DRX Aerosol Monitor and Environmental Enclosure Radio Modems are turned on and connected. Run the X-CTU software on your PC. Select the COM port from the list for the Radio Modem which is connected. Use the Test/Query button to verify that communications from the PC to Radio Modem connected to the PC are okay.



Click the **Range Test** tab to enable the range test functionality. Check the “RSSI” box, which will indicate the signal strength between radio modems during the range test. Type “**rangetest**” into the text box as shown below, and make sure to hit **Enter**, to enter the necessary test string. Hit the **Start** button to start the test.





The test command will be looped between the PC Radio Modem and Environmental Enclosure Radio Modem, and the signal strength is measured and displayed. With this information, the user can adjust the Environmental Enclosure location and antenna direction, to provide the most reliable communication link. Having a clear line of sight between Radio Modems is critical for achieving the best possible signal.

Note

Any time when performing a Range Test with the “RSSI” check box enabled, the X-CTU software updates the RT-DI2 Configuration parameter to “1”, which can cause DustTrak II/DRX monitor or TrakPro software communication issues. Make sure that the RT-DI2 Configuration is set to “0” and written to Modem memory prior to connection to a DustTrak II/DRX monitor or TrakPro software.

Communication and Data Acquisition

The DustTrak monitor records data in either the manual sampling mode or the programmable modes. See the DustTrak II or DustTrak DRX user manual for more information on setting up the logging modes. To download the data, attach the supplied USB cable from the USB pass-through connector to a computer USB port, and use the appropriate commands within the TrakPro software.

Note

In order to download a data file, the DustTrak II monitor **cannot** be in a sampling mode.

To download a file under normal data-logging operations, do the following:

1. Open the Environmental Enclosure.
2. Discontinue sampling.
3. Attach the USB cable from the DustTrak monitor to a notebook computer.
4. Download the data file using TrakPro™ software.

Note

Details for Wireless Radio Modem communications using TrakPro software can be found in the TrakPro Software User's Guide.

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Chapter 4

Maintenance

Daily Maintenance Checks

Check the DustTrak™ II/DRX aerosol monitor a minimum of once a day to change the battery pack(s) and make sure that the instrument is operating properly. A visual inspection of the instrument and case can ensure that the water trap is empty, the sampling inlet is unobstructed and the tubing is not kinked.

Cleaning the Aerosol Inlet

Under normal operating conditions, the external aerosol inlet will remain clean and unobstructed. Under very dirty conditions; however, the inlet may become obstructed with vegetative debris or insects. To ensure the inside of the aerosol inlet is clean, periodically blow compressed air through the bottom of the inlet.



Caution

Do not disassemble the Environmental Enclosure aerosol inlet for any reason. It is **not** designed for field service and reassembly.

Cleaning the Respirable Aerosol Inlet

Follow the same procedure found in the DustTrak II or DustTrak DRX Aerosol Monitor user manual.

When to Change the Battery

Single battery packs are designed to provide power to the DustTrak II/DRX monitor (and optional Radio Modem) for a minimum of 34 hours, even under cold ambient conditions. However, if using the DustTrak II/DRX monitor with External pump (and optional Radio Modem), single battery packs will provide power for a minimum of 23 hours.

If using the Dual Battery Wiring Harness, two battery packs will provide power to the DustTrak II/DRX monitor (and optional Radio Modem) for roughly 65 hours or two battery packs will provide power to the DustTrak II/DRX monitor with External Pump (and optional Radio Modem) for at least 42 hours. To ensure uninterrupted operation, the packs should be replaced daily or within the time period listed above.

If a battery pack has been forgotten and is left connected to a running DustTrak monitor, the extended-life battery will automatically quit delivering power to the DustTrak monitor after its voltage drops below 10.5 V. This cutoff provides protection to the battery pack, which will extend the lifetime of the pack.

If charged batteries are present inside the DustTrak II/DRX battery compartment, power is automatically switched over and powers the DustTrak monitor or DustTrak monitor with External Pump with no loss of data. However, during this period Radio Modem communications may **NOT** work effectively.

Note

The logged data will not be lost even if **both** battery packs lose power.

Replacing the Battery Pack

1. When changing the battery pack, you do not have to interrupt the sampling process as long as fresh batteries are installed in the DustTrak II/DRX aerosol monitor's battery compartment. Replace discharged battery packs with the newly charged packs, taking care to secure the fully charged battery with the VELCRO® straps.
2. If using the Dual Battery Wiring Harness (P/N 801817), be sure to disconnect both batteries from the cable before removing either battery from the enclosure (always replace both battery packs with two fully charged battery packs).
3. When closing the case make sure that the tubing does not become kinked and all wiring is clear from obstruction. Pull the tubing forward while closing the case to prevent any kinked tubing from occurring.
4. To prevent long term damage and loss of capacity, recharge the battery pack(s) as soon as possible, or within one hour maximum after the battery pack is removed.

