HEALTH AND SAFETY

Exposure Monitoring

Model 8535

DUSTTRAK™ Aerosol Monitor Environmental Enclosure

(*for DUSTTRAK™ II and DRX Aerosol Monitor Models 8530 and 8533*)

Operation and Maintenance Manual

P/N 6002097, Revision C
January 2011

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Part Number

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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.

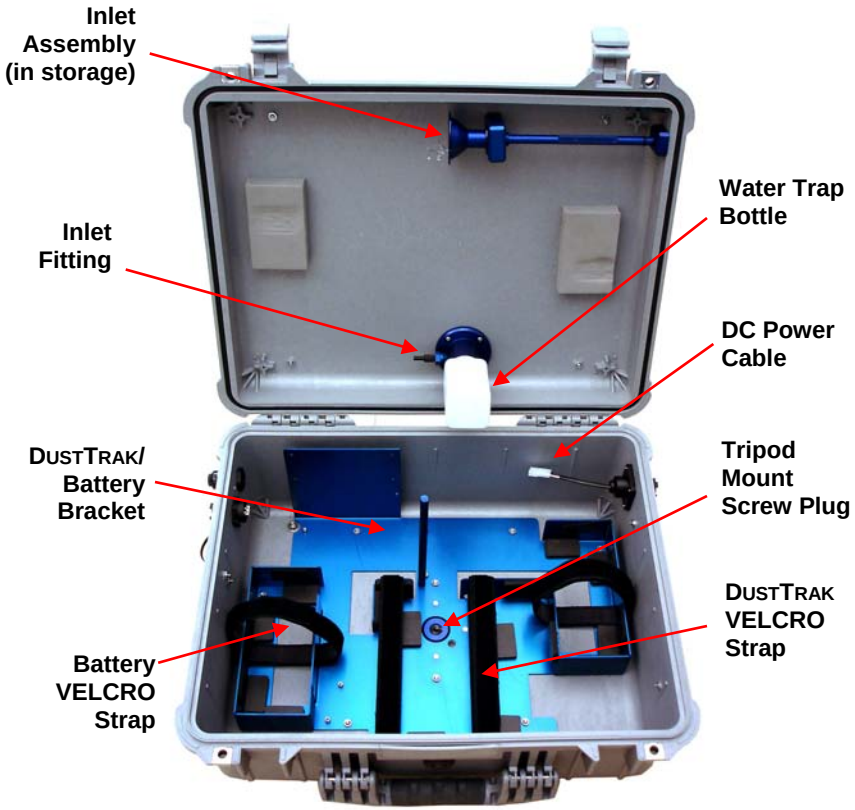


Figure 1: Inside View of Environmental Enclosure

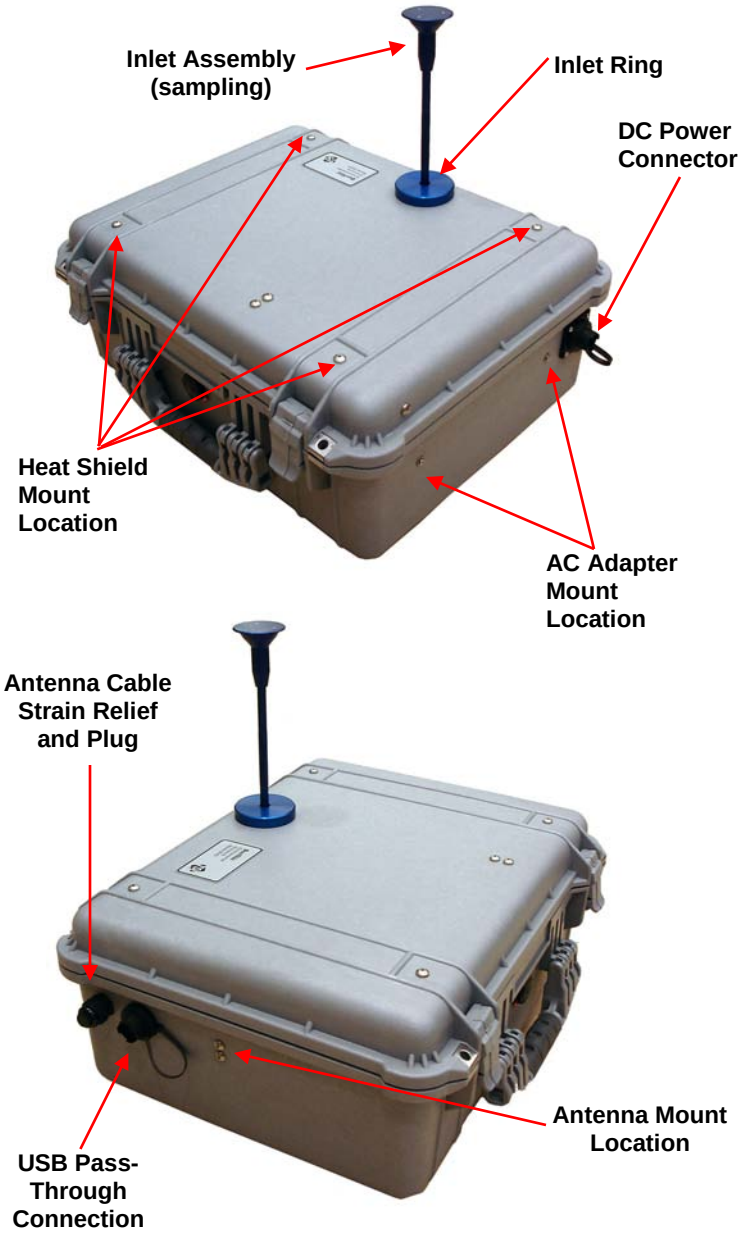


Figure 2: Outside Views of Environmental Enclosure

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	801565	Aerosol Sample Inlet Assembly
	1	3001903	Sample Inlet Tubing
	1	7001267	Inlet Fitting for Sample Tubing
	1	6002016	Water Trap Bottle
	4	2913125	VELCRO® Straps

Item	Qty	Part Number	Description
	1	6002287	Internal DC Power Cable
	1	6002245	12 VDC Weatherproof Power Adapter (90 to 130 VAC)
	1	6002246	12 VDC Weatherproof Power Adapter (170 to 250 VAC)
	3	6002196 6002197 6002198	Universal AC Plug Adapters
	1	2602013	Transport Inlet Plug
	1	5010005	Tripod Mount Screw Plug

Item	Qty	Part Number	Description
	1	3305075	Tripod Mount Screw Plug Wrench
	1	7001338	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
	801802	12 VDC Battery Pack

Item	Part Number	Description
	801803	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)
	801825 801826	2.4 GHz Radio Modem Kit with antenna mount (for enclosure) 2.4 GHz Radio Modem Kit (for base station)
	801811	Solar Cell Power System

Item	Part Number	Description
	801506	Respirable Aerosol Inlet
	801830	Environmental Enclosure Spare Parts

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. Damage to the enclosure or its components can result if these procedures are not followed.

W A R N I N G

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.

C a u t i o n

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**!

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. Hold the inlet assembly by the knurled section on the tube and remove it from the holding bracket by unscrewing it (see Figure 3).

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

2. Carefully slide the inlet through the upper mounting bracket and remove the inlet from the bracket.
3. Remove the Inlet Transport Plug from the top of the Enclosure.

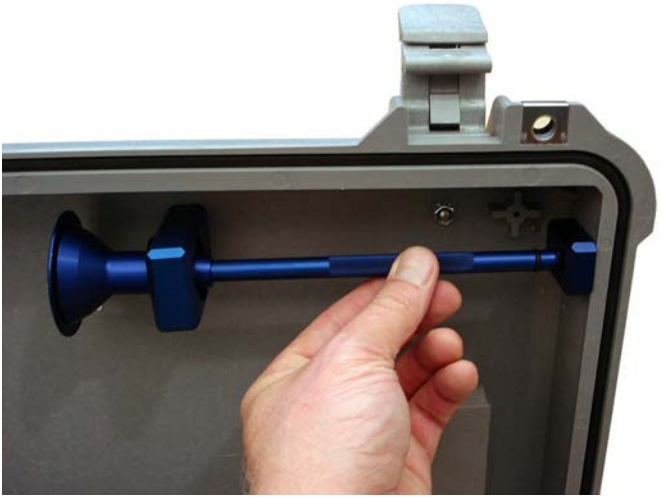


Figure 3: Unscrew Inlet from Inner Bracket

4. Thread the inlet assembly into upper inlet ring found on the top of the Environmental Enclosure (see Figure 4).

Figure 4: 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 7).

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 5). Save these nuts and bolts for future usage when the Heat Shield is not used.

Figure 5: 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 6).

Figure 6: Attach Heat Shield to the top of the Enclosure

4. Now thread the Inlet Assembly into the Inlet Ring as shown in Figure 7.

Figure 7: 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 X-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 8.

Figure 8: 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 9.
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 9: 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 10.

Figure 10: Install Impactor in the Sample Flow

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.

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 11.

