



**PARTICLE
MEASURING
SYSTEMS®**
a spectris company

Without measurement there is no control



Airnet® II Particle Sensors *301, 501, 501A, 510, 510XR,* *510s, 510s XR*

OPERATIONS MANUAL

Airnet® II Particle Sensors 301, 501, 501A, 510, 510XR, 510s, 510s XR

Operations Manual



**PARTICLE
MEASURING
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Airnet® II Particle Sensors 301, 501, 501A, 510, 510XR, 510s, 510s XR
Operations Manual
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Quality Statement

The Quality Policy of Particle Measuring Systems is to strive to meet or exceed the needs and expectations of our customers and to align the activities of all employees with the common focus of customer satisfaction through continuous improvement in the quality of our products and services.

Environmental Information

There are no potential means by which asbestos exposure is possible because there are no materials in the design or manufacture of the Airnet® II Particle Sensor containing asbestos.



This equipment must be properly disposed of at end-of-life by means of an authorized waste management system. Contact our Customer Response Center at (877) 475-3317 or +1 (303) 443-7100 (International Telephone + 01 303 443 7100) for dismantling and disposal information.

Patent Information

U.S. and foreign patents for this equipment are pending.

Manual Conventions

WARNING

A warning in the text is used to notify the user of the potential for bodily injury or death.

CAUTION

A caution in the text is used to highlight an item that if not done, or incorrectly done, could damage the instrument and/or any materials or devices affected by the instrument.

— NOTICE —

A notice in the text is an instructional communication regarding requirements or policies issued by Particle Measuring Systems.



NOTE: A note in the text is used to highlight an item that is of operational importance to the user.

It is important that you observe cautions and warnings while performing the procedures described in this manual. Caution and warning labels are located on and inside the instrument to alert you to potentially hazardous conditions. Please familiarize yourself with this information.



If you have additional questions after reading this manual, navigate to the **Automated Hardware & Software Support** page on www.pmeasuring.com:
<http://www.pmeasuring.com/service-and-support/automated-hardware-software-support>

CE and UKCA Declaration of Conformity

Application of Council Directive(s):	CE	2014/30/EU, 2014/53/EU, 2014/35/EU, RoHS 2011/65/EU, 2015/863
	UKCA	Electromagnetic Compatibility Regulations 2016, Electrical Equipment (Safety) Regulations 2016 The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012
Standard(s) to which Conformity is Declared:	EMC	EN 61326-1:2013 S.I. 2016 No. 1091
	Safety	EN61010-1: 2010, 3rd, Ed., S.I. 2016 No. 1101
	RoHS	BS EN 63000:2018
Manufacturer's Name: Particle Measuring Systems, Inc.		
Manufacturer's Address: 5475 Airport Boulevard Boulder, CO 80301 USA		
Manufacturer's Telephone/FAX: + 1 3034437100 / + 1 3034496870		
Distributor's Name: Particle Measuring Systems, S.R.L.		
Distributor's Address: Via di Grotte Portella 34 00044 Frascati (Roma) ITALY		
Distributor's Telephone/FAX: + 39 06 90530130 / + 39 06 9051315		
Type of Equipment: Particle Monitoring		
Model No: Airnet II 301, 501, 501A, 510, 510XR, 510s, 510s XR		
I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s) and Standard(s).		
Signature:	Signature:	
		
Full Name: Scott MacLaughlin	Full Name: Frank Panofen	
Position: Director of Engineering	Position: Marketing Manager, Life Sciences	
Place: Boulder Date: September 16, 2021	Place: Rome Date: September 16, 2021	

CAUTION

All I/O cables and accessories must meet current factory specifications in order for this unit to remain in compliance with CE marking requirements. Consult the factory for details.
If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Table of Contents

Quality Statement	ii
Environmental Information	ii
Patent Information	ii
Manual Conventions	iii
Table of Contents	1-v
List of Figures	1-ix
List of Tables	1-xi
Chapter 1: Getting Started	1-1
Class I Laser Product	1-3
Airnet II 510XR and 510s XR	1-3
Physical Description	1-4
Top	1-4
Bottom	1-4
Instrument Connections	1-5
Specifications	1-8
Product Dimensions	1-9
Environmental Conditions	1-11
Chapter 2: Unpacking and Installation	2-1
Unpacking	2-1
Recycling	2-1
Shipping List	2-7
Items You Need to Provide	2-8
Installation	2-8
Automated Laser Power Control	2-9
Detector Board Monitor	2-9
Selecting a Location	2-10
Positioning or Mounting the Unit	2-11
Powering the Sensor from 24 VDC	2-12
Powering the Sensor from Power over Ethernet (PoE)	2-13
Connecting the Power Supply	2-13
Connecting the Sample and Vacuum Tubing	2-13

Chapter 3: Configuring for Ethernet	3-1
Configuration Defined	3-1
When to Configure the Sensor	3-1
Required Hardware and Software	3-2
RS-232 Cable	3-2
Setting Configuration Addresses for Ethernet	3-3
Configuration Commands	3-4
Viewing Configuration Settings	3-7
Connecting the Ethernet Cable	3-7
Chapter 4: 4-20 mA Signal Configuration / Operation	4-1
Overview	4-1
4-20 mA Outputs	4-2
Configuring 4-20 mA Outputs	4-3
Required Hardware and Software	4-3
Establishing HyperTerminal Communications	4-4
Configuration Commands	4-5
Viewing Configuration Settings	4-6
Connecting to a SCADA Data Collection System	4-7
Adjusting the 4-20 mA Outputs	4-8
Chapter 5: Maintenance and Performance Checks	5-1
Cleaning the Sensor's Housing	5-1
Cable Connectors	5-1
Performance Checks	5-1
Airflow Rate Check	5-1
Background Count Check	5-2
Chapter 6: Troubleshooting	6-1
Troubleshooting Matrix	6-1
Airflow Rate Errors	6-2
Isolating and Repairing Leaks	6-2
Particle-Induced Counts	6-3
Transient-Induced Counts	6-3
Appendix A: TCP/IP Protocol: A Brief Overview	A-1
TCP/IP's Network Layer	A-1
Ping	A-1
Appendix B: Modbus Protocol	B-1
Modbus Overview	B-1
Input Registers	B-2
Holding Registers	B-5
Coils	B-6
Data Packet Processing	B-7

Associated Values for Specific Registry Entries	B-8
Appendix C: RJ45 Data Connector Installation	C-1
Appendix D: International Precautions	D-1
WARNING	D-1
AVERTISSEMENT	D-1
WARNUNG	D-1
ATTENZIONE	D-1
ADVERTENCIA	D-1
Hazard Symbols	D-2
Symboles de risque	D-2
Warnschilder	D-3
Simboli di pericolo	D-3
Simbolos de peligro	D-4
Appendix E: 有毒或有害的物质和元素	E-1

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List of Figures

Table of Contents	1-v
List of Figures	1-ix
List of Tables	1-xi
Chapter 1: Getting Started	1-1
Figure 1-1 Airnet II Models 301, 501, 510, and 510XR	1-2
Figure 1-2 Airnet II Models 510s and 510s XR	1-2
Figure 1-3 Airnet II (polycarbonate enclosure) LEDs and connections	1-6
Figure 1-4 Airnet II (Stainless Steel enclosure) connections	1-7
Figure 1-5 Airnet II (polycarbonate exterior) dimensions	1-9
Figure 1-6 Airnet IIs (stainless steel exterior) dimensions	1-10
Figure 1-7 Wall mounting bracket dimensions	1-10
Chapter 2: Unpacking and Installation	2-1
Figure 2-1 Horizontal Mounting Bracket	2-11
Figure 2-2 “S” Type Mounting Bracket	2-11
Figure 2-3 “L” Type Mounting Bracket	2-11
Figure 2-4 Dovetail Mounting Bracket	2-11
Figure 2-5 Stainless Steel wall mounting bracket	2-12
Figure 2-6 24 VDC Power Connector	2-12
Chapter 3: Configuring for Ethernet	3-1
Chapter 4: 4-20 mA Signal Configuration / Operation	4-1
Chapter 5: Maintenance and Performance Checks	5-1
Chapter 6: Troubleshooting	6-1

Appendix A: TCP/IP Protocol: A Brief Overview	A-1
Appendix B: Modbus Protocol	B-1
Appendix C: RJ45 Data Connector Installation	C-1
Appendix D: International Precautions	D-1
Appendix E: 有毒或有害的物质和元素	E-1

List of Tables

Table of Contents	1-v
List of Figures	1-ix
List of Tables	1-xi
Chapter 1: Getting Started	1-1
Table 1-1 Airnet II Particle Sensor Specifications	1-8
Table 1-2 Airnet II Particle Sensor Environmental Conditions	1-11
Chapter 2: Unpacking and Installation	2-1
Table 2-1 Recycling options for packaging materials	2-2
Chapter 3: Configuring for Ethernet	3-1
Table 3-1 RS-232 Pin Outs (RJ-11 jack)	3-2
Table 3-2 Terminal Emulator Communications Parameters	3-3
Chapter 4: 4-20 mA Signal Configuration / Operation	4-1
Table 4-3 Terminal Emulator Communications Parameters	4-4
Chapter 5: Maintenance and Performance Checks	5-1
Chapter 6: Troubleshooting	6-1
Appendix A: TCP/IP Protocol: A Brief Overview	A-1
Appendix B: Modbus Protocol	B-1
Table B-1 Input register – configuration	B-2
Table B-2 Input register – data packet	B-3
Table B-3 Holding registers	B-5
Table B-4 Coils	B-6
Table B-5 Associated values for specific registry entries	B-8

Appendix C: RJ45 Data Connector Installation	C-1
Appendix D: International Precautions	D-1
Appendix E: 有毒或有害的物质和元素	E-1

Chapter 1

Getting Started

The Airnet II particle sensor is a laser-optical aerosol particle sensor that accurately detects, counts, and measures particles suspended in air. This manual includes information on operating the following Airnet II models:

- 301
- 501, 501A, 510, and 510XR
- 510s and 510s XR (stainless steel enclosure models)

For ease in understanding, this entire group of Airnet II models is referred in the remainder of this document as Airnet II particle sensors. When a reference is given that ONLY pertains to one or more models in this set, that specific model (or models) is referenced.

An automated laser power control has been implemented that automatically shuts off the laser power after 10 seconds of continuous bad flow. The laser power is restored after 10 seconds of continuous good flow.

Airnet II particle sensors communicate by means of Ethernet with Facility Pro and Facility Net¹, monitoring system and software packages that store and display particle data and allows the user to control the Airnet II.

Airnet II models also have the ability to communicate via Modbus TCP for an easier integration to any third party system.

Airnet II models, except the stainless steel enclosed version, also have the option of adding a 4-20 mA output board that can send a 4-20 mA signal which can be customized for 4-20 mA-capable data systems.

1. This manual references Facility Net when discussing the software used to control these Airnet II particle sensors. However, you can use either Facility Net or Pharmaceutical Net wherever this reference is noted.



