FLIR
Extraordinary Protection

Airtec™
Diesel Particulate Monitor

OPERATORS MANUAL

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TRADEMARKS

PROPRIETARY INFORMATION

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1.0 PRODUCT INTRODUCTION AND DESCRIPTION

The Airtec Diesel Particulate Monitor is a commercial product manufactured and available from FLIR Systems to display elemental carbon levels in real-time, taking the measurement out of the laboratory and placing it in the hands of mine operators and ventilation engineers. Sensitive, rugged and easy to use, the Airtec monitor provides results that are time-and space-resolved. This capability enables rapid modification of vehicle use, personnel placement and mine or building ventilation. The monitor uses technology developed by the diesel particulate group at the NIOSH Pittsburgh Research Laboratory and has been determined to precisely replicate results from their method 5040 test.

In addition to being compact and light-weight enough to be worn on a miner's belt, the Airtec monitor can be mounted in a vehicle cab, on a mine wall or on ventilation equipment. The monitor operates on a Lithium-ion battery for more than a full shift or on AC power using an adapter. Readings are displayed on an LCD screen with a user-selectable backlight and data can be downloaded using supplied software via USB connection for review of an extended monitoring period. The instrument has an integrated air pump and submicron particle size selector.

2.0 PRINCIPLE OF OPERATION

The Airtec measures elemental carbon (EC) in the wearer's breathing zone. Air is pulled through a prefilter at a controlled rate. The prefilter is the same that is used in the NIOSH 5040 test. It consists of a cyclone and impactor to remove particles greater than 0.8 microns. Particles measuring smaller than 0.8 microns pass through the particle size selector to a filter cassette, where the optical transmittance of the filter is monitored by a laser and sensor. The optical transmittance is converted to an EC concentration using a factory calibration stored in the monitor.

3.0 SAFETY PRECAUTIONS

WARNING: The Airtec is for testing purposes only. It should not be used to establish that an environment is safe, and the user should only use it in parallel with established methods of air sampling.

No attempt should be made to open the monitor case except using the Filter Cassette Door. The monitor should only be used with filter cassettes and prefilter cartridges supplied by FLIR Systems. There are no user-serviceable parts in the monitor except for prefilter cartridge and filter cassette replacement.

WARNING: The Airtec is water resistant, but not waterproof. Do not immerse the monitor in water. If the monitor is exposed to a large quantity or pressure of water, allow it to dry thoroughly before using it. Pay particular attention to the self-test result displayed on the LCD screen when the system is powered on. If a serious fault is displayed, contact FLIR Systems for support.

4.0 PRODUCT SPECIFICATIONS

Table 1 describes the Airtec specifications.

Table 1. Airtec Specifications

Characteristic	Description
Weight	600 g (1.32 lbs)
Power Requirements	7.4 VDC (built-in Lithium-ion battery) 100–240 VAC
Sensitivity	< 15 µg/m^3 elemental carbon (EC)
Dynamic Range	~50-600 µg/m^3 (8 hour Time Weighted Average (TWA) EC)
Outputs	LCD display with user-controlled backlight User selectable 1, 5, 15, 60 minute data logging EC, Total Carbon (TC), and 8 hour TWA DPM levels Mini-USB connection Optional 4-20 mA output
Alarms	Alarm, low battery, pump flow
Battery Life	>12 hours
Case Dimensions	13.2cm(H) x 13.2(W) x 6.4cm(D) 5.12"(H) x 5.2"(W) x 2.5"(D)
Data Archive	16MB / 91 days at 1 minute sample intervals
Operating Temperature	-20℃ to ~60℃ -4°F to 140°F
Communication	USB
Collection Media	Filter Cassette
Mounting	May be worn on a belt or mounted on a vehicle or wall

5.0 AIRTEC SYSTEM STANDARD COMPONENTS

Table 2 describes the standard components that ship with the Airtec system.

Figure 1. Airtec system components

Table 2. Airtec System Standard Components

No.	Component	Description
1	Airtec Monitor	Real-time diesel particulate monitor
2	Inlet Prefilter Assembly	Inlet Prefilter and Tubing to connect Prefilter to Airtec monitor
3	Filter Cassette	Replaceable cassette captures media for EC analysis
4	Prefilter Cartridge	Replaceable cartridge prefilters larger particles
5	USB to Mini-USB PC Cable	Cable to connect monitor to PC to download data and change settings
6	9V 2A Power Supply (120VAC)	Charge the battery or provide constant power to the monitor

Software Installation CD (not pictured)	Used for data download to a computer	
Operation Manual (not pictured)	Operator instructions	
Quick Reference Sheet (not pictured)	Laminated operations reference	

6.0 MONITOR FEATURES

Figure 2. Front View – Airtec with Inlet Prefilter Assembly attached and Prefilter Cartridge installed

Table 3. Unit Features – Front View

No.	Feature	Purpose
1	Inlet Prefilter Assembly	Contains Air Inlet, Prefilter and rubber tubing to draw in air and filter out larger particles from entering monitor
2	Prefilter Cartridge	Filters larger particles

Figure 3. Inlet Prefilter Assembly

Table 4. Unit Features – Inlet Prefilter Assembly

No.	Feature	Purpose
1	Prefilter Cartridge Retainer	Plate attached by springs to secure the top of the Prefilter Cartridge to Inlet Prefilter Assembly
2	Prefilter Barb	Used to secure the bottom of the PreFilter Cartridge to the Inlet Prefilter Assembly
3	Air Inlet	Slit that draws air in for particle collection

Figure 4. Top view – LCD Display, Mast and Filter Cassette Door

Table 5. Unit Features – Top View

No.	Feature	Purpose
1	LCD	Displays current operation or an error message
2	Mast	Connects the Inlet Prefilter Assembly to the Filter Cassette (shown with protective black cap over Mast Barb)
3	Filter Cassette Door	Sliding door for access to Filter Cassette Chamber

Figure 5. Back view – Mast Barb, Filter Cassette Door Lock (circled) and Belt Clip

Table 6. Unit Features – Back View

No.	Feature	Purpose
1	Mast Barb	Used to connect Inlet PreFilter Assembly rubber tubing to the Mast
2	Filter Cassette Door Lock	Quarter-turn knob to lock Filter Cassette Door in place
3	Belt Clip	Enables user to wear monitor on a belt

Figure 6. Side view – Buttons 1 and 2 and Power/USB Port Cover

Table 7. Unit Features – Side View

No.	Feature	Purpose
1	Button 1	Used to cycle through the Airtec menus
2	Button 2	Used to select the desired value in each menu
3	Power/USB Port Cover	Protective cover for USB port and power supply jack

7.0 INLET PREFILTER ASSEMBLY INITIAL SET-UP

The Inlet PreFilter Assembly requires set-up before first use.

Step 1:   Remove the Inlet Prefilter Assembly and Prefilter Cartridge from the case.

Step 2:   Gently pull the red caps *(Figure 7)* from both ends of the Prefilter Cartridge and discard.

Figure 7. Prefilter Cartridge

Step 3:   Remove the protective foam from around the Prefilter Cartridge Retainer *(Figure 8)*. The foam may be discarded or saved for future use during transit if desired.
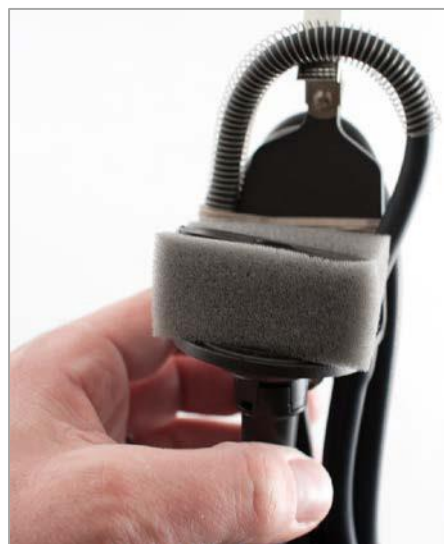
Figure 8. Prefilter Cartridge Retainer with protective foam

Step 4:   Hold the Inlet Prefilter Assembly in one hand.

Step 5:   Press the Prefilter Cartridge Retainer up and out of the way with thumb *(Figure 9)*.

Figure 9. Prefilter Cartridge Retainer and Prefilter Barb (circled)

Step 6:   Hold the Prefilter Cartridge in other hand with protruding inlet (wider side) up.