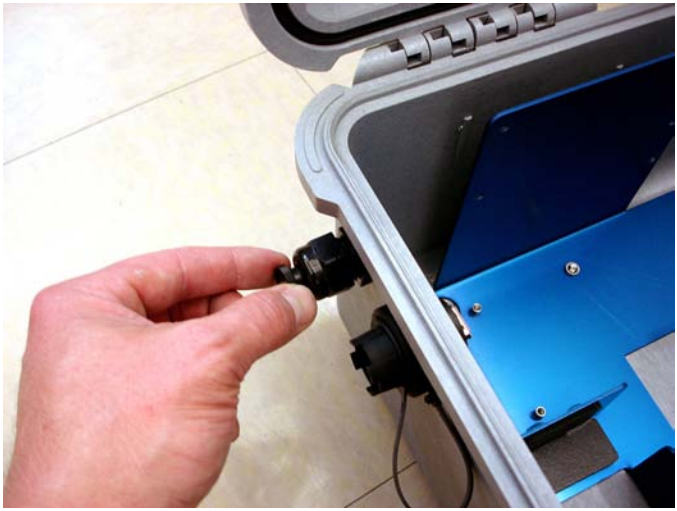


Figure 11: Remove the Antenna Cable Fitting Plug

2. The antenna cable fitting plug can then be stored in the bracket as shown in Figure 12.

Figure 12: Store the Antenna Cable Fitting Plug

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 13.

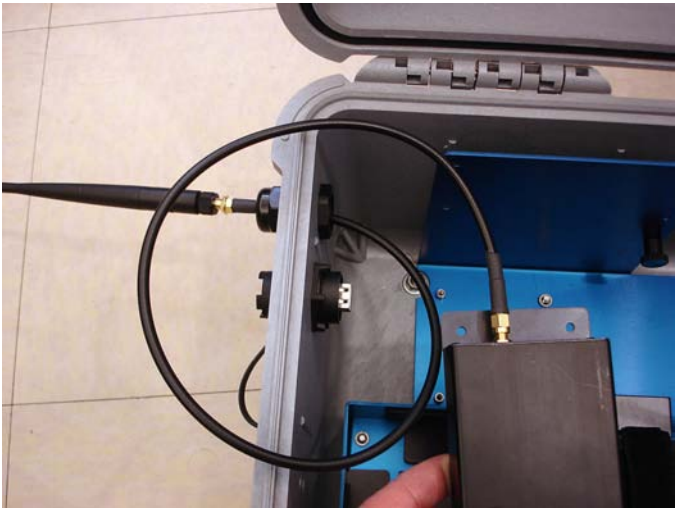


Figure 13: Attach Antenna and Cable to Radio Modem

4. Orient the Radio Modem as shown in Figure 14 (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 14: 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 15.

Figure 15: Antenna Mounting Bracket O-Ring

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

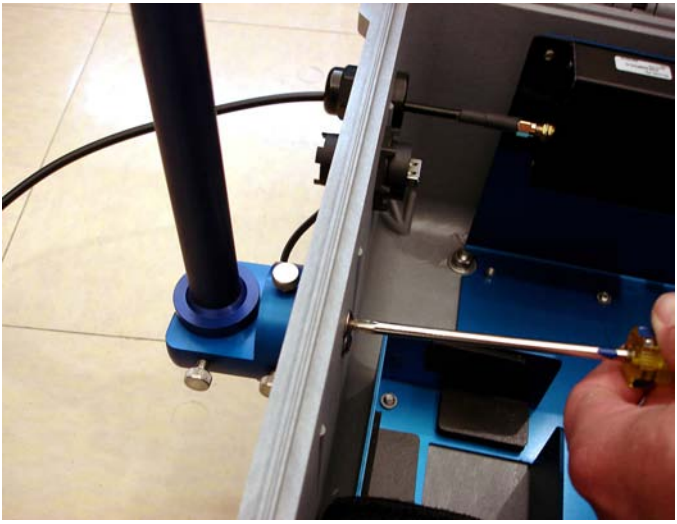


Figure 16: Attach Antenna Mounting Bracket to Enclosure

7. 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.

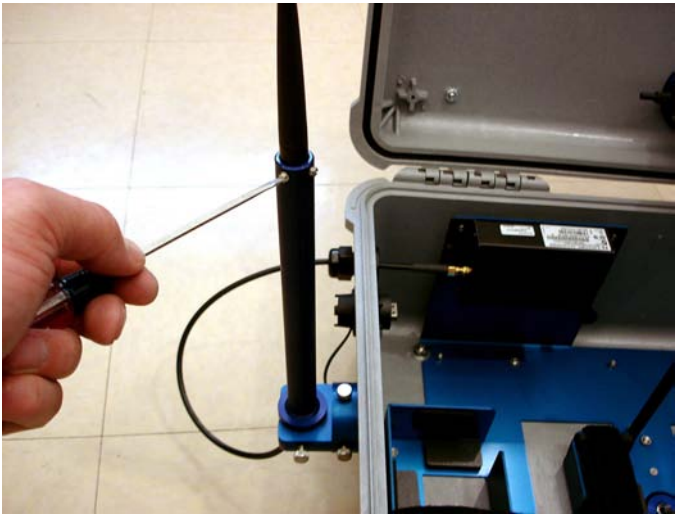


Figure 17: Secure Antenna to Bracket

8. The position of the antenna mount can be adjusted by using the thumbscrews on the base of the bracket, as shown in Figure 18.

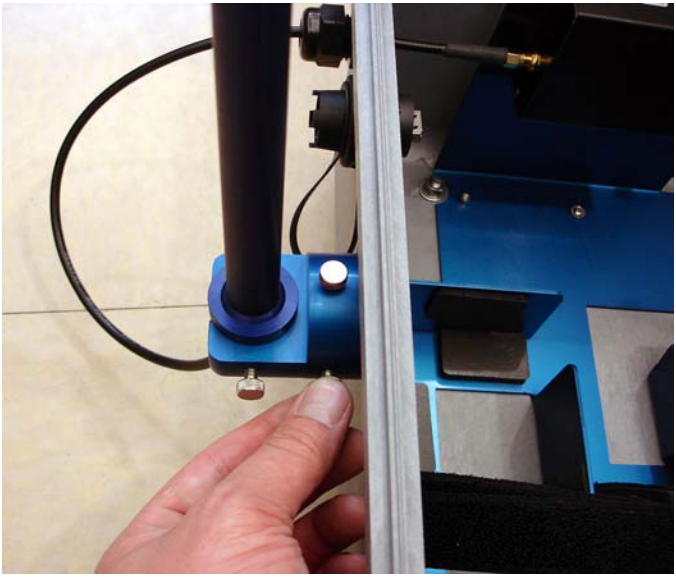


Figure 18: Adjustable Antenna Mount

9. Power is supplied to the Radio Modem through the DC power jack on the right end of the Radio Modem, as shown in Figure 19. When using a Radio Modem inside the Enclosure, always supply power to it through this power connection using the provided internal DC power cable.

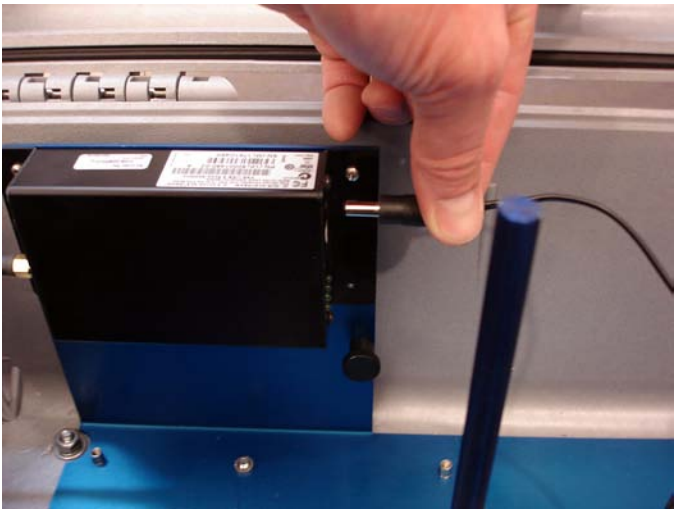


Figure 19: Power Connection to Radio Modem

Install Battery Pack System (optional accessory)

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

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.

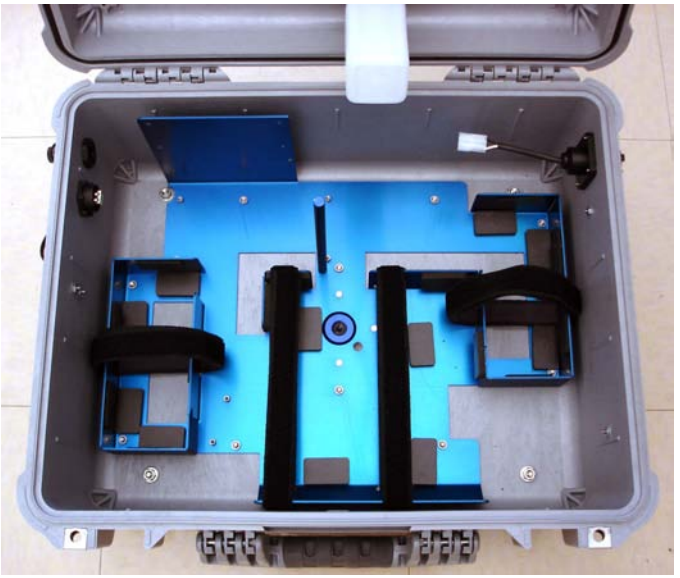


Figure 20: Battery Pack VELCRO® Straps

2. Lift the Battery Pack System with both hands and place in the Enclosure bracket as shown in Figure 21, keeping the battery with the output connector on the right side of the Enclosure. The Battery Pack System cabling is then tucked up against the front of the Enclosure.

