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Without measurement there is no control

Lasair® III
Aerosol Particle Counter

OPERATIONS MANUAL

P/N 1000012958

Lasair® III Aerosol Particle Counter
Operations Manual

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Lasair® III Aerosol Particle Counter 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 Lasair III containing asbestos.

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

Battery Disposal

Lithium ion batteries are classified by the U.S. federal government as non-hazardous waste and are safe for disposal in the normal municipal waste stream. Lithium ion batteries contain recyclable materials and are accepted by some of regional recycling programs.

Particle Measuring Systems, Inc. encourages users to check with their local municipality for lithium ion battery recycling. In North America, contact the Rechargeable Battery Recycling Corporation (RBRC) at www.call2recycle.org. In Europe, contact the European Portable Battery Association. (EPBA) www.epbaeurope.net.

For California consumers, contact Particle Measuring Systems, Customer Service Department at (877)-475-3317 for instructions on returning used, rechargeable batteries for reuse, recycling, or proper disposal at no cost.

Patent Information

U.S. 6167107; Europe 1196832; Japan 3559782
U.S. and foreign patents for the Lasair III particle counter pending.

Wireless Radio Designators

FCC = F4AWLNN551
IC = 3913A-WLNN551
Japan Radio Type Certification = 208-150044

Manual Conventions

This manual uses the following conventions to call the reader's attention to certain text.

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.

CE Declaration of Conformity

Application of Council Directive(s):	2014/30/EU, 2014/35/EU, 2014/53/EU, RoHS 2011/65/EU	
Standard(s) to which Conformity is Declared:	EMC	EN 61326-1: 2013
	Safety	EN 61010-1: 2010, 3rd Ed. EN 60825-1: 2014
	RTTE	ETSI EN 300 328 ETSI EN 301 893
Manufacturer's Name:	Particle Measuring Systems, Inc.	
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Distributor's Telephone/FAX:	+ 39 06 90530130 / + 39 06 9051315	
Type of Equipment:	Particle Counter	
Model No:	Lasair III	

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:**	Giovanni Scialo
Position:	Director of Engineering	**Position:**	Vice President, Life Sciences
Place: Boulder	Date: October 18, 2019	**Place: Rome**	Date: October 18, 2019

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.

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/en/service-and-support/automated-hardware-software-support

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Chapter 1
Introduction

This chapter is a brief introduction to the Lasair® III Aerosol Particle Counter and is intended to provide you with a brief description of the particle counter, a summary of technical specifications, and a range of environmental conditions for which the equipment is designed.

Included in this chapter:

- **Description** on page 1-2
- **The Particle Counter Instrument** on page 1-4
- **Flowrate and Sizing Sensitivities** on page 1-9
- **Lasair III Options** on page 1-9
- **Specifications** on page 1-10
- **Environmental Conditions** on page 1-12

If you are already familiar with the introductory information in this chapter, and are ready to unpack and install your instrument, you may wish to proceed directly to **Getting Started** on page 2-1.

Figure 1-2. Lasair III particle counter

Description

The Lasair III particle counter is a portable, lightweight, and durable airborne-particle counter. Its compact size and comfortable carrying handle enhances its portability.

The Lasair III particle counter is especially useful in applications where portability is important, such as:

- Cleanroom monitoring
- Facility certification
- Troubleshooting
- Trending analysis
- Statistical process control

The particle counter's touch screen controls and intuitive user interface make setup for particle sampling simple. You can easily:

- Set the start and stop time intervals for particle sampling
- Display sampling results
- Set alarm parameters
- Review counter status and analog data.

Standalone or Portable Use

The Lasair III particle counter can be used as either a standalone or portable device. As a standalone particle counter, you can position the unit in a permanent sampling location or connect tubing to collect air samples from a remote location, such as a cleanroom or isolator.

The Lasair III particle counter is also portable and you can easily transport it from one location to another to sample a specific area. This method, for example, is ideal for verifying multiple areas. The data can then be printed from the unit's built-in printer, downloaded from the USB port to a portable storage device (jump drive), transferred to a computer via Ethernet or RS-232, and/or connected to a control software.

Data Storage and Analysis

The Lasair III particle counter has the memory capacity to store 3000 complete data sets, which cannot be edited or altered (thereby meeting 21 CFR 11 compliance). You can connect the particle counter to a computer using a control software to facilitate long term memory storage, as well as data analysis. The software also facilitates the generation of ISO, EU GMP, China GMP, and FS 209E reports.

Refer to **Chapter 4** for additional information. You can communicate with a computer using the Lasair III particle counter as a standalone (stationary) instrument, or as a portable instrument while in the Remote mode. In this mode, you can temporarily disconnect from a control software, collect sampling data in a portable mode, and then connect to a computer to download the information.

How the Particle Counter Works

As air moves from the sample inlet through the sample chamber, a laser beam is projected through the sample chamber so that any particles in the sample will scatter the light. This scattered light is picked up by the collecting optics and converted to a voltage pulse. The amplitude of the voltage pulse corresponds to the size of the particle. The number of pulses corresponds to the number of particles.

The incoming particle data is allocated according to size to the appropriate channel for counting. Both differential and cumulative counts can be displayed.

Once sampled, air leaves the sampling chamber through the pump and travels to a HEPA filtered exit, that removes 99.97% of particles 0.3 µm or larger.

The Particle Counter Instrument

The particle counter has a large, 8.4-inch color touch screen that makes it easy to see data, and includes an intuitive and easy-to-use navigation structure. Information can also be entered using a USB keyboard.

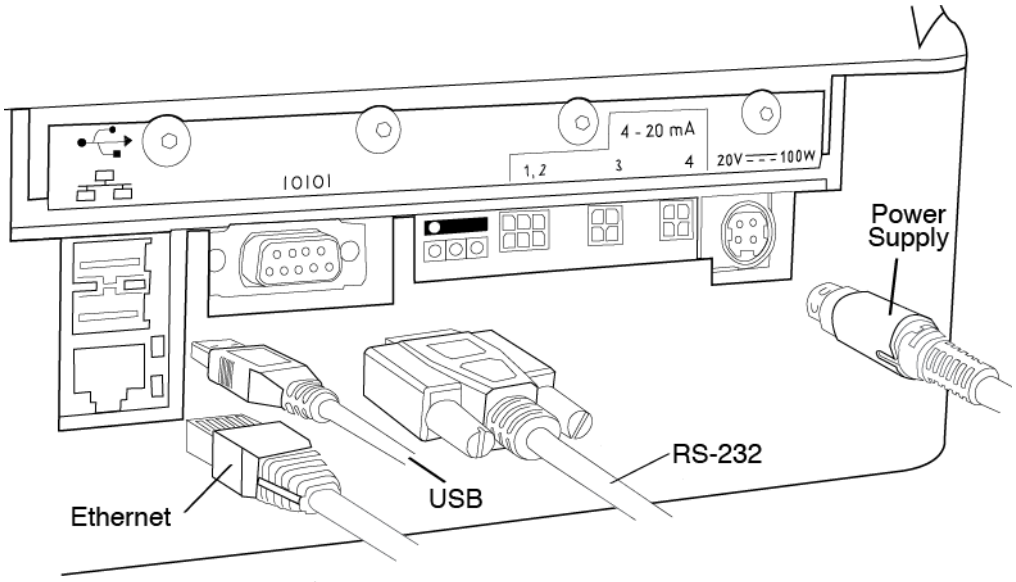


Figure 1-1. Electrical connections

The Lasair III particle counter's internal software for collecting, displaying, analyzing, storing, and reporting data is 21 CFR Part 11 compliant. The software stores up to 3,000 samples, and 50 sampling recipes and 400 locations can also be stored to reduce labor time and potential errors.

NOTE: The maximum number of locations when using Facility Net or Pharmaceutical Net is 250.

The software can be easily configured to display information in 1 of 12 languages. The instrument has a built-in thermal printer for the immediate printing of data.

Electrical Connections

There are three USB ports on the Lasair III, one on the front and two on the back of the unit for exporting sampling data and/or connecting a USB keyboard.

Electrical connections located on the back panel of the unit include:

- Two (2) USB ports
- Ethernet port
- RS-232 connection
- Two (2) – single channel 4-pin 4-20 mA connections
- One (1) – dual channel 6-pin 4-20 mA connection
- DC Input (+20VDC 120 watts)

Refer to **Appendix B** for cable pin-out information.

Sample Probes

A standard isokinetic sampling probe (ISP), constructed out of Ultem® 1000, is included with the particle counter that can be mounted directly onto the instrument's sample inlet. Or, to extend the reach of the sample probe, sample tubing can be added.

Optional Probes

The following isokinetic sampling probes (ISPs) are available and are dependent on the unit's configuration.

- ISP, stainless steel (1 CFM) – P/N 1000012952 (optional)
- ISP, stainless steel (50 LPM) – P/N 1000012953 (optional)
- ISP, stainless steel (100 LPM) – P/N 1000012954 (optional)
- ISP, Ultem 1000 (1 CFM) – P/N 1000012579 (standard)
- ISP, Ultem 1000 (50 LPM) – P/N 1000012578 (standard)
- ISP, Ultem 1000 (100 LPM) – P/N 1000012577 (standard)

Optional Sensors

In addition to connecting a probe to collect air flow for particle counting, you can connect up to four analog environmental sensors using the 4-20 mA input connections, such as:

- Temperature/Relative Humidity (T/RH) sensor – P/N 501050-01 (optional)
- An air velocity sensor that provides a 4-20 mA output
- A differential pressure sensor that provides a 4-20 mA output

The particle counter has two four-pin and one six-pin channel input connections for a 4-20 mA input. Max. 40 mA, 50 mA resettable fuse.

Sensor Connectors are available to adapt other supplier sensors for the Lasair III particle counter's 4-20 mA channel input connections.

- 4-contact plug (P/N 1000008464)
- 6-contact plug (P/N 1000004257)
- Contact pin (P/N 1000013095)

Positioning Accessories

For more precise positioning, the following accessories are available from Particle Measuring Systems:

Tripods

- Floor tripod – P/N MI008
- Table tripod – P/N 1000000979 (Not for use with the Lasair III 5100 unit)

For a complete list of parts and supplies included with the Lasair III particle counter, see the **Shipkit List** on page 2-1.

Wall/Hand/Tripod Adapters

A wall/hand/tripod adapter, specific to the particle counter model, is included and shipped with each Lasair III particle counter. Additional adapters are available for purchase, if needed:

- Wall/hand/tripod adapter (1 CFM) – P/N 1000012955
- Wall/hand/tripod adapter (50 LPM) – P/N 1000012956
- Wall/hand adapter (100 LPM) – P/N 1000012957

Battery

The Lasair III particle counter requires 100-240 V, 50/60Hz for the external AC to DC power supply. Optional lithium ion batteries and battery chargers are also available from Particle Measuring Systems.

- Lithium Ion Battery – P/N 1000012758
- Battery Charger with one (1) bay, 115 V – P/N 90101118-10
- Battery Charger with one (1) bay, 230 V – P/N 90101118-20
- Battery Charger with four (4) bays, 115 V – P/N 90101119-10
- Battery Charger with four (4) bays, 230 V – P/N 90101119-20

For a 1 CFM unit, a single battery runs for approximately three hours, and dual (using two) batteries run for approximately six hours based on continuous sampling and printing every minute. Battery run and charging times vary with conditions, such as tube length, sample time, and use of the built-in thermal printer. All battery chargers are CE-compliant.

TouchRAM Supplies and Accessories

The following TouchRAM supplies and accessories are available from Particle Measuring Systems (unless otherwise noted):

- TouchRAM wand (reader) – P/N 1000013035
- TouchRAM button (memory storage) – P/N 1000013036
- USB adapter for TouchRAM Wand – P/N 1000013034

Other Supplies and Accessories

The following optional items for the Lasair III particle counter are also available from Particle Measuring Systems:

- USB storage drive – P/N 1000004753

Additional Zero count filters:

- Zero count filter (1 CFM) – P/N 90104050
- Zero count filter (50 LPM) – P/N 90104052
- Zero count filter (100 LPM) – P/N 90104055
- Lasair III Particle Counter Validation Manual – P/N 90510005
- Standard thermal paper – P/N 1000000975
- Cleanroom thermal paper – P/N 1000009974

Flowrate and Sizing Sensitivities

The Lasair III particle counter is ISO 21501-4 compliant and comes in three different models with a flowrate of 1 CFM (310B or 310C), 50 LPM (model 350L), or 100 LPM (model 5100). The particle counter measures particle sizes ranging from 0.3 µm to 25 µm, depending on the model selected. Each model has six channels with preset thresholds.

These channels are listed in **Table 1-1**.

Model No.	Pre-set Channel Thresholds	Flow Rate
310B	0.3, 0.5, 1.0, 3.0, 5.0 10.0 µm	1.00 CFM ± 5% (28.3 LPM)
310C	0.3, 0.5, 1.0, 5.0, 10.0, 25.0 µm	1.00 CFM ± 5% (28.3 LPM)
350L	0.3, 0.5, 1.0, 5.0, 10.0, 25.0 µm	50 LPM ± 5%
5100	0.5, 1.0, 2.0, 5.0, 10.0, 25.0 µm	100 LPM ± 5%

Table 1-1. Pre-set channel thresholds and flowrate

Additionally, a two-channel user-selectable pharma mode, that uses only the 0.5 µm and 5.0 µm channels, is available in each unit.

Lasair III Options

For those situations where the existing alarms are not sufficient there is an optional alarm siren available. This siren is a hardware addition to the unit and adds the capability of a fourth level of sound to the alarm settings. It measures up to 104 dB at one meter from the unit. Contact Particle Measuring Systems for further information about the optional alarm siren.

Specifications

	310B	310C	350L	5100
Channels	0.3, 0.5, 1.0, 3.0, 5.0 10.0 µm	0.3, 0.5, 1.0, 5.0, 10.0, 25.0 µm	0.3, 0.5, 1.0, 5.0, 10.0, 25.0 µm	0.5, 1.0, 2.0, 5.0, 10.0, 25.0 µm
Flow Rate	1.0 CFM ± 5% (28.3 LPM)	1.0 CFM ± 5% (28.3 LPM)	50 LPM ± 5%	100 LPM ± 5%
Calibration	Meets ISO 21501-4 requirements			
Maximum Concentration[a]	> 1,380,270/ft^3	> 1,380,270/ft^3	> 832,599/ft^3	> 688,495/ft^3
Counting Efficiency	50% ± 20% for most sensitive threshold			
Zero Count	< 7.07 counts/m^3	< 7.07 counts/m^3	< 4.00 counts/m^3	< 2.00 counts/m^3
Data Storage	3000 complete data sets. Data cannot be edited or altered meeting 21 CFR 11 compliance.			
Communication Modes	• Ethernet or RS-232 • USB data downloading • Optional built-in wireless Ethernet • Modbus TCP			
Controlling Software	DataAnalyst, Facility Net, Pharmaceutical Net, Microsoft® Internet Explorer® 8.0+, Firefox®, Google Chrome®			
Remote Operation	• Remote web browser operation • Real-time download to Facility or Pharmaceutical Net • USB download			
Reports	• USB reports • Sample printouts • Cleanroom certification reports for ISO, EU GMP, China GMP, and FS209E • Averaging			
Environmental Sensors	• Four 4-20 mA inputs, 40 mA each • 50 mA resettable fuse			
Languages	English, French, German, Italian, Japanese (Kanji), Korean, Mandarin Chinese (Traditional or Simplified), Polish, Portuguese, Russian, Spanish			

Table 1-2. Specifications

	310B	310C	350L	5100
Display and Printer	• 8.4” color VGA display (640 x 480) • IR touch screen (IP65 rated) • Built-in thermal printer			
External Surface	Polycarbonate (PC)			
Enclosure Cleaning Materials	Bleach, ethyl/isopropyl alcohol, peroxide/quaternary ammonium solutions			
Sample Tubing ID[b]	3/8-inch 8 m max. length	3/8-inch 8 m max. length	1/2-inch 8 m max. length	3/4-inch 8 m max. length
Sample Output Filtering	Internally filtered to > 99.97% at 0.3 µm			
External AC to DC Power Supply	• **Input:** 100 – 240 V, 50/60 Hz, 2 A • **Output:** 19 VDC, 7.89 A • AC input voltage fluctuation shall not exceed + 10%. (Requires a grounded electrical supply for safety.)			

Optional Battery	• Rechargeable Lithium Ion battery pack NL2024HD or RH2024HD34
	• **Estimated continuous operation is:**
	  • 3 hr (single) and 6 hr (dual) for 1 CFM unit
	  • 2.5 hr (single) for 50 LPM and 3 hr for 100 LPM (dual)			

Optional Alarm Siren	100 dB Alarm Siren			
Dimensions (H x W x D)	11.9 x 12.9 x 10.2 in (30.1 x 32.7 x 25.9 cm)			
Weight	• 13.2 lb (6 kg) without battery • 16.5 lb (7.5 kg) with two optional batteries			
Operating Environment	• **Temperature:** 0-30°C • **Humidity:** 5-95% RH non-condensing			

Table 1-2. Specifications

a. Less than 10% coincidence loss at maximum recommended concentration.

b. For pharmaceutical applications, tubing length should equal 2m maximum.

Environmental Conditions

The following environmental conditions apply to the Lasair III particle counter:

Operating Temperature Range	0 – 30 °C
Humidity Range	5 – 95% RH non-condensing
Storage and Transportation Temperature	-30° – 50 °C
Maximum Altitude	6,562 ft. (2000 m)

Installation Requirements	• Indoor use only
	• Pollution degree 2
	• Over voltage category I
	• Ordinary protection (not protected against harmful ingress of moisture)
	• **External AC to DC Power Supply:**
	  • Overvoltage Category II
	  • Class I Equipment (Electrical grounding from the main power source to the product input is required for safety.)

Laser Classification	Class 1, complies with US 21 CFR 1040.10 and EN60825-1. An internal, enclosed Class 4 laser is used per EN60825-1.