Step 7:   Press the cartridge end into the Prefilter Barb until snug *(Figure 10)*.

Figure 10. Prefilter Cartridge attached to Prefilter

Step 8: Place the Prefilter Cartridge Retainer over the top of the cartridge *(Figure 11)*.

Figure 11. Prefilter Cartridge Retainer attached to top of installed Prefilter Cartridge

Step 9: Press the Luer® fitting end of the Inlet Prefilter Assembly tubing into the top of the Prefilter Cartridge *(Figure 12)*.

Figure 12. Inlet Prefilter Assembly tubing connected to top of the Prefilter Cartridge

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Step 10: Remove the cap from the other end of the rubber tubing *(Figure 13, circled)*. The cap may be discarded or saved for future use during transit if desired.
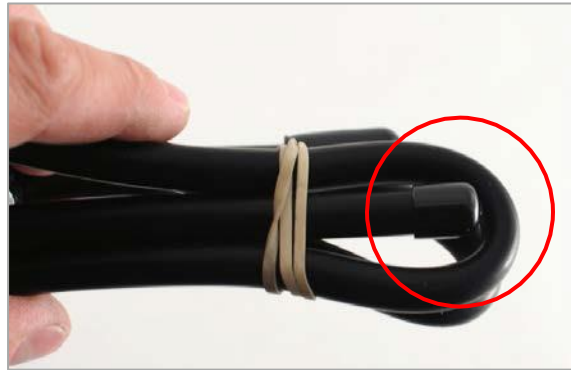
Figure 13. Tubing Cap

Step 11: Remove the black cap at the end of the Mast protecting the Mast Barb. The cap may be discarded or saved for future use during transit if desired.

Step 12: Slide the exposed end of the tubing over the Mast Barb *(Figure 14)* until it completely covers the barb.

Figure 14. Inlet Prefilter Tubing attached to Mast Barb

8.0 MONITOR POWER

There are two ways to power the Airtec:

- Factory-installed internal lithium-ion battery (DC power)
- External power supply provided with the monitor (AC power)

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The monitor will run on battery power unless the power supply is connected. The power supply also serves as a battery charger (Section 21).

CAUTION: Use only the power supply provided with the Airtec.

The jack for the power supply is located under the Power/USB Port Cover. The cover attaches to the monitor via a small swivel peg. Follow the steps below to run the monitor via the power supply.

Step 1:   Place thumb and index finger on the tab at the bottom of the Power/USB Port Cover.

Step 2:   Gently lift tab and pull the cover slightly away from the monitor.

Step 3:   Carefully rotate the cover up to reveal the power jack underneath *(Figure 15)*.

Figure 15. Power/USB Port Cover

Step 4:   Connect the barrel plug end of the power supply barrel plug into the jack on the monitor *(Figure 16)*.

Figure 16. Power Supply connection

Step 5:   Connect the power supply to a standard 120VAC wall socket.

Step 6:   Press Button 2 to illuminate the LCD and display the charge/battery indicator during charging. The battery will charge even if the display is not illuminated.

9.0   LOAD AND REMOVE AN AIRTEC FILTER CASSETTE

A Filter Cassette will last ten (10) hours or more in most underground mine atmospheres. Valid measurements may be taken up to approximately a NIOSH TWA level of 600 µg/m^3 if the unit is continuously operating.   The working lifetime of a cassette will depend on the level of diesel particulate material in the air. In relatively clean environments, a cassette will have a longer lifetime compared to operation in areas with higher levels of particulates. Many users will choose to install a new filter cassette for every day or shift of use. This practice will suffice for a full shift of use in all except very high DPM concentration environments.

The monitor will alarm when the filter cassette has approximately 1/3 of its life (EC capacity) remaining. The alarm message "FILTER WARNING" will appear on the display. Press either control button to dismiss the warning.

When nearly all of the filter EC capacity has been used, the warning "CHANGE FILTER" will appear on the display. When the "CHANGE FILTER" warning appears, further data taken with that cassette will NOT be valid. The filter cassette should be changed immediately. The alarm can be dismissed by changing the cassette or pressing either control button.

WARNING: Only filter cassettes provided by FLIR Systems should be used in the monitor. NIOSH 5040 cassettes should not be used in the monitor to provide real-time EC data.

Perform the steps below to load and remove the filter cassette.

WARNING: Always verify the monitor is turned off before accessing the filter cassette.

Step 1:   Hold the monitor in one hand with the Filter Cassette Door facing out and the Power/USB Port Cover side facing into the palm *(Figure 17)*.

Figure 17. Hold monitor with the Filter Cassette Door facing out

Step 2:   Turn the Filter Cassette Door Lock ¼-turn counter-clockwise to unlock the door *(Figure 18)*.

Figure 18. Filter Cassette Door Lock

Step 3:   Grasp the Filter Cassette Door with the other hand *(Figure 19)*.

Figure 19. Gently slide Filter Cassette Door until it stops

Step 4:   Gently slide the door vertically until it stops to reveal the Filter Cassette Chamber *(Figure 19)*.

NOTE: The Filter Cassette Door has two "stops" when a cartridge is in the chamber. The first stop is when the door meets the resistance of the Luer fitting of the Mast in the cassette. The second stop is after the Luer fitting of the Mast has been released from the cassette and the slider travel is limited by the monitor's design. Figure 20 below left shows the door at the first "stop" while the right image shows the door at the final or second "stop".

Figure 20. Filter Cassette Door opened to first stop (left) and second stop (right)

The cassette chamber has a red Luer fitting inside *(Figure 21, circled)* to secure the bottom of the Filter Cassette in place. The Mast, which extends inside the chamber, has a Luer fitting attached to its end. This fitting slides into the end on the top of the cassette. The Filter Cassette is locked in place when the door is slid down.

Step 5:   If a Filter Cassette is already in the chamber, remove it by sliding the cassette toward the top of the chamber until it disengages from the Luer fitting at the bottom of the chamber.

Step 6:   Discard the used cassette in accordance with local regulations.

Step 7:   Inspect the cassette chamber to ensure there are no obstructions or foreign material.

Step 8:   Unwrap a new Filter Cassette. Discard packaging.

Step 9:   Remove the red and blue caps at the ends of the cassette.

Step 10:   Place the monitor onto a hard surface with the buttons facing down and the cassette door facing up *(Figure 21)*.

Figure 21. Filter Cassette Chamber with Luer fitting

Step 11:   Insert the new cassette with the white filter towards the bottom Luer fitting *(Figure 22)*.

Figure 22. Filter Cassette inserted in cassette chamber

Step 12:   Grasp the top of the Mast and slide it toward the Filter Cassette while holding the cassette in place until the Mast fitting aligns with the upper cassette receptacle *(Figure 23)*.

Figure 23. Slide Mast Luer into the Filter Cassette

WARNING: Use light pressure to slide the Mast to avoid cracking the Filter Cassette.

Step 13:   Gently wiggle the cassette from side to side while holding it as shown in Figure 23 to ensure that both fittings are securely inserted into the cassette receptacles. If there is no motion, the cassette is properly installed.

Step 14:   Gently slide the Filter Cassette Door over the cassette chamber until it is completely closed *(Figure 24)*.

Figure 24. Filter Cassette Door closed

WARNING: The Mast fitting is not fully inside the cassette receptacle if the door does not completely close. To adjust, slide the door open and gently wiggle the Filter Cassette side to side to realign. Slide the Mast fitting into the end then slide the door closed again.

Step 15:   Turn the Filter Cassette Door Lock ¼-turn clockwise until it clicks, locking the door in place.

10.0 HOME SCREEN

The LCD will display the Home Screen after the monitor is powered on. The Home Screen displays the monitor name, status icons and messages, time (HH:MM 24-hour format), and date *(Figure 25)*.
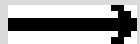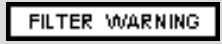

Figure 25. Airtec Home Screen

10.1 STATUS ICONS

Two status icons are displayed above the monitor name. They indicate the status of the battery charge level and if there is sufficient airflow. Either the icon for sufficient airflow or the icon for insufficient airflow will be displayed, not both icons.