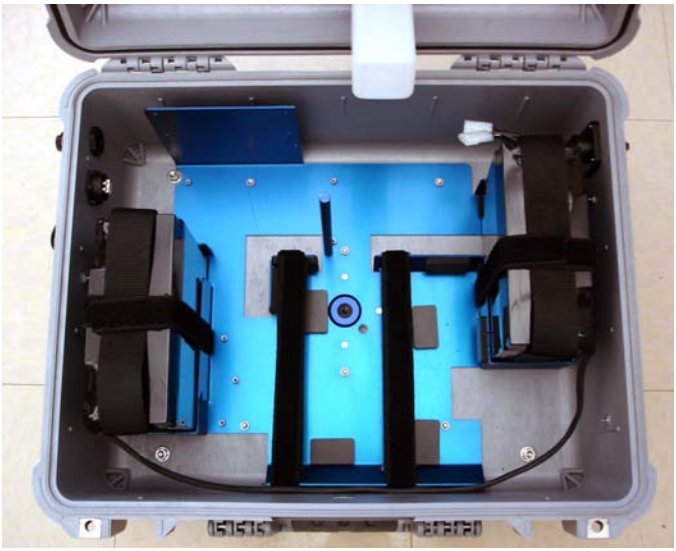


Figure 21: Install the Battery Pack System

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

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 22.

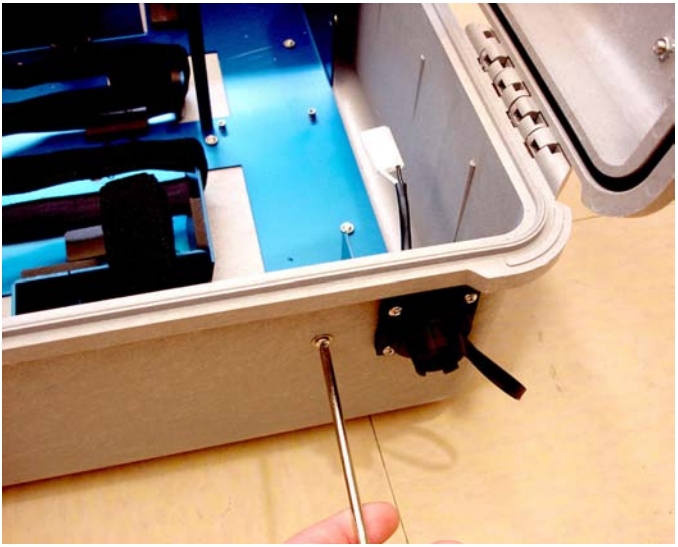


Figure 22: Remove the Adapter Mounting Screws

2. Attach the AC adapter to the Enclosure as shown in Figure 23, using the existing mounting screws and sealing washers.

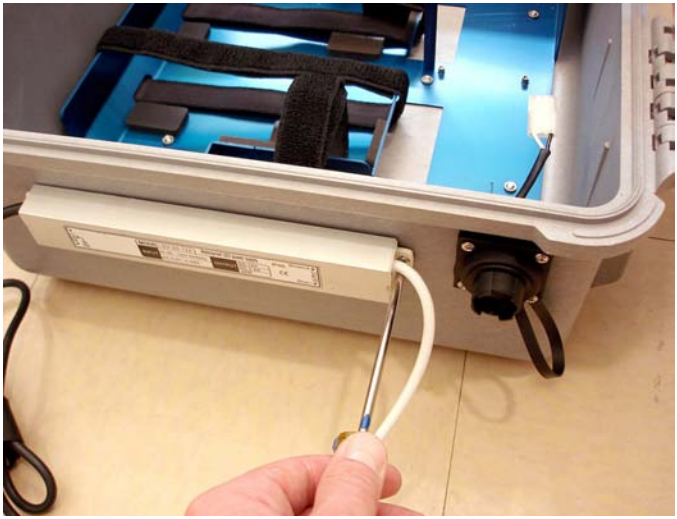


Figure 23: Attach the Adapter to the Enclosure

3. Connect the DC power output cable from the adapter to the Enclosure DC input connector as shown in Figure 24.

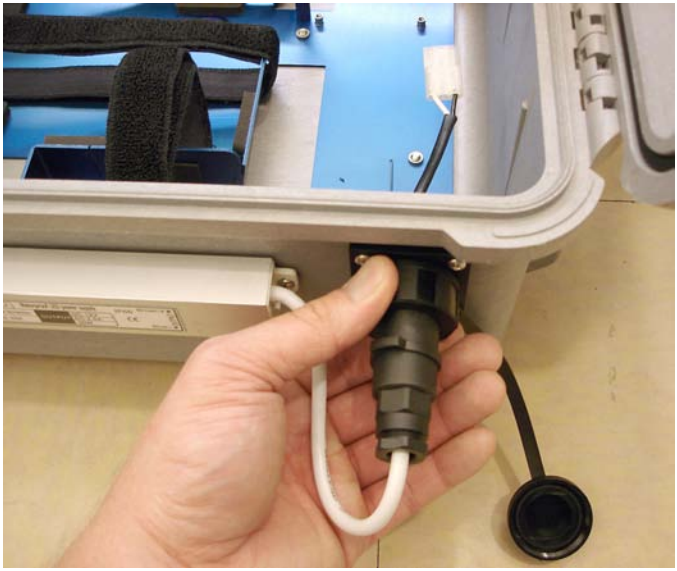


Figure 24: Connect Adapter DC Cable to Enclosure

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 25.

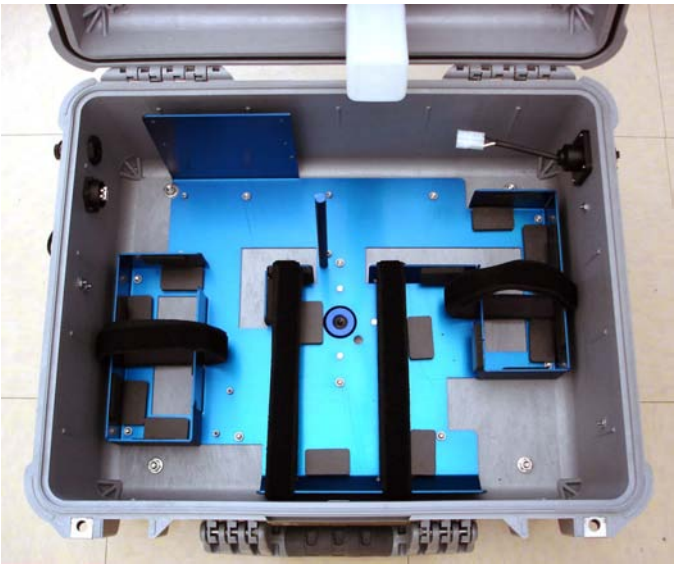


Figure 25: DUSTTRAK™ Aerosol Monitor VELCRO® Straps

2. Install the DUSTTRAK™ monitor into the bracket as shown in Figure 26 and tightly secure in place with the VELCRO® straps.

Figure 26: 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 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 27. This provides a communication link between the DUSTTRAK™ monitor and the Radio Modem.

Figure 27: Connect USB Cable for Radio Modem

2. 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 28. 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.

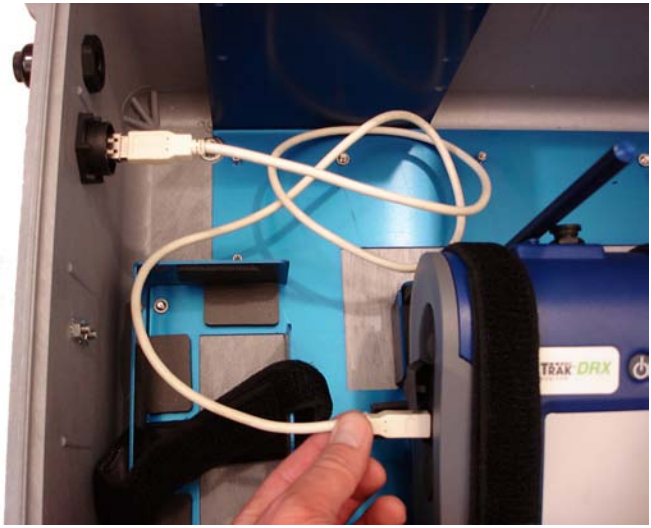


Figure 28: Connect USB Cable for Pass-through

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 29.

Figure 29: 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) Using external weatherproof AC adapter, when AC power is desired.

2) Using the optional Battery Pack System.

3) Using the optional Solar Cell Power System.

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 30).

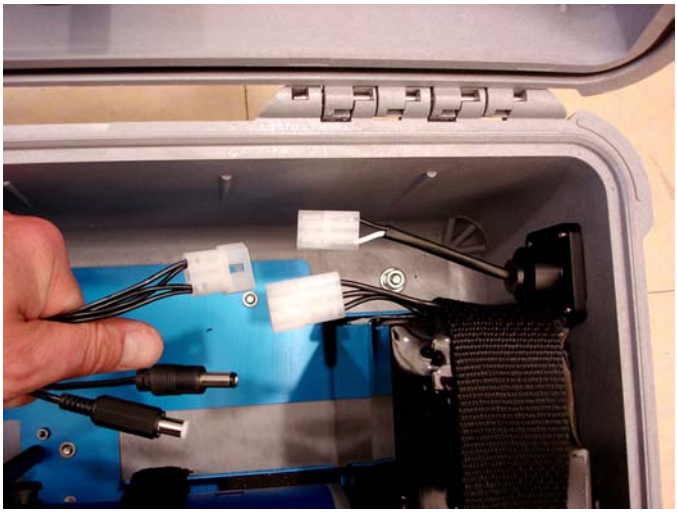


Figure 30: Internal DC Power Connections

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 document). 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. These battery packs enable the DUSTTRAK™ monitor and optional Radio Modem to operate for at least 24 hours (even in cold conditions). The battery packs should be rotated and properly charged after each use, to ensure a prolonged lifetime (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 changing the external Battery Packs.

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).