Figure 1-1 Airnet II Models 301, 501, 510, and 510XR

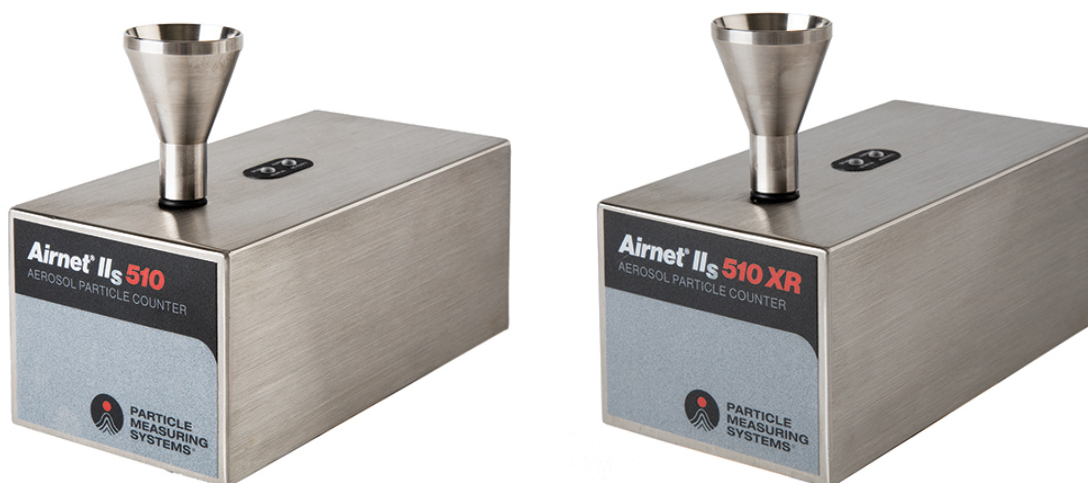


Figure 1-2 Airnet II Models 510s and 510sXR

Class I Laser Product

The Airnet II particle sensors are Class 1 laser products.

WARNING

This instrument is a Class 1 laser product.^a Use of controls, adjustments, or performance of procedures other than those specified here may result in hazardous radiation exposure.

a. National Center for Device and Radiological Health (formerly BRH).

Airnet II 510XR and 510s XR

The variant optical block components of the Airnet II 510XR and 510s XR particle sensors are coated with a special Teflon[®] lining that allows them to withstand environments that standard particle sensors cannot.

These environments are non-condensing and potentially corrosive or oxidizing to other standard model Airnet or Airnet II particle sensors. Tests performed at the Boulder factory allow Particle Measuring Systems to define environments where you can use the Airnet II 510XR and 510s XR particle sensors.

CAUTION

When using the Airnet II 510XR or 510s XR particle sensors, it is important to verify with Particle Measuring Systems that the unit can be used safely under specific site conditions. Failure to verify this shall automatically void the warranty.

Physical Description

Top

Two LEDs are located on the top of each Airnet II particle sensor chassis:

- **Status LED** – Indicates the operational status of the instrument.
- **Activity LED** – Flashes when a particle is detected.

When connected to Facility Net software, the LED is controlled by Facility Net's alarm settings. When disconnected from Facility Net, you can set the unit to run the status LED two distinct ways.

- Set the status LED to flash green when disconnected.
- Set the status LED to represent the internal state of the flow and laser status. The LED will normally remain green, except for a low flow or laser status error. The failure state depends upon how the particle sensor is configured in Facility Net. You can set the LED to appear green, flashing, or dimmed.

Bottom

Airnet II 301, 501, 501A, 510, and 510XR (Polycarbonate enclosure version):

The bottom of the Airnet II unit contains four tapped-thread fittings that match the countersunk screw holes on three of the four mounting brackets. These brackets are used to mount the Airnet II to vertical or horizontal surfaces.

Airnet II 510s, and 510s XR (Stainless steel enclosure version):

The bottom of the Airnet II Stainless Steel enclosure version unit contains a dedicated single thread fitting that match the countersunk screw holes of the dedicate wall mounting stainless steel bracket (provided with the Airnet II 510s and 510s XR).

Instrument Connections

Airnet II 301, 501, 501A, 510, and 510XR (Polycarbonate enclosure version):

All connectors are found on the back of the unit's chassis, including:

- **Electrical Power** – Power can be provided through the 24 VDC power connector (see **Figure 2-6** on page 2-12) or through the Ethernet connection if Power over Ethernet (PoE) is being utilized.

NOTE: If any modifications are made to the factory connector, make sure to verify the 24 VDC and GND lines before connection to the Airnet II unit.

- **Ethernet** – The UTP Ethernet connector allows the unit to communicate with Facility Net by connecting an Ethernet cable from the particle sensor to the Ethernet hub.
 - Modbus is also communicated via this connection when it is configured.
 - When connected to a router that provides PoE the Ethernet connection will power the system also.

NOTE: For best results, use a CAT 5 UTP cable. If PoE is used, you must use a shielded CAT 5 UTP cable or ground the unit locally.

- **RS-232** – The RS-232 RJ-11 jack is used for configuring the unit and performing limited diagnostics.
- **Vacuum Source** – The barbed fitting allows a source of house vacuum (> 12 in. Hg for 510/510XR units and > 11 in. Hg for 301 and 501/501A units) to be supplied to the unit.

NOTE: Airnet II 301, 501, 501A, 510, and 510XR connection is a 1/4 inch tubing connection.

- **Calibration** – A BNC connector is available for calibrations only and is not used for system operation.
- **Optional 4-20 mA Output** – The six-pin Molex® connector outputs a scaled 4-20 mA signal that transmits the following:
 - Channel 1 and 2 particle counts
 - Instrument status messages

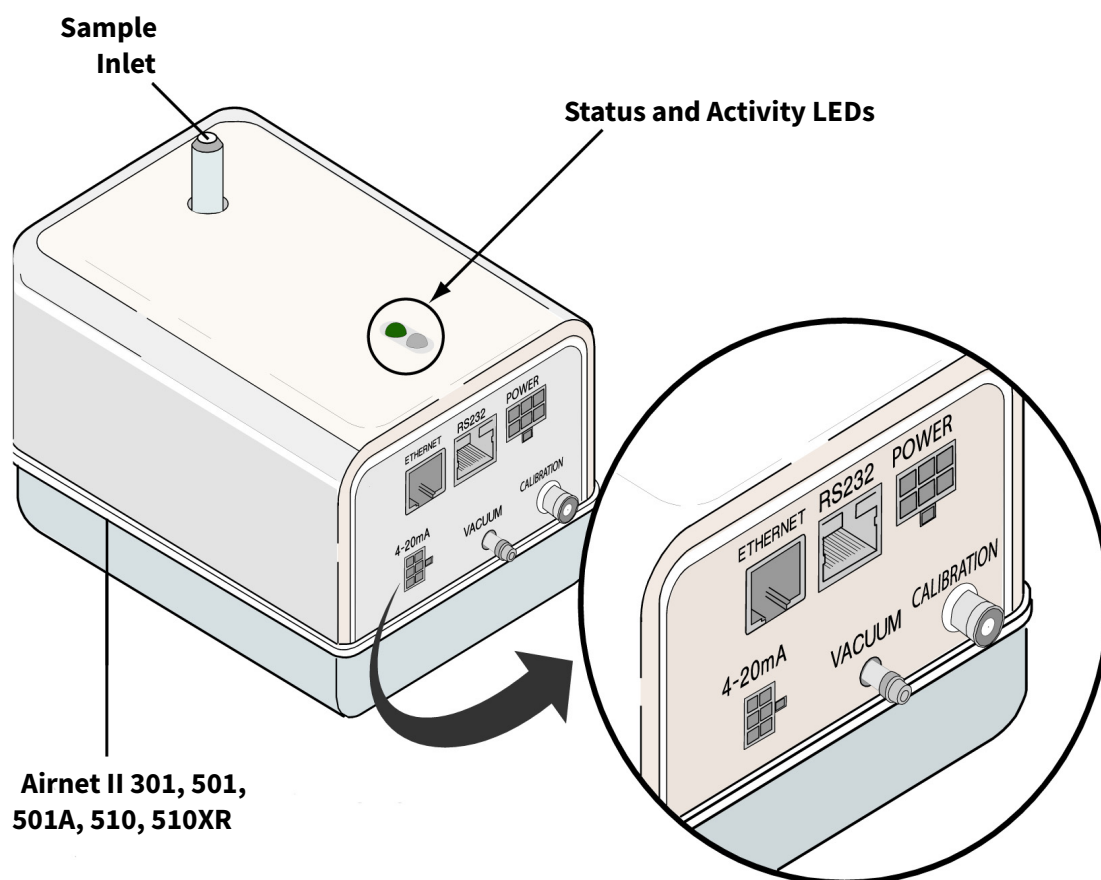


Figure 1-3 Airnet II (polycarbonate enclosure) LEDs and connections

**Airnet II 510s, and 510s XR
(Stainless steel enclosure version):**

All connectors are found on the bottom of the units' chassis, including:

Ethernet connector – For data transferring and power over Ethernet powering (PoE).

- Ethernet - The UTP Ethernet connector allows the unit to communicate with FacilityPro and Facility Net by connecting an Ethernet cable from the particle sensor to the Ethernet hub.
- Modbus is also communicated via this connection when it is configured.
- The instrument must be connected to a dedicated Ethernet switch that provides PoE in order to provide the necessary power to the system.

NOTE: PoE requires a shielded CAT 5 UTP cable or ground the unit locally.

RS-232 – The RS-232 RJ-11 jack is used for configuring the unit and performing limited diagnostics.

Vacuum Source – The barbed fitting allows a source of house vacuum (>12 in. Hg for 510/510XR units and >11 in. Hg for 301 and 501/501A units) to be supplied to the unit.

NOTE: Airnet II 510s, and 510s XR connection is a push-in fitting connection for 8 mm OD tubing.