Table 8. Status Icons

Icon	Description
｜｜｜｜｜ (battery icon)	Indicates the level of the battery charge
Low Bat !	Indicates the battery charge is extremely low
(flow rate icon, crossed arrow)	Indicates the flow rate is too high or too low
(flow rate icon, arrow)	Indicates the flow rate is within the specified range
Alarm State	Indicates an alarm condition; press Button 1 to acknowledge the alarm and dismiss the icon.
(bell icon)	Indicates an alarm condition; icon will remain until alarm is cleared by restarting the monitor or replacing the Filter Cassette.
CHANGE FILTER	Indicates Filter Cassette should be changed soon. Press Button 1 to acknowledge the alarm and dismiss the icon.
	Indicates Change Filter warning has been activated. Icon will remain until alarm is cleared by replacing the Filter Cassette.
FILTER WARNING	Indicates EC loading on Filter Cassette is high and will be out of the monitor's range if further sampling is conducted. Press Button 1 to acknowledge the alarm and dismiss the icon. The alarm is cleared by replacing the Filter Cassette.

10.2 STATUS MESSAGES

The Home Screen will display either "OK" or "Err" to indicate the status of the monitor. Table 9 describes these messages.

Table 9. Status messages

Message	Description
OK	System is functioning normally
Err	System has encountered an error

11.0 BASIC OPERATION

Step 1:   Connect the Prefilter and Prefilter Cartridge *(Section 7)*.

Step 2:   Load a Filter Cassette if needed *(Section 9)*.

Step 3:   Press and hold Button 1 until the LCD illuminates to turn on the monitor. The Home Screen will display *(Section 10)*.

The LCD will briefly display the start up screen identifying the monitor and firmware version followed by the Home Screen. The screen backlight will automatically dim after 30 seconds. Press either Button 1 or Button 2 to turn on the backlight.

WARNING: Condensation may form on the optics if the monitor is brought from a colder area to a warmer area. This will result in a temporary drop in photodiode voltage that may be mistaken for a high EC value. An interval of 5-10 minutes may be required before the monitor temperature allows valid data to be obtained during such temperature changes.

The monitor's default operational settings will be acceptable for most users. Advanced users can easily change operational parameters, such as sampling interval and air flow rate by connecting to a PC *(Section 19)*.

EC data in µg/m^3 of air is displayed on the LCD screen and stored in non-volatile memory. The user can track data in two ways — write it down or download it to a PC via the included USB cable at a later time.

The rechargeable lithium-ion battery will operate the monitor for up to 12 hours. The Filter Cassette should be replaced after the monitor alarms *(Section 9)*.

Step 4: Press and hold Button 1 for four (4) seconds to turn off the monitor when sampling is complete. The LCD will display "Powering down" and then turn off *(Figure 26)*.

Figure 26. Airtec Home Screen while monitor is powering down

12.0 OPERATION VERIFICATION

Perform the steps below to verify the monitor is operating properly.

Step 1: Press and hold Button 1 until the LCD illuminates to turn on the monitor. The Home Screen will display.

Step 2: Pinch the black rubber tubing that connects the inlet prefilter assembly to the monitor.

The sound of the pump will change and the 'Flow Error' error message will appear on the display to indicate a flow restriction *(Figure 27, circled)*. If this does not occur, remove the Filter Cassette and check the Luer receptacles to ensure they are not cracked *(Section 9)*.
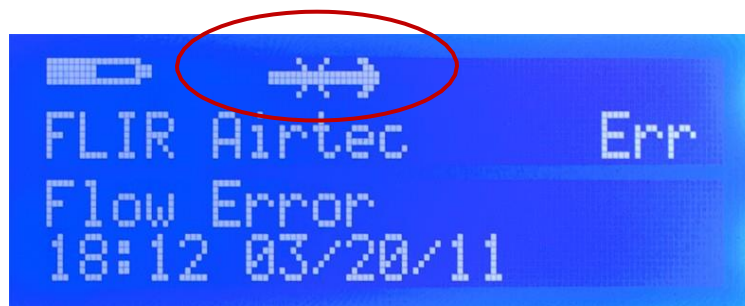

Figure 27. Flow Error message on Home Screen

Step 3: Release the tubing. The sound of the pump will change again and the 'Flow Error' icon will be replaced with the 'Ok Flow' icon to indicate the monitor is functioning properly *(Figure 28, circled)*.

Figure 28. OK Flow message on Home Screen

13.0 MENU NAVIGATION

Button 1 cycles through the Airtec menus in order as shown in Table 10. Button 2 scrolls through the setting options for a given menu. Press Button 1 to navigate to the menu that needs to be changed. Press Button 2 to toggle between the values available. Press Button 1 again to accept the value selected with Button 2 and advance to the next screen.

Table 10 describes the menus and setting options available for each menu. A Menu Navigation Flow Chart is also available in the Appendix.

Table 10. Airtec Menus and menu navigation

Menu	Description
Home Screen	Displays monitor name, status icons, status messages, Time (HH:MM 24-hour format) and date
	From the Home Screen:
	Press Button 2 to display the monitor settings and EC value
	Press Button 2 again to display the monitor settings and TC value
	Press Button 2 again to display NIOSH TWA
	Press Button 2 again to display Run Time (HH:MM:SS format). The value is the cumulative time the monitor has been running.
	Press Button 2 again to return to the Home Screen
	Press Button 1 to cycle through the Airtec parameter settings noted below
Sensor Voltage	Displays the voltage output of the laser sensor (reference only). This menu is only

	available if advanced settings are turned on. Refer to Table 12 to turn on advanced settings. There are no values to select on this menu.
Battery Voltage	Displays the current battery voltage (reference only) This menu is only available if advanced settings are turned on. Refer to Table 12 to turn on advanced settings. **NOTE:** A charged battery will read approximately 8.3V, and the monitor will display a low battery warning at a level of approximately 7.4V. There are no values to select on this menu.
Reset Runtime	Displays **Yes?** Press Button 2 to reset the displayed run time to zero.
Sample Rate	Monitor has preprogrammed sampling times of 1, 5, 15 or 60 minute intervals. Higher (longer) values provide lower time resolution EC data. This setting is recommended for use in areas with low EC values. Smaller (shorter) values provide higher time resolution and are recommended in areas with higher EC levels. Press Button 2 to toggle between 1, 5, 15 or 60 minute sampling intervals. Press Button 1 to select time. Default setting is 1 sample/minute.
Flow Rate	Can be set to HIGH (1.7 lpm) or LOW (0.85 lpm). A higher flow rate is recommended for enhanced sensitivity in low EC environments. Press Button 2 to toggle between High or Low flow rates. Press Button 1 to select desired value. Default setting is HIGH.
Sensitivity Range	The monitor can automatically switch between LOW and HIGH detector sensitivity. Through a PC connection, the auto ranging function can be disabled, allowing the monitor to be set to HIGH or LOW manually. With auto ranging disabled, press Button 2 to toggle between HIGH or LOW range. Press Button 1 to select desired value. Default setting is AUTO Range.
TC Factor	A multiplier used to convert EC levels to TC levels. The TC Factor is different for every mine/environment. The default setting is 1.000 and the TC Factor can be set via the PC connection interface.

14.0 MOUNTING THE MONITOR

The Airtec has been designed for personal monitoring. It may also be mounted to a tripod, a vehicle or on a mine wall for area monitoring.

Step 1:   Affix the monitor to a belt using the belt clip *(Figure 29, left)*.

Step 2:   Clip the Inlet Prefilter Assembly near the breathing zone via the attachment clip *(Figure 29, right)*.

WARNING: The air inlet must be positioned within the MSHA 30.CFR 70/71.208 breathing zone for personal monitoring defined as within 18 inches of the mouth.

Figure 29. Mounting for personal monitoring

The monitor is also equipped with a ¼-20 tripod mount behind the belt clip for additional mounting options *(Figure 30, circled)*. To use, remove the screws securing the belt clip to the monitor and attach to a tripod ¼-20 mounting plate.

Figure 30. ¼-20 tripod mount under Belt Clip (circled)

15.0 PC CONNECTION

Connection to a PC allows the user to download data and logs, change settings and view live information via the Hyper-Terminal or the AirtecView software.

NOTE: The monitor cannot be powered or charged via the USB connector.

The USB port is located under the Power Supply/USB Port Cover. The cover attaches to the monitor via a small swivel peg. Follow the steps below to access the port.

Step 1:   Place thumb and index finger on the tab at the bottom of the Power/USB Port cover.