Note
Prior to using the Battery Pack for the first time, a full recharge is recommended.

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 the "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 31 shows the Environmental Enclosure mounted on a surveyor tripod. Use the supplied tripod screw plug wrench to remove the plug, then attach the Enclosure to the tripod.

Figure 31: 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. The following steps should be taken to ensure that no damage is done to the enclosure or its components during transportation:

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 and install it into the inlet-mounting bracket inside the lid of the enclosure.
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 DUSTTRAK™ II/DRX aerosol monitor and battery pack.
5. 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 32. 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 32: 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 33).

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 33: 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 ½". Pass the power cable through that access hole while attaching the individual pieces of the cable strain relief, as shown in Figure 34.

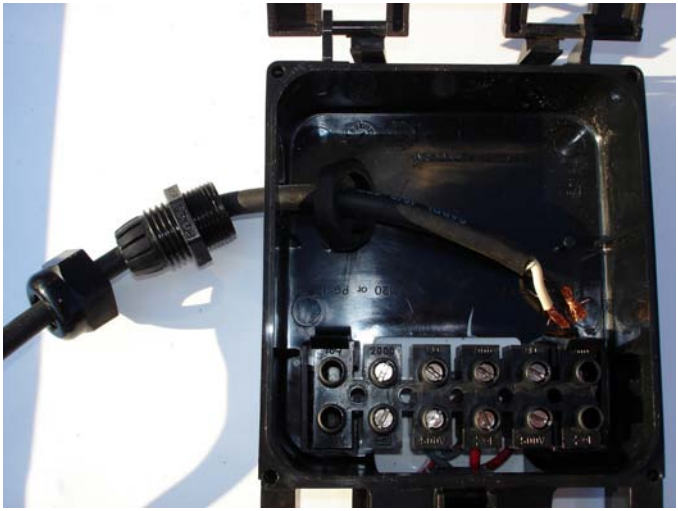


Figure 34: Strain Relief and Power Cable Through Access Hole

3. Next attach the power cable to the Solar Cell screw terminals as shown in Figure 35.

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.

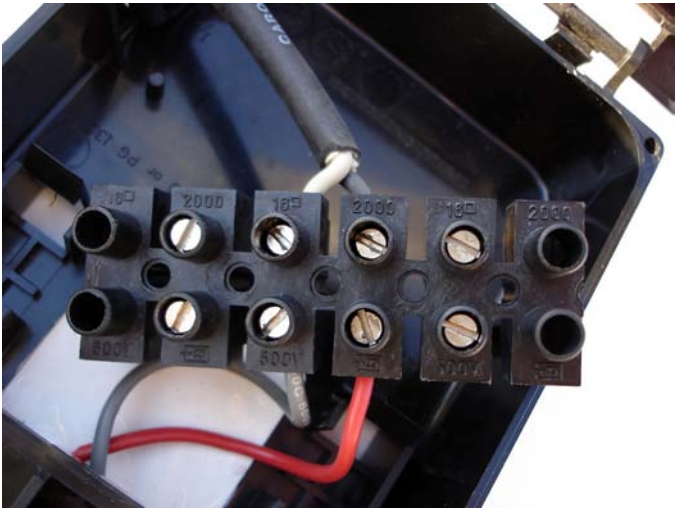


Figure 35: Power Cable Connection to Solar Cell Terminals

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 36.

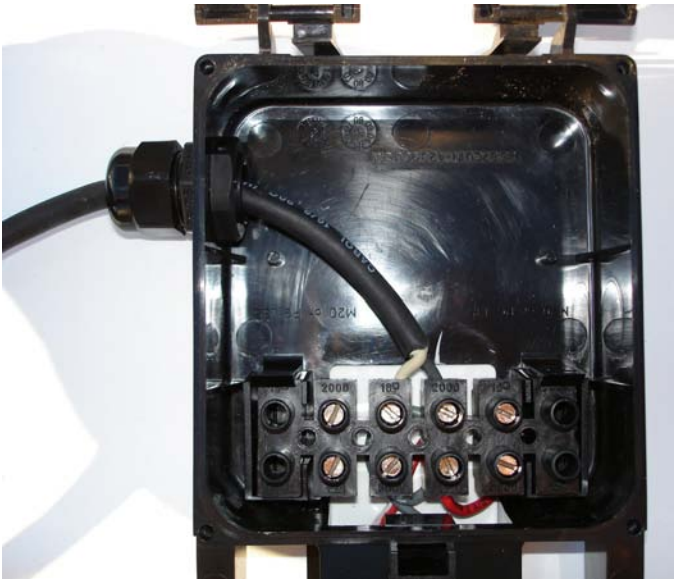


Figure 36: Secure Terminal Block and Tighten Strain Relief

5. Next attach the sealing strip to the inside of the junction box cover, as shown in Figure 37.

Figure 37: Apply Sealing Strip to Junction Box Cover

6. Then attach the cover to the junction box using the supplied screws, as shown in Figure 38.

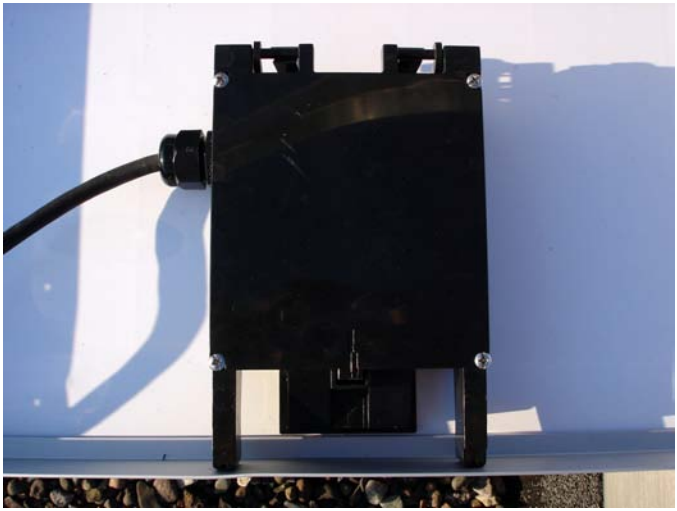


Figure 38: Attach Junction Box Cover

7. Now attach the two Solar Cells to the adjustable angle Mounting Frame using the supplied bolts, as shown in Figure 39.

Figure 39: 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 40.

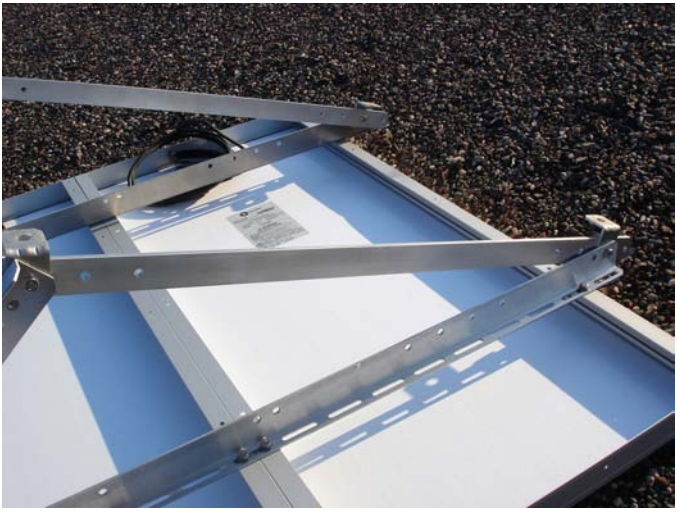


Figure 40: Assemble the Support Bar to the Mounting Frame

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

The Mounting Frame may be secured to the ground using the bolt locations at the end of each frame arm, or by adding sandbags or other weights to the support bar.

9. Connect the Solar Cell cables to the Solar Battery Enclosure box as shown in Figure 41. 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 41: 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 42. 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.

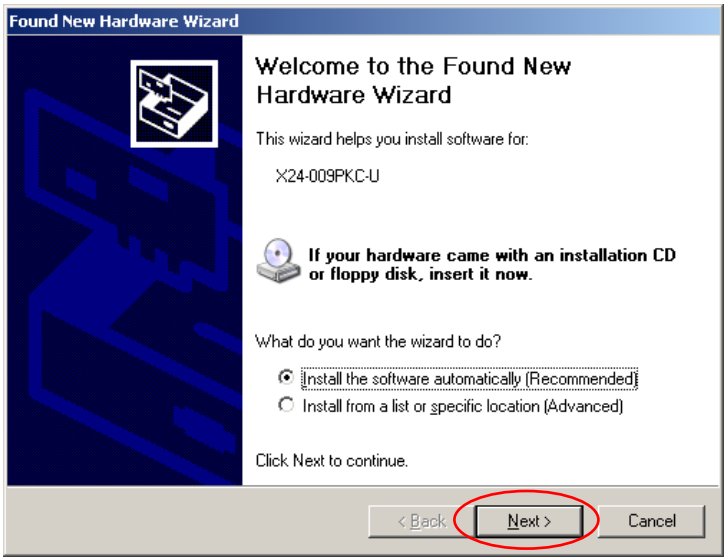
Note
The Solar Charge Controller has built-in low voltage cutout protection for the Solar Battery. If extended non-sunlight conditions occur, causing the Solar Battery to become deeply discharged, the Solar Charge Controller temporarily cuts off output power. The Red LED on the Solar Charge Controller 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 42: Connect Power from the Solar Cell Power System to the Environmental Enclosure

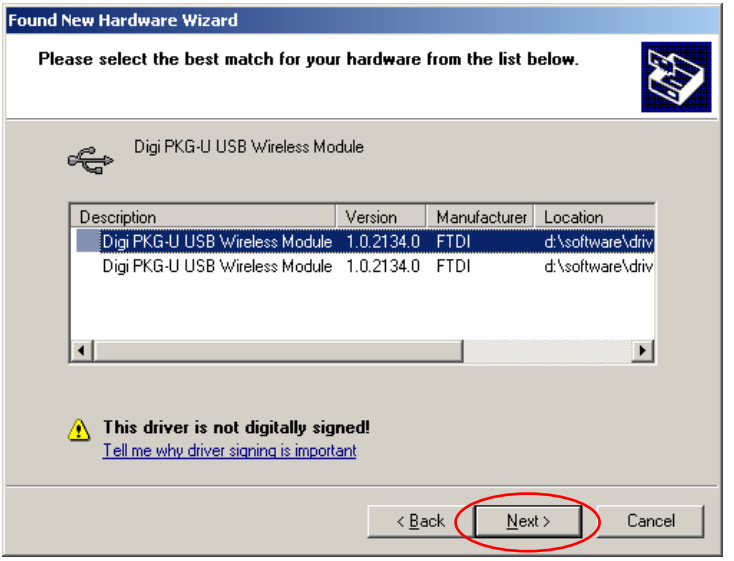
Setup Radio Modems (optional accessory)

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.