Recharging the Battery Packs

1. Disconnect the battery pack from the DustTrak II/DRX aerosol monitor and remove it from the Environmental Enclosure. Take it to a protected area where it can be charged undisturbed for 8 to 9 hours. Before charging any battery pack, please completely read the "Battery Charger Owner's Manual" that was provided along with your charger. Do **NOT** attempt to charge Battery Packs using the Dual Battery Wiring Harness (P/N 801817). The Dual Battery Wiring Harness is designed to be used to power the 8530, 8531,

8533, 8530EP, or 8533EP and the wireless radio modem during instrument operation only.

The information below is **NOT** intended as a substitute to the charger manual. The charger manual will cover all important warnings and operating instructions for using the charger. The steps below guide you through the battery pack charging process steps.

2. Select the manual switch setting on the back of the charger to the setting that matches the correct power distribution present in your local area (i.e., 115 VAC or 240 VAC).
3. Connect the charger to the battery pack by connecting the battery pack output connector to the mating charger connector.
4. Plug the battery charger's power AC plug (Red colored) into an AC outlet. The "ON" LED will light red momentarily then the "ON" LED will turn off and the "CHARGE" LED will light solid yellow. This indicates that the charging process has started.
5. The "CHARGE" LED will remain lit solid yellow until the battery pack is charged to a state of charge of 80% then the "CHARGE" LED will start to flash yellow for the remainder of the charging process until the battery pack reaches a fully charged state. The duration of time the charger will remain in charging mode depends upon state of discharge of the battery. It is important to allow the charger to go through a complete charging routine in order to charge each battery pack to an optimum level. Even if a battery pack is already charged, the charging process will take a minimum of one hour.

Note

Do **NOT** stop charging a battery before it is completely charged.

Battery packs should be completely charged before using. Once the battery pack is completely charged, the yellow "CHARGE" LED light will turn off, and then the "READY" LED will light green to indicate that the battery pack is ready for use. The battery is fully charged at this point. The charger can remain connected in this state indefinitely—it will continue to float charge the battery at a very low level with no risk of overcharging the battery.

Leaving the battery pack connected while not in use is highly recommended, and doing so will maintain the battery at a fully charged state and support optimum battery pack health while it is not in use.

6. **ALWAYS DISCONNECT THE CHARGER FROM THE AC POWER SUPPLY (REMOVE AC PLUG FROM WALL SOCKET) BEFORE REMOVING THE BATTERY PACK FROM THE CHARGER AFTER CHARGING HAS COMPLETED.** This will prevent the possibility of arcing during the battery disconnect process.
7. The charger is equipped with a time-out feature. The time-out feature is designed to prevent over-charging aging battery packs or battery packs having poor health due to abuse. The time-out feature may also protect against charger faults. The time-out feature does **NOT** trigger during normal operation of charging healthy battery packs. This feature is triggered if a battery pack does not reach the correct state of charge within a defined time period. When the time-out feature is triggered, the charger will simply shut-down charging the battery and is indicated by a continuous flashing of the green “READY” LED.

In the event that the time out feature is triggered, remove the battery pack from service immediately and recycle the battery pack appropriately. When a time-out event occurs, the charger must be reset before being used again. To reset the charger simply disconnect the battery from the charger, or disconnect the AC plug from the charger momentarily then reconnect the charger to AC power. If the time-out feature should trigger multiple times on different battery packs, contact TSI Incorporated for assistance.

Note

Do Not Store A Battery Pack That Has Not Been Fully Charged. Storing a discharged battery for any length of time will negatively affect the battery life.

Battery Pack Life

Battery packs will age over time per usage and care. The battery packs will last 180 to 200 cycles on average. One cycle being defined as one battery pack discharge and one recharge process. With optimal use and care the life of a battery pack may possibly be increased beyond 200 cycles. To obtain optimal battery health, keep battery packs on charge in a cool, dry, and well-ventilated area while **NOT** in use, and recharge battery packs immediately after use. This assumes that the batteries are being used to run a DustTrak II /DRX aerosol monitor every day and that they are properly cared for and rotated daily. Replacement battery packs may be ordered from TSI. See Chapter 1 on “[Parts Identification](#)” for more information.