Step 2:   Gently lift tab and pull the cover slightly away from the unit.

Step 3:   Carefully rotate the cover up to reveal the female mini-USB connection port underneath the cover *(Figure 31)*.

Figure 31. Power Supply/USB Cover

Step 4:   Connect the USB cable into the connection port *(Figure 32)*.

Figure 32. USB connection to a PC

See Section 16 for instructions to interface with a computer.

16.0 AIRTECVIEW SOFTWARE INSTALLATION

AirtecView Software will collect, log, plot, and display all of the data transmitted by the Airtec monitor.

AirtecView has the following minimum computer requirements:

- ☐ Pentium 4 or higher
- ☐ Windows 2000 SP3/XP/Vista
- ☐ 1024x768 resolution or higher video adapter
- ☐ minimum 256 MB of RAM
- ☐ 12 MB free hard disk space
- ☐ Microsoft compatible mouse

NOTE: It is strongly recommended that all programs be closed before installing the software.

Perform the steps below to install AirtecView Software**.**

Step 1:   Insert the AirtecView CD shipped with the unit. If installation does not start automatically click open the software folder and run "setup.exe". Wait for the Welcome Screen to appear**.**

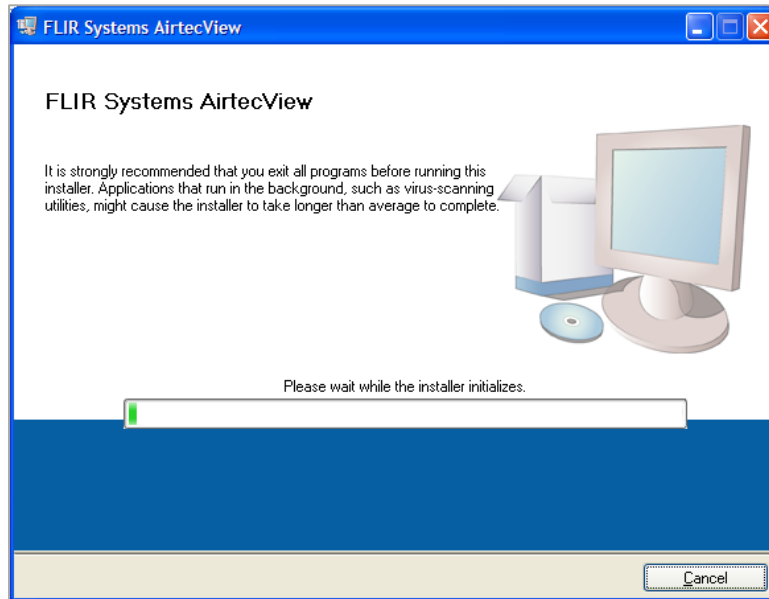Step 2:   Click "Next>" from the Welcome Screen *(Figure 33)*.

Figure 33. AirtecView Welcome Screen

The destination directories for the installation are shown on the Destination Directory Screen *(Figure 34)*. If different destination directories are required, select the "Browse…" button and select the desired directory.

Figure 34. Destination Directory Screen
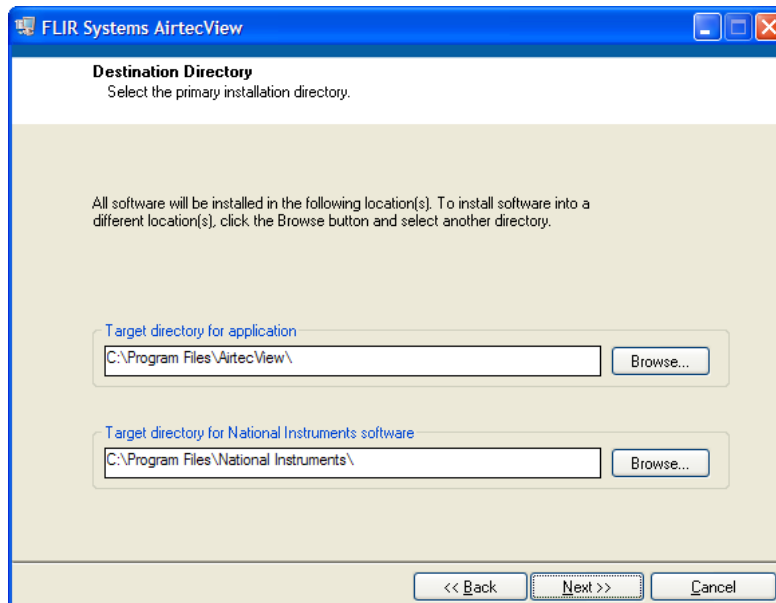
Step 3: Click on "Next>" from the Destination Directory Screen. The Start Installation Screen *(Figure 35)* will appear.
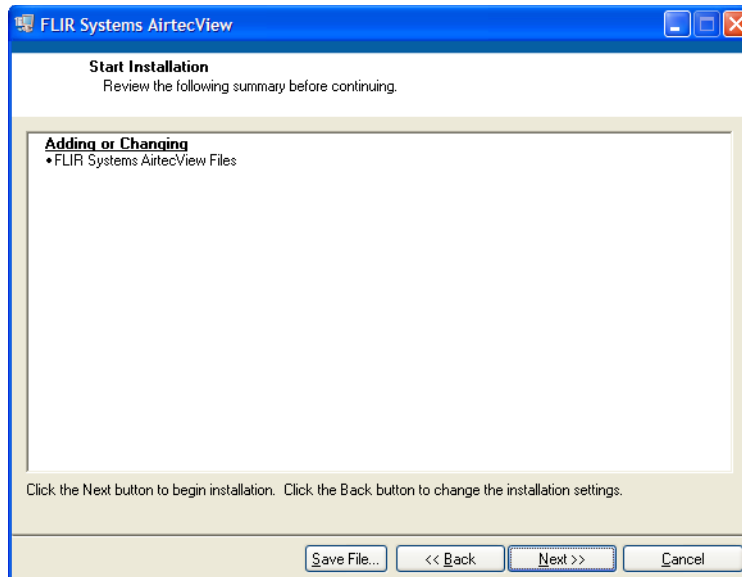

Figure 35. Start Installation Screen

Step 4: Click on "Next" to start installation. The Installing Screen *(Figure 36)* will appear while the software is installing.
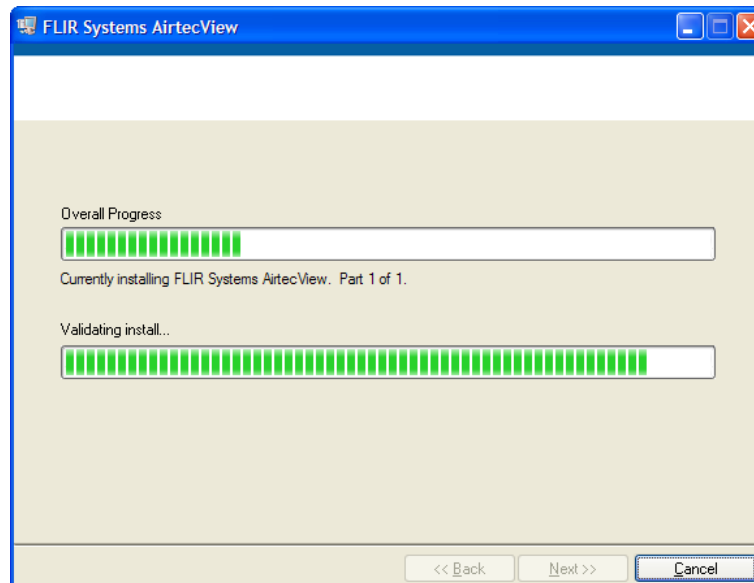
Figure 36. Installation progress Screen