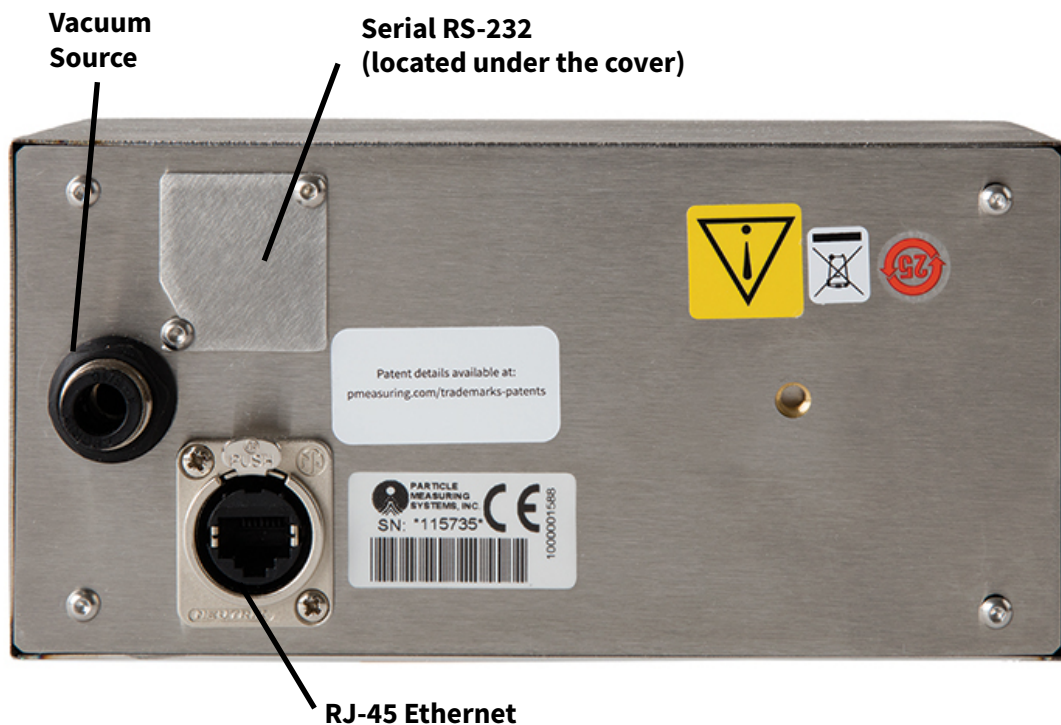


Figure 1-4 Airnet II (Stainless Steel enclosure) connections

Specifications

Table 1-1 Airnet II Particle Sensor Specifications

	301	501	501A	510 510 XR	510s 510s XR
Channel thresholds (µm)	0.3 and 0.5	0.5 and 5.0	0.5 and 1.0	0.5 and 5.0	
Sample flowrate ^a Alarm at 15% variation	0.1 CFM (2.8 LPM)			1.0 CFM (28.3 LPM)	
Counting efficiency (Meets ISO 21501-4)	50% ± 20% for most-sensitive channel. Meets ISO 21501-4.				
	100% ± 10% at 1.5 to 2.0 times channel 1 size. Meets ISO 21501-4.				
Zero count level	<70.7 counts/m ³			<7.07 counts/m ³	
Maximum particle concentration ^b	5,695,168 / ft ³	9,578,238 / ft ³		957,824 / ft ³	
Ingress protection	N/A				IP65
Flow system	External vacuum				
Vacuum source	> 11 in Hg (> 375 mBar) below atm pressure			> 15 in Hg (> 410 mBar) below atm pressure	
Material (chassis)	Polycarbonate (PC)				Stainless steel 316L
Dimensions (L x W x H)	5.3 x 3.6 x 3.8 in (13.5 x 8.9 x 9.6 cm)				3.5 x 7.1 x 4.0 in (8.9 x 17.8 x 10.1 cm)
Weight	1.6 lb (0.73 kg)				2.4 lb (1.08 kg)
Power	<ul style="list-style-type: none">24 VDC (0.5 A) 100-240 VAC ± 10%, 50-60 Hz, Power Supply (optional), or use of Power over Ethernet 48 VDC via a PoE routerExternal AC to DC Power Supply (optional) Input: 10-240 V~, 50-60 Hz, 2 A Output: 24 VDC, 2.08 A				PoE 48 VDC, 0.25 A
Communications	<ul style="list-style-type: none">Ethernet connector requiring cable type CAT 5 UTP (shielded if PoE is utilized)RS-232 (configuration and diagnostic tool only, no data)FacilityPro or Facility Net interfaceModbus TCP communication				
	Optional 4-20 mA: <ul style="list-style-type: none">two channels for particle dataone channel for instrument status				N/A
Status indicators	<ul style="list-style-type: none">Laser and flow status: two-color LEDActivity: one-color LED				
Calibration	System is calibrated per ISO 21501-4.				

a. Allow 15% (± 5%) for variations in sample flow.

b. Greater than 90% accuracy (less than 10% coincidence loss) at maximum recommended ambient concentration.

Product Dimensions



Figure 1-5 Airnet II (polycarbonate exterior) dimensions

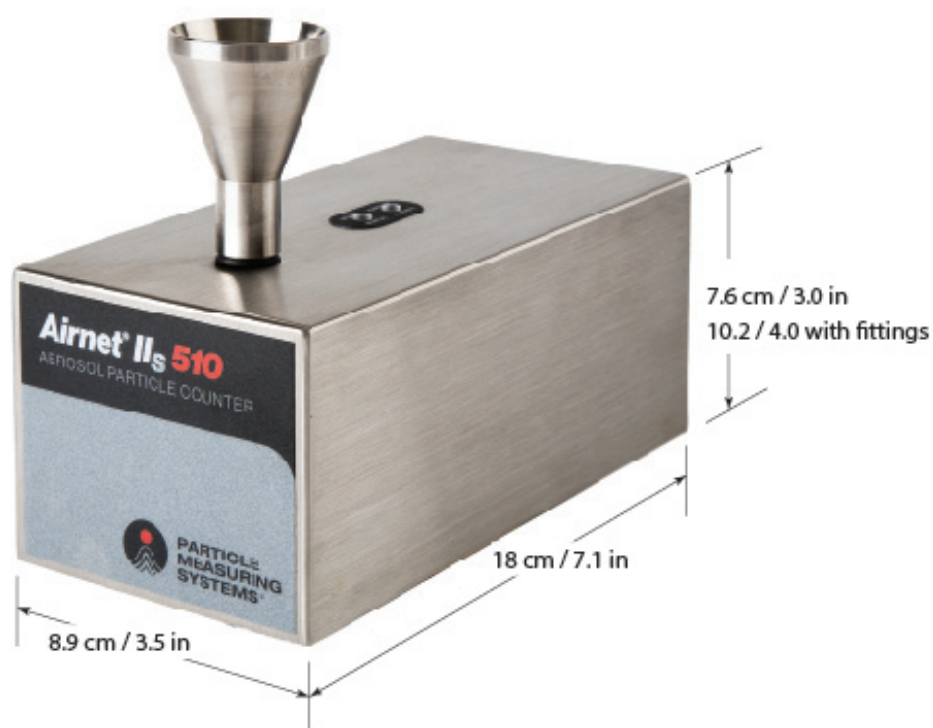


Figure 1-6 Airnet II s (stainless steel exterior) dimensions

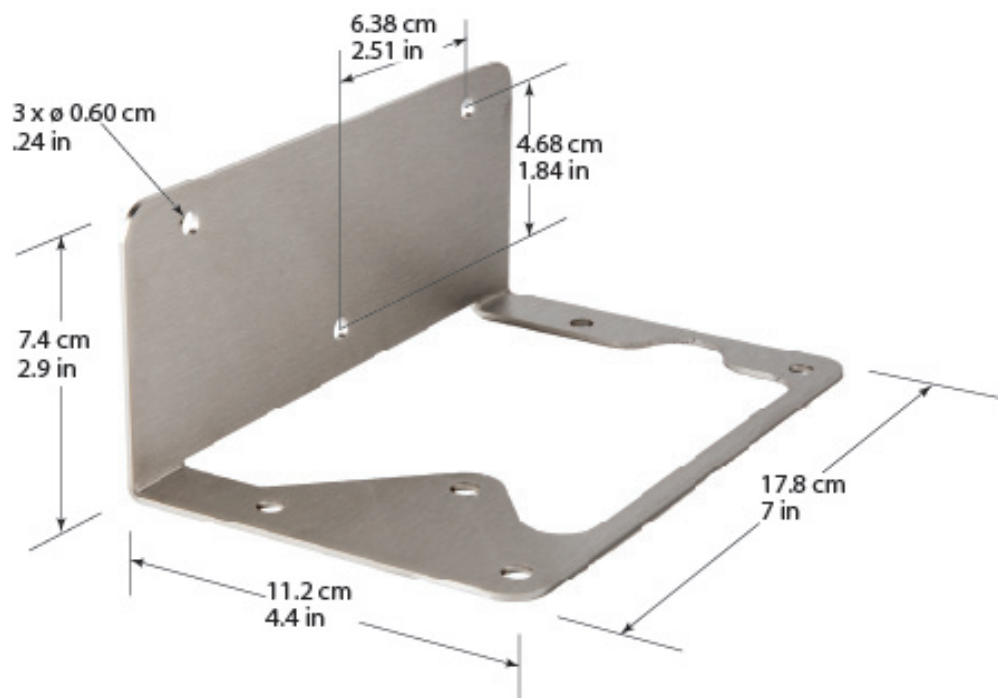


Figure 1-7 Wall mounting bracket dimensions

Environmental Conditions

The following environmental conditions apply to the Airnet II particle sensor:

Table 1-2 Airnet II Particle Sensor Environmental Conditions

Operating temperature	4 – 35 °C (39 – 95 °F)
Humidity conditions	5 – 95% RH, non-condensing
Storage and transportation temperature	-10 – 50 °C (-10 – 122 °F)
Maximum altitude	6,562 ft (2000 m)
Installation requirements	<p>Indoor use only</p> <p>Pollution degree 2</p> <p>Over voltage category I</p> <p>Ordinary protection (The polycarbonate enclosure version is not protected against harmful ingress of moisture.)</p> <p>External AC to DC Power Supply:</p> <p>Over-voltage Category II</p> <p>Class I Equipment (Electrical earth ground from the mains power source to the product input is required for safety.)</p>
Ingress protection	IP65 (Stainless steel enclosure only)
Laser classification	Class 1, complies with US 21 CFR 1040.10 and EN60825-1. Internally as enclosed Class 3B laser is used per EN60825-1.

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Chapter 2

Unpacking and Installation

Unpacking

1. Carefully open the container and remove the Airnet II particle sensor.
2. Ensure that all components listed in the following section are included, and inspect each unit for any damage.
3. If any components are damaged, immediately notify the shipper and Particle Measuring Systems.
4. After you have determined that the shipment is undamaged, store the packing materials for future shipping needs. Warranties may not apply if return shipping containers are inadequate.

NOTE: If you do not keep your shipping materials for future servicing needs, the following section on recycling will provide guidance on sustainable disposal.

Recycling

With your shipment, you receive packaging materials that can be 100% recycled. They may include those listed in the following table, depending on the items purchased.

Table 2-1 Recycling options for packaging materials



Packaging Material	Example
<p>Polyethylene (PE) foam inserts</p> <p>Cushions products and accessories during shipment.</p> <p>Recyclable with your local PE foam recycling center.</p>	
<p>Sealed Air InstaPak® polyurethane (PU) foam</p> <p>Cushions products and accessories during shipment.</p> <p>Recyclable at all Sealed Air InstaPak locations. See page 2-6 for the full listing of global offices.</p>	

Table 2-1 Recycling options for packaging materials**Low-density polyethylene (LDPE) film**



Used to wrap products and accessories.