Table 1-3. Environmental conditions

Chapter 2
Getting Started

Included in this chapter:

- **Unpacking Instructions** on page 2-1
- **Assembly and Installation Instructions** on page 2-7

Unpacking Instructions

Inspecting for Any Shipping Damage

Before you begin, perform a visual inspection to see if the shipping container was damaged during shipping. If the shipping container is damaged, STOP unpacking and notify the shipper immediately.

If the shipping container appears to be in good condition, continue to carefully unpack the container and inspect the contents for any damage. If you identify any damage during this inspection process, notify the shipper.

Shipkit List

Review the list of items included with your shipment. If any items are missing, contact Particle Measuring Systems Customer Service Center at (877) 475-3317 or +1 (303) 443-7100.

A example packing list is provided in **Table 2-1** on page 2-2. The list included with your shipment will be specific to your order and Lasair iII model (310B, 310C, 350L or 5100).

	310B	310C	350L	5100
Lasair III Particle Counter **Quantity: 1**				
	P/N: 101209-XXXX	P/N: 101210-XXXX	P/N: 101217-XXXX	P/N: 101235-XXXX
Isokinetic Sampling Probe and Plug **Quantity:** **1 Probe** **1 Plug**				
	ISP: P/N 1000012579 Plug: P/N 1000001023	ISP: P/N 1000012579 Plug: P/N 1000001023	ISP: P/N 1000012578 Plug: P/N 1000009426	ISP: P/N 1000012577 Plug: P/N 1000013174
Tripod Adapter **Quantity: 1**				
	P/N 1000012955	P/N 1000012955	P/N 1000012956	P/N 1000012957

Table 2-1. Shipkit list

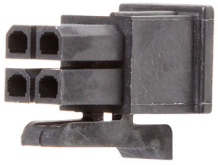
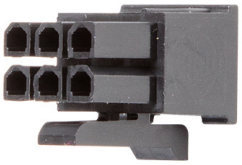
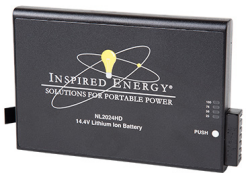
	310B	310C	350L	5100
Sample Tubing **10 ft (3.05 m)** **Quantity: 1**				
	P/N MI153		P/N 1000016726	P/N 1000016756
Zero-count Filter **Quantity: 1**				 Back Front
	P/N 90104050		P/N 90104052	P/N 90104055
4 Pin Connectors **Quantity: 3**				
	P/N 1000008464			
6 Pin Connectors **Quantity: 1**				
	P/N 100004257			

Table 2-1. Shipkit list

<table>
<tr><th></th><th>310B</th><th>310C</th><th>350L</th><th>5100</th></tr>
<tr><td rowspan="2">Female Gold-plated Contacts for 20-24 AWG Wire

Quantity: 24</td><td colspan="4"> </td></tr>
<tr><td colspan="4">P/N 1000013095</td></tr>
<tr><td rowspan="2">Battery

P/N 1000012758</td><td colspan="4"> 
</td></tr>
<tr><td colspan="3">Quantity: 1</td><td>Quantity: 2</td></tr>
<tr><td rowspan="2">Power Supply

Quantity: 1</td><td colspan="4"> </td></tr>
<tr><td colspan="4">P/N 1000012755</td></tr>
<tr><td rowspan="2">Thermal Printer Paper

Quantity: 3</td><td colspan="4"> </td></tr>
<tr><td colspan="4">P/N 1000000975</td></tr>
<tr><td colspan="5">Table 2-1. Shipkit list</td></tr>
</table>

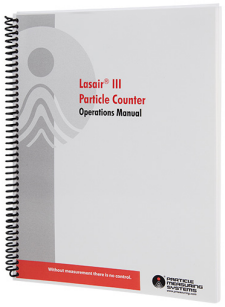
	310B	310C	350L	5100
CP USB Storage Jump Drive and Cap **Quantity:** **Jump Drive: 1** **USB Cap: 1**				
	Jump Drive P/N 1000004753		USB Cap P/N 1000013021	
Operations Manual **Quantity: 1**				
	P/N 1000012958			
Wi-Fi Antenna **(Available with WiFi configuration only)**				
	P/N 90101290			

Table 2-1. Shipkit list

	310B	310C	350L	5100
TouchRAM **Quantity:** **1 USB Adapter** **1 Wand** **4 Buttons**				
	USB Adapter P/N 1000013034	Wand P/N 1000013035		Button P/N 100003036
Temperature and Relative Humidity (TRH) Probe **Quantity: 1**				
	P/N 501050-01			
Validation Manual **Quantity: 1**				
	P/N 9051005			
DataAnalyst Software **Quantity: 1**	P/N 450800			

Table 2-2. Optional items (Not included in standard shipkit)

Storing Shipping/Packing Materials

After unpacking the instrument, make sure to save and store all the shipping and packing materials for future use. These shipping containers and packing materials are made specifically to protect the Lasair III particle counter during initial shipments, as well as future calibration or return servicing shipments.

CAUTION
To protect the instrument, always pack and ship the Lasair III particle counter using its original packing materials and shipping container. Failure to do so may void the warranty, and additional charges may be assessed for replacement containers reissued for return shipments.

Assembly and Installation Instructions

The Lasair III particle counter requires minimal assembly for use. Some of these assembly tasks include:

- **Connecting Sample Probes** on page 2-7
- **Inspecting for Any Shipping Damage** on page 2-1
- **Powering the Unit** on page 2-10
- **Installing the Battery Packs** on page 2-11
- **Attaching Computer Connections (Optional)** on page 2-14

Connecting Sample Probes

Use this instruction to connect an Isokinetic Sample Probe (ISP) to the Lasair III particle counter. You can connect a sample probe directly to the particle counter's sample inlet, or extend the reach of the sample probe by connecting sample tubing.

Additional accessories for mounting the particle counter on a tripod or wall are available to help with proper cleanroom isolation and precise positioning. Refer to Positioning Accessories on page 1-5 for a complete list.

To connect the sample probe directly to the sample inlet:

1. Remove the protective cap from the particle counter's sample inlet.
2. Position the ISP over the sample inlet of the particle counter (located on the top of the unit).
3. Gently–but firmly–press downward on the sample probe until it reaches the base of the sample inlet.

To connect the sample probe to tubing:

Each Lasair III particle counter comes with 10 ft. (3.05 meters) of sample tubing. You can cut the tubing to a smaller length, if needed. For tubing longer than 10 ft (3.05 meters), use a continuous length of tubing, up to a maximum 26 ft (8 meters).

NOTE: If you intend to sample for particles greater than 1 µm, it is recommended to use the minimum length required to reach the sampling area. In pharmaceutical applications, tubing length should be a maximum of two meters.

1. Remove the protective cap from the particle counter's sample inlet.
2. Place one end of the tubing over the Lasair III sample inlet and press down (while gently moving it side-to-side) until it reaches the base of the inlet.
3. Insert the free end of the tubing into one end of a Wall/Hand/Tripod adapter (supplied with each ISP Lasair III).
4. Place the sample probe on the other end of the Wall/Hand/Tripod adapter.
5. Mount the adapter using the two 1/4-20 screw holes as necessary.

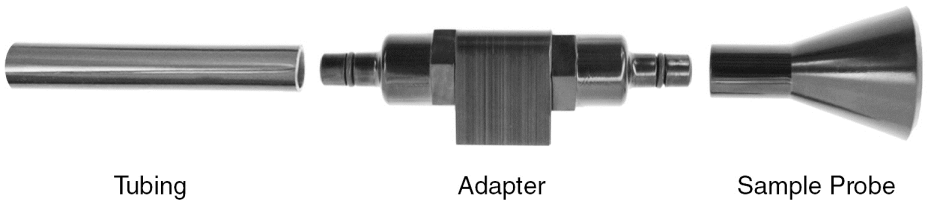


Figure 2-1. Sample probe-to-tubing adapter

NOTE: The adapter's O-ring will hold the sample probe securely to the adapter.

To secure the sample probe to a tripod:

1. Place the provided tripod adapter on top of the tripod base, aligning the adapter's screw openings with the tripod's screws.
2. Tighten the screw wheel to secure the adapter to the tripod.
3. Connect the tubing by first removing the protective cap from the particle counter's sample inlet.
4. Place one end of the provided sample tubing over the sample inlet and press down, gently moving it side-to-side until it reaches the base of the inlet.
5. Insert the free end of the tubing into one end of the adapter that you mounted on the tripod in steps 1-2.
6. Place the sample probe on the other end of the adapter.
7. Position the tripod at your sampling point.

Connecting Sensors

You can connect up to four analog environmental sensors using the Lasair III particle counter's 4-20 mA input connectors. These input connectors are located on the back panel of the particle counter as shown in **Figure 2-2**.

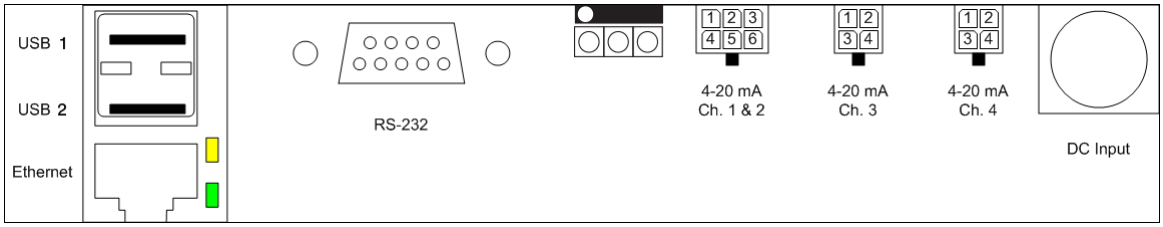


Figure 2-2. Connectors on back panel

To connect a 4-20 mA sensor:

1. If using another supplier's sensor, terminate and replace any attached connectors with Lasair III particle counter 4-20 mA connectors.
2. Refer to the pin-out information located in **Appendix B**. Otherwise, if using a Particle Measuring Systems TRH sensor, go to step 2.

NOTE: Each Particle Measuring Systems TRH sensor is pre-assembled with the corresponding 4-20 mA input plug connector. For sensors from other suppliers, Sensor Connectors (4-contact [P/N 1000008464], 6- contact [P/N 1000004257], and contact pin [P/N 1000013095]) are available to adapt sensors for connection to Lasair III particle counter.

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3. Lift the connection shield on the lower back panel of the particle counter to locate the appropriate 4-20 mA input.
4. There are two 4-pin connectors and one 6-pin connector. See **Figure 2-2.**
5. Plug the sensor into the connector.

Powering the Unit

The Lasair III particle counter is rated at 20 VDC (120 W) and can be operated from an AC source or internal batteries. When using the AC source, the external power supply requires 100-240 Volt 50/60 Hz AC power to produce the 20 VDC, which powers the particle counter.

CAUTION
Fluctuations in the AC Main supply voltage are not to exceed +10% of the rated supply voltage range.

Installing the Battery Packs

1. Insert one or two lithium battery packs into the Lasair III particle counter to enable portable operation.

NOTE: The 100 LPM units must be powered by two batteries.

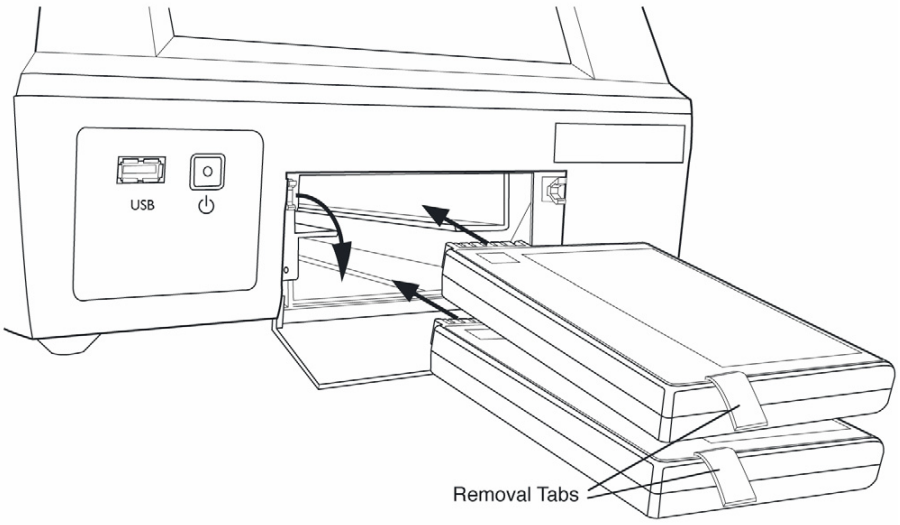

Figure 2-3. Insert one or two lithium battery packs

2. Remove the battery from its packaging.

3. Pre-charge the battery using the Lasair III External Battery Charger (optional).

NOTE: The Lasair III External Battery Charger is an optional accessory available from Particle Measuring Systems. The batteries can also be charged inside the unit by connecting to a main power supply.

NOTE: When using the Lasair III particle counter to re-charge batteries while also sampling, the available power to charge may be reduced during sampling operation. Therefore, it may take longer to recharge the batteries if you are also simultaneously sampling.

4. Press the battery door latch down to open the door.
5. Hold the battery with the removal tab on the left side.
6. With the battery contacts entering first, slide the battery pack into one of the particle counter's battery chamber slots (located on the lower front of the unit) until it stops.
7. If using two batteries in the particle counter, repeat steps 1-5 for the second battery.
8. Use the side latch to secure the battery(ies) in place.
9. Close the battery door.

NOTE: To completely remove the Lasair III particle counter's power, the battery pack(s) must be removed in addition to disconnecting the power cord.

Connecting to an AC Power Source

Before you begin to connect to an AC power source, you will need the following items:

Item	Comments
External AC to DC power supply	Standard U.S. Government Energy Information Administration (EIA) power input of 100-240VDC, 50–60 Hz. Only use the included power supply to prevent damage and assure proper operation.
U.S. power cord with plug	Included with U.S. shipments only.
International power cord (included)	The power cord for international shipments does not come assembled with a plug. You will need to connect an applicable power plug, configured for your country's voltage and frequency specifications.
Surge protector (recommended)	To protect the unit from any voltage spikes, use a good quality surge protector.

Table 2-3. Items required for AC power source connection

To connect to the external AC to DC power supply:

WARNING
Before you begin, ensure that the external AC to DC power supply has been properly grounded.

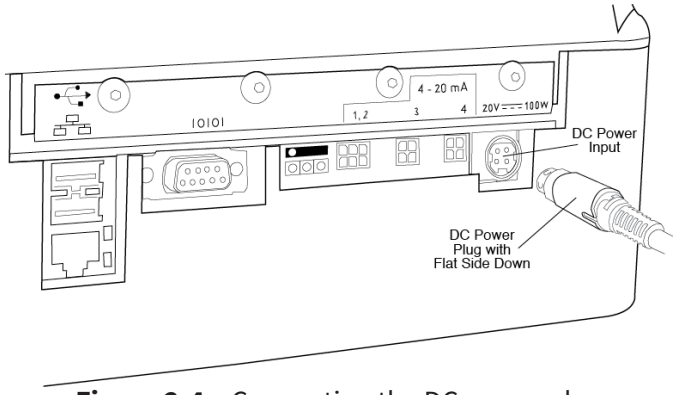

Figure 2-4. Connecting the DC power plug

1. For non-U.S. locations, connect the correct AC power plug to the provided international power cord. For U.S. locations, use the U.S. AC power cord.
2. Insert the DC power plug (with the flat side facing down) into the DC power input, as shown in **Figure 2-4**.
3. Plug the AC power cord into a surge protector, and then into the external AC to DC power supply.

CAUTION
The main power disconnect is the power cord. Ensure that it is easily accessible. Also remove the lithium batteries (if installed) to remove all power.

Attaching Computer Connections (Optional)

If you are connecting the Lasair III particle counter to a computer directly or indirectly, you will need the appropriate cabling or bridge:

- Crossover cable (P/N AE1938) or straight-through (Ethernet) cable (P/N CD22) – Use when connecting directly to a computer without going through an Ethernet network (optional).
- Straight-through (Ethernet) cable (P/N CD22) – Use when connecting indirectly to a computer through a hub or other device on an Ethernet network. Connect the straight-through cable between the Lasair III particle counter and the hub.

To connect a cable:

1. Locate the correct cable for your installation (as discussed above).
2. Lift the connection shield on the lower back panel of the particle counter to locate the Ethernet port (shown in **Figure 2-2** on page 2-9).
3. Insert the cable into the Ethernet port on the back of the Lasair III particle counter.
4. Connect the other end of the cable into the Ethernet port of the computer or hub.

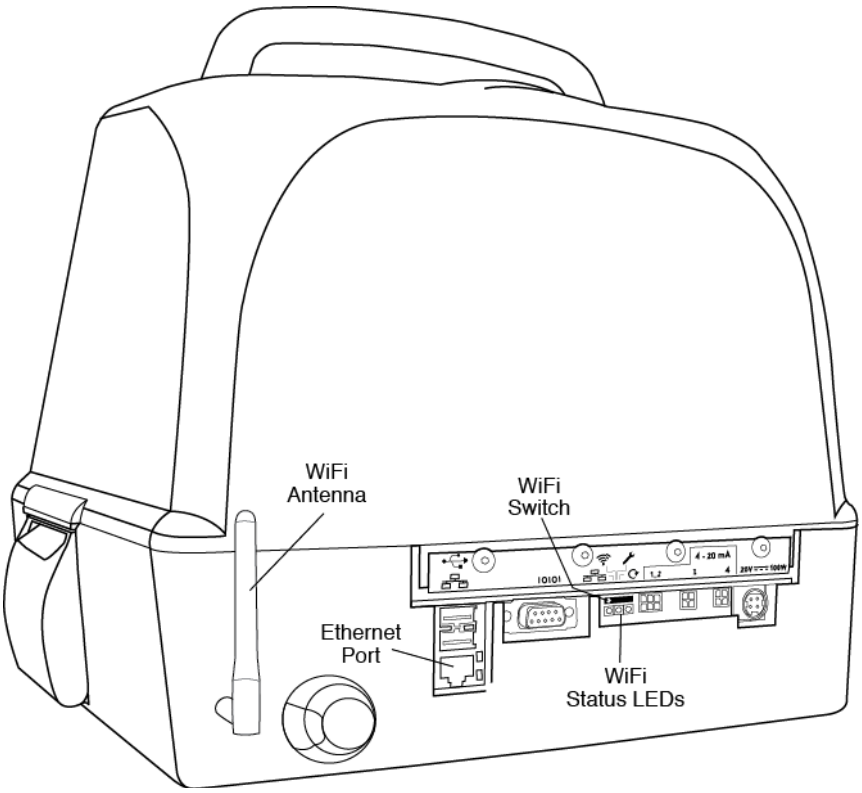

Figure 2-5. WiFi connections and Ethernet port (back panel)

Internal Wi-Fi (Factory Installed Option)

Attach the supplied Wi-Fi antenna to the rear of the unit as indicated in the figure above. For configuration and use of the wireless feature please see **Appendix M**.