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Step 5:   Click on "Finish" when the installation is complete *(Figure 37)*.
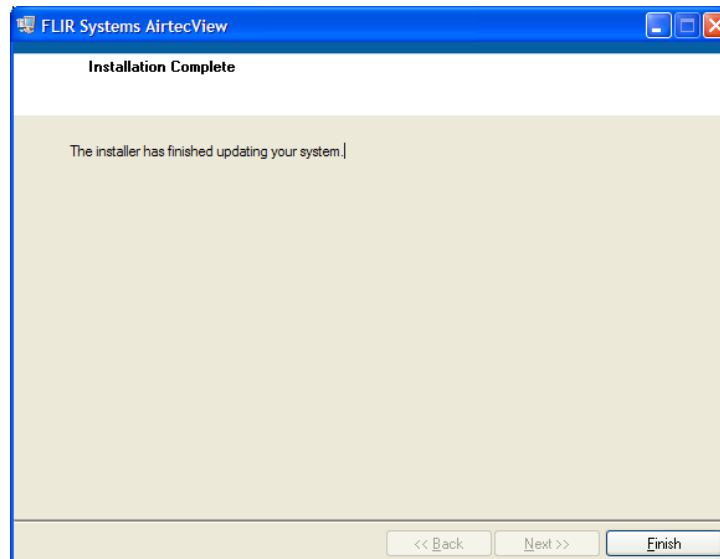
Figure 37. Installation Complete Screen

It may be necessary to restart the computer after the software has been installed. If a restart is required, the **Restart Screen** *(Figure 38)* will appear. Click on **"Restart"** to finish the installation.
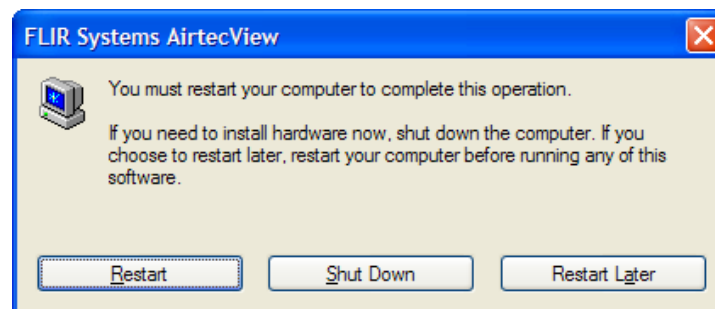
Figure 38. Restart Screen

The AirtecView Software is now installed.

17.0 USB CONFIGURATION DRIVER

The USB Configuration Driver is needed. To install the USB driver follow the steps below.

Step 1:   Click open "D:\Airtec Drivers\USB" folder from the Installation CD.

Step 2:   Run "CDM 2.02.08.exe".

The latest drivers can be downloaded from:

http://www.ftdichip.com/Drivers/VCP.htm
http://www.ftdichip.com/Drivers/CDM/CDM20814_Setup.exe

The drivers are installed automatically without any user intervention.

The computer will recognize an Airtec when it is connected to the USB port and it will assign it a COM port.

18.0 OPERATION WITH AIRTECVIEW SOFTWARE

Perform the steps below to start AirtecView Software.

Step 1:   Choose Program→ FLIR Systems → AirtecView from the Start Menu. The program will start with the main AirtecView screen *(Figure 39)*.
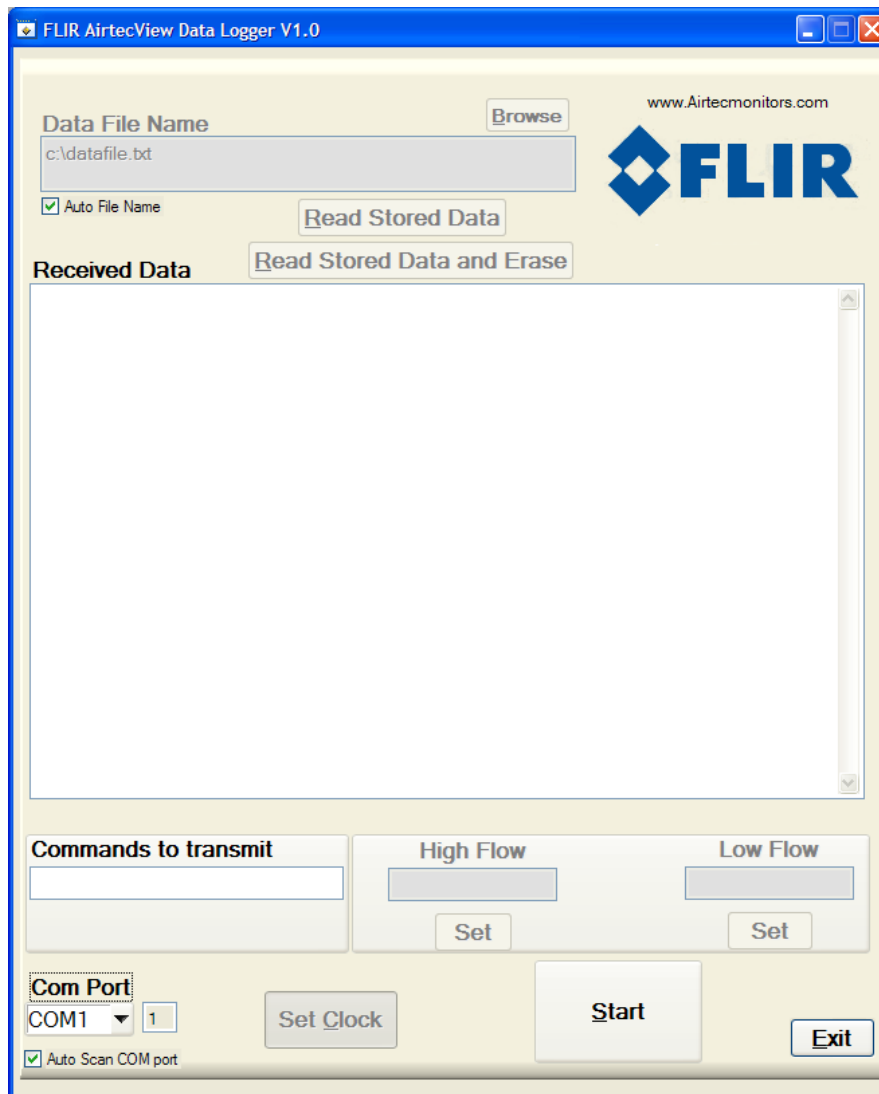
Figure 39. AirtecView Main Screen

Auto File Name is selected by default. This option will create a file with the monitor's serial number and date and time when the log file is created.

NOTE: It is recommended the Auto File Name default be selected.

Step 2: Enter the directory where files are to be saved when prompted. Example file name: "*Airtec_0107_02-25-2011_14-42.csv*".

Uncheck the Auto File Name box to manually choose the file name entry. Enter a log filename in the box under Data File Name. To select a different file from the default, click on the "Browse…" button

and choose the desired file. The log file will record every message transmitted by the Airtec monitor along with time and date stamps.

Auto Scan COM Port option is selected by default. This will allow the software to automatically detect the COM port that the monitor is connected. Uncheck the box and select the COM port that the monitor is connected to *(Figure 40)* if the automatic scan for the COM port is not chosen.
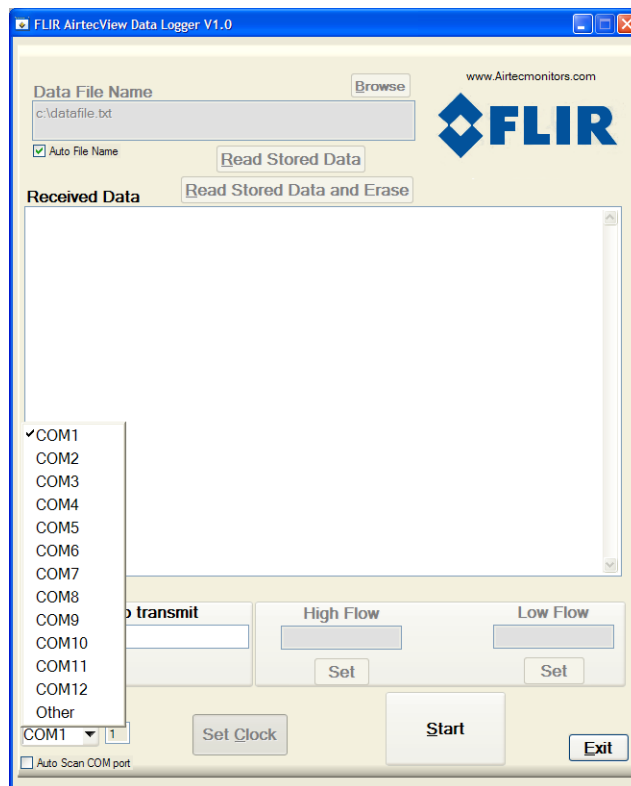
Figure 40. AirtecView COM selection Screen

Assuming the log file is 'C:\ Airtec_0107_02-25-2011_14-42.csv" one more file that may be generated with this software. File C:\ Airtec_0107_02-25-2011_14-42-stored.csv stores data that has been already been stored in the internal storage memory. It will not store other messages transmitted by the instrument. This is the file used to post-process data. A sample header and data in the file is shown *(Figure 41)*.