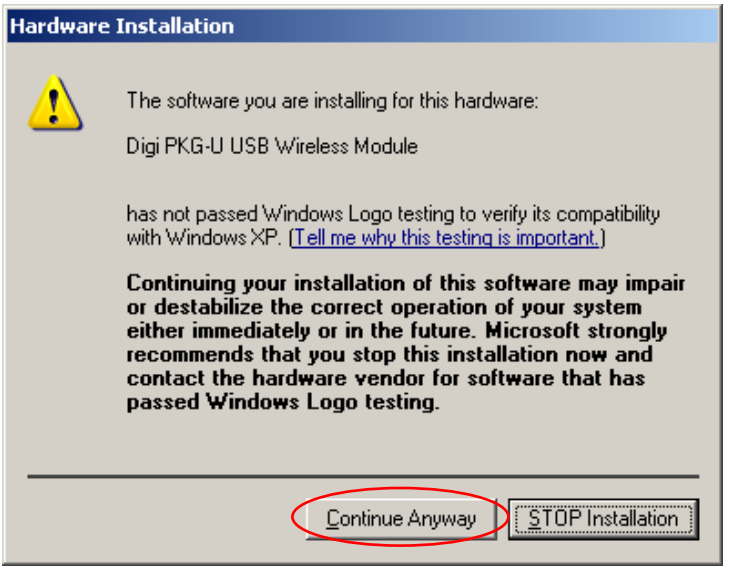
1. Insert the Radio Modem CD into your CD-ROM. Connect the Radio Modem to your PC through a USB cable.



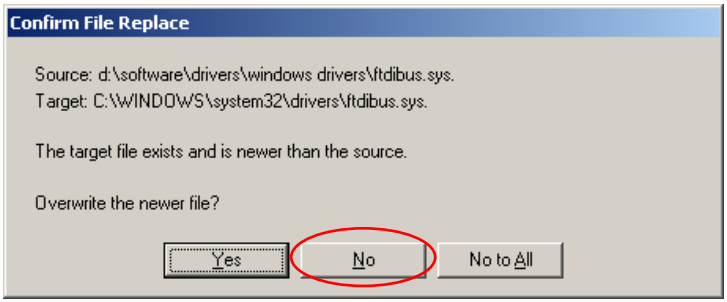
2. Click **Next** on the popup screen.



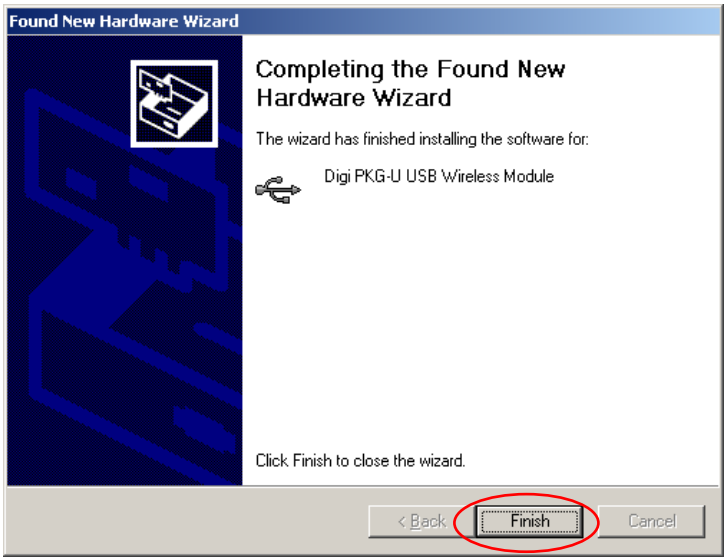
3. Select the first device and click **Next** when prompted. When Windows prompts for driver installation, click **Continue Anyway**.



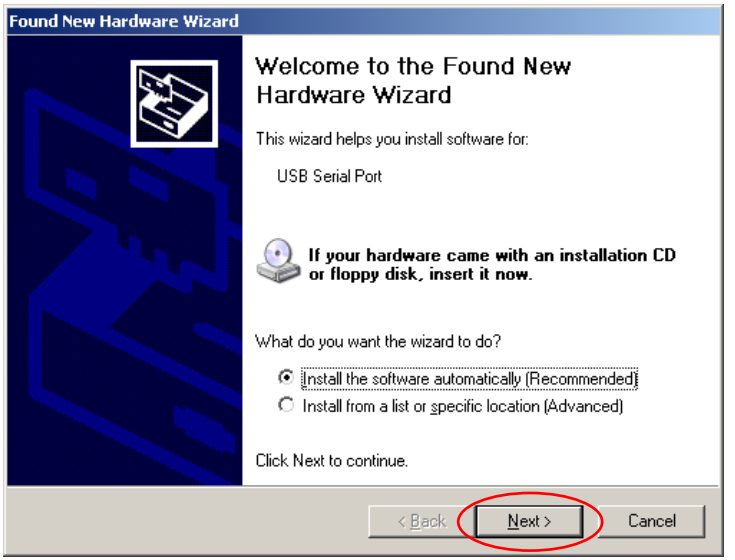
4. Click **No** if you are asked to replace newer FTDI files.

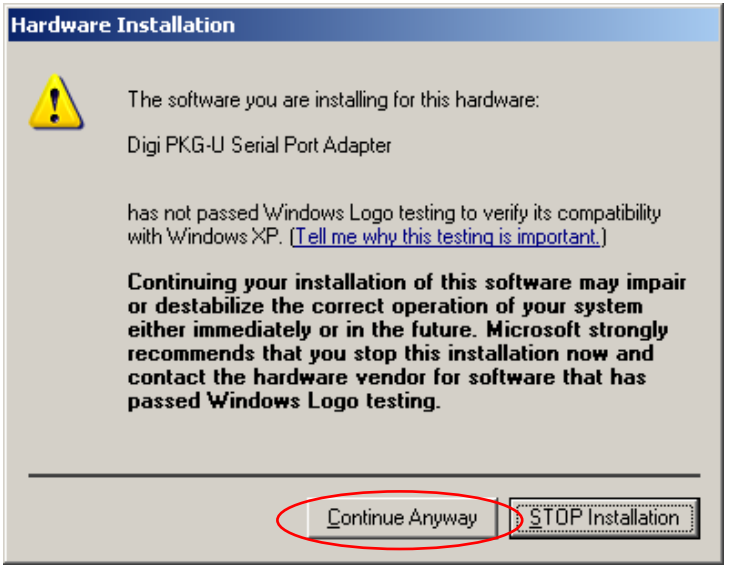


5. Click **Finish** when you finish installation.

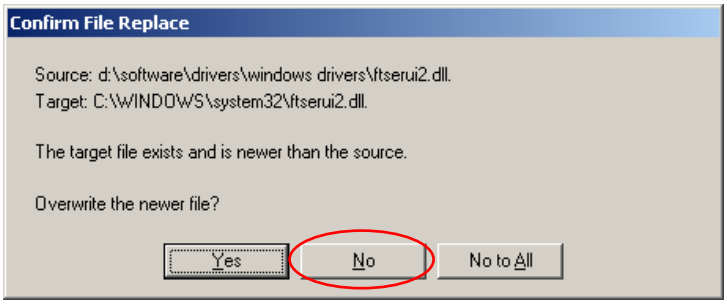


6. After the first round of installation, a new Hardware Wizard screen will popup. Follow these steps to install the COM port driver.