Recyclable at your local plastic film recycling center.

Go to this web address to look up pickup locations in the United States:
<https://www.plasticfilmrecycling.org/>



Table 2-1 Recycling options for packaging materials

<p>LDPE bubble wrap</p> <p>Used to wrap products and accessories.</p> <p>Recyclable at your local plastic film recycling center.</p> <p>Go to this web address to look up pickup locations in the United States: https://www.plasticfilmrecycling.org/</p>	
<p>Cardboard</p> <p>Used as the primary shipping container.</p> <p>Recyclable worldwide at cardboard and paper recycling centers.</p>	



Instapak[®] Foam Packaging

SIMPLE FACTS ABOUT FOAM-IN-PLACE PACKAGING AND THE ENVIRONMENT

The cushions protecting this product are made of Instapak[®] polyurethane packaging foam, a material that minimizes the amount of packaging used without compromising the protection of shipped goods. Instapak[®] packaging complies with international legislation restricting the presence of heavy metals.

Source Reduction

Instapak[®] foam has superior cushioning abilities that provide maximum protection with a minimum of material. Less packaging is used, so less enters the waste stream.

Reuse

Instapak[®] foam cushions can be reused for multiple shipments or reshaped manually into carton fillers to fit the next product shipped.

Instapak[®] Foam Return Program

Instapak[®] foam can be returned to the sites listed on the reverse side of this card. All returned foam is diverted from the landfill and efficiently transported to local Waste-to-Energy facilities. Please follow the following steps to return your Instapak[®] foam:

For parcel sized shipments, please send the cushions prepaid (COD's will not be accepted) to the location on the back side of this card that is closest to you.

The shipment should be addressed to **Attn: Foam Return Program**. For LTL or larger sized shipments, or if you prefer to drop the material off in person, please email the location closest to you to schedule a drop off time.

Instapak[®] foam may be bagged, baled or boxed. The foam must be clean, dry and not adhered to any corrugated cardboard material.

Using Instapak[®] foam to protect products makes good environmental sense. For more information about Instapak[®] foam, please call Sealed Air's toll-free general environmental information number:

1-800-982-6197

or visit our website:

www.sealedair.com/instapakprotects

SealedAir.com

Corporate Office: Sealed Air Corporation (US)
2415 Cascade Pointe Boulevard, Charlotte, NC 28208
www.sealedair.com

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Instapak® Foam Return Locations

UNITED STATES

CALIFORNIA
Sealed Air Corporation (US)
19440 Arenth Ave.
City of Industry, CA 91748
InstapakReturn-CA-South@SealedAir.com

CALIFORNIA
Sealed Air Corporation (US)
1835 West Almond Ave.
Madera, CA 93637
InstapakReturn-CA-North@SealedAir.com

CONNECTICUT
Sealed Air Corporation (US)
10 Old Sherman Tpke.
Danbury, CT 06810
InstapakReturn-CT@SealedAir.com

ILLINOIS
Sealed Air Corporation (US)
7110 Santa Fe Dr.
Hodgkins, IL 60525
InstapakReturn-IL@SealedAir.com

KENTUCKY
Sealed Air Corporation (US)
Louisville Industrial Center
7665 National Turnpike, Suite 100
Louisville, KY 40214
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NEW JERSEY
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To collect and recycle Instapak® foam, a local member company of INTERSEROH or VFW (umbrella organizations for hundreds of local waste haulers) should be called. If you need additional information on alternate options call Sealed Air Verpackungen
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1-800-982-6197

For current return locations in
Europe, call our Netherlands office:
(31) (24) 3710111

Or visit our website:
www.sealedair.com/instapakprotects

Shipping List

Airnet II 301, 501, 501A, 510, and 510 XR (Polycarbonate enclosure version):

Part Name	Quantity
Isokinetic air sampler (probe)	1
“L” Type mounting bracket (or one of three alternate brackets ^a)	1
Phone jack cable, RS-232 ^b	1
Operations manual ^c	1
Universal AC to DC power supply 100–240 VAC, 50/60 Hz (Optional)	1
Power connectors and Molex pins	
Molex 6-pin square receptacle	1
Molex crimp pins, female (6)	6
4-20 mA output connectors (Optional)	
Molex Micro Fit 3.0 6-pin square receptacle (optional)	1
Molex crimp pins, female (6) (optional)	6

- a. You must order alternate brackets in advance.
- b. Used only for configuring the Airnet II particle sensor.
- c. For large orders with multiple units, Particle Measuring Systems may elect to limit the number of Operations Manuals included in the shipment.

Airnet II 510s, and 510s XR (Stainless steel enclosure version):

Part Name	Quantity
Isokinetic air sampler (probe)	1
“L” Type mounting wall bracket	1
Phone jack cable, RS-232 ^a	1
Operations manual ^b	1

- a. Used only for configuring the Airnet II particle sensor.
- b. For large orders with multiple units, Particle Measuring Systems may elect to limit the number of Operations Manuals included in the shipment.

Items You Need to Provide

The following items are not included, and you will need to provide:

- Ethernet cable
- 4-20 mA cable (necessary only if 4-20 mA signal output is used)
- Computer
- Facility Pro monitoring system, Facility Net or Pharmaceutical Net software
- Modbus software (necessary only with Modbus communication)
- Power cables, IEC type C 13, necessary for local power or PoE Ethernet hub

Installation

The following instructions are included to guide you through the installation process. Please pay close attention to the **NOTE**, **CAUTION**, and **WARNING** text.

Installation includes the following steps:

- Selecting an Appropriate Location
- Positioning or Mounting the Unit
- Connecting the Power Supply (24 VDC power supply or PoE power)
- Connecting a Communications Cable
- Connecting Sample Tubing or Sample Probe (as applicable)
- Attaching Vacuum Tubing

NOTE: If installation of the Airnet II particle sensor will prevent access to its RS-232 port (needed for configuration), configure the particle sensor first and then install the unit. See **Setting Configuration Addresses for Ethernet** on page 3-3 or **Configuring 4-20 mA Outputs** on page 4-3.

Automated Laser Power Control

Airnet II particle sensor units contain an automated laser power control that automatically shuts off the laser power after 10 seconds of continuous bad flow. The laser power is restored after 10 seconds of continuous good flow.

Detector Board Monitor

The Airnet II particle sensor has an automatic monitor to assure the detector board is operating correctly. In many applications the normal condition is *no particle counts being detected* for an extended period of time.

If a detector board fails and indicates no counts, this could be similar to not having any particle counts being measured. To address this unlikely but possible failure mode a monitoring algorithm is used to indicate a detector board failure. If a failure occurs it will be indicated within a certain amount of time depending upon the type of instrument being used. Those times are:

- Airnet II 301 – 152 minutes
- Airnet II 501 – 812 minutes
- Airnet II 510 and 510s – 152 minutes
- Airnet II 510XR and 510s XR – 152 minutes

This failure will be indicated identically to a laser failure. Using the serial commands will allow for specific diagnostics to indicate this was a detector board failure.

Selecting a Location

When choosing the location for the Airnet II particle sensor(s), consider the following to improve the utility of the unit.

Sample Point – Position the particle sensor to ensure that the sampling probe is pointed INTO the airflow you want to monitor.

CAUTION

Do NOT use the Airnet II particle sensor with sample tubing greater than six feet (1.8 M) long. Lengths greater than six feet can cause the following negative effect:

- A decreased flow through the sample chamber, resulting in particle counts that are too low. Instead of using long tubing lengths, move the particle sensor closer to the sample point.

- **Accessibility** – The unit should be readily accessible for connecting and disconnecting cables, and so on.
- **Interference with existing equipment** – The unit should not interfere with access to existing or known future equipment installations.
- **Visibility** – The unit's front and top panels should be visible from a reasonable position.
- **Mounting surfaces** – The proposed mounting surface should allow mounting hardware to engage properly and should be of sufficient strength to support the unit safely.
- **Vacuum and purge tubing** – The unit should be located near appropriate sources of vacuum and purge gas (if necessary).
- **Cables** – The unit should be located near a source of grounded electrical power, an Ethernet port, and any other devices it must communicate with. Cables should reach from the unit to the connector without strain.
- **Environmental conditions** – The unit should be located in an environment consistent with its temperature, humidity, altitude, and other relevant specifications.
- **Electromagnetic interference** – The unit should be located away from strong electromagnetic fields.

Positioning or Mounting the Unit

The Airnet II particle sensor can be positioned so that it stands on its four feet (Polycarbonate enclosure version only) or it can be mounted to a vertical surface with a mounting bracket that attaches to the bottom of the sensor's chassis with machine screws (provided).

The Airnet II particle sensor is attached to a chosen surface with one of the following four types of mounting bracket:

- A horizontal mounting bracket for attaching to a horizontal surface (Polycarbonate enclosure version only)
- An S-shaped mounting bracket for attachment to a horizontal surface (Polycarbonate enclosure version only)
- An L-shaped mounting bracket for attachment to a vertical surface
- A dovetail mounting bracket for attachment to a vertical surface (Polycarbonate enclosure version only)

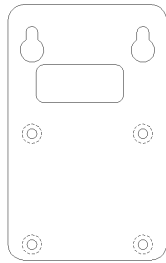


Figure 2-1 Horizontal Mounting Bracket

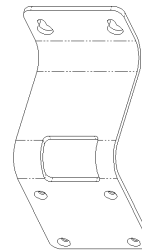


Figure 2-2 "S" Type Mounting Bracket

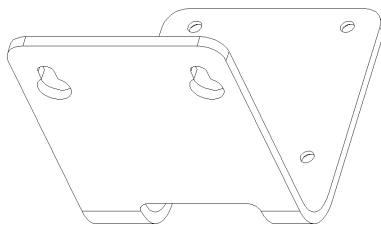


Figure 2-3 "L" Type Mounting Bracket

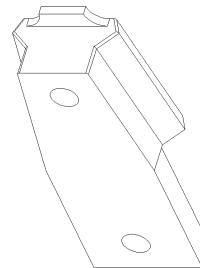


Figure 2-4 Dovetail Mounting Bracket

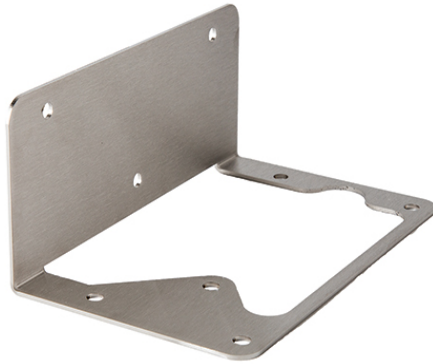


Figure 2-5 Stainless Steel wall mounting bracket
(Airnet II 510s and 510s XR version only)

Powering the Sensor from 24 VDC

For Airnet II 301, 501, 501A, 510, and 510 XR (Polycarbonate enclosure version only):

The Airnet II particle sensor can be powered with sources other than the optional power supply. The unit may also be powered using a source of 24 VDC power that may be connected to multiple Airnet II particle sensors. Ensure that the 24 VDC supply wiring is sized 18 AWG (0.75 mm²) minimum and the supply is current limited to 8 A maximum or fused at 5A maximum.