	Time	Date	Optical Se	Flow Sensor Actual	Air Flow Level	Sensitivity	TWA	5 min EC	Current EC	Fault Status
$rd-data	12:57	1-Jan	891	512	1	0	0	0	0.832	1
$rd-data	12:40	1-Jan	884	506	1	0	0	0	0.337	1

Figure 41. AirtecView COM selection Screen

Step 3:   Power on the monitor to start the collection process.

Step 4:   Select the "Start" button to begin the data logging process. The button will change to the
             "Stop" indication.

If the file name already exists, a dialog box will appear asking if the existing file should be overwritten.
When the Auto File Name option is selected, the directory to select where the files will be saved will
appear *(Figure 42)*.
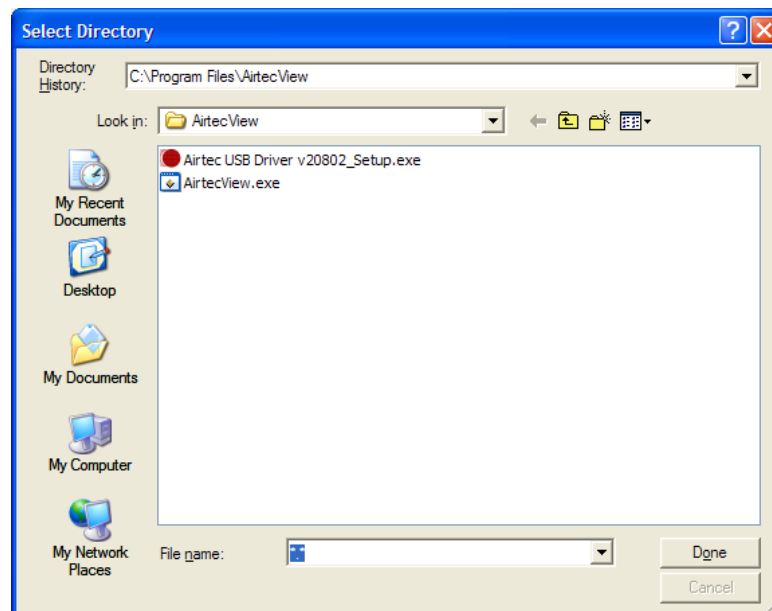
Figure 41. AirtecView COM Selection Screen

The Data Logger Screen *(Figure 42)* will appear once the software has started.

Figure 42. AirtecView Data Logger Screen

Table 11 describes the buttons on the Data Logger Screen.

Table 11. Data Logger Screen Button Descriptions

Button	Description
Read Stored Data	Click to read data stored in the internal storage memory without deleting it
Read Stored Data and Erase	Click to read then delete data stored in the internal storage memory

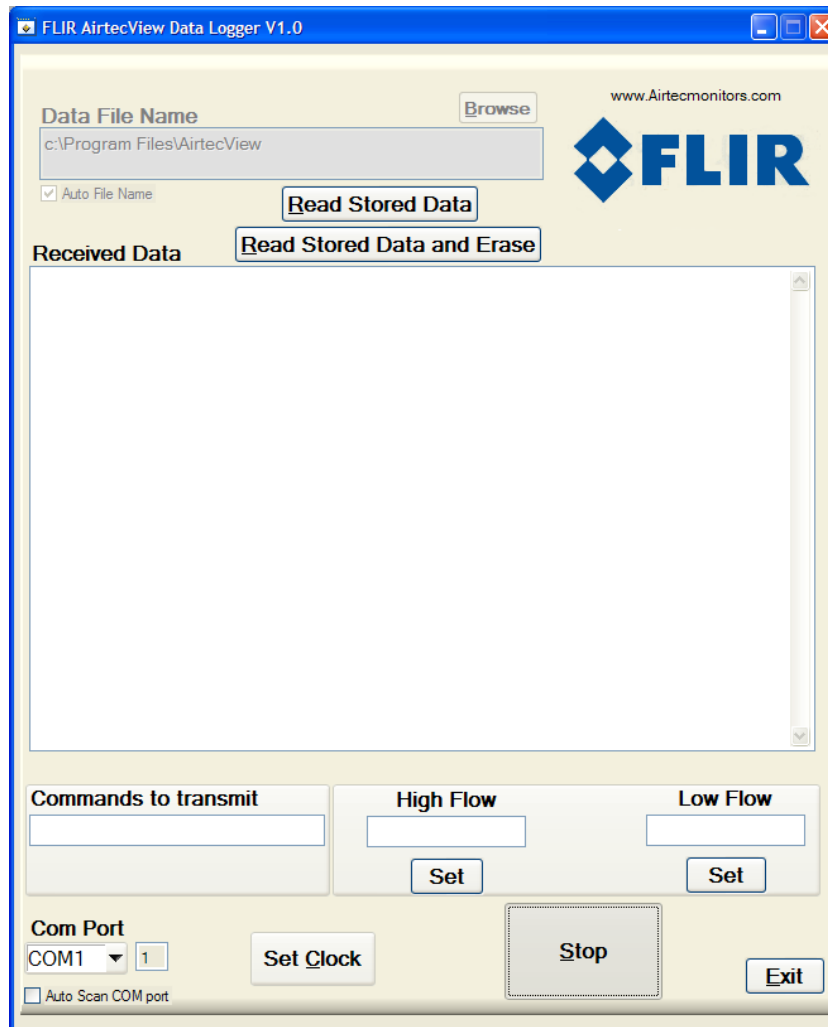|	
Set Clock	Click to set the date/clock on the monitor to the current time of the computer.
Set	Allows user to set high and low flow rates in LPM based on their measurements. Type high and low flow values in the respective box and click SET to save to memory.
Received Data Box	Displays data received from the monitor
Stop Button	Click at any time to stop the data collection process
Exit Button	Click at any time to exit the software program

NOTE: The data file name and the communications selection cannot be changed once data collection has started.

19.0 AIRTECVIEW SOFTWARE FEATURES

AirtecView software has many features. If there are no error messages regarding the communication interface, the unit will start recording data. There is one plot on the main screen.

The Received Data Screen *(Figure 43)* will list will the data messages received from the Airtec monitor.
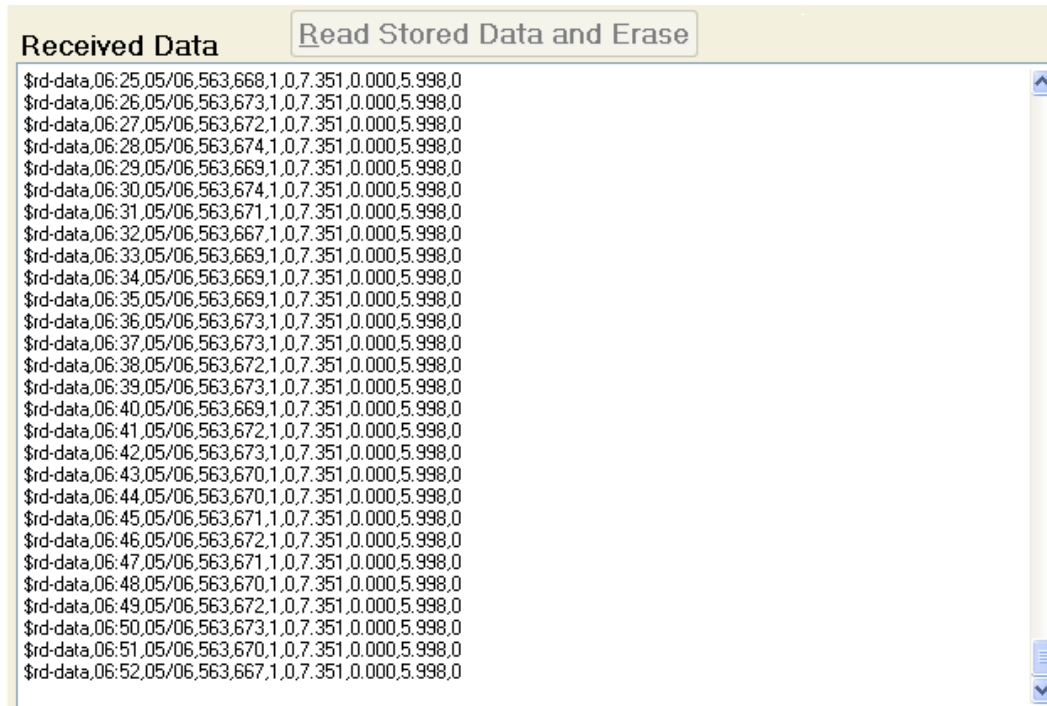
Figure 43. Received Data log

The AirtecView software allows the user to send commands to the monitor directly (*Advanced Users Only*). To send a command, click on the Commands to Transmit box on the Data Logger Screen *(Figure 42)*, type the command, and hit *Enter*. For a list of command, please consult Section 23.