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Chapter 3
Taking a Sample - Quick Guide

Take a quick sample with the Lasair III particle counter, without connecting to a computer or additional setup. Use the following **Quick Guide Summary** or **Quick Guide Step-by-Step Instructions** to guide you through the process.

Quick Guide Summary

From the **Navigation** panel, locate the SAMPLE group and press **Sampling**.

Sampling Setup Screen

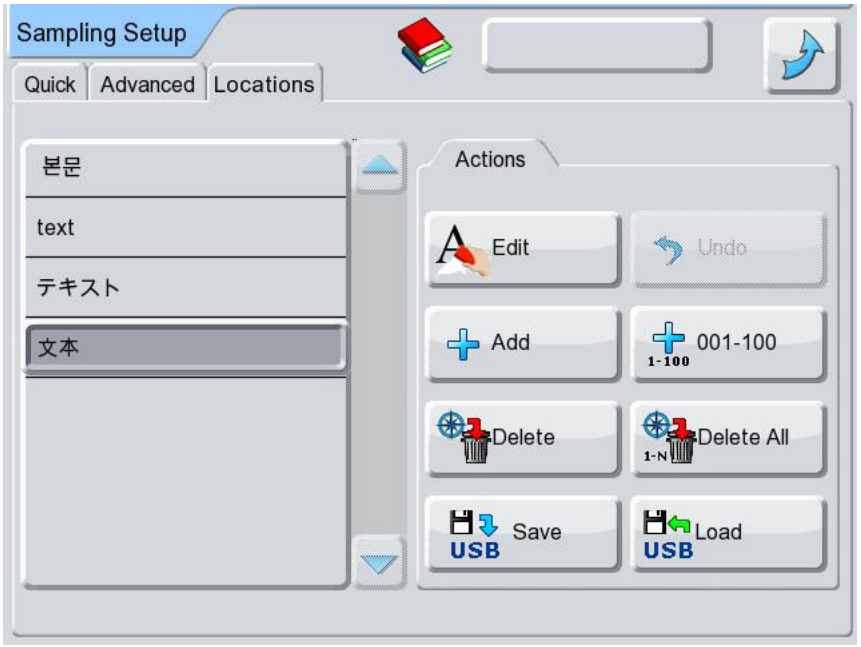

Figure 3-1. Locations tab of the **Sampling Setup** screen

The **Quick** tab of the **Sampling Setup** screen has the following fields and buttons:

Enter the number of **Samples** to be taken

Enable the **Auto Print** button (optional)

Enter the **Sample Time** (or volume, if selected)

Return to the **Main Display**

Quick Guide Step-by-Step Instructions

Before you begin:

1. Review the safety information. (See **Chapter 1** and **Appendix A**)
2. Assemble the particle counter. (See **Chapter 2**)

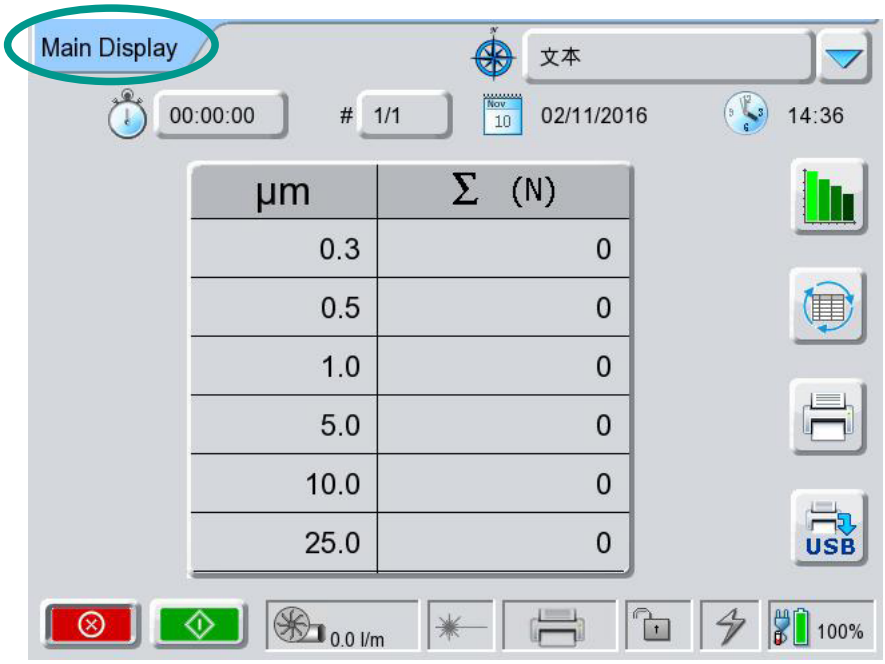

Figure 3-2. Location of the **Main Display** tab

To take a quick sample:

1. Press the green **Standby**/**On** button on the front of the instrument to turn on the particle counter.

2. The **Main Display** with the data display region appears.
3. Press the **Main Displa**y tab (located on the upper left corner of the display) to show the navigation panel (see **Figure 3-3**).

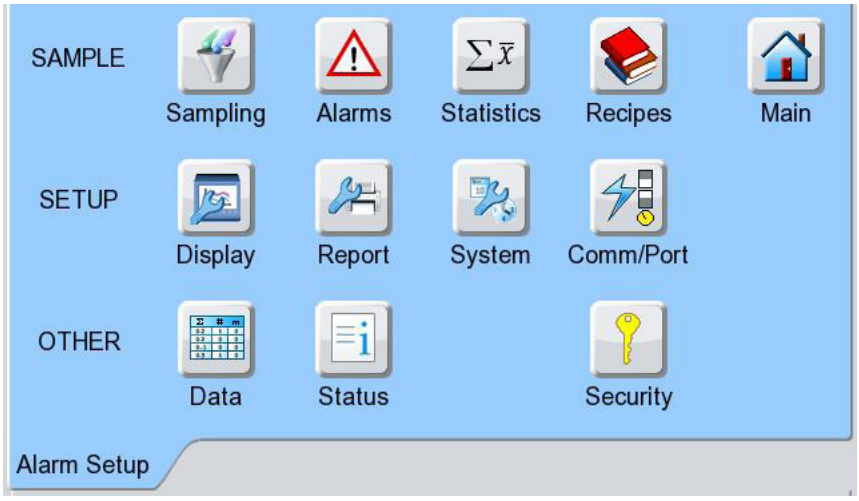

Figure 3-3. Navigation panel

4. Press the **Sampling** button to display the **Sampling Setup** screen.

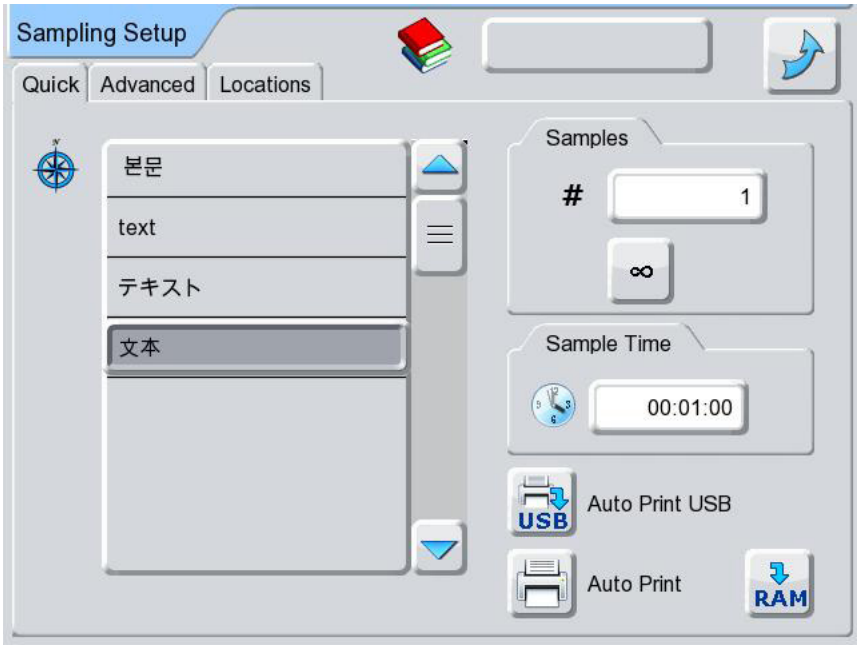

Figure 3-4. Sampling Setup screen

5. Press the **Sample #** field to enter a new number of samples to take, or use the default value (1).
6. Do one of the following:
   a. To run a sample based on a length of time, press the **Sample Time** field to enter a new length of time, or use the default (00:01:00). See **Figure 3-5**.
   b. To run a sample based on volume, press the **Advanced** tab and click on the icon shown to the right. Enter the desired value into the **Sample Volume** field. You may also use the default volume (0.0500 m^3).
   c. To run continuous sampling, press the **Continuous Sampling** button.

NOTE: Either the **Sample Time** or **Sample Volume** field displays depending on the **Sample Size** selection in the **Advanced** tab.
For more information, see **Advanced Tab** on page 6-5.

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7. If the **Sample Time** or **Sample Volume** field is pressed, a keyboard for entering those values appears.
8. Enter the desired value and press **OK**, or press **Cancel** to exit.

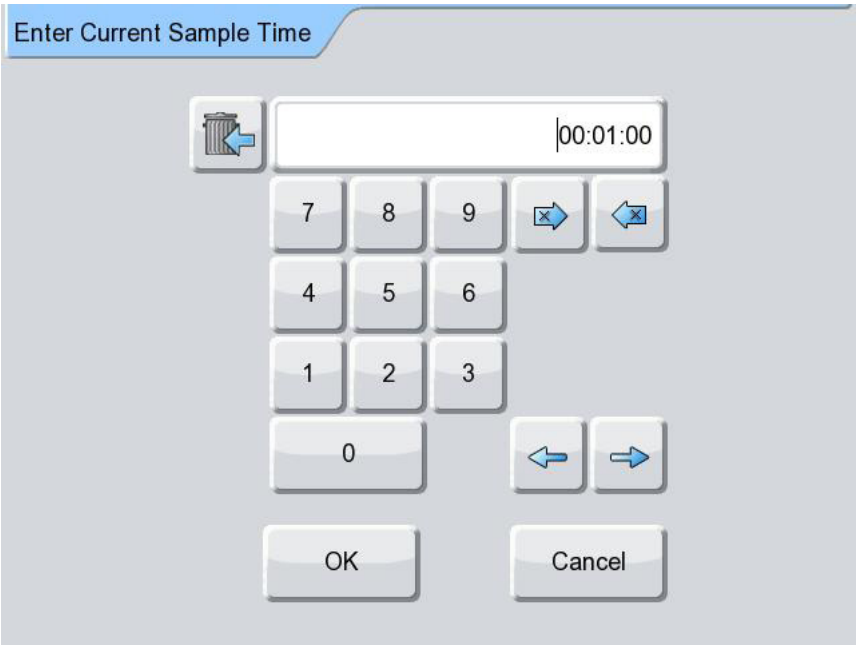


Figure 3-5. Touch keyboard for entering the desired **Sample Time** value

9. Select one of the following, as needed:

- To automatically print to a USB key, insert the USB key into the USB port (located on the bottom-left of the front of the particle counter) and press the **Auto Print USB** button.
- To automatically print to the particle counter's thermal printer, press the **Auto Print** button.
- If neither is selected, no information will be automatically sent to the USB key or thermally printed.

NOTE: Either button will appear shaded darker when enabled, or grayed out when unavailable (a USB key must be inserted to select **Auto Print USB**).

---

10. Press the **Return** button to return to the **Main Display**.

11. Press the **Start Sampling** button.

- The particle counter will begin sampling, printing the data to the USB key or thermal printer, if selected in step 9.
- If neither option is selected, print at any time during the measurement cycle by pressing either the **Auto Print USB** or **Auto Print** button located on the **Main Display**.

Chapter 4
Communicating with a Computer

This chapter includes information for computer communications with the Lasair III particle counter. Although the Lasair III is a standalone instrument with its own built-in firmware, you can also control the instrument with optional software or through a Web browser.

In **Remote** mode (operationally independent of a supplemental computer), the Lasair III particle counter has the memory capacity to store 3000 complete data sets, which cannot be edited or altered (thereby meeting 21 CFR 11 compliance). Once this memory is full, the instrument automatically erases memory in order to add additional sampling data. The oldest data is erased first.

Connecting the Lasair III particle counter to a computer provides the capability for increased memory capacity and long term data storage. Additional software also provides the added ability to analyze the data.

It is also possible to use the Lasair III particle counter with a Web browser. A Web browser allows the ability to control the particle counter from a separate location, as well as obtain the data.

When using an external software or Web browser, you also have the flexibility to activate a **Remote** mode that temporarily disconnects communication to the computer for portable sampling. After collecting the samples, you can then download the data to the computer.

Control Software and Data Interface Options

There are three types of options for communicating with a computer from the Lasair III particle counter, including:

- **PMS Software and Communication Protocols**
- **Third Party Control Software**
- **Web Browser**

PMS Software and Communication Protocols

Particle Measuring Systems offers various control/data management software and communication protocol solutions.

The following data management and facility monitoring software systems have been customized to work specifically work with PMS instrumentation:

PMS Data Management and Instrument Control

- **DataAnalyst** – This software stores data from a Lasair III particle counter and provides additional analysis and reporting options that are 21 CFR Part 11 compliant. This application will support connecting to multiple Lasair III particle counters, store the data from each instrument, and then allow for analysis of the raw data in tabular and graphical formats. DataAnalyst has the capability of generating reports, as recreating room certification reports to meet ISO, EU GMP, China GMP, and FS209E standards. For more information on configuring DataAnalyst to work with Lasair III particle counters, see the DataAnalyst User's Manual. Note that Lasair III firmware version 1.3.000 or later requires DataAnalyst Version 2.
    - Anywhere DataAnalyst is later mentioned in this manual, Facility Net or Pharmaceutical Net also apply.
- **Facility Net**, **Pharmaceutical Net**, or **FacilityPro** – These control software systems (optional purchases from Particle Measuring Systems, Inc.) control the Lasair III particle counter, as well as store and analyze data to provide a comprehensive view of the environmental and process monitoring conditions of a facility. You can collect, display, analyze, store, and report data collected from the Lasair III particle counter.
- **Lasair Serial Interface** – The RS-232 serial protocol allows you to transfer data from the Lasair III particle counter, and write your own routines to control the particle counter.

- **PMS Multi-Drop Protocol** – This serial protocol facilitates communicating in a multi- drop environment, such as an RS-485 system, containing more than one Lasair III particle counter. In addition to transferring data from several particle counters, you can write your own routines to control the particle counters.

Communication Protocol

Use PMS TCP/IP protocol to transmit data between the Lasair III particle counter to DataAnalyst, Facility Net, or Pharmaceutical Net via an Ethernet network. For more information, see **Appendix D**.

Configuring Communications

After you have set up and configured the communication protocol to connect the particle counter to a computer, you must also configure communications on the Lasair III particle counter. Refer to **Appendix C**.

Third Party Control Software

You can also export data collected with the Lasair III particle counter to your Facility

Management System (FMS) using third-party software:

- **USB Port** – There are three USB ports, one on the front and two on the back panel, for transferring data from the Lasair III particle counter to your computer via USB mass storage device.
- **Native Serial Interface** – This RS-232 protocol allows you to write your own communications routine to communicate with the particle counter, including feedback messages.
- **PMS Multi-Drop Protocol** – This is another RS-232 protocol that allows communicating in a multi-drop environment (like a telephone party-line), such as Configuring Communications (Control Software).
- **Modbus TCP** – This is an industry standard communication protocol that may be used to collect and control data from the instrument. See **Appendix H**.

Web Browser

This Web interface runs with a Web browser, such as Internet Explorer® or Firefox®. The interface looks and functions similar to the front panel screen, allowing you to remotely control and view sampling. Additionally, data can be quickly transferred to a computer. For information on how to setup and configure the Lasair III particle counter to work with a Web browser, see **Appendix G**.

Chapter 5
Using the Particle Counter

This chapter discusses navigating the touch screen and the **Main Display** screen, where you can view your sample data in a variety of formats.

Setup for the various screens, as well as other operating options, are covered in subsequent chapters.

This chapter includes:

- **Navigating the Touch Screen** on page 5-2
- **Main Display Screen** on page 5-5
- **Example Output** on page 5-18
- **International Language Support** on page 5-28

Navigating the Touch Screen

The Navigation panel allows you to quickly access any screen in the system. It also allows you return to the screen you were viewing with a single press.