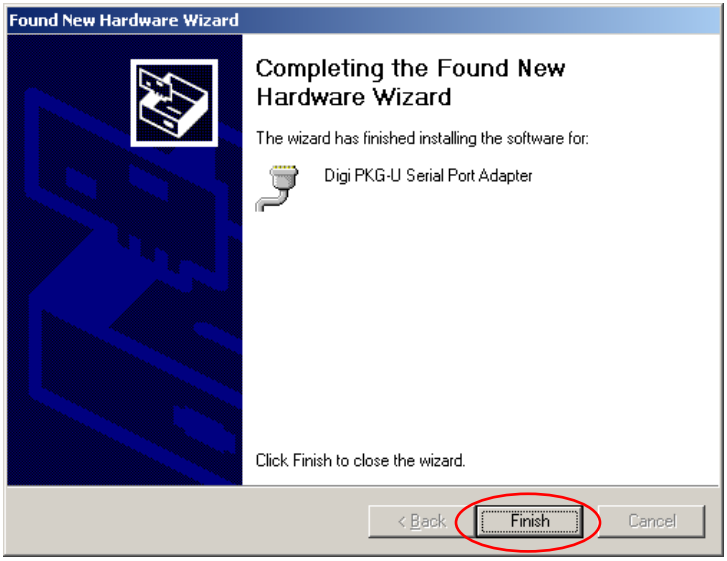




7. Click **Next** and **Continue Anyway** to continue.



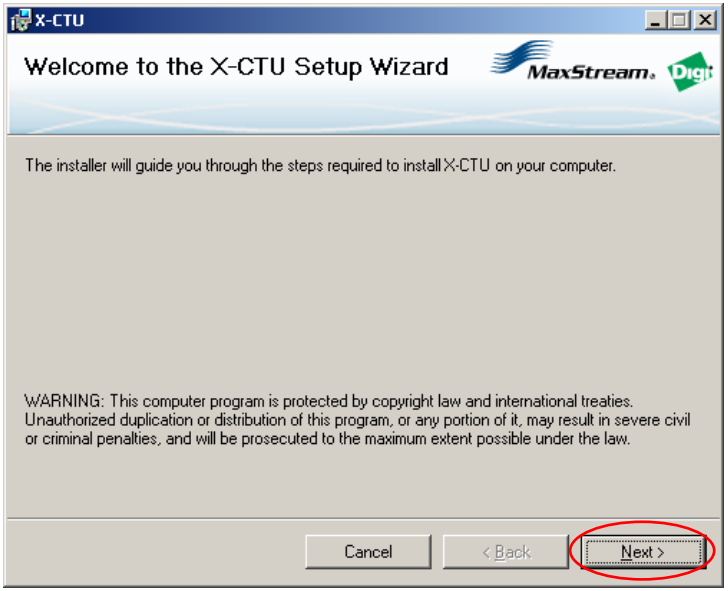
8. Click **No** if asked to replace any newer FTDI files.



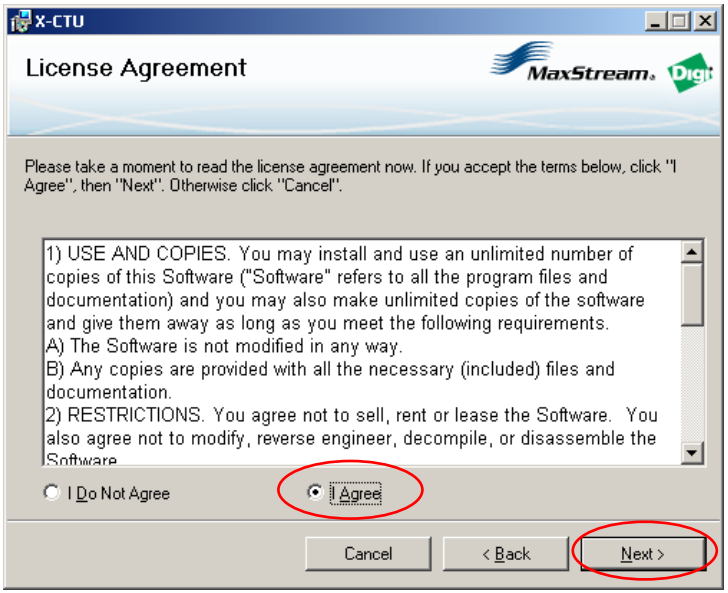
9. Click **Finish** after the serial port adapter is installed.

Setup Radio Modem Configuration Software

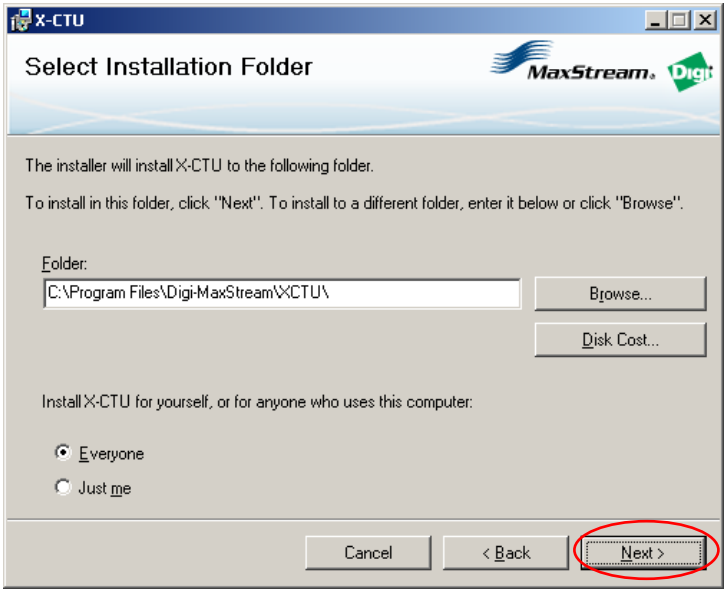
1. Insert the Radio Modem CD into your CD-ROM, the Digi X-CTU software startup screen will come up automatically, click **Install X-CTU software** button on the startup screen.



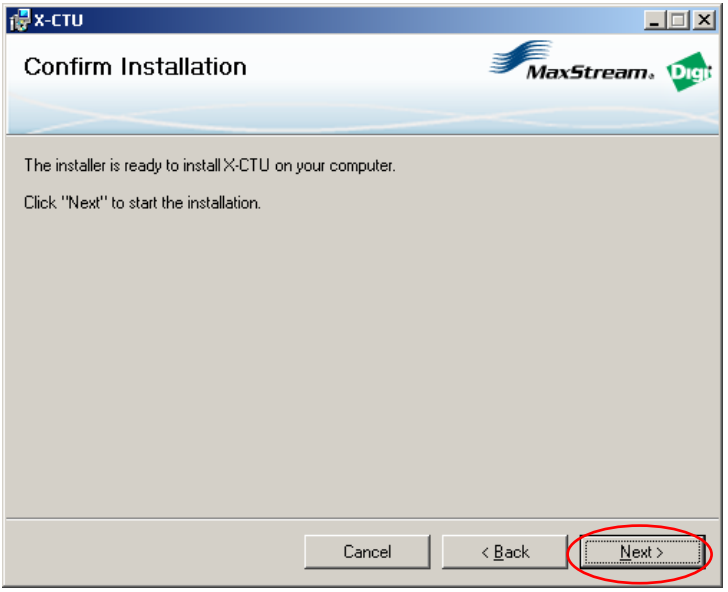
2. Click **Next** on the popup screen.



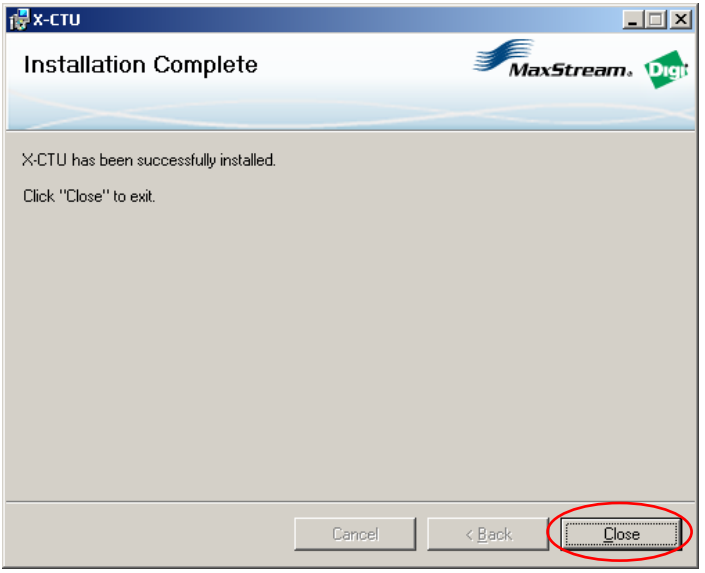
3. Select **I Agree** and click **Next**.



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.