20.0 DATA DOWNLOAD

The Airtec is equipped with a USB communication port for interface with a computer via AirtecView software.

20.1 COMMUNICATIONS OVERVIEW

The Airtec will transmit data through the USB port.

To communicate data by USB:

Step 1:   Install the USB drivers with the monitor not attached to the computer *(Section 16.2)*.

Step 2:   Connect the monitor and computer by USB cable.

Step 3:   Start AirtecView.

Step 4:   Configure the software with parameters in Section 17.0.

Step 5:   Restart the monitor after installation is complete.

21.0 DATA INTERFACE SPECIFICATION

The USB connection will appear as a COM port connection at the host computer.

The USB virtual COM port is set up as follows:

- ☐   57600 Baud Rate
- ☐   8 data bits
- ☐   1 stop bit
- ☐   No parity
- ☐   No handshake

Data is transmitted after each sensor reading based on the rate interval set by the user.

If the monitor encounters a fault condition, it will transmit a fault string in the following format:

$fault,fault_string where **fault_string** is an information string that is terminated by the LF/CR characters.

Other strings transmitted by the monitor are monitor status information. The format is **Info,info_string** terminated by LF/CR characters.

22.0 AIRTEC MESSAGES

All communication strings are terminated by LF/CR characters. Table 12 is a complete list of Airtec messages.

Table 12. Airtec Messages

String	Description	Parameters
$info, sensor level below threshold	The Airtec is sensing light levels below threshold.	

	Verify laser is on.	
$data, a,b,c,d,e,f,	Prints sensor reading once per rate interval set by the user	a – time (hh:mm:ss) b – date (mm/dd) c – raw sensor reading (0-1023), 1023 = 5V d – flow sensor reading, (0-1023), 1023 = 5V e – flow level (0 = low, 1 = high) f – sensor gain level (0 = low, 1 = high)
$conc, n1, n2, n3, n4, n5, n6, n7, n8, n9, n10	Prints EC numbers calculated	n1 – transmittance n2 - absorbance n3 – current EC reading (ug/m^3) n4 – EC TWA (ug/m3) n5 – ignore n6 – EC 5 minute (ug/m3) n7 – EC 10 minute (ug/m3) n8 – EC 15 minute (ug/m3) n9 – initial voltage (V) logged used in calculating the EC number n10 – current sensor raw reading in Volts
$infor, Revision 1.00, build 0173	Version and build numbers	
$FLIR Airtec, monitor number = 570-BETA-0011	Monitor's serial number	
$fault, 10, optical circuit error. Check light source and/or light sensor	Light sensor may be blocked or laser has failed	
$fault, 20, low battery	Battery level is low	
$fault, 30, flow sensor detected abnormal condition (*f*)	Flow sensor reading is outside permitted range. Check for obstacles	*f* – current flow sensor reading (0-1023), 1023 = 5V
$fault, 80, unable to reset – stopping	The monitor has experienced a hardware error and it will stop the data collection. Message is Fatal	

$rd-data, **hh:mm**, **nn/dd**, **s**, **f**, **fl**, **g,x,y,z,v**	Displays data stored in internal memory in response to *$dump_data* or *$read_data* commands. Data is only stored internally if the rate is set to 1 minutes or higher	**hh** – hour (24 hr) **mm** – minute **nn** – month **dd** – day **s** – raw sensor reading (0-1023), 1023 = 5V **f** – flow sensor reading (0-1023), 1023 = 5V **fl** – flow level (0 = low, 1 = high) **g** – sensor gain level (0 = low, 1 = high) **x** – TWA value **y** – 5 min EC **z** – EC value **v** – fault byte (see table $info,fault status = **x** below for possible codes)
$fault_clear, n	Monitor was able to clear a fault	N –fault number as set by $fault message
$flow set to high = *n*	Flow was changed by the user	*n* – number corresponding to high flow rate
$flow set to low = *n*	Flow was changed by the user	*n* – number corresponding to low flow rate
$info,fault status = **x**	Monitor response to the $faults command	**x – fault code according to table below** | Bit	Fault
---	---
0	Flow Error
1	Flow pump error
2	Change filter
3	Low battery
4	Light sensor fault
5	Not used
6	Not used
7	Not used	

$s, *w*, 570-BETA-*z*, *build* **u**	Displays monitor number and firmware information. This is a response to the *$status* command	**w** – firmware version number **z** – monitor serial number **u** – firmware build number
$info,memory erase complete	Indicates FLASH has been erased. This is printed when the $erase command is issued	
$info,no data to read	No data stored internally	
$alarm	The monitor detected an alarm condition	
$info,Powering Down….	Monitor is powering down	
Charging….	The monitor is being charged	

23.0 AIRTEC COMMANDS

The monitor is also designed to accept commands. These are described in Table 13.

Table 13. Airtec Accepted Commands

COMMAND	DESCRIPTION	PARAMETERS
$tc_factor, x.x	Set the TC factor	x.x – (float number). Number must be between 0.0 - 655.3. Default is 1.0
$ec_factor, x.x	Set the EC factor	x.x – (float number). Number must be between 0.0 - 655.3. Default is 217
$set_time, t*hh:mm:ss*	Sets the time on the monitor	*hh* –hour (24 hr) *mm* –minute *ss* –second
$set_date, d*yy-mm-dd*	Sets the date on the monitor	*yy* –year *mm* –month *dd* –day
$set_day, y*d*	Sets the day of the week on the monitor	*d* – current day 1 = Sunday, 7 = Saturday
$status	Monitor sends back its status	Monitor answers with $s message, as shown above
$dump_data	Displays all of data stored in internal memory. Once the data is displayed, it is erased from internal memory. Data is only stored internally if the rate is set to 1 min or higher	Monitor answers with $read_data… as explained above
$read_data	Displays all of data stored in internal memory. The data is not erased from internal memory. Data is only stored internally if the rate is set to 1 min or higher	Monitor answers with $read_data… as explained above
$faults	List the current monitor's faults. The monitor responds with $info message described above	
$erase	Erase all FLASH data	

$alarm_msg,*x*	Tells the monitor if and which alarm message to print	*x* - 0 – generic alarm message 1 – EC alarm message 2 – TC alarm message
$ec_on,*x*	Tells the monitor whether to print the EC data on the LCD	*x* - 0 – no EC message 1 – EC message
$adv_on,x	Turns on advanced menus: sensor and battery voltages	*x* - 0 – Advanced menus OFF 1 – Advanced menus ON
$enable_auto_range,x	Turns sensitivity auto range on and off	*x* - 0 – Auto Range OFF 1 – Auto Range ON
$high_flow_measured,x	Sets the high flow rate used in the EC algorithm	where x is the actual flow rate measured such as 1.7 SLPM
$low_flow_measured,x	Sets the low flow rate used in the EC algorithm	where x is the actual flow rate measured such as 0.85 SLPM

All of these strings must be terminated by CR. If the monitor receives an invalid command, it will transmit **$INVALID** back to the host. Otherwise, the monitor will perform the command and only send a string back if data is requested.

24.0 4-20MA NETWORK COMMUNICATION

The Airtec 4-20mA analog output is a standard 2-wire, loop-powered interface for transmitting the five (5) minute average EC reading. An output current range of 4-20mA corresponds to the five (5) minute EC range of 0-500 $\propto$g/m^3. The output is reverse-voltage and over-voltage protected, and operates over a loop voltage range of 9-40VDC.