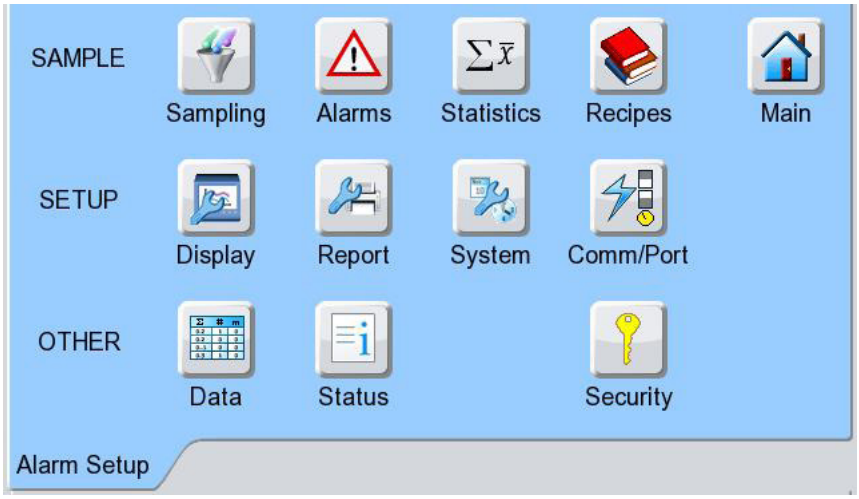


Figure 5-1. Navigation panel

To display the Navigation panel, press the blue tab in the upper left-hand corner.

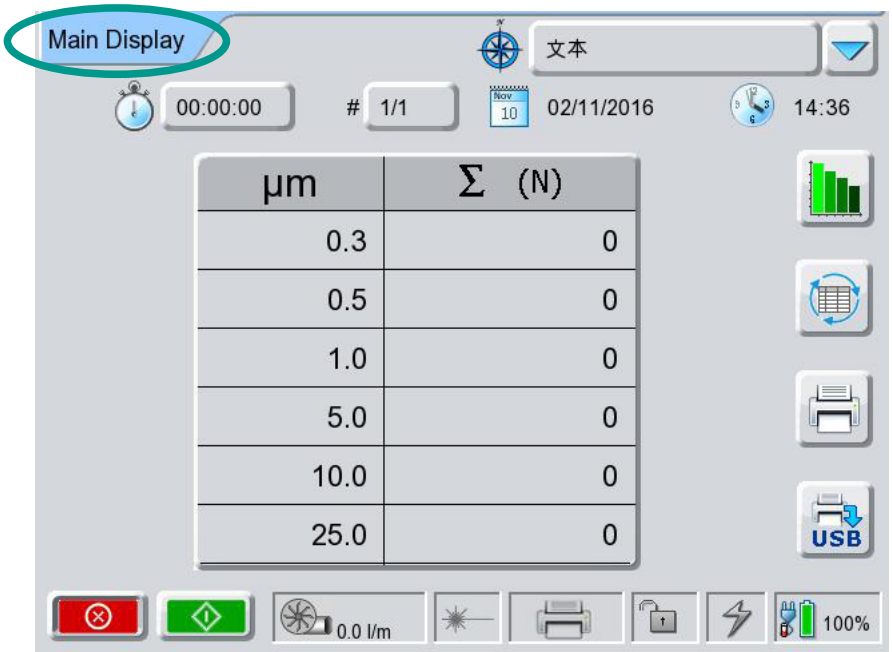


Figure 5-2. Location of the **Main Display** tab

This blue tab is always present on every screen. Press the tab (now near the bottom left of the screen, as in **Figure 5-1**) to close the panel.

The Navigation panel allows access to every screen of the system. Press the **Main** button to go to the **Main Display** screen (see **Figure 5-5** on page 5-5).

Return to the Main Display Screen

When viewing a SETUP screen (such as the **Sampling Setup** screen in the example below), you can return to the Main Display screen by pressing the Return button.

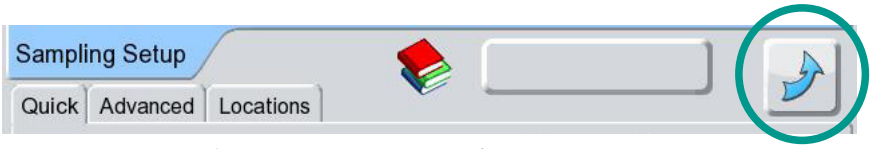


Figure 5-3. Location of Return button

Hierarchical Chart of Buttons on the Navigation Panel

This chart shows the buttons for the screens that you can access through the Navigation panel as well as the tabs in each screen.

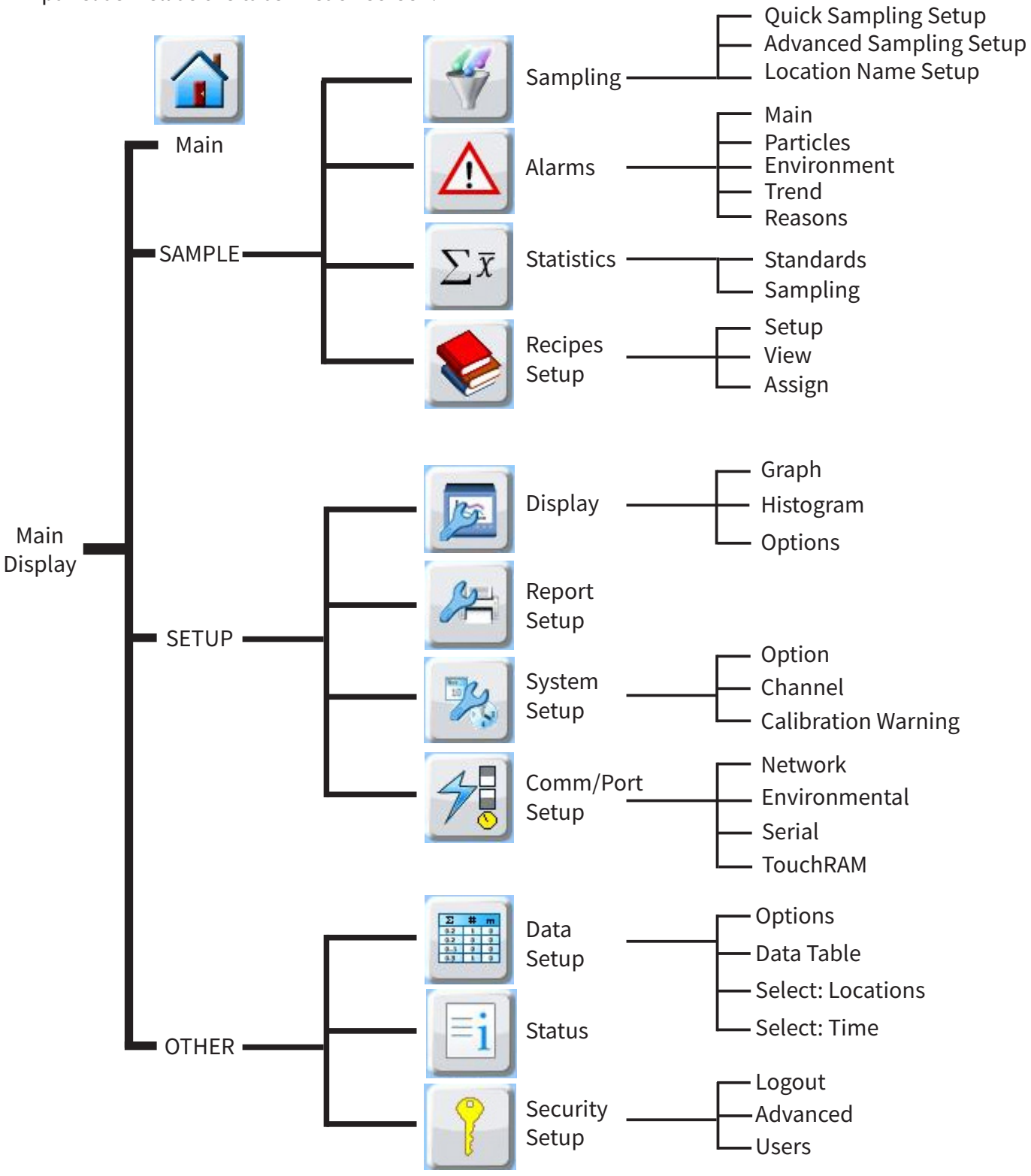


Figure 5-4. Navigation panel buttons

Main Display Screen

When you first turn on the Lasair III particle counter, the Main Display screen displays.

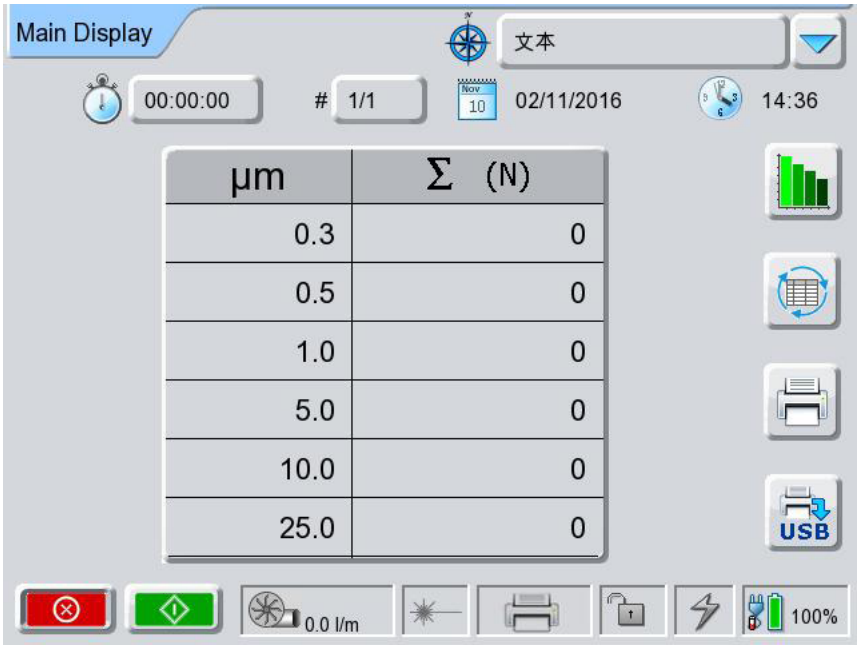


Figure 5-5. Main Display screen

Use the **Main Display** screen for viewing sampling data in a variety of formats, monitoring the status of the Lasair III particle counter, and printing your sampling results.

The screen displays data collected from the current sample. Data remains on the screen until a new sample is started. The data on this screen is automatically saved and stored in the Lasair III particle counter's memory. You have the option to display sample data in several formats or display environmental information. For information about the displays available, see **Data Display Options** on page 5-11.

The **Table 5-1** defines the fields, buttons, and status alerts on the Main Display screen. Some buttons and fields on the **Main Display** screen are different in Statistics Mode. For information about these differences, see **Chapter 10**.

Image	Name	Description
	Success Status Indicator	When displayed, indicates the sampling was successful.
	Failure Status Indicator	When displayed, indicates the sampling failed.
	Acknowledge Alarm	When displayed, indicates that the sampling has exceeded limits you have set for particle and environment values. The background of the Main Display screen also flashes red to indicate the alarm status. Press this button to turn the alarm off.
	Location List	Selectable list of stored locations. A scroll bar is included to help navigate through the list.
	Sample Time	Time length for the sample or time remaining in current sample. Depending on the parameters set on the Advanced tab of the **Sampling Setup** screen, either the Sample Volume indicator or the Sample Time field displays.
	Sample Volume	Volume amount to sample or volume remaining in current sample. Depending on the parameters set on the Advanced tab of the **Sampling Setup** screen, either the Sample Volume indicator or the Sample Time field displays.
	Inter-Sample Delay	Indicates time between samples.
	Inter-Sample Time Remaining	Initial delay before beginning sample.
	Sample Number	The number of the sample and the total samples planned. In continuous sampling, only the current sample number displays.

Table 5-1. Sampling status indicators

Image	Name	Description
	Current Date	The current date. This field is view-only.
	Current Time	The current time, updated every second.
Table 5-1. Sampling status indicators		

Table 5-2 lists the buttons that can be found on the **Main Display** screen.

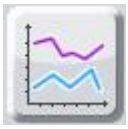
Image	Name	Description
	Histogram	Displays sampling in a graphical bar format. See **Histogram Chart** on page 5-15.
	**Trend Graph**	Displays sampling data in a graphical chart format. See **Trend Graph** on page 5-16.
	Change Display	Switches data display among the Cumulative Only, the Differential and Cumulative, and the Environment display formats.
	Print	Prints sampling results to thermal printer. See **Example Print Output** on page 5-18.
	Save to USB	Saves sampling results to a USB key. See **Example USB Output** on page 5-23.
	Start	Starts the sampling process. For information about the behavior of Start and Stop buttons in Continuous Pump mode, see **Sampling Setup Screen** on page 6-2.
	Stop	Stops the sampling process.
Table 5-2. Control buttons		

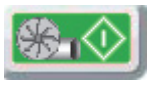
Image	Name	Description
	**Start Pump**	Available when Continuous Pump mode has been enabled. Enable by pressing the Continuous Pump button from the **Sampling Setup** screen. (see **Figure 6-8** on page 6-16). • When the Start Pump button is first pressed, it will start the pump. • Press the Start Pump button a second time to begin the sampling process.
	Stop Pump	Available in Continuous Pump mode after the Start Pump button has been pressed. • If the Stop Pump button is pressed during sampling, the sampling will be stopped. • If the Stop Pump button is pressed before sampling, the pump will be stopped.

Table 5-2. Control buttons

The buttons described in **Table 5-3** display when the unit is in Statistics mode. For more information about the Main Display in Statistics mode, see **Main Display Screen** on page 10-4.

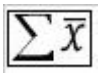
Image	Name	Description
	Statistics Mode	Replaces the Trend or Histogram button when the unit is in Statistics Mode. Press this button to exit Statistics mode.
	**Statistics Summary Mode**	Replaces the Change Display button when the unit is in Statistics Mode. Press this button to display the Statistics Summary screen. The Statistics Summary is only available in Statistics Mode.

Table 5-3. Statistics mode control buttons

Table 5-4 lists status indicator icons and their descriptions.

Image	Name	Description
	Flow Status with Normal Pump Operation	Shows the current state of the pump and its flowrate. The following indicators show the flow status under normal operation: • If the pump indicator is blue, the pump is operating normally and is active. • If the pump indicator is gray, the pump is operating normally and is inactive.
	Flow Status with Faulty Pump Operation	Indicates that the pump is operating incorrectly and the airflow deviates more than 5% from the device sampling rate during the sampling process. • If the pump indicator is blue and has a red X, the pump is on but operating incorrectly. • If the pump indicator is gray and has a red X, the pump is off and operating incorrectly. • If the pump indicator is gray and has a black X, the pump is out of order, typically because of over-current errors.
	Normal Laser Operation Indicator	Shows laser status when it is operating normally. • If this laser indicator is red, the laser is operating properly. • If this laser indicator is gray, the laser is inactive.
	Faulty Laser Operation Indicator	Shows laser status when it is operating incorrectly. • If the laser indicator is red and has a red X, the laser is on but operating incorrectly. • If the laser indicator is gray and has a red X, the laser is off and operating incorrectly.

Table 5-4. Instrument status indicators

Image	Name	Description
	Print Queue Indicator	Indicates the current state of the print queue. • If the indicator is gray, the print queue is operating properly. • If the indicator displays with a black X, the print queue is operating incorrectly.
	Password Protection Disabled	When gray, this indicates password protection is disabled.
	Administrator Enabled	When blue, this indicates password protection has been enabled, but can be bypassed by the Administrator currently logged onto the system.
	Password Protection Enabled	Indicates password protection is enabled and the current (non-Administrator) user cannot make changes.
	Communications Status Indicator	Indicates the communications status. • When blue, the device is connected to DataAnalyst, FacilityNet, or PharmaceuticalNet. • If the indicator is gray, no connection is present.
	Power Indicator – AC Power	Lasair III particle counter is powered using AC power. No batteries are inserted.
	Power Indicator – Battery	Lasair III particle counter is battery-powered. The fill level indicates the percentage of battery power remaining.
	Power Indicator – Battery Charging	Lasair III particle counter is powered by AC power and is charging the batteries. The fill level indicates battery power remaining.

Table 5-4. Instrument status indicators

Data Display Options

You can view sample data in a number of ways on the Main Display screen. The table in the center of the screen changes based on your selection.

- **Cumulative Only Table** on page 5-11
- **Differential and Cumulative Display** on page 5-13
- **Environment Display** on page 5-14
- **Histogram Chart** on page 5-15
- **Trend Graph** on page 5-16

You can also display Environmental data when using environmental sensors.

Cumulative Only Table

Press the **Cumulative Only Table** button (circled in **Figure 5-6**) on the **Main Display** screen to rotate through three views:

- Cumulative (see **Figure 5-6** on page 5-12)
- Differential and Cumulative (see **Figure 5-7** on page 5-13)
- Environment (see **Figure 5-8** on page 5-14)

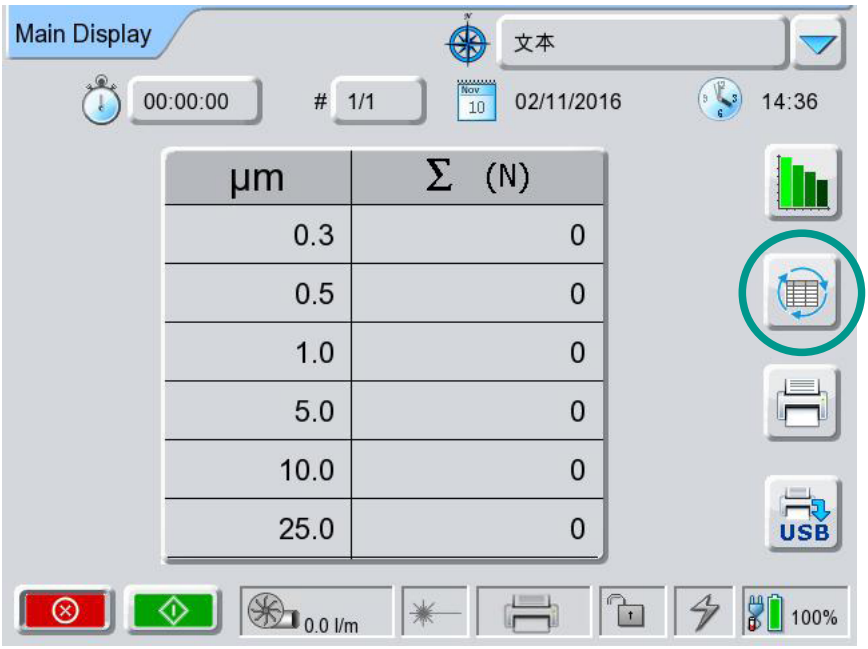


Figure 5-6. Cumulative Only table display

Use the **Cumulative Only** table to monitor sample data organized by the number of particles per the associated size of each particle.