If battery packs are stored off of charge for durations longer than 30 days then longer charge times and shorter run-times may result due to degraded battery health. Battery pack health will diminish at a much more rapid pace if **NOT** recharged immediately (within one hour maximum) after use.

It is important to remove a battery pack from service if signs of diminished run-time or longer charge time are observed. These are signs of battery pack aging and poor general battery health. A battery pack in good health will take near 8 to 9 hours to fully charge. A battery pack that provides 30% less product run-time than expected is ready to be removed from service. If a given battery pack provides a run-time of 24 hours or less for the DustTrak monitor (and optional Radio Modem) or a run-time of 17 hours or less for the DustTrak monitor with External Pump, the battery pack should be removed from service and properly recycled in accordance with local environmental regulations.

Battery Pack Health Status Check

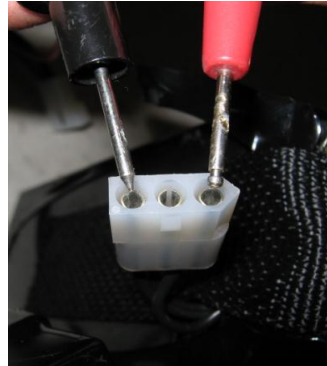
TSI highly recommends consistently monitoring the health of all battery packs in possession. This status check is intended to help with that process and should be performed in addition to the use and handling instructions listed within this manual. This status check is not intended as a replacement for any other use and handling instructions as all instructions are important to follow to maintain battery health and to get the maximum life from battery packs. It is important to follow the following process to help to identify a battery pack that is no longer in good health and needs to be recycled.

Battery Pack Health Check Procedure

1. Check the battery pack visually for any signs of bulging or abnormal appearance.
2. Connect the battery to the TSI Battery Charger Part #801809.
3. Plug in power to the charger.
4. Keep the battery pack on charge until the charger's "Ready" LED light is lit green indicating that the battery is now completely charged.
5. Disconnect power from the charger.
6. Disconnect the battery pack from the charger.
7. Let the battery pack rest (off of charger) for at least one hour.

8. Using a DC Volt Meter, connect the “red” (positive) test lead of the meter to the battery pack output connector at the conductor located closest to the triangle-shaped side of the connector. Please see the illustration.

9. Connect the “black” (negative) test lead of the DC Volt Meter to the battery pack output connector at the bottom conductor as illustrated in the picture.



10. Record the voltage measured by the DC Volt Meter.

11. If the measured voltage is ≤ 12.9 volts, this battery pack is no longer in good condition and should **NOT** be charged. Remove this battery from service and recycle the battery according to local, state, or federal regulations.

12. However, if the measured voltage is ≥ 13 volts, this battery is in good operating condition and is able to be charged unattended, using the new TSI Battery Charger Part #801808 or #801809.

Emptying the Water Trap

If any water or moisture has accumulated in the water trap, be sure to unscrew the water trap from the internal inlet and empty it. Take care when removing and reinstalling the bottle to prevent damage to the threads. The bottle must be securely hand tightened to seal against the O-ring to prevent leaking. Make sure the tightly secured bottle is oriented in the position shown in Figure 7.

Storage Precautions

This instrument must be stored in a location where the temperature remains between -20 and 60°C (-4 and 140°F).

Chapter 5

Troubleshooting the Environmental Enclosure

The table below lists the symptoms, possible causes and recommended solutions for common problems encountered with the DustTrak™ II/DRX Aerosol Monitor Environmental Enclosure.

Symptom	Possible Cause	Corrective Action
DustTrak monitor does not turn on.	Uncharged Battery Pack. Battery Pack not plugged into DustTrak monitor. Bad Battery Pack (no longer able to be recharged).	Make sure Battery Pack is fully charged. Plug battery power plug into the power jack in DustTrak monitor. Replace with new Battery Pack.
Readings are unusually low.	Zero was not checked on DustTrak monitor. Plugged external inlet. Sampling in wind speeds over 22 mph. Enclosure located near an object that obstructs the flow.	Re-zero DustTrak monitor at desired sampling conditions. Remove inlet from the Enclosure; blow out debris with compressed air. Rinse with clean air, if needed. DO NOT DISASSEMBLE COVER ON INLET ASSEMBLY. Take off water trap bottle and clean all exposed surfaces. DustTrak monitor will under-sample slightly in high wind speeds. No correction possible. Move the Environmental Enclosure into a more open area.