Connection to network wiring is made via the included plug with solder cup pins. The plug parts are shipped in a blister pack *(Figure 44, left)*.   The plug requires assembly before use. The manufacturer's assembly instructions are included with the pack. Perform the steps below to set up the 4-20mA network communication.

Figure 44. Plug parts kit blister pack (left) and assembled plug (right)

Step 1:   Follow the manufacturer's instructions to assemble the plug *(Figure 44, right)*.

Note: With the key feature at the 12:00 position, the top pin should be tied to the loop supply and bottom pin tied to the loop return.

Step 2:   Remove the protective red rubber cap *(Figure 45, left)* to uncover the 4-20mA receptacle on the unit *(Figure 45, right)*.   Store cover for future use if desired.

Figure 45. Protective red cap (left) covering 4-20mA receptacle (right)

Step 3:   Insert the assembled plug into the receptacle, aligning the red dots on the plug and receptacle *(Figure 46)*.

Figure 46. Insert plug into 4-20mA receptacle

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The 4-20mA plug uses a keyed push-pull mechanism to prevent the plug from being accidentally disconnected from the monitor. To unplug the plug from the receptacle, grasp the wide, ribbed portion of the plug barrel and pull away from the monitor *(Figure 47)*.

Figure 47. Pull plug out of receptacle to remove

25.0 PREFILTER CARTRIDGE REPLACEMENT

The Prefilter Cartridge should be replaced after three Filter Cassette changes.

Step 1:   Gently pull the tubing off the Prefilter Cartridge to disconnect.

Step 2:   Lift Cartridge Retainer up and away from the cartridge.

Step 3:   Gently pull the cartridge off the prefilter. Discard in accordance with local regulations.

Refer to Section 7 to attach a new cartridge.

26.0 CHARGING THE BATTERY

The Airtec ships with a factory-installed 7.4 VDC lithium-ion battery. The battery icon on the LCD indicates the level of charge remaining. For best results it is recommended the battery be recharged after each shift. Follow the steps below to recharge the battery.

CAUTION: The battery will be partially charged at delivery. For best results fully recharge the battery prior to first use.

Step 1:   Place thumb and index finger on the tab at the bottom of the Power/USB cover.

Step 2:   Gently lift tab and pull cover slightly away from the unit.

Step 3:   Carefully rotate cover up to reveal the power jack underneath the cover *(Figure 48)*.

Figure 48. Power/USB Port Cover

Step 4:   Connect the barrel plug of the provided power supply to the jack on the monitor *(Figure 49)*.

Figure 49. Power Supply connection

Step 5:   Connect the power supply to a standard 120VAC wall socket.

Step 6:   Press Button 2 to illuminate the LCD and display the charge/battery indicator during charging. The battery will charge even if the display is not illuminated.

It will take approximately four (4) hours to recharge the battery after an eight hour shift. Charging is complete when the battery indicator indicates a full charge.

27.0 TROUBLESHOOTING

Table 14. Troubleshooting

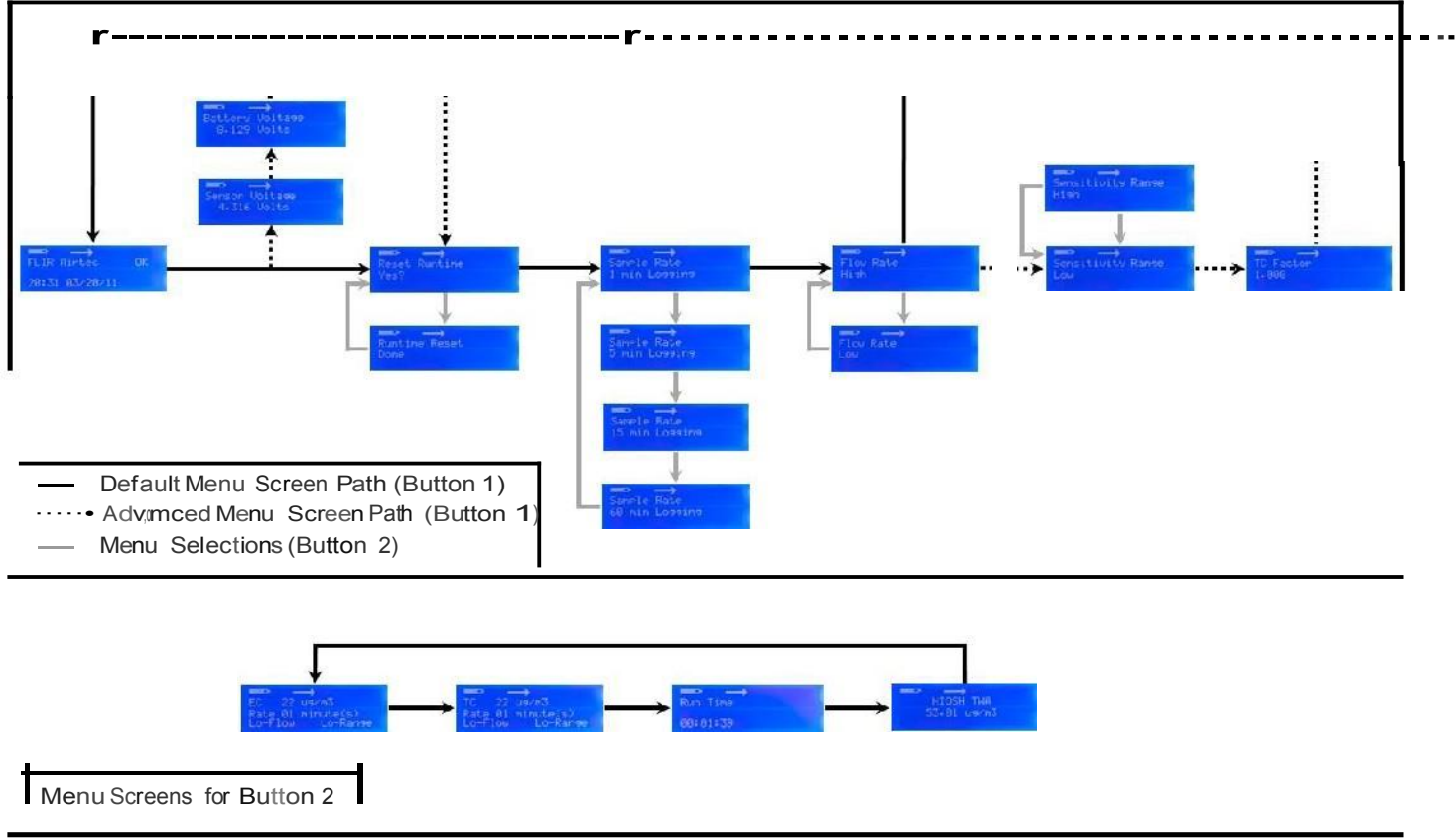| Problem	Possible Solutions
Monitor does not power on	Plug in to start charging, then turn the unit on and check the battery level
Prefilter Cartridge Door does not close	Filter Cassette is not properly seated in chamber. See Section 9.
Receive a system error	Review Table 11. Contact FLIR Systems Customer Support for assistance.

Support Lines: U.S. 877.439.8324, Intl. 603.324.7800
Technical Support: Option 3; E-mail: support@extech.com
Repair & Returns: Option 4; E-Mail: repair@extech.com

28.0 REORDERING

Reordering information is given as a resource only. Please contact FLIR Systems for more information and pricing.

Table 15. Airtec Replacement Parts

Part Number	Description
ATC-02-A	Prefilter Cartridge
ATC-01-A	Filter Cassette

— Default Menu Screen Path (Button 1)
······ Advanced Menu Screen Path (Button 1)
— Menu Selections (Button 2)

Menu Screens for Button 2

29.0 WARRANTY

Limited Warranty and Remedy. FLIR warrants that, upon delivery, each Product will be free from defects in materials and workmanship and will operate in all material respects in accordance with applicable instructions and manuals provided by FLIR. Coverage under this Limited Warranty shall commence immediately upon delivery and is valid for a period of one year from the date of the invoice. This warranty will not apply to any Product that (a) has not been operated and maintained in accordance with applicable instructions and manuals, (b) has been repaired or altered by unauthorized personnel, or (c) has been misused, abused, damaged or subjected to operation for which it was not intended.