The **Cumulative Only** table on the Main Display screen has the following columns:

- Particle Size
- Cumulative Count

The **Particle Size** refers to the cumulative particle count from the most recent sample for each channel enabled. The results are shown side-by-side in the center of the screen. The parameters for a cumulative or differential format and the unit of measure are set using the **Advanced** tab of the **Sampling Setup** screen.

Cumulative Count refers to a number of particles of a certain size and larger that are found in one sample.

Differential and Cumulative Display

Press the **Cumulative Only Table** button on the **Main Display** screen to view the **Differential** and **Cumulative** table.

Figure 5-7. Differential and Cumulative table display

Use the **Differential** and **Cumulative** table to monitor sample data by the number of particles of a certain size or larger and number of particles of a specific size for each particle size.

The **Differential** and **Cumulative** table on the **Main Display** screen has the following columns:

- **µm:** Particle Size
- **Δ (N/m³):** Differential Count
- **Σ (N/m³):** Cumulative Count

Differential refers to a number of particles of a specific size that are found in one sample. **Particle Size** and **Cumulative Count** are the same as in the **Cumulative Only** display.

Environment Display

Press the **Cumulative Only Table** button (circled in **Figure 5-6** on page 5-12**)** on the **Main Display** screen to view the **Environment** table.

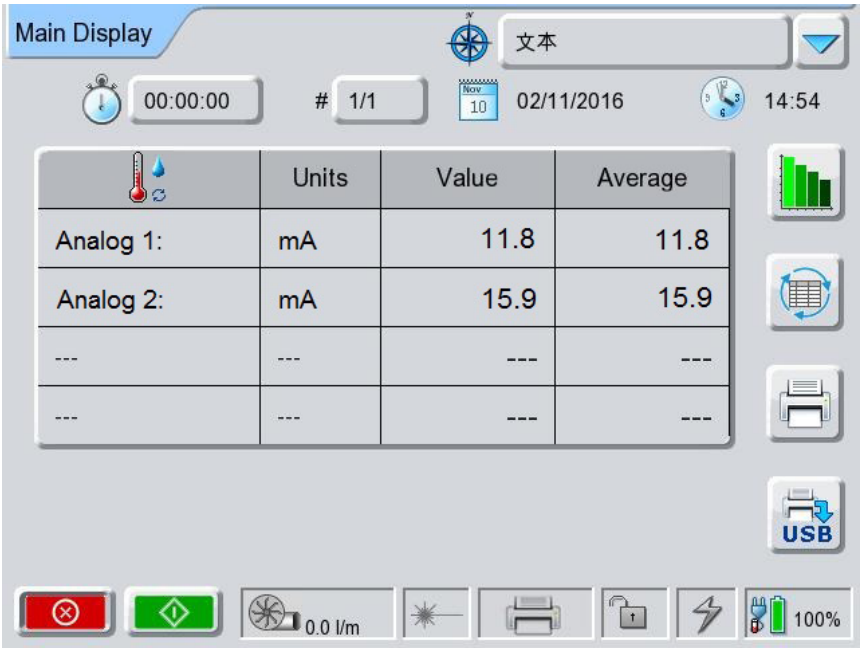


Figure 5-8. Environment table display

Use the **Environment** table on the Main Display screen to view data collected by any environmental sensors (such as a temperature and relative humidity sensor).

The table contains four rows for each available analog channel and the following four columns:

- **Name:** Name set for the channel
- **Units:** Unit name set for the channel
- **Value:** Current calculated value for the channel
- **Average Value:** Average calculated value for the channel

Histogram Chart

Press the **Histogram Chart** button on the **Main Display** screen to view the Histogram chart.

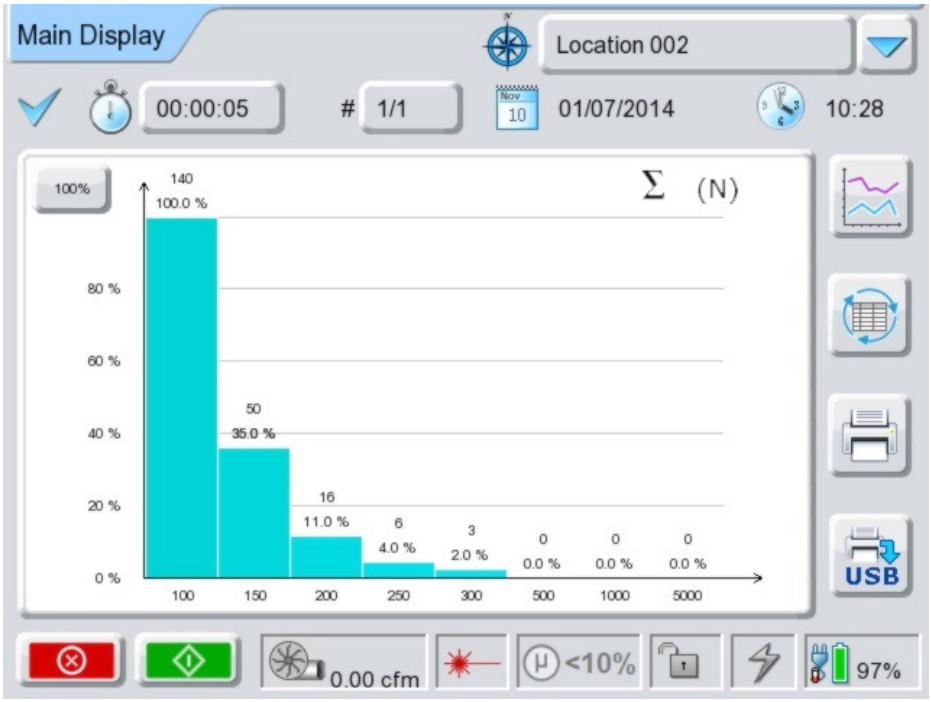


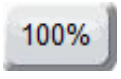
Figure 5-9. Histogram chart display

Use the Histogram chart on the **Main Display** screen to monitor all the channels in a graphical bar format. The chart can display differential or cumulative count using percent full, linear, or log scales depending on the current setting for sampling. You set the parameters for the chart display using the **Display Setup** screen (see **Display Setup Screen** on page 7-2).

The X-Axis (horizontal) labels the bars with the channels. The Y-Axis (vertical) represents the scale (percent full, linear, or log).

The Histogram chart updates each second. Above each bar are view-only data. The data depends on the scale used.

- **Percent full scale:** Channel's percentage of current maximum value
- **Log and Linear scale:** Channel's value compared to current maximum value



indicates the Maximum Value. Press this button to change to the desired value.

Trend Graph

Press the **Trend Graph** button on the Main Display screen to view the Trend graph.

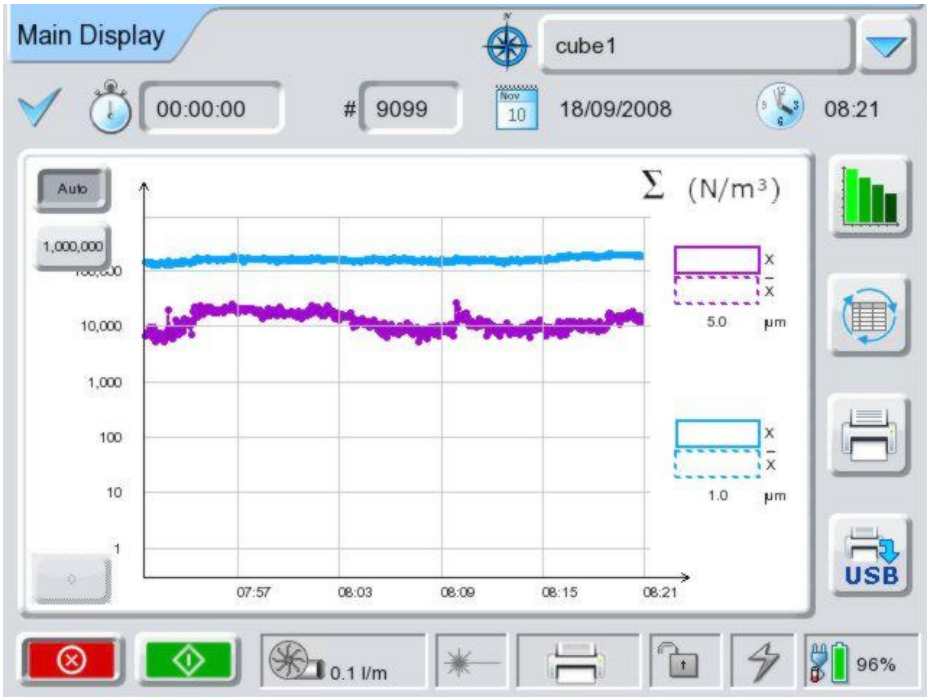


Figure 5-10. Trend graph display

Use the Trend graph on the **Main Display** screen to monitor up to two channels that you specify. The graph displays the cumulative count of raw or normalized data depending on the current setting for sampling. You set the parameters for the Trend graph using the Graph tab of the **Display Setup** screen.

The X-Axis is a linear time scale from 5 to 120 minutes. The Y-Axis is either logarithmic or linear. The line colors indicate the channels while the line patterns indicate the following:

- **Thick line:** Threshold alarm level
- **Normal thickness line:** Cumulative particles count
- **Dashed line:** Moving average
- Line pattern and color for the moving average line

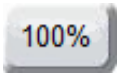
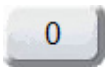
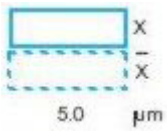
Image	Name	Description
	Auto Scaling	Enables you to see all the sampling data when the maximum value is changing during sampling.
	**Maximum Value**	Displays the maximum value set in the Graphs tab of the Display Setup screen. Press this button to change the maximum value and disable auto-scaling.
	**Minimum Value**	Displays the minimum value set in the Graphs tab of the Display Setup screen. Press this button to change the minimum value and disable auto-scaling.
	**Legend**	For each channel, displays information about the graph lines. There are two legends, one for each channel. Each legend has the following information: • **Solid box:** Line color and style for actual line count • **Dashed box:** Line color and style for moving average value • **x (next to solid box):** Most recent value • **x (next to dashed box):** Moving average value

Table 5-5. Field definitions in the **Trend** graph display

Example Output

You can output sampling results to:

- The built-in thermal printer
- A USB key
- **PMS software:** DataAnalyst, Facility Net, and Pharmaceutical Net

For information about transferring sampling data to PMS software, see the user guide that comes with the software.

Example Print Output

Press the Print button on the Main Display screen to print messages and data. This section describes the messages and data that appear on the printout generated by the Lasair III particle counter's thermal printer. The descriptions are listed by line number, from top to bottom in the order the lines appear on the printed output.

NOTE: This numbering is for description purposes only and does NOT appear on the actual printer output.

Final Sample Report

1	Final Sample Report				
2	Heading One				
3	Heading Two				
4	Instrument ID:				Lasair III
5	Serial Number:				82217
6	Calibrated:				01/01/2016
7	Batch ID:				Batch ID
8	Operator:				Operator Name
9	Location:				#001
10	Recipe:				Recipe Name
11	Room:				Room
12	02/01/2016 04:35:30				
13	02/01/2016 04:36:30				#0
14	Sample Status:				VALID
15	Particle Data				
16	µm		Δ (N)		∑ (N)
16	0.3		101339		1009584
16	0.5		881337		976833
16	1.0		47836		95496
16	5.0		5539		7832
16	10.0		2222		2293
16	25.0		71		71
17	Environmental Data				
18			Avg	Min	Max
19	Analog 1	mA	8.2	8.1	8.4
19	Analog 2	mA	15.8	15.8	15.9
19	Analog 3	mA	NaN	NaN	NaN
19	Analog 4	mA	NaN	NaN	NaN
20	00:01:00				0.05 m^3/min
21	Alarm Reason:				
22	Alarm Reason text				

Figure 5-11. Example Final Sample Report - Thermal Printout

Line No.	Displayed Text	Description
1	**Final Sample Report**	Title of Report. Possible values: • **Final:** Report printed after the sampling completed. • **Partial:** Report printed during the sampling process.
2	**Heading One**	Heading 1 text specified in the Report Setup screen. Not shown if Heading One field is blank.
3	**Heading Two**	Heading 2 text specified in the Report Setup screen. Not shown if Heading Two field is blank.
4	**Instrument ID**	Name/ID of the particle counter that produced the data.
5	**Serial Number**	Serial number of the particle counter that produced the data.
6	**Calibrated**	Date on which the particle counter was last calibrated.
7	**Batch ID**	Batch ID text specified in the Report Setup screen. Not shown if Batch ID field is blank.
8	**Operator**	Operator text specified in the Report Setup screen or the current logged user if the security is enabled. Set on Report Setup screen or Security screen.
9	**Location**	Location as specified by user.
10	**Recipe**	Name of the recipe used, if any. This field is not saved with data, and will only print from the Main Display screen, not from the saved Data Table. Sample Data that has been collected with a recipe will not indicate the recipe if the data is printed from the Data Table screen. If there is no recipe, this line is blank.
11	**Room**	Room is specified in the Statistics Setup screen and only displays in Statistics mode.
12	**02/01/2016 04:35:30**	Start date/time stamp

Table 5-6. Thermal printout legend

Line No.	Displayed Text	Description
13	**02/01/2016 04:36:30 #0**	Date stamp (day / month / year) followed by a time stamp (hour : minute : second) when the sample ended, and the number of the sample. **NOTE:** The sample number is not shown when the sample is printed after an Alarm Acknowledge Reason is selected.
14	**Sample Status**	Status of sample. Possible values: • **VALID:** Particle counter did not detect any condition that would invalidate the sample. • **INVALID:** Particle counter detected a condition that invalidates the sample.
15	**Particle Data**	Header for particle data report that follows.
16	**µ ΔN ΣN or µ ΔN/m³ ΣN/m³**	Column headers: • **µ:** Particle size in microns • **Δ:** Number of particles detected of that size. When followed by N, indicates raw counts. When followed by N/m3, indicates normalized cubic meters. • **Σ:** Sum of all particles of particle size and larger counted. When followed by N, indicates raw counts. When followed by N/m3, indicates normalized cubic meters.
16	**0.5 88137 976833**	Channel and channel data. For column definitions, see Line 15 above.
17	**Environmental Data**	Header for analog data that follows. This information displays only if there are analog sensor and only of one or channels is enabled.
18	**Avg Min Max**	Column headers for average, minimum, and maximum values for analog.

Table 5-6. Thermal printout legend

Line No.	Displayed Text	Description
19	**Analog 4 mA 8.2 8.1 8.4**	Average, minimum, and maximum values for the analog channel. If a channel is enabled, but a sensor is not attached, the value is NaN.
20	**00:01:00 1.001 cfm** **(Alternate unit: m^3/min)**	Sample time and sample size.
	Alarm: Pump	(Not shown) This line prints when the particle counter senses that the flowrate is outside the boundary of 1 cfm ±5%.
	Alarm: Laser	(Not shown) This line prints when the particle counter senses that the laser power is out of the specified range.
	Alarm: > 10%	(Not shown) This line prints when 10% coincidence error is exceeded during a sample.
21	**Alarm Reason**	This line prints on alarm, if Alarm Reasons are enabled. See **Example Print Output** on page 5-18.
22	**Alarm Reason text**	This line prints user text on alarm, if Alarm Reasons are enabled. See **Example Print Output** on page 5-18.

Table 5-6. Thermal printout legend

NOTE: Please refer to **Chapter 6** for more information about the Alarm Acknowledgment feature.

NOTE: When the Lasair III particle counter is operated in Statistics mode, the printout includes different data than the example shown. For information about the messages and data on the statistics mode printout, see **Printing a Statistics Report** on page 10-18.

Example USB Output

Press the Auto Print USB button on the Main Display screen to save data to the inserted USB key.

The data format of the .MHT files saved to a USB key depends on the data display format shown on the Main Display screen at the time you press the USB Output button. The following sample report describes the messages and data that appear when a report is generated when the **Main Display** screen shows the Cumulative or Differential and Cumulative data display.

Other displays provide different information, although the first eleven items appear on all reports. The descriptions are listed by line number, from top to bottom in the order the lines appear on the printed output.

NOTE: The numbers on the example report are for description purposes only and do NOT appear on the actual file output.

Final Sample Report

					21 CFR 11 Compliant
1	**Final Sample Report**				
2	Heading One				
3	Heading Two				
4	Instrument ID:				Lasair III
5	Serial Number:				82217
6	Calibrated:				01/01/2016
7	Batch ID:				Batch ID
8	Operator:				Operator Name
9	Location:				#001
10	Recipe:				Recipe Name
11	Date & Time:				01/01/2016 06:23:42
12	Sample:				1
13	Sample Status:				VALID
14	Particle Data				
15	Normalized Counts				Time: 00:01:00
16	µm		Δ (N) / m^3		∑ (N) / m^3
17	0.3		101339		1009584
17	0.5		881337		976833
17	1.0		47836		95496
17	5.0		5539		7832
17	10.0		2222		2293
17	25.0		71		71
18	Volume: 0.0500 m^3				Flow: 0.0500 m^3/min
19	Environmental Data				
20			Avg	Min	Max
21	Analog 1	mA	8.2	8.1	8.4
21	Analog 2	mA	15.8	15.8	15.9
21	Analog 3	mA	NaN	NaN	NaN
21	Analog 4	mA	NaN	NaN	NaN
22	Alarm Reason				
23	Alarm Reason text				

Figure 5-12. Example Final Sample Report - USB output

Line No.	Displayed Text	Description
1	**Final Sample Report**	Title of Report. Possible values: • **Final:** Report printed after the sampling completed. • **Partial:** Report printed during the sampling process.
2	**Heading One**	Heading 1 text specified in the Report Setup screen. Not shown if Heading One field is blank.
3	**Heading Two**	Heading 2 text specified in the Report Setup screen. Not shown if Heading Two field is blank.
4	**Instrument ID**	Name/ID of the particle counter that produced the data.
5	**Serial Number**	Serial number of the particle counter that produced the data.
6	**Calibrated**	Date on which the particle counter was last calibrated.
7	**Batch ID**	Batch ID text specified in the Report Setup screen. Not shown if Batch ID field is blank.
8	**Operator**	Operator text specified in the Report Setup screen or Security screen. Not shown if Operator field is blank.
9	**Location**	Location as specified by user.
10	**Recipe**	Name of the recipe used, if any. This field is not saved with data, and will only print from the Main Display screen, not from the saved Data Table. Sample Data that has been collected with a recipe will not indicate the recipe if the data is printed from the Data Table Screen. If there is no recipe, this line is blank.
11	**Date & Time**	Date and time at which the sample was taken.
12	**Sample**	Number of the sample.