If using a local power source a receptacle and crimp pins are available that attach to the ends of the power cable. The crimp pins are then inserted into the square receptacle.

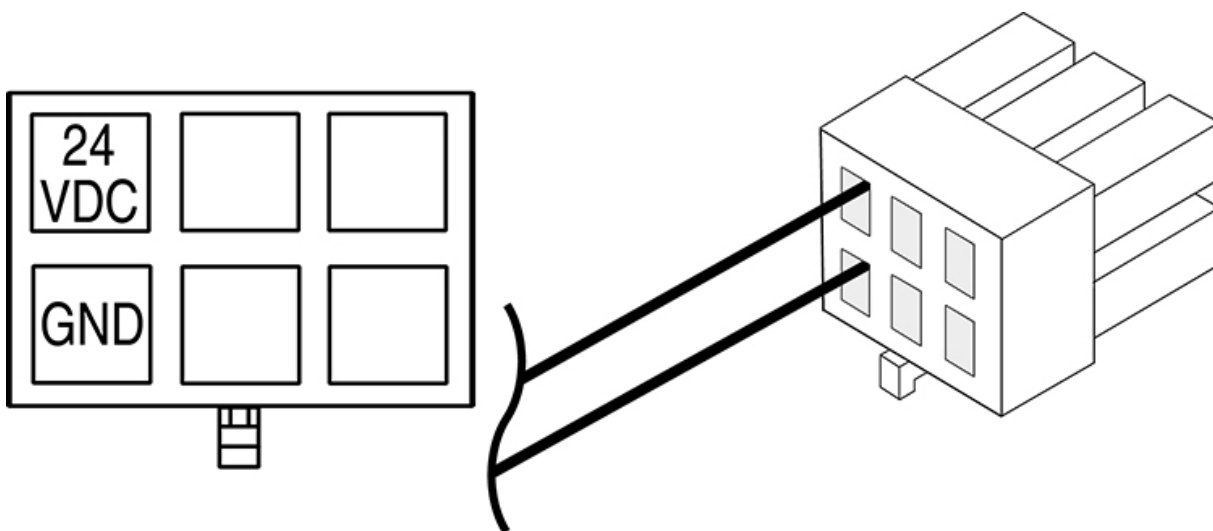


Figure 2-6 24 VDC Power Connector

Powering the Sensor from Power over Ethernet (PoE)

For All Airnet Models

The Airnet II can be powered from a Power over Ethernet Router that conforms to IEEE 802.3af. A shielded CAT5 cable must be used or a local ground connected to the sensor for proper operation when using PoE.

The Airnet II 510s and 510s XR is provided with a ruggedized Ethernet cover.

Appendix C provides instructions for installing the RJ45 Data Connector.

Connecting the Power Supply

After the Airnet II particle sensor has been physically installed with its bracket, connect the sensor to an appropriate power source.

After the supply cable is connected, the sensor's Status LED should illuminate indicating that the unit is receiving power.

If the LED does not illuminate, test the power source and the power supply. If the power source and power supply are all right, the unit may be faulty.

The Airnet II also has the capability of being powered through Power over Ethernet. This requires the use of an internet hub designed to operate with such systems. As well as the use of a CAT5 shielded cable or grounding the Airnet II particle sensor locally.

Connecting the Sample and Vacuum Tubing

The plumbing connections are the following:

Sample inlet	<p>The sample inlet can be used with the sampling probe alone or with tubing and the sampling probe.</p> <p>NOTE: Ensure that the Airnet II particle sensor's sampling probe is pointed into the airflow to be monitored.</p>
House vacuum source	<p>The Airnet II 301, 501, 501A, 510, and 510 XR (Polycarbonate enclosure version) particle sensor has a barbed vacuum fitting for connection of 1/4 ID tubing.</p> <p>The Airnet II particle sensor 510s, and 510s XR (stainless steel enclosure version) has a push-in fitting for connection of 8 mm OD tubing.</p> <p>See Figure 1-3 on page 1-6.</p> <p>The vacuum source should be</p> <ul style="list-style-type: none">• > 15 inches of Hg for 510/510XR and 510s/510s XR (> 410 mBar below atm pressure)• > 11 inches Hg for 301 and 501/501A units. (> 375 mBar below atm pressure)

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Chapter 3

Configuring for Ethernet

Configuration Defined

You can configure the Airnet II particle sensor to communicate with FacilityPro and Facility Net, send 4-20 mA signals to a SCADA system (Polycarbonate enclosure version only), or both depending upon the options ordered. Before it can do either, you must configure the sensor.

In this chapter, configuration is the process of making the software and communications settings that will enable the Airnet II particle sensor to communicate with FacilityPro or Facility Net by means of an Ethernet network.

Sensors to be used to communicate in Modbus must be configured for proper operation (see **Appendix B**, Modbus Protocol).

NOTE: The following information assumes that the user has a working knowledge of terminal emulation software such as HyperTerminal®.

When to Configure the Sensor

If it will be difficult or impossible to take a computer to the Airnet II particle sensor after installation, it should be configured before installation.

If access to the sensor after installation will be easy, you can configure the sensor either before or after installation.

Required Hardware and Software


- RS-232 cable
- Computer loaded with terminal emulation software

NOTE: Microsoft Windows® includes a terminal emulator called HyperTerminal. Other terminal emulator programs, are widely available. Your IT administrator or microcomputer support person may be able to provide assistance.

RS-232 Cable

A suitable cable (PMS-CD1995) is provided in your shipment. The wiring for this cable is as follows:

Table 3-1 RS-232 Pin Outs (RJ-11 jack)

Pin 1	DSR	
Pin 2	Transmit	
Pin 3	Receive	
Pin 4	RTS	
Pin 5	CTS	
Pin 6	GND	

NOTE: Pins 1, 4, and Pin 5 are shorted together.

Setting Configuration Addresses for Ethernet

Follow these steps to configure the Airnet II particle sensor to communicate with Facility Net by means of an Ethernet network.

CAUTION

As with any network-capable software, do not attempt to connect the Airnet II particle sensor to a network without your network administrator's cognizance and explicit permission. The administrator will need to approve, and in most cases will issue addresses.

To configure the sensor:

1. Connect the Airnet II particle sensor to a computer that has terminal emulation software.
2. Start the terminal emulation software and proceed to the COM 1 parameters dialog box.
3. Set the following communication parameters:

Table 3-2 Terminal Emulator Communications Parameters

Baud Rate	9600
Data Bits	8
Parity	N
Stop Bits	1
Flow Control	Off
Parity Check	Off
Carrier Detect	Off
Connector	Appropriate to hardware (COM1, for example)

When communications are established with the unit, a prompt appears. Enter the Configuration commands (see "Configuration Commands" below) to set the following addresses:

4. Set the IP address.
5. Set the multicast address.
6. Set the mask address.
7. Set the gateway address.
8. Enter the "write" command.

Configuration Commands

?

Displays a command summary for the selected operational mode (a summary of the information in this table).

Sta(tus)

Displays the following information:

- Current firmware version number
- MAC address
- IP address
- Multicast address
- Net mask
- Gateway
- Queue size (if used with Facility Net)
- Connection status (if used with Facility Net)
- Operational mode

Set ip aaa.bbb.ccc.ddd

The IP address is used when communicating across networks. This command sets the address in the form of aaa.bbb.ccc.ddd. Each three-digit series is a value of 0–255, separated by a period (.) character. An example of a valid IP address is **010.255.000.060**.

Set mas(k) aaa.bbb.ccc.ddd

Sets the network mask address using a decimal notation form of aaa.bbb.ccc.ddd. Each three-digit series is a value of 0–255 separated by a period (.) character. The mask separates the network address from the host address. This address is common to all devices on the logical network. Usually the mask will be similar to 255.255.255.000. Your network administrator will tell you if you need to enter this field.

Set mul(ticast) aaa.bbb.ccc.ddd

The multicast address must be set when using Facility Net. This command sets the multicast address in a decimal notation form of aaa.bbb.ccc.ddd. Each three-digit series is a value of 0–255 separated by a period (.) character. This address is unique to the hardware it serves. An example of a valid multicast address is: **224.100.100.001**.

Set gat(eway) aaa.bbb.ccc.ddd

The gateway address is used when communicating across different networks. This command sets the gateway address in a form of aaa.bbb.ccc.ddd. Each three-digit series is a value of 0–255 separated by a period (.) character. Use gateway 000.000.000.000 if no gateway device is available on the network. An example of a valid gateway address is: **010.255.000.060**.

Set que(ue) x

When used with Facility Net, you can enter a data queue size in order to buffer data while the unit is not connected.

The value of **x** can be set anywhere between 1 and 1440. The queue size to enter depends on the specific application. In general, the value should be made large enough to minimize data loss when disconnected, but not so large as to create significant delays in the reception of real-time data when reconnected.

When a data queue size is set greater than one, the Airnet II particle sensor will:

- Continue sampling if it was initially started, and then disconnected
- Queue up to the number of samples defined by the queue size
- Unload the queued data in chronological order when reconnected
- Periodically delete elements of the queue for which Facility Net has received the data

When the queue size is set to one (1), the Airnet II particle sensor reverts to a mode where there is no data queue, the unit reboots when disconnected and parameters specific to batch processing are enabled.

Set mode x

The unit will run under one of two possible operational modes: PMS Operational Mode or Modbus Mode. When shipped from the factory, the unit is in the PMS Operational Mode.

- When the value of **x** is set to zero (0), the unit will reboot into the PMS Operational Mode.
- When the value of **x** is set to two (2), the unit will reboot into the Modbus Mode.

Select the PMS Operational Mode for use with Facility Net calibration, allowing for the use of a data queue.

Select the Modbus mode to communicate via Modbus TCP (see **Appendix B**, Modbus Protocol).

Set sam (ple) x y

This command sets the minimum sample interval to **x** seconds and the maximum sample interval (used when zero particles are detected) to **y** seconds. It is not required to set the sample interval when running the Airnet II particle sensor with Facility Net.

Write

Saves the most recent changes. **You must send this command** after setting up the instrument, or your parameters will be lost when the sensor is de-energized.

NOTE: When the programming is complete, record these settings for future reference.

Unit Serial Number:**TCP/IP Settings for the Airnet II particle sensor :**

Date			
Software Version			
Set By			
MAC Address			
IP Address			
Multicast Address			
Net Mask Address			
Gateway Address			

Viewing Configuration Settings

Type **sta(tus)** and press the **Enter** key to display the Airnet II particle sensor's configuration settings, software version, and connection status.

If this command does not produce any kind of activity on the display screen:

- the terminal emulator may be set up incorrectly, or
- the cable may be improperly connected or faulty.