Symptom	Possible Cause	Corrective Action
<p>Readings are unusually low. (cont.)</p>	<p>Leak in the inlet.</p>	<p>Make sure the upper inlet assembly and the water trap are screwed in tightly.</p> <p>Make sure tubing is secured on the enclosure barb and the DustTrak monitor.</p> <p>Make sure inlet assembly O-ring is in place.</p> <p>Re-grease the O-rings sealing the inlet assembly and the water trap bottle.</p>

Appendix A

Specifications

Specifications are subject to change without notice.

Environment Enclosure

Sampling Conditions

Sensor Type	0 to 22 mph (0 to 36 kph)
Operating Temperature	32 to 120°F (0 to 50°C)
Storage Temperature	-4 to 140°F (-20 to 60°C)

Physical

External dimensions (HWD)	8.1 x 16.9 x 20.6 in. (21 x 43 x 52 cm)
Weight (with Internal Battery System and DustTrak)	38 lb (17 kg)

Maintenance Requirement

Maintenance Check/ Clean inlet	Weekly or daily if concentrations of over 30 mg/cm ³ are measured.
Re-grease O-rings	As needed

Internal Battery System

Internal Battery Pack	12 VDC, 22 Ah
Battery Run-time	DustTrak II/DRX with internal pump: 34 to 36 hours (typical) DustTrak II/DRX with external pump: 21 to 24 hours (typical) DustTrak II/DRX with external pump and Heated Inlet accessory: 15 hours (typical)
Battery Charge Time	8 to 9 hours at 72°F (22°C) (New battery, deep discharge to 95% charge) <i>Dual Battery Wiring Harness, setup using two 22 Ah battery packs: Run-time is typically twice the time quoted for a single battery pack for either internal or external pump configurations.</i>

Solar Power System

Power Requirements

Solar System Run-time	Continuous (with adequate sunlight)
Rated Maximum Cell Power	80 watts (per Cell)
Power Tolerance	±5%
Nominal Voltage	12 Volts
Solar System Battery	12 VDC, 100 Ah
Battery Run-time	90 to 120 hours (typical, full-charge to power cutoff, when no sunlight for charging)
Battery Charge Time	<10 hours at 72°F (22°C) (New battery, deep discharge to 95% charge, with adequate sunlight)
Operating Temperature	32 to 120°F (0 to 50°C)
Storage Temperature	-4 °F to 140°F (-20 to 60°C)

Physical (Solar Panels)

Dimensions (HWD)	2 x 43 x 48 in. (5 x 109 x 122 cm)
Weight	34 lb (15.3 kg)

Physical (Battery and Case)

Dimensions (HWD)	8.5 x 15.3 x 17 in. (22 x 39 x 43 cm)
Weight	85 lb (38.3 kg)

Wireless Radio Modem

Power Requirements

Power Supply Voltage	5 to 12 V
Receive Current	90 mA @ 922 MHz, 115 mA @ 2.4 GHz
Transmit Current	185 mA @ 922 MHz, 200 mA @ 2.4 GHz
Power Down Current	50 mA
Operating Temperature	32°F to 158°F (0°C to 70°C)
Storage Temperature	-4°F to 158°F (-20°C to 70°C)

Physical

Power Supply Voltage	5 to 12 V
Dimensions (HWD)	1.12 x 5.50 x 2.75 in. (3 x 14 x 7 cm)
Weight	7.1 oz (200 g)

Country specific wireless transmission information

US, Canada, Australia, New Zealand	922 MHz
Europe, Asia	2.4 GHz

Transmission Ranges

Indoor/Urban Range (with 2.1 dB dipole antenna)	Up to 1500 feet (450 m) @ 922 MHz, Up to 600 feet (180 m) @ 2.4 GHz
Outdoor RF line-of-sight range (with 2.1 dB dipole antenna)	Up to 7 mi (11 km) @ 922 MHz, Up to 3 mi (5 km) @ 2.4 GHz
Outdoor RF line-of-sight range (with high gain antenna)	Up to 20 mi (32 km) @ 922 MHz, Up to 10 mi (16 km) @ 2.4 GHz
Transmit Power Output	100 mW (20 dBm) @ 922 MHz, 50 mW (17 dBm) @ 2.4 GHz
Data Rate	9,600 bps



UNDERSTANDING, ACCELERATED

TSI Incorporated – Visit our website www.tsi.com for more information.

USA Tel: +1 800 874 2811

UK Tel: +44 149 4 459200

France Tel: +33 4 91 11 87 64

Germany Tel: +49 241 523030

India Tel: +91 80 67877200

China Tel: +86 10 8219 7688

Singapore Tel: +65 6595 6388