Table 5-7. USB output legend

Line No.	Displayed Text	Description
13	**Sample Status**	Status of sample. Possible values: • **VALID:** Particle counter did not detect any condition that would invalidate the sample. • **INVALID:** Particle counter detected a condition that invalidates the sample.
14	**Particle Data**	Header for particle data report that follows.
15	**Normalized Counts Time**	Type of data and time within sampling when data captured. Possible values for type of data: • **Normalized:** Counts of particles displayed per unit of volume. • **Raw:** Counts of particles displayed as basic count.
16	**µ ΔN ΣN** **or** **µ ΔN/m³ ΣN/m³**	Column headers: • **µ:** Particle size in microns • **Δ:** Number of particles detected of that size. When followed by N, indicates raw counts. When followed by N/m3, indicates normalized cubic meters. • **Σ:** Sum of all particles of particle size and larger counted. When followed by N, indicates raw counts. When followed by N/m3, indicates normalized cubic meters.
17	**0.5 88137 976833**	Channel and channel data. For column definitions, see Line 15 above.
18	**Volume**	Volume sampled.
18	**Flow**	Flow rate sampled.
19	**Environmental Data**	Header for analog data that follows. This information displays only if there are analog sensor and only of one or channels is enabled.
20	**Avg Min Max**	Column headers for average, minimum, and maximum values for analog.

Table 5-7. USB output legend

Line No.	Displayed Text	Description
21	**Analog 4 mA 8.2 8.1 8.4**	Average, minimum, and maximum values for the analog channel. If a channel is enabled, but a sensor is not attached, the value is NaN.
	Alarm: Pump	(Not shown) This line prints when the particle counter senses that the flowrate is outside the boundary of 1 cfm ± 5%.
	Alarm: Laser	(Not shown) This line prints when the particle counter senses that the laser power is out of the specified range.
	Alarm: > 10%	(Not shown) This line prints when 10% coincidence error is exceeded during a sample.
22	**Alarm Reason**	This line prints on alarm, if Alarm Reasons are enabled. See **Example Print Output** on page 5-18.
23	**Alarm Reason text**	This line prints user text on alarm, if Alarm Reasons are enabled. See **Example Print Output** on page 5-18.

Table 5-7. USB output legend

International Language Support

The Lasair III supports several foreign languages. The desired language can be set by opening the Navigation panel and pressing System. Then press the down arrow and use the scroll bar to choose from a drop-down list of available language.

The character set for entering user parameters, such as location names and recipes, is in Unicode so that Asian and other non-Latin character sets can be displayed. Location names and recipes with these characters may be loaded into the instrument either with the Web interface, or a USB file. The pop-up keyboard on the screen only supports standard ASCII characters. Text files which are written by the Lasair III (CSV files, alarm reasons and location name files) are generated in UTF8. The Lasair III can read text files (such as location names) that are in standard ASCII, UTF8 or Unicode (big-endian or little-endian).

Chapter 6
Setting Sampling and Alarm Parameters

The Lasair III particle counter's large touchscreen display and intuitive screens make sampling and alarm setup easy. During this setup process, you will define the parameters that will be used when collecting sample data and set alarm limits and features for all available particle channels.

The following sections provide an overview of the Sampling Setup and Alarm Setup screens, and definitions for the fields and buttons on each screen to help assist you in the setup process.

- **Sampling Setup Screen** on page 6-2
- **Alarm Setup Screen** on page 6-12

Sampling Setup Screen

Navigate to Main Display > Sample > Sampling.

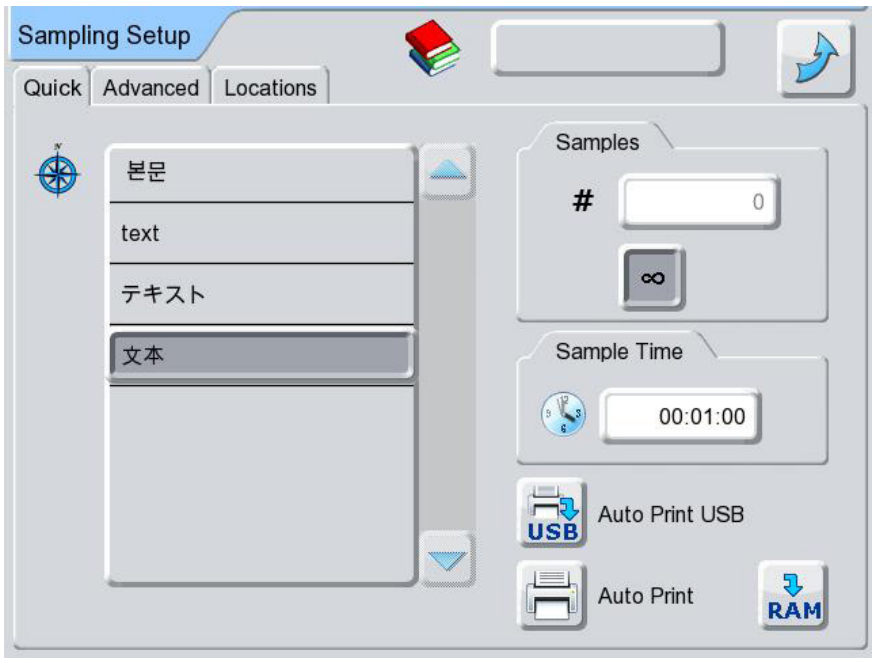


Figure 6-1. Quick tab of the **Sampling Setup** screen

Use the **Sampling Setup** screens to set up the parameters that will be used for collecting sample data. These sampling parameters are assigned to specific sampling locations.

The **Sampling Setup** screen is comprised of three tabs:

- **Quick Tab** on page 6-3
- **Advanced Tab** on page 6-5
- **Locations Tab** on page 6-10

Quick Tab

Image	Name	Description
	Recipe Name	This field is blank during initial setup. However, after you set up recipes (**Chapter 9**) the name of the recipe which is being used displays in the top-right area of the Sampling Setup screen. This is a view-only field. If any sampling parameters are changed, then this field is blank.
	Location List	This field is blank during initial setup. However, once you set up locations, a selectable list of stored locations displays. A scroll bar is included to help navigate through the list.
	Number of Samples	Count of samples taken (0-3000) in a sequence. The default value is 0.
	Continuous Sampling	Sample Size by Time or Volume Defined size of sample. The size can be defined in by time (default option) or by volume. The size type is selected on the Advanced tab.
	Auto Print USB	Prints sampling results to a USB key. This button is only activated when a USB key is inserted.
	Print	Automatically prints sampling results after each sample to the Lasair III thermal printer.
	Write to TouchRAM	Writes all current settings to TouchRAM button.

Table 6-1. Buttons on the **Quick** tab

Image	Name	Description
 	Sample Time **or** **Sample Volume**	**Sample Time** The time format is 00:00:00 representing hours, minutes, and seconds. The minimum Sample Time is 00:00:06 and the maximum time is 24:00:00. The default value is the last used value which is stored in the battery- backed memory. **Volume of Sample** The volume format is 0.0000 m^3 or 0.00 ft^3 or 0.00 L, depending on the current units. The allowed range of values is 0.0047 to 71.99949 for m^3, 0.1640 to 2547.63824 for ft^3, and 4.6667 to 71999.497 for liters. The unit of measure displays next to the numerical value, and is changed via the Advanced tab (see below).

Table 6-1. Buttons on the **Quick** tab

Advanced Tab

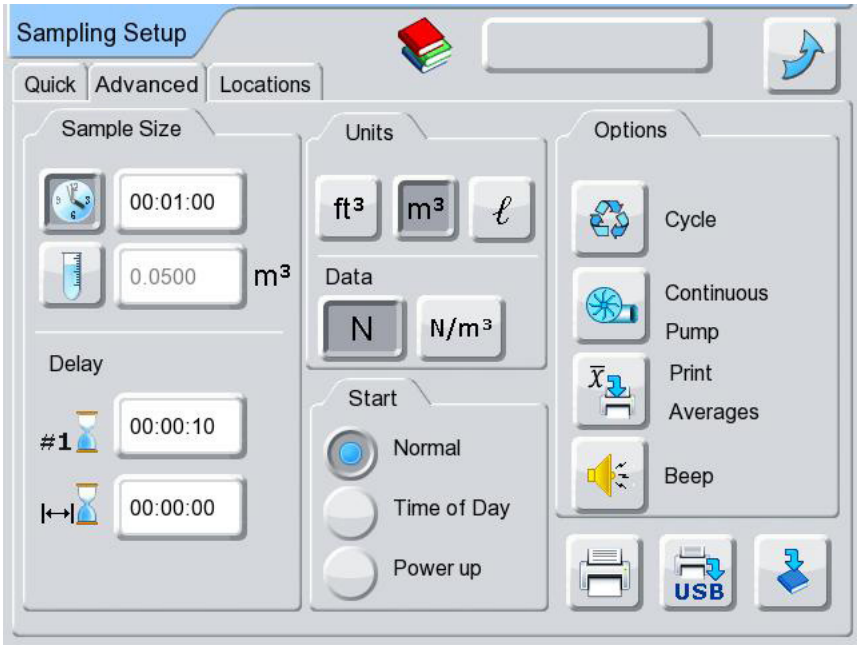


Figure 6-2. Advanced tab of the **Sampling Setup** screen

Image	Name	Description
	Recipe Name	This field is blank during initial setup. However, after you set up recipes (**Chapter 9**) the name of the recipe which is being used displays in the top-right area of the Sampling Setup screen. This is a view only field. If any sampling parameters are changed, then this field is blank.
	Location List	This field is blank during initial setup. However, once you set up locations, a selectable list of stored locations displays. A scroll bar is included to help navigate through the list.
	Number of Samples	Count of samples taken (0-3000) in a sequence. The default value is 0.
	Continuous Sampling	**Sample Size by Time or Volume** Defined size of sample. The size can be defined in by time (default option) or by volume. The size type is selected on the **Advanced** tab.

Table 6-2. Sample Size section of **Advanced** tab, **Sampling Setup** screen

Image	Name	Description
	Sample Time **or** **Sample Volume**	**Sample Time:** The time format is 00:00:00 representing hours, minutes, and seconds. The minimum Sample time is 00:00:06 and the maximum time is 24:00:00. The default value is the last used value which is stored in the battery-backed memory. **Sample Volume:** The volume format is 0.0000 m^3 or 0.00 ft^3 or 0.00 L, depending on the current units. The allowed range of values is 0.0047 to 71.99949 for m^3, 0.1640 to 2547.63824 for ft^3, and 4.6667 to 71999.497 for liters. The volume unit of measure displays next to the numerical value. Once the unit of measure in selected on the Units mini-tab, the unit of measure (such as ft^3) displays next to the numerical value.

Table 6-2. Sample Size section of **Advanced** tab, **Sampling Setup** screen

Delay

Image	Name	Description
	Initial Delay	Amount of time the pump will run before the particle counter begins to sample. The format is 00:00:00 for hours, minutes, and seconds. The maximum value is 99:59:59.
	Inter-Sample Delay	The wait time between samples. The format is 00:00:00 representing hours, minutes, and seconds. The maximum value is 99:59:59.

Table 6-3. Buttons in the **Delay** section of **Advanced** tab, **Sampling Setup** screen

Units

Image	Name	Description
	Cubic Foot (US)	Selects cubic foot (ft^3) as the unit of measure for the sample.
	Cubic Meter (Metric)	Selects cubic meter (m^3) as the unit of measure for the sample.
	Liter	Selects Liter (L) as the unit of measure for the sample.
	Raw Data	Selects raw data as the data type for the sample.
	Normalized Data	Selects normalized data as the data type for the sample. Normalized data is shown with: • 2 decimal digits if liters are selected • 1 decimal digit if feet are selected • 0 decimal digits if meters are selected

Table 6-4. Buttons in the **Units** section of **Advanced** tab, **Sampling Setup** screen

Start

Image	Name	Description
	Normal	Designates the Start button on the Main Display screen to activate sampling when pressed. This is the default option.

Table 6-5. Buttons in the **Start** section of **Advanced** tab, **Sampling Setup** screen

Image	Name	Description
	Time of Day	Activates the particle counter to start sampling at the pre-designated time of day. When selected, a dialog box for Time of Day entry appears on the Main screen.
	Power up	Causes the particle counter to start sampling immediately after turning the instrument on. If calibration is needed, the Calibration Prompt/ Reminder dialog displays as the sampling commences.

Table 6-5. Buttons in the **Start** section of **Advanced** tab, **Sampling Setup** screen

Options

Image	Name	Description
	Cycle	Continuously collects a finite number of samples. Typically the Sample Average is also activated with this Cycle Mode. The Cycle Mode setting is saved in both TouchRAM buttons and recipes.
	Continuous Pump	Enables or disables a Continuous Pump mode. Start and Stop buttons on the Main Display activate as follows: • When the Start button is first pressed, it will start the pump. Press it a second time and it will begin the sampling process. • If the Stop button is pressed during sampling, then the sampling will be stopped. • If the Stop button is pressed before sampling, the pump will be stopped.

Table 6-6. Buttons in the **Options** section of **Advanced** tab, **Sampling Setup** screen

Image	Name	Description
	Print Averages	Causes the particle counter to print average values at the end of sampling. When measuring normalized counts the Print Averages only prints normalized results. If the measurement is being done in raw counts the Print Averages will print both raw and normalized counts.
	Beep	Enables the particle counter to make an audio signal (beep) when some amount of particle is counted. When enabled, a pop-up selection box is shown on the main screen allowing the operator to set the number of particles per beep (1, 10, 100…100,000) or turn the mode off.
	Auto Print USB	Automatically prints sampling results to a USB key. This button is only activated when a USB key is inserted.
	Auto Print to Default Printer	Automatically prints sampling results after each sample to the Lasair III thermal printer. This button is selected by default.
	Save Recipe	Saves the current sampling parameters to a recipe. The default name is whatever recipe is currently selected. If an existing recipe name is used, that recipe name is replaced with the new parameters. A statistics recipe may be re-written with a sampling recipe, and vice-versa.

Table 6-6. Buttons in the **Options** section of **Advanced** tab, **Sampling Setup** screen

Locations Tab

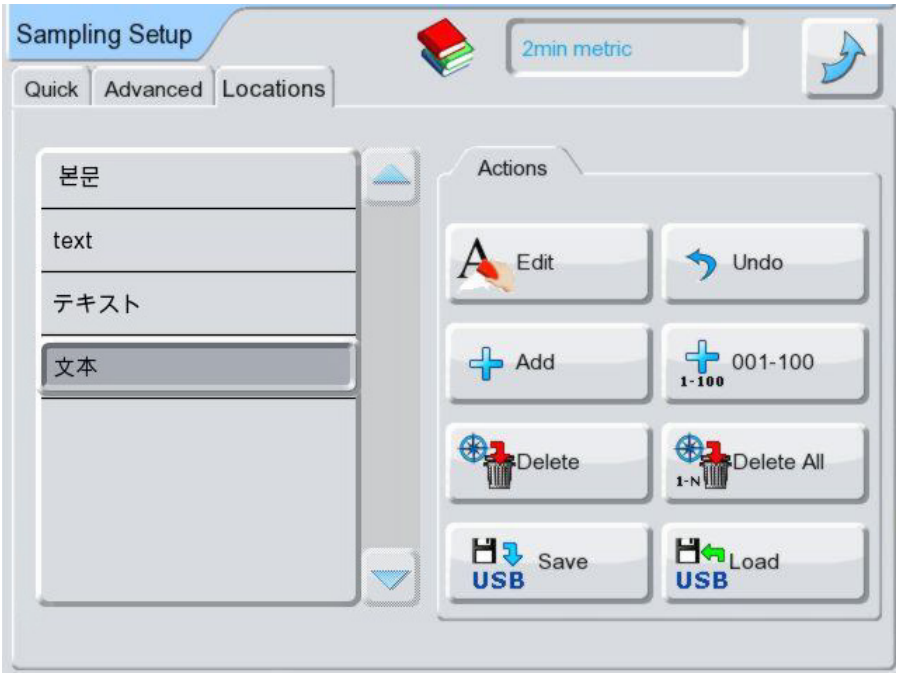


Figure 6-3. Locations tab of the **Sampling Setup** screen

If you are moving the instrument to different sampling locations, the Lasair III particle counter lets you name those locations in the Location Name Setup screen. Once you have the locations named, you can select a location name to label the sampling data.

Initially, no location names will appear in the list box on the left side of the screen. Location names can be added individually, or locations numbered 1–100 can be added automatically. You can store up to 400 locations.

NOTE: Only 250 locations may be used with Facility Net or Pharmaceutical Net software.

Asian characters composing the languages of Japanese (Kanji), Korean and Mandarin Chinese (Traditional or Simplified), may be used to create a Location Name.

NOTE: The GUI will show Asian characters as locations, but the only way to input an Asian-character location is via the Web Browser. See **Appendix G** for instructions on how to enter Asian characters for locations.