Connecting the Ethernet Cable

The Airnet II particle sensor communicates with FacilityPro or Facility Net software by means of a CAT 5 UTP Ethernet cable. The sensor is designed to work best with a CAT 5 UTP cable. Other types of Ethernet cable may produce excess noise. Your Information Systems Manager, Network Administrator, or other appropriate computer support personnel may be able to assist in procuring a cable or fabricating a custom-length cable.

When connecting the Airnet II particle sensor to a network, FacilityPro or Facility Net software will find the sensor on the network. If using Facility Net, refer to the *Facility Net Operations Manual*.

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Chapter 4

4-20 mA Signal Configuration / Operation

NOTE: The following chapter only applies to Airnet II 301, 501, 501A, 510 and 510 XR (Polycarbonate enclosure version).

Overview

The Airnet II particle sensor has an option to be ordered with the ability to transmit three 4-20 mA signals. To use the 4-20 mA output capabilities, the option must be installed in the Airnet II.

One signal communicates instrument status and the other two signals transmit particle count data from two channels. This data is typically collected and processed by a SCADA system.

NOTE: The Airnet II particle sensor can output data to Facility Net software while it also outputs 4-20 mA signals to a SCADA system.

4-20 mA Outputs

The instrument status signal is not controllable by the user. The two particle count signals are channels 1 and 2.

First signal output	Channel 1 particle counts
Second signal output	Channel 2 particle counts
Third signal output	Instrument status

Each channel is capable of driving a grounded load of 400 ohms or less. All grounds are common and are common to the internal analog ground of the sensor.

Channel	301	501	501A	510	510XR
1	0.3 µm	0.5 µm	0.5 µm	0.5 µm	0.5 µm
2	0.5 µm	5.0 µm	1.0 µm	5.0 µm	5.0 µm

Current	Flow Status	Laser Status
8 mA	OK	OK
12 mA	OK	Bad
16 mA	Bad	OK
20 mA	Bad	Bad

The signals are output through a 6-pin Mini-Fit, Jr. connector plug located on the sensor's rear panel.

Configuring 4-20 mA Outputs

Configuring the 4-20 mA outputs is the process of setting parameters to define the collection of the channel data, and to enable the data collection system to correctly interpret this data.

First, establish communications with the Airnet II particle sensor, and then use software commands to configure the sensor.

NOTE: The following information assumes that the operator has a working knowledge of terminal emulation software such as HyperTerminal.

Required Hardware and Software

- Computer loaded with HyperTerminal, or other terminal emulation software
- RS-232 configuration cable (provided in your shipment). Wiring for this cable is as follows:

Pin 1	DSR
Pin 2	Transmit
Pin 3	Receive
Pin 4	RTS
Pin 5	CTS
Pin 6	GND



NOTE: Windows includes a terminal emulator called HyperTerminal. Other terminal emulator programs are widely available. Your IT administrator or microcomputer support person may be able to provide assistance.

Establishing HyperTerminal Communications

To set HyperTerminal for communications with the sensor

1. Connect the Airnet II particle sensor to a computer with the provided RS-232 cable.
2. If the computer is not running, start it and open your terminal emulation program.
3. Proceed to the COM1 parameters dialog box.
4. Set the following communications parameters, and press **Enter**. A prompt (>) will appear on the computer display.

Table 4-3 Terminal Emulator Communications Parameters

Baud Rate	9600
Data Bits	8
Parity	N
Stop Bits	1
Flow Control	Off
Parity Check	Off
Carrier Detect	Off
Connector	Appropriate to hardware (COM1, for example)

5. At the prompt (>), enter the appropriate commands to set the parameters for your 4-20 mA application. Record your parameters for future reference. (A list of available commands are described in the following section.)

Unit Serial Number:

Configuration Commands

The following commands are available to use when setting 4-20 mA signal parameters.

?

Displays a command summary (a summary of the information in this table).

sta(tus)

If in PMS Operational mode, displays the current firmware version number, MAC address, IP address, Multicast address, Net mask, gateway, and connection status. It will also display current 4-20 mA parameters if that option was selected.

set sam(ple) x y

This function sets the minimum sample interval to x seconds and the maximum sample interval (used when zero particles are detected) to y seconds.

This value is stored in permanent memory and is used by the instrument when it starts. This value can be changed by means of the Ethernet interface (Facility Net). However, when the Airnet II particle sensor is de-energized, the value set by the Ethernet interface is replaced by the value in permanent memory. When the 4-20 mA option is used, it always runs by the first sample interval.

set cumul n

This function selects between cumulative and differential data for the first two configurable 4-20 mA outputs if that option is available.

If n equals 1, the data is cumulative and represents the number of particles detected that are larger than the size specified for the channels.

If n equals 0, the data is differential and represents the number of particles detected that are between the size specified for the first output channel and the size specified for the second output channel.

set eos n

If n is set to 1 then the data in each channel is updated only at the end of each sample interval and is held constant for the duration of the subsequent sample interval. If n is equal to 0, the 4-20 mA channels are updated approximately every 100 milliseconds.

set raw n

If n is 1, the data in each channel is simply the number of particles detected. If n is 0, the data is normalized by dividing the counts by the volume sampled. The output units are counts per cubic foot.

set sca(le) n,n

This value defines the scaling of two 4-20 mA channels. This value corresponds to 20 mA at the output. The lower end of the range is always defined so that 4 mA corresponds to zero particles. The units of this value are defined by the settings entered by the **cumul** and the **raw** commands. The first *n* applies to channel 1. The second *n* applies to channel 2.

write

Saves the most recent changes. ***You must send this command*** after completing the instrument setup, or your parameters will be lost when the sensor is de-energized.

Viewing Configuration Settings

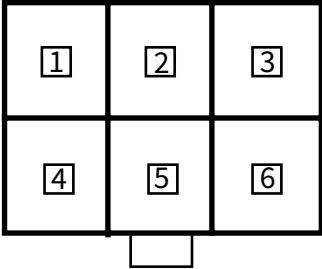
Typing **sta(tus)** and then pressing the **Enter** key results in a display of the Airnet II particle sensor's configuration settings, software version, and connection status.

If typing **status** or **?**, and then pressing the **Enter** key, does not produce any activity on the display screen:

- the terminal emulator may be set up incorrectly, or
- the cable may be improperly connected or faulty.

Connecting to a SCADA Data Collection System

To connect to a SCADA data collection system, build a cable that will allow connection of the Airnet II particle sensor to the SCADA system's 4-20 mA input. The cable must be compatible with the 6-pin Molex Micro Fit 3.0 connector plug located on the rear of the sensor. The following pins are used on the connector

Pin	Function	 Instrument connector view
1	Current output for Channel 1	
2	Current output for Channel 2	
3	Current output for Status	
4	Ground (Channel 1 return)	
5	Ground (Channel 2 return)	
6	Ground (Status return)	

1. Connect the cable from the Airnet II particle sensor's 4-20 mA output to the data collection system's input.
2. Set up the data collection system to correctly interpret the sensor's 4-20 mA output.

Adjusting the 4-20 mA Outputs

The 4-20 mA outputs can be adjusted to compensate for normal variations in the electrical components. The 4-20 mA outputs are only guaranteed to be within +/- 0.2 mA (1% full scale) without any adjustment.

Each of the three 4-20 mA outputs can be adjusted separately. A current meter must be connected to the 4-20 mA output to be adjusted.

To adjust a 4-20 mA output, connect to the setup interface of the sensor:

1. Issue the command **current adjust**.
2. The operator will be prompted for the index of the 4-20 mA output to be adjusted (Output Channels 1-3 are indexed 0-2). The offset and scale factors for the selected output will be set to 0 and 1 respectively.
3. The sensor will then apply 4 mA to the selected output. The operator will be prompted to enter the actual reading as measured by the current meter. The unit will automatically calculate the appropriate offset factor to be applied to that output.
4. The sensor will then apply 20 mA to the selected output. The operator will be prompted to enter the actual reading as measured by the current meter. The unit will automatically calculate the appropriate scale factor to be applied to that output.
5. The operator will be prompted to enter "y" to accept the channel adjustment. If accepted, the new offset and scale factors will be saved. Whether accepted or not, the unit will reboot and restart normal operation.

Chapter 5

Maintenance and Performance Checks

There is nothing within the Airnet II particle sensor that is user-serviceable. You can, however, clean the sensor's housing and repair or replace cables and cable connectors.

Cleaning the Sensor's Housing

The Airnet II particle sensor is housed in a sturdy Polycarbonate or Stainless Steel 316L housing (based on the version ordered) and should provide many years of trouble-free performance. Periodically it may be helpful to wipe the case with a clean, lint-free cloth moistened with deionized water or a mild cleanser.

Cable Connectors

Occasionally a cable connector may be damaged through an accident. The RS-232 and UTP Ethernet connections are somewhat fragile. If a connector is damaged, be careful not to aggravate the problem by forcing a cable into a damaged connector. A Particle Measuring Systems Service Representative can repair or replace damaged connectors.

Performance Checks

Complete the following procedures to verify that your instrument is operating properly.

Airflow Rate Check

The sample flow is factory-set using a critical orifice and is not adjustable. If the flow drops by 15%, there may be a blockage in the critical orifice or inlet jet.

The following instrument(s) will be needed:

- A 0.1 CFM $\pm 5\%$ flow meter for models 301, 501, 501A
- A 1.0 CFM $\pm 5\%$ flow meter for models 510, 510XR, 510s and 510s XR

To check the air flowrate:

1. Disconnect all sample tubing and sample probes.
2. Connect the unrestricted test flow meter to the sample inlet fitting.
3. Run a sample and monitor the flow meter readings. The measured flow should be the following:
 - Models 301, 501, 501A – 0.085 to 0.115 CFM ($\pm 5\%$)
 - Models 510, 510XR – 0.085 to 1.15 CFM ($\pm 5\%$)

Background Count Check

Perform this check upon installation or when suspected contamination or noise-induced counts may be causing inaccurate data. Background counts can be caused by power line transients, cosmic ray particles, or RFI or EMI noise counts. Externally induced counts are the exception; the only way to verify externally induced counts is to perform this procedure.

To perform this procedure, you will need an absolute filter rated at less than 0.2 micron (effective to 0.1 micron in air).

To perform a background count check:

1. Locate the Airnet II particle sensor to where it will normally be used.
2. Remove the isokinetic sample horn.
3. Place the 0.2 micron absolute filter and inlet tubing adapter in series with the sample inlet flow tube.
4. Run six 10-minute samples.
5. Verify that background count rates average less than ten counts per ten minutes when using the specified filter.
6. Return the instrument to normal operation by removing the filter from the sample line.

Chapter 6

Troubleshooting

Use this chapter to help troubleshoot issues with the Airnet II particle sensor, such as power issues, communication messages, errors, leaks, and particle and transient-induced counts.