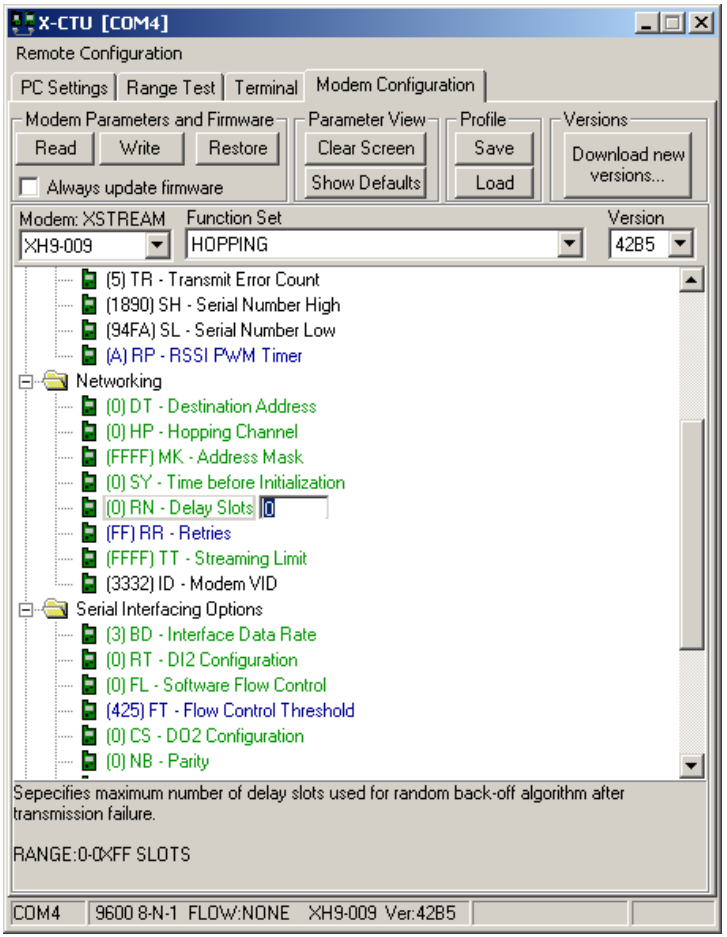
Configure Radio Modem Settings

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.**

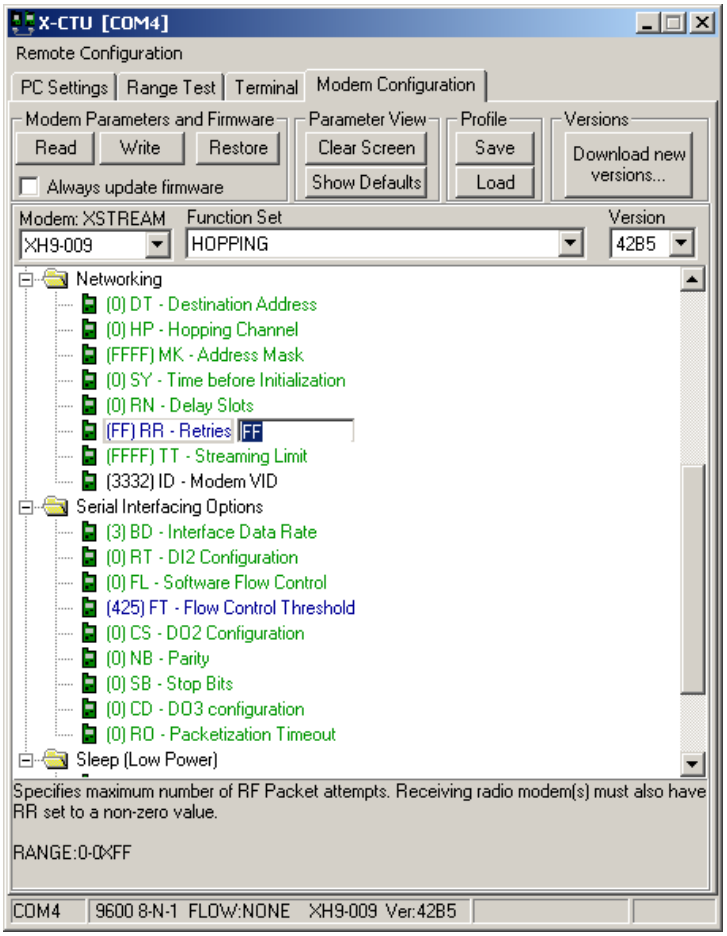
1. Connect the Radio Modem to the USB port of a PC.
2. Run the X-CTU software and select the COM port for the Radio that is connected.
3. Click **Modem Configuration** tab.
4. Click **Read** to display the current settings stored in the Modem.
5. Update each of the following Radio Modem settings by clicking 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 are ***not*** recommended, and may result in loss of communication. Leave all other Radio Modem settings at their default values during the configuration process.

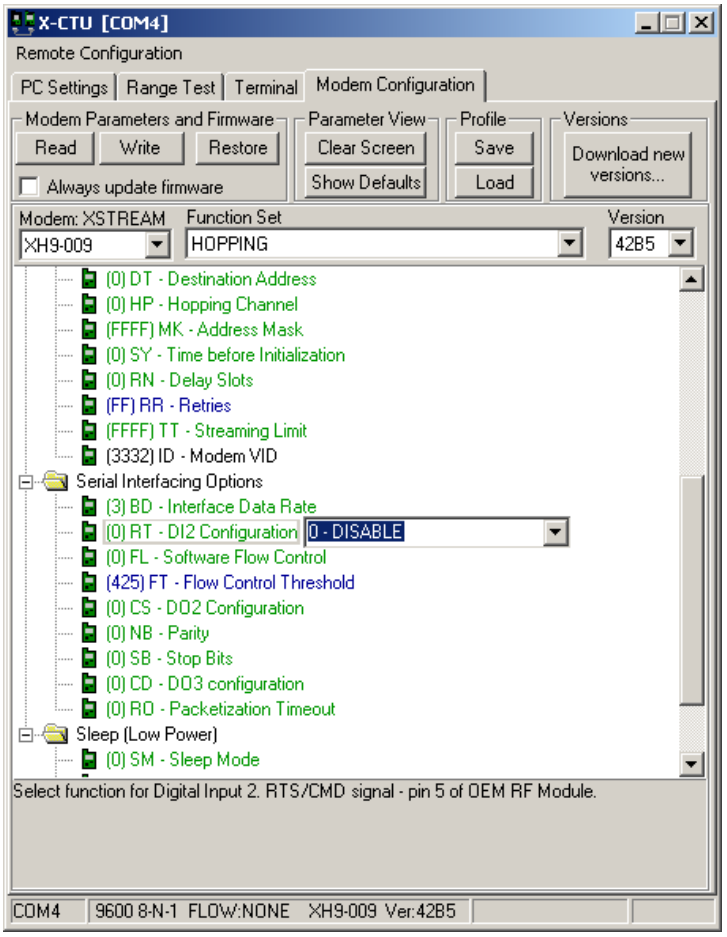
RN-Delay Slots: Set this to "0".



FF-Retries: Set this to “FF”.



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



6. 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. When it is desired 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.

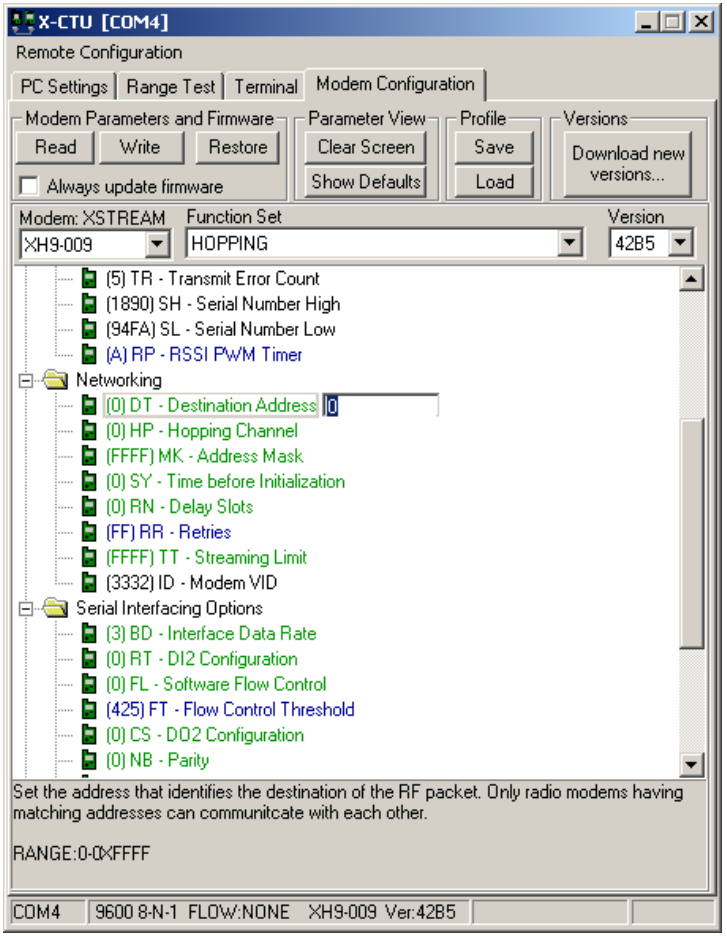
The Destination Address value can be set as a hexadecimal (base-16) value between 0000 and FFFF. Set the modem address using the Digi X-CTU software on your PC.

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 are not recommended, and 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

The Environmental Enclosure should be set up 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. It should not, for example, be placed at the corner of a building, which would cause swirling wind currents and result in poor particle sampling.

The Environmental Enclosure should be used 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

The battery pack within the Environmental Enclosure should be changed every 24 hours of use 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 deeply discharged, and also prevents the DUSTTRAK™ monitor from operating below its rated voltage input. Preventing this condition will prolong the life of the battery. Battery packs should also be fully charged prior to storage to prolong the life of the battery.

Note
Prior to using the Battery Pack for the first time, a full recharge is recommended.

Charging Battery Pack

1. Plug the provided battery charger into an AC outlet. The charger's Green LED will light to indicate that power is on and it is ready to charge a battery pack.
2. Plug the charger connector into the battery pack connector. The Red LED on the charger will light, indicating that the battery pack is in full charge mode. This LED will remain lit until the pack is close to end-of-charge state.
3. When the battery pack is close to being fully charged, the Green LED will come back on, which indicates a trickle charge mode. The battery is considered fully charged at this point. The charger can remain connected in this state indefinitely—it will continue to trickle charge the battery at a very low level until it reaches a maximum charge.