Actions

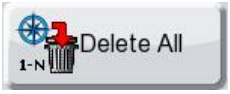
Image	Name	Description
	Edit Location	Allows the changing of the selected location. Displays a touch pad keyboard (with alpha and numeric characters) for entering the name. The current name displays on the input field of the keyboard for changing.
	Add Location	Allows the entry of a new location. Displays a touch pad keyboard (with alpha and numeric characters) for entering the name. The input field is initially blank.
	Delete Location	Deletes the current location selected.
	Save to USB	Saves location settings to a USB key. This button is only activated when a USB key is inserted.
	Undo	Restores the previous location after the following operations: • Edit Location • Add Location • Delete Location • Delete All Locations • Create Numbered Locations
	Create Numbered Locations	Automatically numbers new locations with names starting with 001 to 100. This button is enabled only if the list is empty.
	**Delete All Locations**	Deletes all locations in the list. A message displays to prompt the operator for confirmation.
	Load USB	Loads locations from the USB key to the particle counter.

Table 6-7. Buttons in the **Actions** section of **Locations** tab, **Sampling Setup** screen

Alarm Setup Screen

Navigate to **Main Display > Navigation Panel > Alarms**.

Press the **Main Display** tab located on the upper left corner of the display to view the Navigation Panel, as shown in **Figure 6-5**. Press the **Alarms** button on the Navigation Panel to view the **Alarm Setup** screen. The Alarm Setup screen appears as shown in **Figure 6-6**.

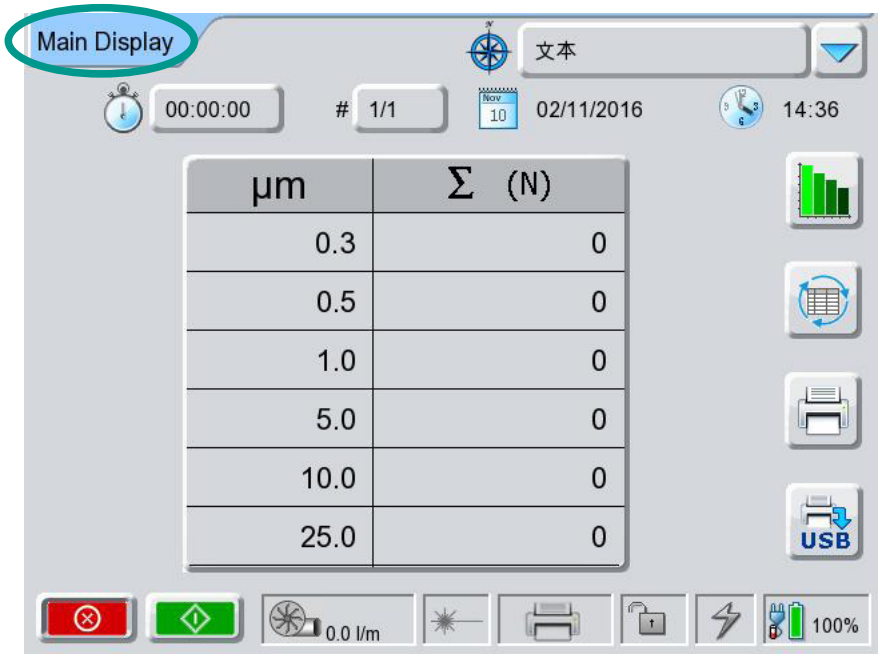


Figure 6-4. Location of the **Main Display** tab

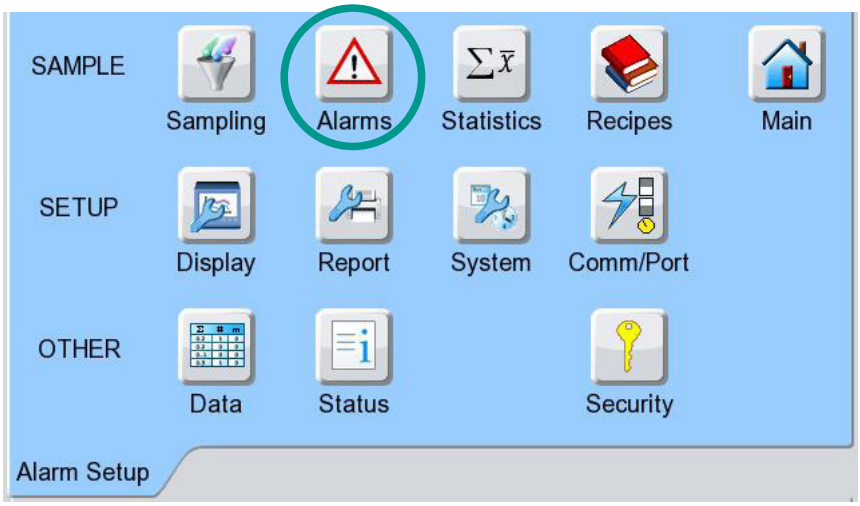


Figure 6-5. Alarms button on the Navigation panel of the **Main Display** screen

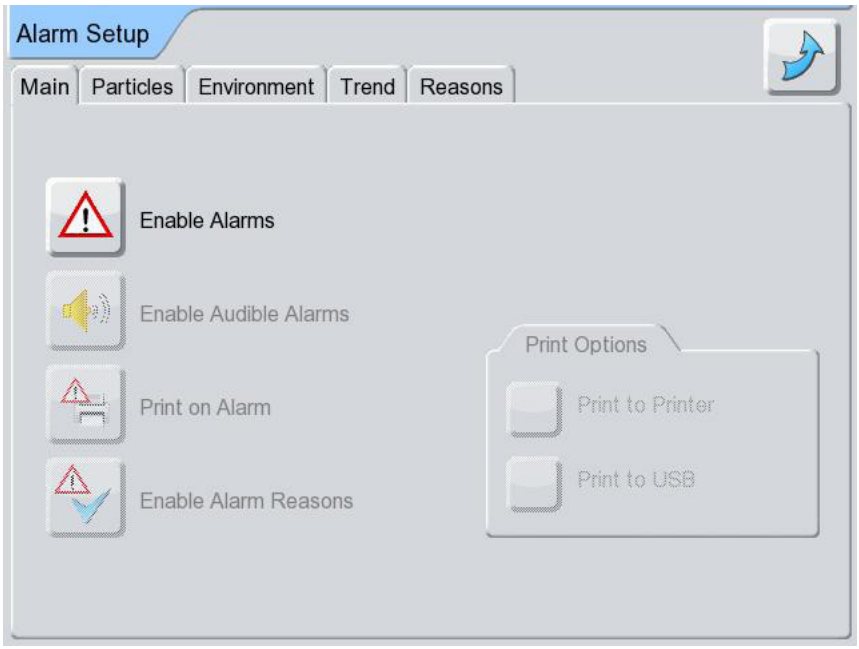


Figure 6-6. Main tab of the **Alarm Setup** screen

Use the **Alarm Setup** screen to set alarm limits for all available particle channels. One particle alarm may be set for each particle size channel—and each particle alarm may be individually enabled or disabled. Additionally, alarms can be set for both minimum and maximum values for each analog channel.

NOTE: The Lasair III particle counter automatically adjusts alarm settings according to the changes you made in the sample settings so that the proportions will remain constant.

NOTE: When changing between 6-channel mode and 2-channel mode the alarm settings will not transfer properly. Alarm settings will need to be reestablished when changing between modes.

NOTE: **Alarm Activation**: Once an alarm indication occurs on the display during operation the alarm will remain active until it is acknowledged by the user.

The Alarm Setup screen is comprised of five (5) tabs:

- **Main Tab** on page 6-14
- **Particles Tab** on page 6-16
- **Environment Tab** on page 6-18
- **Trend Tab** on page 6-20
- **Reasons Tab** on page 6-23

Main Tab

The **Main** tab controls the global alarm settings, as shown in **Figure 6-6**, and **Table 6-8** describes the controls shown.

Image	Name	Description
	Enable Alarms	The **Enable Alarms** button controls the state of all alarms (particle alarms, environmental alarms, and trend alarms). When the button is disabled, all alarms are disabled. When the button is enabled, alarms are enabled according to the enable state of each alarm setting.
	Enable Audible Alarms	The **Enable Audible Alarms** button enables or disables an audible buzzer when an alarm occurs.
	Print On Alarm	The **Print On Alar**m button enables printing on a particle or trend alarm. If the button is enabled, the device will schedule samples to print when the sample contains particle or environmental alarms. If the user has enabled the alarm reasons feature and the user has pre-defined alarm reasons, samples with particle or environmental alarms will not print until the user has assigned an alarm reason to the sample.

Table 6-8. Buttons in the **Main** tab of the **Alarm Setup** screen

Image	Name	Description
	Enable Alarm Reasons	The **Enable Alarm Reasons** button enables the alarm reason feature. The user may predefine up to 30 alarm reasons, 32 characters in length, and assign an alarm reason to a sample if the sample contains a particle or environmental alarm.
	Print to Printer	The **Print To Printer** checkbox, when selected, enables printing on alarm to the thermal printer. This control will only be enabled if the **Print On Alarm** button is also enabled.
	Print to USB	The Print To USB checkbox, when selected, enables printing on alarm to an attached USB drive. This control will only be enabled if the **Print On Alarm** button is also enabled and if a valid USB drive is attached to the device.

Table 6-8. Buttons in the **Main** tab of the **Alarm Setup** screen

Particles Tab

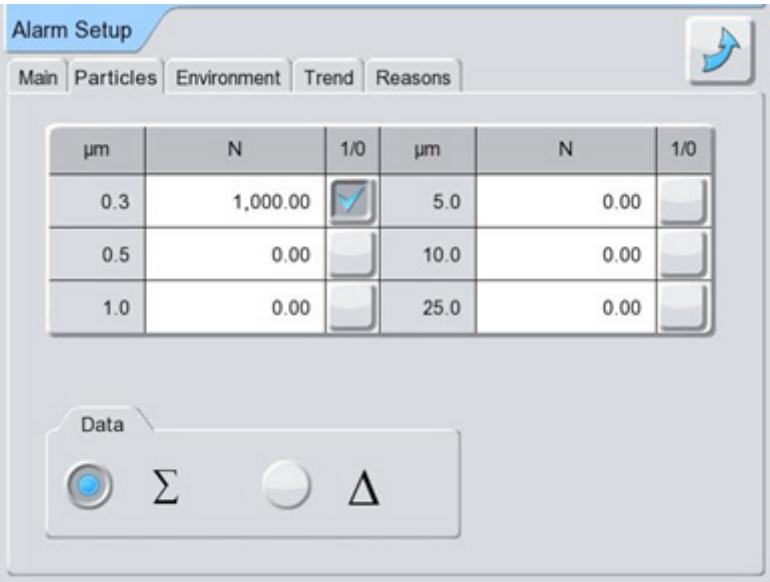


Figure 6-7. Particles tab of the **Alarm Setup** screen

Use the check boxes and options in the Particles tab in the Alarm Setup screen to:

- Turn the alarm for each channel ON or OFF.
- Select either cumulative or differential count as the basis for triggering the alarm for any channel.

The components of the Particles tab in the Alarm Setup screen are described below.

Figure 6-8. Particle Alarms table header

The Particle Alarms Table defines alarms for each available particle size channel. The left side of the table has rows for the smallest three (3) channels, and the right side has rows for the largest (3) channels.

Size Column

The first column of each half is the size column. The size column displays the channel's particle size. The header indicates the units of each particle size, micrometers (µm).

Triggering Value Column

The second column of each half is the triggering value column. The triggering value column displays the triggering value of the channel. This is also the value at which the channel will activate a particle alarm for the sample.

NOTE: The device will automatically adjust a particle alarm's triggering value according to any changes to the unit of measure in the Sampling Setup screen.

The unit of measure for the triggering value depends on the current sample setup. It can be one of the following:

- N
- N/ft^3
- N/m^3
- N/ℓ

On/Off Column

The third column of each half is the on/off column. Press the checkbox to turn the alarm on for the respective particle size. When the checkbox is not selected the respective particle alarm is turned off.

Image	Name	Description
	Cumulative Count Option	Alarms are based on cumulative particle counts. Cumulative count is the number of particle counts of a certain size and bigger in one sample.
	Differential Count Option	Alarms are based on differential particle counts. Differential counts are the number of particle counts of a certain size in one sample.

Table 6-9. Buttons and fields in the **Particles** tab of the **Alarm Setup** screen

Environment Tab

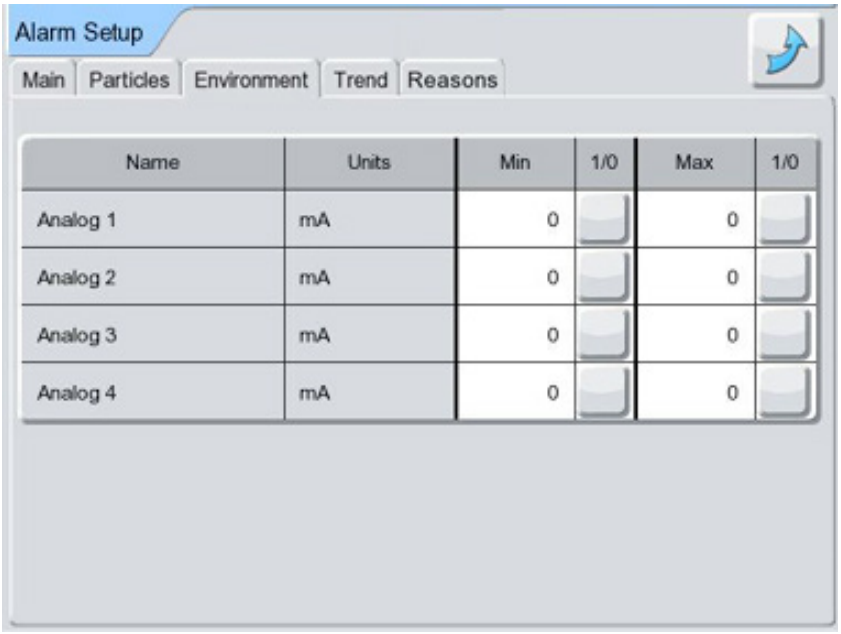


Figure 6-9. Environment tab of the **Alarm Setup** screen

Figure 6-10. Analog Channel table header

Name

Display name (up to 16-characters) for the channel.

Units

Display units (up to 10 characters) for the channel.

Min

Allows entry of minimum value (with a format of 0.00) for alarm.

1/0

A toggle button to turn the alarm On for the low value (a check mark displays) or Off (a blank button displays).

Max

The Low triggering value allows the user to set maximum value for alarm. The field initially set to 0 (zero).

1/0

A toggle button to turn the alarm On (a check mark displays) for the high value or Off (a blank button displays).

Trend Tab

The Trend tab defines alarms using a time frame window. The triggering value of the alarm is displayed on the trend graph, and alarms can be set for each channel. When the alarm for a channel is set, it will display as a horizontal line on the graph with the color of the channel it belongs to. The vertical position of the line will correspond to the alarm limit value. When the trend alarm condition is reached, the particle counter will react with a sample alarm.

Figure 6-11 shows the Trend tab of the Alarm Setup screen.

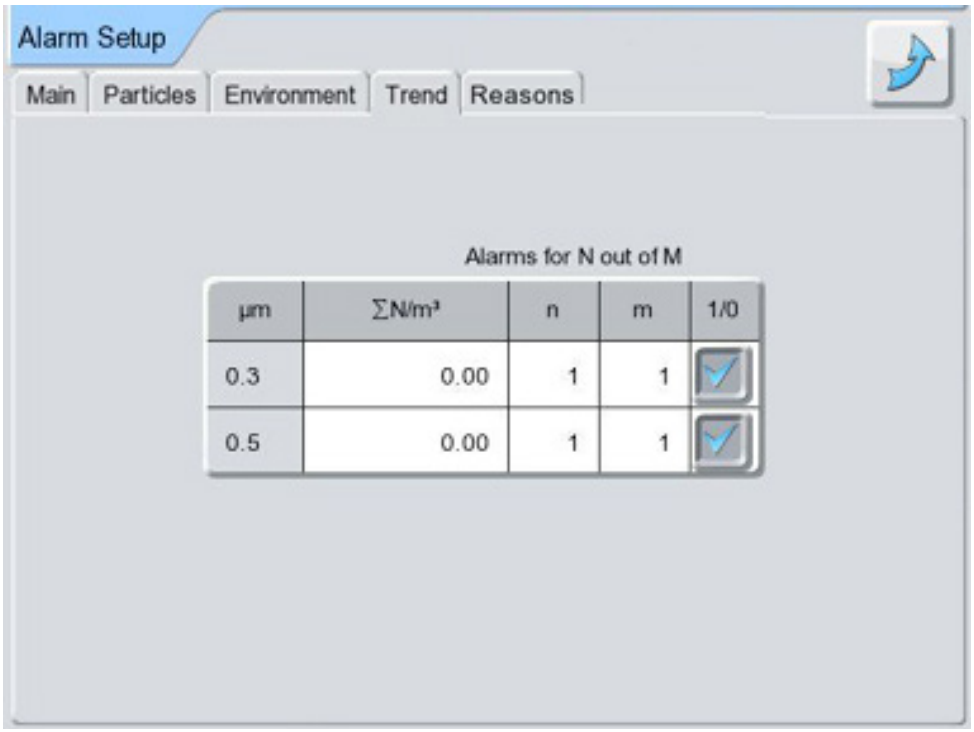


Figure 6-11. Trend tab of the **Alarm Setup** screen

Figure 6-12. Trend table header

The Trend table will contain two rows with the first row representing the first trend channel count, and the second row representing the second trend graph channel count.

µm

The size of particles (with a format of 000.0) collected by channel. This field is view only.

∑ N

Allows setting triggering value (in a format of 00,000,000 and moving point) for the channel.

The cumulative data is used for the value. The unit of measure for the value depends on the current sample setup. It can be N, N/ft^3, N/m^3, liters.

The trigger value will be automatically adjusted according to the changes, which are made in the sample settings so that the proportions will remain constant. By default, the trigger value is zero (0).

Triggered Samples Count (n)

Allows entry of the number of samples (1 to 35) that should have exceeded the alarm limit value to turn on the alarm. The value of this field should be less or equal to the Last Number of Samples value (m).