Troubleshooting Matrix

Problem	Symptoms	Possible Cause	Try...
No power	No lights or No communications	Power supply not connected to a power source	Check the seating of the power supply cable in the unit. Verify that the power supply is plugged in.
		Electrical power source fault	Check the electrical outlet for power, including any power strips or surge protectors.
		Power supply faulty	Try a different power supply.
		If using PoE	Verify power is being supplied
Communications not established – Facility Net displays “Communications Error”.	Unable to view data from working sensor	Ethernet cable problem	Replace the Ethernet cable that connects the sensor to an Ethernet hub.
		Unit not configured correctly	Re-configure the unit. First check the sensor’s IP Address and the computer’s IP Address.
		Computer hardware or software problem	Substitute a computer with known good Ethernet capability. Refer to your computer’s Ethernet card documentation to correct the fault.
Laser failure	Status light indication	BAD Laser	Return the unit to your local service center.
		Detector board failure	

Airflow Rate Errors

As a result of the performance check procedure (see **Chapter 5**), the flowrate at the sensor's inlet should be the following:

- 0.1 CFM for models 301, 501, and 501A 0.085-0.115 CFM ($\pm 5\%$)
- 1.0 CFM for models 510, 510s, and 510XR/510s XR 0.85-1.15 CFM ($\pm 5\%$)

A flowrate error greater than 15% ($\pm 5\%$) indicates that maintenance is required.

Low flow could be due to an obstructed orifice, leaks or insufficient vacuum.

A minimum of 15 inches of Hg (> 410 mBar below atmospheric pressure) vacuum is required at the Airnet II particle sensor's critical orifice for the 510/510XR, and 510s/510s XR units. Greater than 11 inches Hg (> 375 mBar below atmospheric pressure) is required for the 301 and 501/501A units to provide the sample flowrate. If the flowrate is still low after determining that there is sufficient vacuum, perform the following procedure.

Isolating and Repairing Leaks

To isolate and repair leaks:

1. Remove the top and bottom halves of the instrument.
2. Run samples.
3. While a sample is running, use a bulb syringe to blow a small amount of smoke around the possible leak paths and watch for an increase in the number of counts.

The following locations are possible leak paths:

- Where the inlet jet meets the body of the sample block
 - Around the laser diode
 - Around the photodiode
 - Around the laser window
 - Around the beam dump
 - Around the mirror plug
4. If a leak is suspected around the inlet jet, remove the jet and O-ring, clean lubricate and/or replace parts.
 5. Reassemble the unit.
 6. If a leak is suspected around the laser diode or photodiode, contact Particle Measuring Systems for assistance.

Particle-Induced Counts

If background counts are too high, it is usually due to contamination within the isokinetic sampling horn.

To clean the isokinetic sampling horn:

1. Remove both the isokinetic sampling horn and jet and flush both with a cleaning solvent (alcohol, acetone, and so on).
2. Dry the isokinetic sampling horn and the jet using clean pressurized air.
3. Replace the jet and horn. Make sure to line up the alignment indicators.

Transient-Induced Counts

Line transients (RFI or EMI noise counts) are generally subtle and unique to a certain installation. If these counts are suspected, call your Particle Measuring Systems representative.

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Appendix A

TCP/IP Protocol: A Brief Overview

NOTE: This information is provided to help Airnet II particle sensor users who are not familiar with TCP/IP protocol understand more about the sensor configuration process. It is not a substitute for the guidance of your network administrator.

TCP/IP's Network Layer

TCP/IP's **Internet Protocol** or IP is designed to interconnect packet-switched communication networks to form an internet.

In summary, the IP protocol's main functions are:

- Provide the basic unit for data transfer
- Addressing
- Routing
- Fragmentation of datagrams

Ping

TCP/IP systems can use a utility named *PING* (Packet InterNet Groper) to test station and network integrity. The TCP/IP-32 add-on protocol for *Microsoft Windows for Workgroups 3.11* includes a *PING* function that must be run from a *Windows DOS* window.

To use the Windows TCP/IP PING:

1. With Windows running, open a DOS window by double-clicking on the MS-DOS Prompt icon.
2. At the DOS prompt, type PING <IP ADDRESS> (using the address of the device for which you wish to test your computer's LAN communications).

The *PING* utility will report whether or not the other device responded, and what the response time was.

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Appendix B

Modbus Protocol

Communications with the Airnet II can be done via Modbus TCP. The following Modbus register map has comments and notes to help with its intended use.

Modbus Overview

The map contains three sections:

- 1.** Input registers – Read only information for ID and data collection
- 2.** Holding registers – Read/Write parameters for configuring the device
- 3.** Coils – Read/write individual bits to control the device

The supported functions include:

- | | |
|-----------|---------------------------------------|
| 1 | Read Coils |
| 5 | Write Single Coil |
| 15 | Write Multiple Coils |
| 4 | Read Input Registers |
| 3 | Read Holding Registers |
| 6 | Write Single Holding Register |
| 16 | Write Multiple Holding Registers |
| 23 | Read/Write Multiple Holding Registers |
| 22 | Mask Write Holding Register |

- Any registers accessed but not defined will generate an address error.
- Spare coils/registers will “set” without error and always return a zero value.
- Registers set with invalid data will return a function error.

There is a setting available that toggles the interpretation of selected dual-register values. These values can be interpreted as integer representations of floating point numbers with a fixed scaling factor or as IEEE-754 floating point representations of that value. Refer to the register map to determine which register pairs have this feature applied. This setting can be made in the setup interface, and saved in non-volatile storage, or set real-time via a coil.

Input Registers

The input registers are in two sections: Configuration & Data

The configuration section contains:

- Map Version
- Firmware Version
- Product Name
- Flow and Volume Scale Factors
- Flow Rate
- Number of channels (Particle & Analog)
- Particle channel sizes

The scale factors are values representing the power of 10 associated with the fixed scaling of that parameter in the map. The channel sizes are in two registers representing integer nanometers.

The data section starts with configuration information – Calibration date and serial number. This allows for a single contiguous read when this particular information is desired along with the regular sample data. If not desired, then skip this section and begin reading at register 30212.

The Device Status register contains all the Coil bits for convenience. The host can use this to check for data availability, for example.

The Device State register is a single register in which the **LSByte** is a state value and the **MSByte** is an associated sub-state value.

The time stamp set of registers is a "time_t" value.

The Data Packet Status is two registers for growth. 3 bits are used.

Flow Rate and Volume are in CF. These can be read either as integer values with fixed scales or as Floats. The float mode is recommended to get best accuracy.

The location register is not utilized. It is intended for manifold systems (if applicable).

The number of channels and analogs varies across instruments by the purchased options.

Table B-1 Input register – configuration

Input Registers		Description (Configuration)	Comment	Notes
30001	ushort	Modbus Map Version	Version 1.00 (Static 100)	
30002	ushort	Sensor Firmware Version	Firmware version (*100)	
30003	string	Product Name: Char 00, 01	Serial Number	
30004	string	Product Name: Char 02, 03	Serial Number	
30005	string	Product Name: Char 04, 05	Serial Number	
30006	string	Product Name: Char 06, 07	Serial Number	
30007	string	Product Name: Char 08, 09	Serial Number	

Table B-1 Input register – configuration (Continued)

Input Registers		Description (Configuration)	Comment	Notes
30008	string	Product Name: Char 10, 11	Serial Number	
30009	string	Product Name: Char 12, 13	Serial Number	
30010	string	Product Name: Char 14, 15	Serial Number	
30011	ushort	Scale: Flow Rate	Multiplier in fixed: Flow Rate	3 (1000)
30012	ushort	Scale: Volume	Multiplier in fixed: Volume	4 (10000)
30013	ushort	Flow Rate (high)	Flow * 10 Scale cfm	Float Mode
30014	ushort	Flow Rate (low)	Flow * 10 Scale cfm	Float Mode
30015	ushort	Number of Particle Channels	Variable across types	2
30016	ushort	Number of Analog Channels	Variable across types	0
30017	ushort	Channel 1 Size (high)	nanometers	
30018	ushort	Channel 1 Size (low)	nanometers	Type
30019	ushort	Channel 2 Size (high)	nanometers	
30020	ushort	Channel 2 Size (low)	nanometers	Type

Table B-2 Input register – data packet

Input Registers		Description (Data Packet)	Comment	Notes
30201	ushort	Calibration Date (Month)	Calibration Date	
30202	ushort	Calibration Date (Day)	Calibration Date	
30203	ushort	Calibration Date (Year)	Calibration Date	
30204	string	Serial Number: Char 00, 01	Serial Number	
30205	string	Serial Number: Char 02, 03	Serial Number	
30206	string	Serial Number: Char 04, 05	Serial Number	
30207	string	Serial Number: Char 06, 07	Serial Number	
30208	string	Serial Number: Char 08, 09	Serial Number	
30209	string	Serial Number: Char 10, 11	Serial Number	
30210	string	Serial Number: Char 12, 13	Serial Number	
30211	string	Serial Number: Char 14, 15	Serial Number	
30212	ushort	Device Status (high)	Device Status Mask	
30213	ushort	Device Status (Low)	Device Status Mask	
30214	ushort	Device State	Device State	
30215	ushort	Number of data samples in queue	Number of samples in queue	

Table B-2 Input register – data packet (Continued)

Input Registers		Description (Data Packet)	Comment	Notes
30216	ushort	Time Stamp (high)	time_t	
30217	ushort	Time Stamp (low)	time_t	
30218	ushort	Sample Time (high)	Seconds * 100	Float Mode
30219	ushort	Sample Time (low)	Seconds * 100	Float Mode
30220	ushort	Data Packet Status (high)	Bit Mask	
30221	ushort	Data Packet Status (low)	Bit Mask	
30222	ushort	Flow Rate (high)	Flow * 10 Scale cfm	Float Mode
30223	ushort	Flow Rate (low)	Flow * 10 Scale cfm	Float Mode
30224	ushort	Volume (high)	Volume * 10 Scale cf	Float Mode
30225	ushort	Volume (low)	Volume * 10 Scale cf	Float Mode
30226	ushort	Location	Location value	n/a
30227	ushort	Number Particle Channels	Variable across types	2
30228	ushort	Number Analog Channels	Variable across types	0
30229	ushort	Particle Channel 1 (high)	Cumulative Raw Ch1	
30230	ushort	Particle Channel 1 (low)	Cumulative Raw Ch1	
30231	ushort	Particle Channel 2 (high)	Cumulative Raw Ch2	
30232	ushort	Particle Channel 2 (low)	Cumulative Raw Ch2	

Holding Registers

For Airnet II, any change to the Holding registers creates a new configuration and so stops the unit if sampling. The new configuration, when completely defined, will be run on the next start-up.

The real-time clock is set via a "time_t" value.

The sample interval and Hold/Tare times are single registers for number of seconds to process. This should make it easy for the host to set.