Zeroing the DUSTTRAK™ II/DRX Aerosol Monitor

The DUSTTRAK™ II and DUSTTRAK™ DRX monitor should always be zeroed before beginning a sample. See the instructions in the DUSTTRAK™ II or DUSTTRAK™ DRX user manual for more information. If possible, the instrument should be zeroed 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 affect 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, a padlock should be used 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

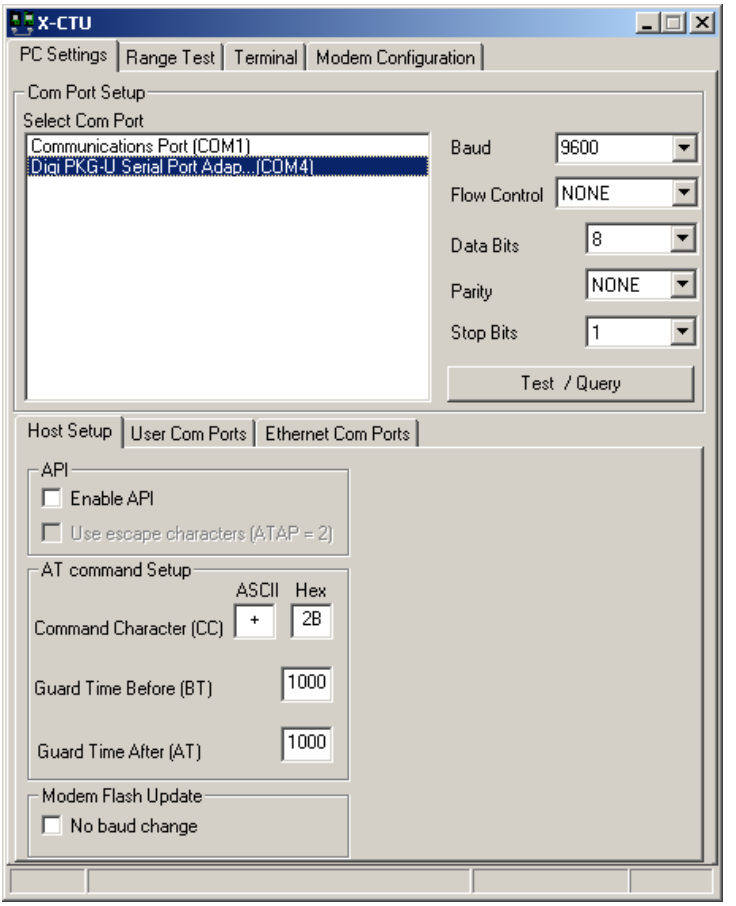
Before beginning a sample, check to see that all of the following conditions are satisfied:

- ✓ 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.

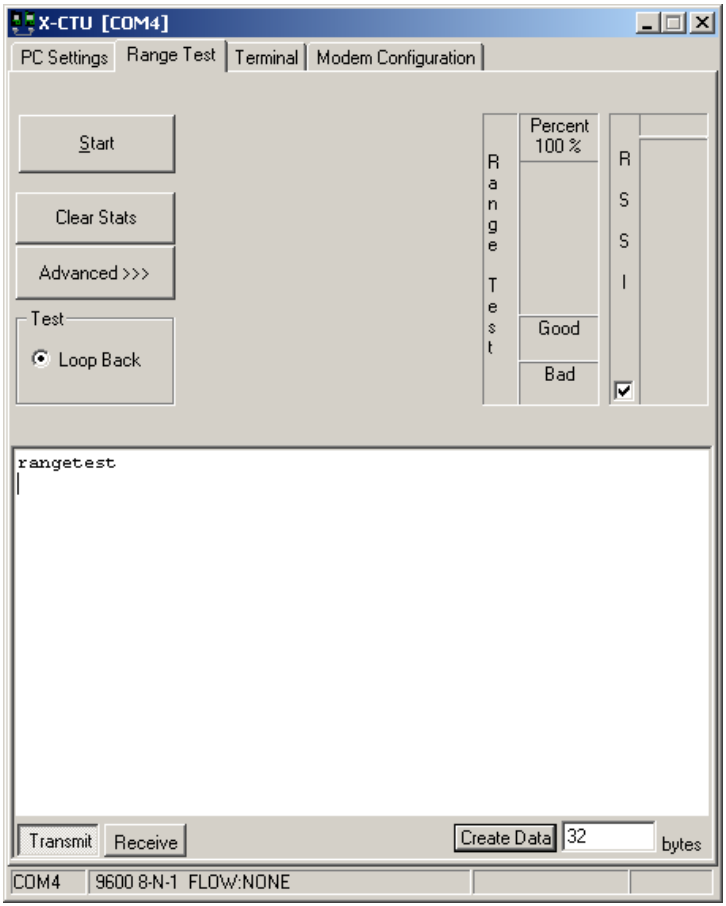
After the completion of monitoring, follow the procedures for transporting the Environmental Enclosure in the Setting Up section of this manual. This prevents the instrument from becoming damaged.

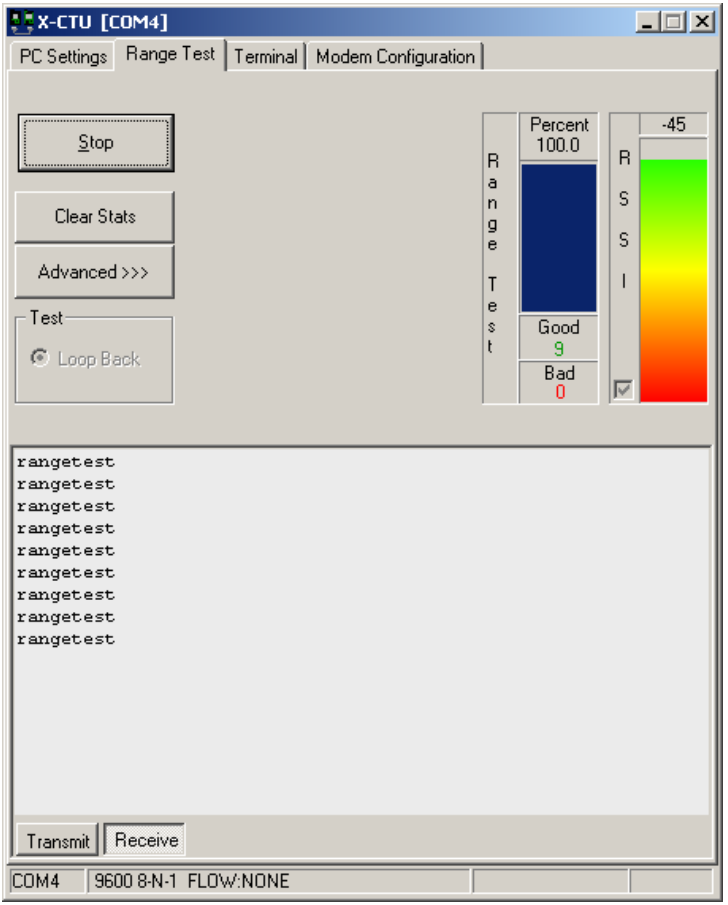
Radio Modem Range Test

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. The Test/Query button can be used 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.


X-CTU [COM4]
PC Settings
Range Test
Terminal
Modem Configuration
Start
Clear Stats
Advanced >>>
Test
Loop Back
Range Test
Percent
100 %
Good
Bad
RSSI
rangetest
Transmit
Receive
Create Data
32
bytes
COM4
9600 8-N-1 FLOW:NONE



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 a Range Test is performed 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. The data can be downloaded by attaching the supplied USB cable from the USB pass-through connector to a computer USB port, and using 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.

Chapter 4

Maintenance

Daily Maintenance Checks

The DUSTTRAK™ II/DRX aerosol monitor should be checked a minimum of once a day to change the battery pack and make sure 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

The battery packs are designed to provide power to the DUSTTRAK™ II/DRX monitor for a minimum of 24 hours, even under cold ambient conditions. To ensure uninterrupted operation, the packs should be replaced daily. If a battery pack has been forgotten and 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 with no loss of data.

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

Replacing the Battery Pack

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 the discharged battery pack with the newly charged one, taking care to secure the fully charged battery with the VELCRO® straps. When closing the case make sure that the tubing does *not* become kinked. Pull the tubing forward while closing the case to prevent this from occurring. To prevent long term damage and loss of capacity recharge the battery promptly after removing it.

Recharging the Battery Packs

The following steps should be followed to correctly recharge the battery packs:

- 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 10 hours..
- Supply AC power to the charger. The Green LED on the front of the charger will light to indicate power is on and it is ready for use.
- Insert the power connector protruding from the battery pack into the output connector attached to the charger. The charger now fast-charges the battery pack. This is indicated by an illuminated Red LED.
- Charging is complete when the Red LED shuts off and the Green LED comes back on. A trickle charge will maintain the full charge. A fully discharged battery may require up to 10 hours to fully charge.

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

Lead acid batteries have a finite life of about 300 charging cycles. This means that the two battery packs last around two years without need of replacement. 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.

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 8.

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.	Make sure Battery Pack is fully charged.
	Battery Pack not plugged into DUSTTRAK monitor.	Plug battery power plug into the power jack in DUSTTRAK monitor.
	Bad Battery Pack (no longer able to be recharged).	Replace with new Battery Pack.
Readings are unusually low.	Zero was not checked on DUSTTRAK monitor.	Re-zero DUSTTRAK monitor at desired sampling conditions.
	Plugged external inlet.	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.
	Sampling in wind speeds over 22 mph.	DUSTTRAK monitor will under-sample slightly in high wind speeds. No correction possible.
	Enclosure located near an object that obstructs the flow.	Move the Environmental Enclosure into a more open area.
	Leak in the inlet.	Make sure the upper inlet assembly and the water trap are screwed in tightly.
		Make sure tubing is secured on the enclosure barb and the DUSTTRAK monitor.
		Make sure inlet assembly O-ring is in place.
		Re-grease the O-rings sealing the inlet assembly and the water trap bottle.

Appendix A

Specifications

Specifications are subject to change without notice.

Environment Enclosure

Sampling Conditions

Wind Speed	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, 36 Ah
Battery Run-time	24 to 40 hours (typical)
Battery Charge Time	8 hours at 72°F (22°C) (New battery, deep discharge to 95% charge)

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

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

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