Table B-3 Holding registers

Holding Registers		Description (Setup)	Comment
40001	ushort	Real Time Clock (high)	time_t
40002	ushort	Real Time Clock (low)	time_t
40003	ushort	Sample Interval	Seconds
40004	ushort	Hold/Tare Time	Seconds
40005	ushort	Repeat Count	Repeat Count

Coils

- 1** The data collection coil will enable/disable sampling. It will start a sequence of samples if the repeat count has been set.
Read & Write: 1 = Sampling Enabled, 0 = Sampling Disabled
- 2** The data available coil is used to both inform the host that data is now available and to delete the next queued data packet (if desired).
Read: 1 = Data Available, 0 = No Data Available
Write: 0 = Delete queued data element
- 3** The data clear coil will delete all data in the queue.
Write: 1 = Delete all queued data
- 4** The reset sensor coil will reset the sensor.
Write: 1 = Reset Sensor
- 5 & 6** The Green and Red LED (usually a single dual-color LED) can be set/read independently.
Read & Write: 1 = LED on, 0 = LED off
- 7** The external alarm does not exist on the Airnet II
- 8** The IEEE float control will change the appropriate registers (refer to the map) from a dual-register integer with fixed scaling to a dual-register IEEE-754 Float representation. This value can also be set into non-volatile storage via the setup interface ("set instrument float n" – where n=1 on or n=0 off).
Read & Write: 1 = Float mode enabled, 0 = Float mode disabled
- 9 – 32** Spare.

Table B-4 Coils

Coils	Description (Coils)		Comment	
00/01	Data Collection	On/Off	Sampling Control	
00/02	Data Available	Yes/No	Data Available/Queue Control	
00/03	Data Clear	Toggle	Data Queue Delete	
00/04	Reset Sensor	Toggle	Reset control	
00/05	Status LED: Green	On/Off	Status LED: Green Control	
00/06	Status LED: Red	On/Off	Status LED: Red Control	
00/07	External Alarm	On/Off	External alarm	n/a
00/08	IEEE-754 Float	On/Off	Modbus Float representation	
Spare	24 spare coils		Reserve "common" coils	
00/33	Set Digital Output 1	On/Off		option 2
00/34	Set Digital Output 2	On/Off		option 2
00/35	Set Digital Output 3	On/Off		option 2

Table B-4 Coils

Coils	Description (Coils)		Comment	
00/36	Set Digital Output 4	On/Off		option 2
00/37	Set Digital Output 5	On/Off		option 2

Data Packet Processing

The unit can provide real-time data or queued data or both. There is only one section of Input registers assigned for data to handle this information.

If the unit is setup to queue data then the data shown is the oldest data in the queue. The data available coil bit will be set if there is data in the queue. The data available bit can be cleared in which case that data element shown is popped-off of the queue. If there is more data in the queue, the new data will be shown and the data available coil bit will be set. If there is no more data in the queue, the data available bit will only be set again once the next sample is completed.

If the queue is set to one, then the data shown is always the last data processed and is representative of real-time data only. Since the queue is circular - the next sample will replace the single one in the queue.

Queued data will always be available - even when not sampling.

If there is no data available - the input registers will yield zeros. This is done instead of generating an execution exception so that the customer can simply read the data packet, along with the Device Status, in one command.

Associated Values for Specific Registry Entries

Table B-5 Associated values for specific registry entries

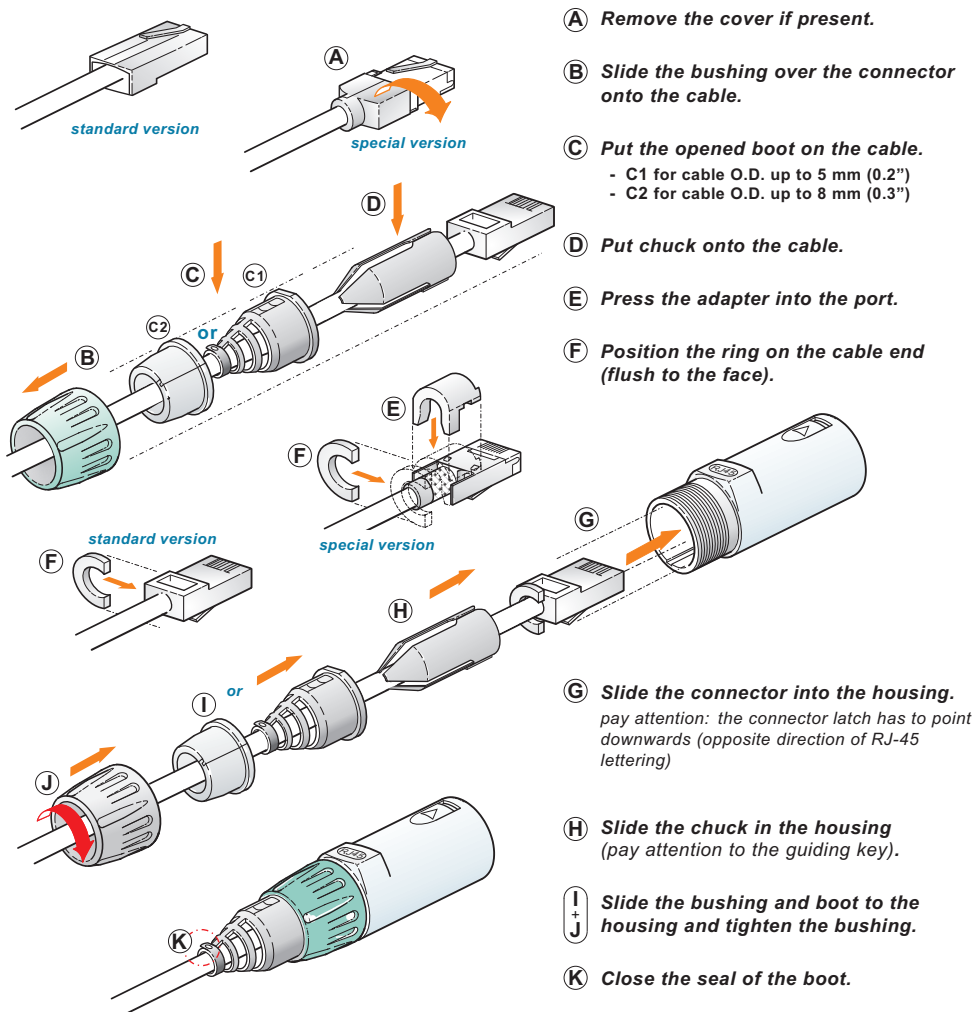
Device Status Entries	0x0001	Data Collection	Matches the common coil settings
	0x0002	Data Available	
	0x0004	Data Clear	
	0x0008	Reset	
	0x0010	Green Status	
	0x0020	Red Status	
	0x0040	External Alarm	
	0x0080	IEEE Float mode	
Device State Entries (LSByte)	0	Idle	
	1	Sampling	
	2	Maintenance	
	3	Error	
Device SubState Entries (MSByte)	0	Idle	n/a
	0	Sampling	n/a
	1	Sampling	Tare
	0	Maintenance	n/a
	1	Maintenance	Calibration
	0	Error	n/a
Data Packet Status Entries	0x0001	Laser Good	
	0x0002	Flow Good	
	0x0004	Hardware Good	

Appendix C

RJ45 Data Connector Installation

EtherCon® Ruggedized RJ45 Data Connector

Assembly Instructions



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Appendix D

International Precautions

WARNING

This instrument is designated as a Class 1 laser product and complies with US 21 CFR 1040.10 and EN 60825-1. Use of controls, or adjustment, or performance of procedures other than those specified in this manual may result in hazardous radiation exposure.

AVERTISSEMENT

Cet appareil est classé comme produit laser de Catégorie 1 et est conforme aux normes US 21 CFR 1040.10 et EN 60825-1. L'utilisation de commandes, de réglages ou l'exécution de procédures autres que celles spécifiées dans le présent document peut provoquer une exposition à des radiations dangereuses.

WARNUNG

Bei diesem Gerät handelt es sich um ein Laserprodukt der Klasse 1, welches den Normen US 21 CFR 1040.10 und EN 60825-1 entspricht. Das Justieren der Lasereinheit, das Verändern des Gerätes oder Einsatzbereiche, die nicht den Vorgaben dieser Anleitung für das Gerät entsprechen, können dazu führen, dass gefährliches Laserlicht austritt.

ATTENZIONE




Lo strumento è classificato come prodotto laser di Classe 1 e rispetta l'US 21 CFR 1040.10 e l'EN 60825-1. L'uso dei comandi o la regolazione dello strumento, o l'esecuzione delle procedure con metodi non conformi a quanto specificato in questo manuale possono provocare una pericolosa esposizione alle radiazioni.

ADVERTENCIA

Este instrumento está catalogado como producto láser de Clase 1 y cumple con las normativas US 21 CFR 1040.10 y EN 60825-1. El uso de controles o el ajuste o la realización de procedimientos que no sean los especificados en este manual pueden provocar la exposición a radiación peligrosa.




Hazard Symbols

The meaning of hazard symbols appearing on the equipment is as follows:

Symbol	Nature of Hazard
	Attention, consult accompanying documents.
	Dangerous High Voltage
	Warning – Laser radiation! Avoid exposure to beam.




Symboles de risque

Des symboles représentant les risques sont placés sur l'appareil. Leur signification est la suivante:

Symbole	Nature du risque
	Attention, consulter les documents d'accompagnement
	Danger Electricite
	Avertissement – Rayonnement laser ! Éviter toute exposition au faisceau.



Warnschilder

Die, an dem Gerät angebrachten Warnschilder haben folgende Bedeutungen:

Symbol	Gefahrenart
	Achtung! In den beiliegenden Unterlagen nachschlagen
	Achtung Hochspannung
	Warnung – Laserstrahlung! Nicht in den Strahl blicken.

Simboli di pericolo

Il significato dei simboli di pericolo che appaiono sugli strumenti il seguente:

Simbolo	Natura del pericolo
	Attenzione. Consultare i documenti allegati
	Tensione Pericolosa
	Avvertenza – Radiazione laser! Evitare l'esposizione ai raggi

Simbolos de peligro

Los simbolos de peligro que aparecen en el equipo significan:

Símbolo	Naturaleza del Peligro
	Atención, consultar los documentos adjuntos.
	Peligro alto voltaje.
	Advertencia – ¡Radiación láser! Evite exponerse al rayo.

Appendix E

有毒或有害的物质和元素

Part Name 部件名称	有毒或有害的物质和元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴联苯醚 (PBDE)
电源供应	X	O	X	O	O	O
印刷电路装配	X	O	X	O	O	O
光学元件	X	O	X	O	O	O
激光	X	O	X	O	O	O
机械部件	X	O	X	O	O	O
电缆	X	O	X	O	O	O
<p>O: 表示用于部件的所有同族物质中所含的有毒或有害物质低于SJ/T11363-2006规定的限度要求。</p> <p>X: 表示用于部件的至少一种同族物质中所含的有毒或有害物质高于SJ/T11363-2006规定的限度要求。</p>						

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