Last Number of Samples (m)

Allows entry of the time frame (1 to 35) windows for the alarm. The value in the field shows how many last samples will be used for determining alarm condition. The value of this field should be grater or equal to the Triggered Samples Count value (m). If the Enable Flag is set and Last Number of Samples value (m) is less than Triggered Samples Count value (n), then (n) is set equal (m). The label for the column is (m) string. The default value is 1.

1/0

A toggle button to turn the Enable Flag On (a check mark displays) or Off (a blank button displays). The Enable Flag enables using the alarm for the channel.

Alarm Condition

The alarm goes on if there are at least n samples from last m samples where the alarm limit value exceeded. The following table shows an example of the state of alarm after different samples with an alarm limit value is 1000.

Sample #		1	2	3	4	5	6	7
Sample Count		900	1100	1100	1100	900	900	1100
n	**m**							
1	1	Off	On	On	On	Off	Off	On
1	3	Off	On	On	On	On	On	On
2	3	Off	Off	On	On	On	Off	Off
3	3	Off	Off	Off	On	Off	Off	Off

Reasons Tab

The Reasons tab of the Alarm Setup screen manages the user-defined alarm reasons. **Figure 6-13** shows the Reasons tab of the Alarm Setup screen.

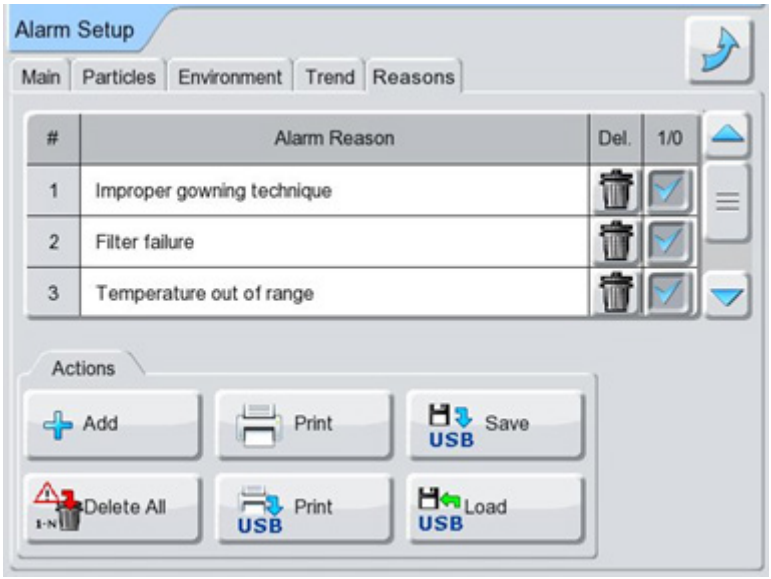


Figure 6-13. Reasons tab of the **Alarm Setup** screen

This tab provides an Alarm Reasons Table to add, delete, or modify individual alarm reasons. The alarm reasons created on the Reasons tab may be assigned to a sample with particle or analog / environmental alarms. Users may define up to 30 different alarm reasons, and each alarm reason may be up to 32 characters in length.

Additionally, this tab provides controls to:

- Delete all alarm reasons
- Print the alarm reasons to the thermal printer
- Print the alarm reasons to an attached USB drive
- Save alarm reasons to a text file to an attached USB drive
- Load alarm reasons from a text file on an attached USB drive

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NOTE: An alarm reason may not be modified or deleted after the alarm reason is assigned to a sample containing particle or analog alarms. Additionally, when any alarm reason is assigned to a sample containing particle or analog alarms, the device will disable the Delete All button. To modify or delete an alarm reason assigned to a sample containing particle or analog alarms, first delete the sample from the device.

NOTE: The GUI will show Asian characters as locations, but the only way to input an Asian-character location is via the Web Browser. See **Appendix G** for instructions on how to enter Asian characters for locations.

The Alarm Reasons table displays and manages the user-defined alarm reasons.

Figure 6-14. Alarm Reason table header

Index Column

The first column is the Index column. This column indicates the Alarm Reason number.

Alarm Reason Text Column

The second column is the Alarm Reasons Text column. This column presents the text of each alarm reason, and the user may modify the alarm reason text by touching the row of the alarm reason the user wishes to modify.

NOTE: This column will be disabled, preventing any modifications to the alarm reason text, for any alarm reasons that are assigned to samples with particle or analog alarms.

Delete Column

The third column is the Delete Reason Column. Press the button to delete the alarm reason.

NOTE: This column will be disabled for any alarm reasons that are assigned to samples with particle or analog alarms.

On/Off Column

The fourth column is the On/Off Column. Press the checkbox to turn the alarm reason on, which allows the alarm reason to be assigned to a sample containing particle or analog alarms. When the checkbox is not selected the respective alarm reason is turned off and may not be assigned to a sample containing particle or analog alarms.

The components of the Reasons tab in the Alarm Setup screen are described in **Table 6-10**.

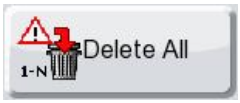
Image	Name	Description
	Add Alarm Reason	Press this button to add a new alarm reason to the Alarm Reasons table.
	**Delete All Alarm Reasons**	Press this button to delete all alarm reasons in the Alarm Reasons table. This button will be disabled if any alarm reasons are assigned to samples with particle or analog alarms.
	Print Alarm Reasons	Press this button to print out a list of all alarm reasons to the thermal printer.
	Print to USB	Press this button to print out a list of all alarm reasons to an attached USB drive. This button will be disabled if no valid USB drive is attached to the device.
	Save to USB	Press this button to save the alarm reasons to a UTF-8-encoded text file. This button will be disabled if no valid USB drive is attached to the device.
	Load USB	Press this button to load alarm reasons from a UTF-8-encoded text file. This button will be disabled if no valid USB drive is attached to the device.

Table 6-10. Components of the **Reasons** tab of the **Alarm Setup** screen

Assigning Alarm Reasons

If a sample contains a particle or analog alarm and the Alarms Reasons feature is enabled, the Alarm Acknowledgement button prompts an Alarm Reason Assignment dialog to appear. **Figure 6-15** shows the Main Display screen with a particle alarm set for Channel 1, with a trigger value of 1,000 cumulative counts.

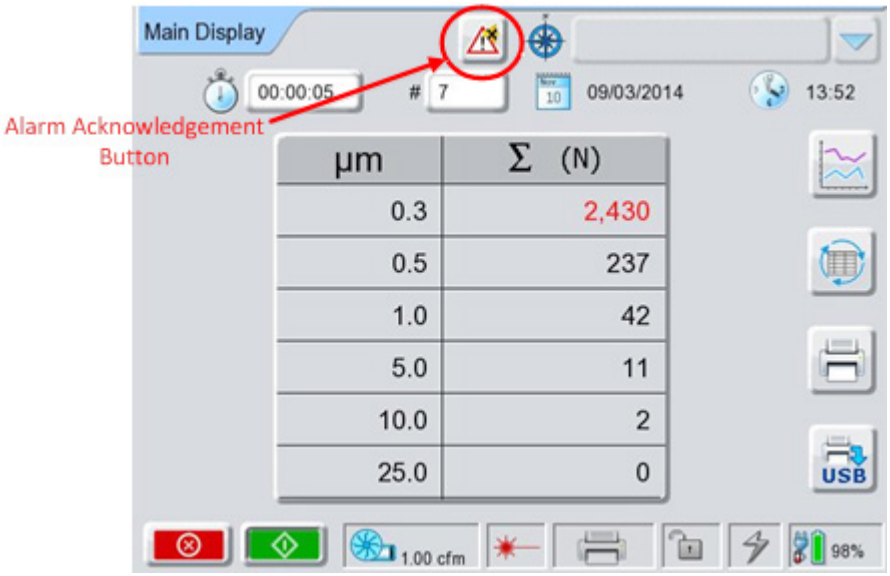


Figure 6-15. Main Display screen with **Alarm Acknowledgement** button shown

When the Alarm Acknowledgement button is pressed, the button will present one of two dialogs to assign an alarm reason. If only a single sample with a particle or analog alarm has completed, the button will prompt a Single-Sample Alarm Acknowledgement dialog, as shown in **Figure 6-16**.

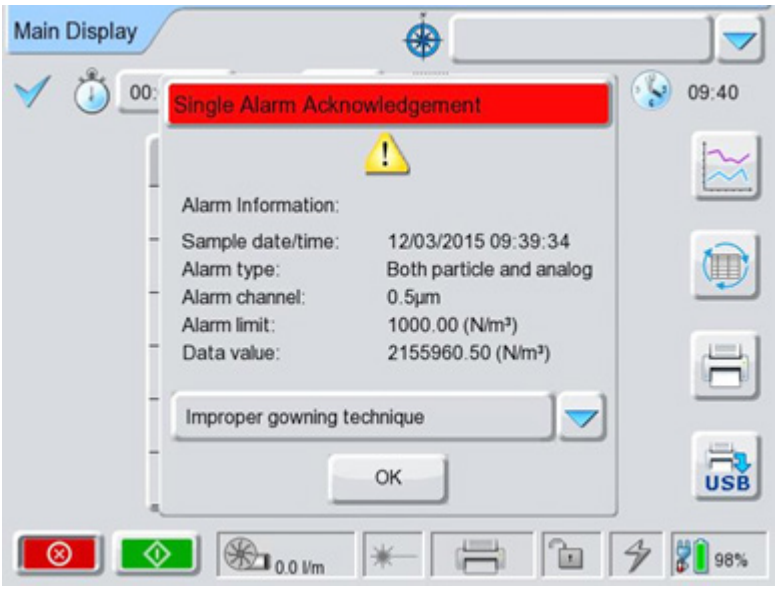


Figure 6-16. Single-Sample Alarm Acknowledgement dialog

The Single-Sample Alarm Acknowledgement dialog presents basic information about the sample, such as:

- The sample date and time
- The alarm type (Particle, Analog, or both)
- The most significant alarming source (either the smallest particle size for which a particle alarm has occurred, or the first analog channel name for which an analog alarm has occurred)
- The trigger value for the most significant alarm
- The data value for the most significant alarm

The alarm reason may be selected from the drop-down list found at the bottom of the dialog.

NOTE: Only enabled alarm reasons will be shown in the drop-down list.

Once the alarm reason has been selected, the user will be prompted to confirm the selection.

NOTE: The Alarm Acknowledgement dialog will only appear if the feature is enabled AND at least one alarm reason is enabled.

NOTE: Once an alarm reason has been assigned a sample, the alarm reason may not be modified or deleted until the sample is deleted.

If more than one sample with a particle or analog alarm has completed, the Alarm Acknowledgement button (shown in **Figure 6-8**) will prompt a Multiple-Sample Alarm Acknowledgement dialog, as shown in **Figure 6-13**.

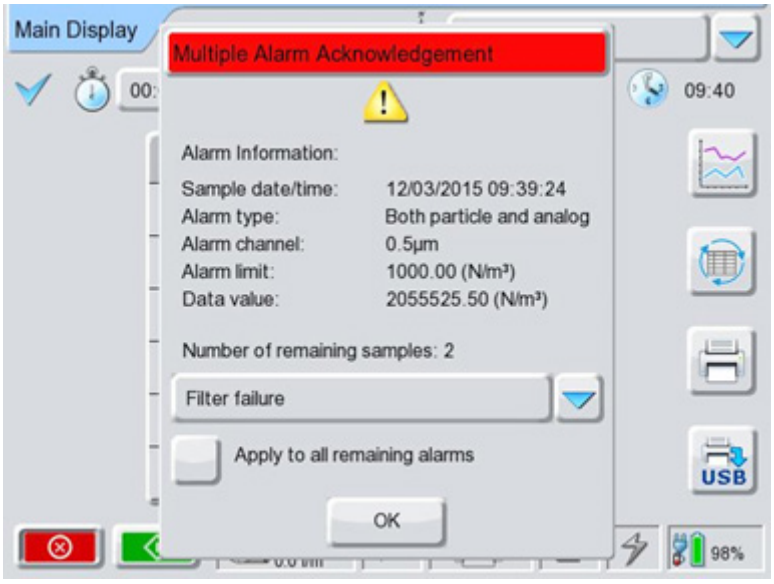


Figure 6-17. Multiple-Sample Alarm Acknowledgement dialog

The Multiple-Sample Alarm Acknowledgement dialog presents basic information about the oldest sample, such as:

- The oldest sample's date and time
- The oldest sample's alarm type (Particle, Analog, or both)
- The oldest sample's most significant alarming source
- The trigger value for the most significant alarm
- The data value for the most significant alarm
- The number of samples for which the Multiple-Sample Alarm Acknowledgement dialog applies.

The Multiple-Sample Alarm Acknowledgement dialog will assign an alarm reason to each individual sample with a particle or analog alarm, starting with the oldest and working towards the newest.

Additionally, if the "Apply to all remaining alarms" checkbox is selected, the selected alarm reason will be applied to all remaining samples with particle or analog alarms that have not yet been assigned an alarm reason.

NOTE: Once an alarm reason has been assigned a sample, the alarm reason may not be modified or deleted until the sample is deleted.

If the device is powered down during the alarm acknowledgement phase, all samples with particle or analog alarms that have not yet been assigned an alarm reason will be assigned the non-customizable alarm reason "No reason provided."

If the alarm reason feature is enabled, and any samples with particle or analog alarms are acknowledged from the web server, the samples will be assigned the non-customizable alarm reason "Acknowledged by web."

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Chapter 7
Setting General Parameters

This chapter describes how to use the Display Setup, System Setup, and Security Setup screens. Typically, these tabs are used initially to set up the system, such as setting trend channels, screen brightness and the date and time.

You may also to want to set user passwords for added security.

- **Display Setup Screen** on page 7-2
- **System Setup Screen** on page 7-12
- **Security Setup Screen** on page 7-19

Display Setup Screen

From the Navigation panel, locate the SETUP group and press Display.

Use the Display Setup screen to set up options for the LCD screen and graph drawing.

The Display Setup screen is comprised of three tabs:

- **Graphs Tab** on page 7-2
- **Histogram Tab** on page 7-6
- **Options Tab** on page 7-12

Graphs Tab

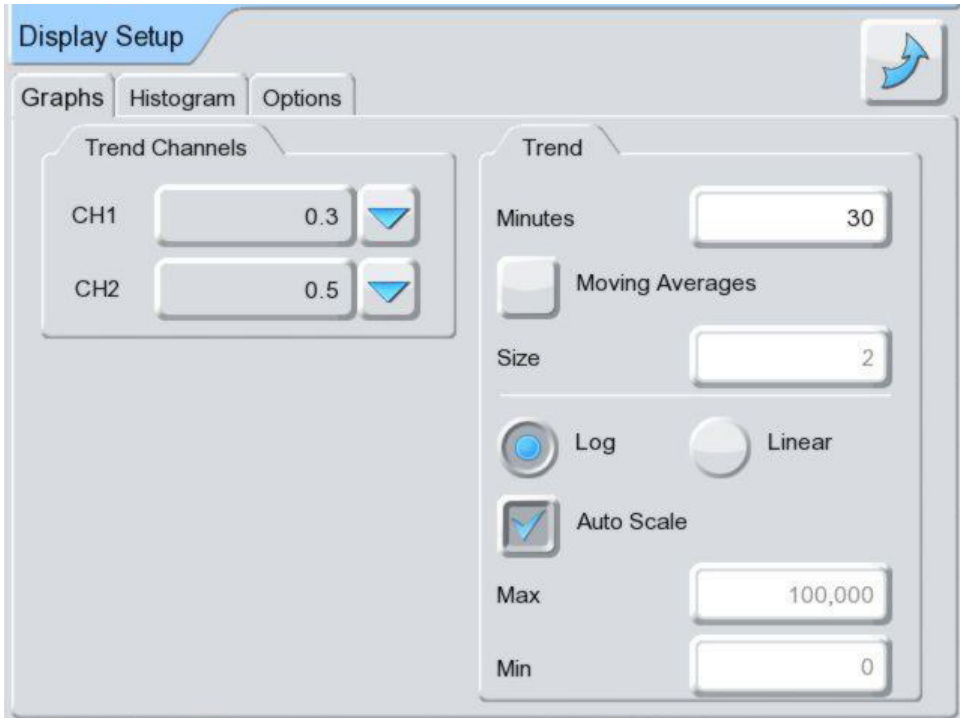


Figure 7-1. Graphs tab of the **Display Setup** screen

The Graphs tab is for setting parameters for the trend graph and histogram, which can be displayed on the Main Display screen.

The following tables describe the two comprising sections of the **Graphs** tab: **Trend Channels**, and **Trend** on page 7-3.

Trend Channels

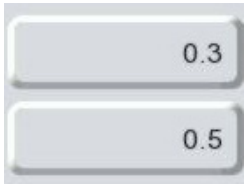
		
CH1 **or** **CH2**	**Channel Size**	Press the down arrow (located to the far right of the CH1 and CH2 button) to display a list of available channels. Press one of these channels to select it as the first channel to display on the graph.

Table 7-1. Buttons and fields in **Trend Channels** area of **Graphs** tab on **Display Setup** screen

Trend

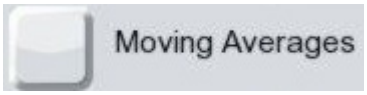
Image	Name	Description
	Minutes	The interval to display on the graph (5-120). The default value is 30.
	**Moving Averages**	Displays the moving average value on the graph for two channels. The moving average value is the mean value for the N last samples, where N is the Moving Average Size.

Table 7-2. Buttons and fields in **Trend Channels** area of **Graphs** tab on **Display Setup** screen

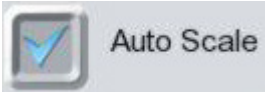
Image	Name	Description
	Size	Defines how many last samples are to be used for calculating the Moving Average (2-10). The default value is 5. • The value for this field should be less than the number of samples for the X-axis. • This field only displays when the Moving Average Option is enabled.
	Log	This option sets the logarithmic scale for the Y-axis where: • 0 (zero) is the minimum value • 0 to 1 the scale is linear • 1 to maximum the scale is logarithmic when any next point is a factor of 10. The minimum value cannot be changed. The maximum valuedepends on the Auto Scale option.
	Linear	This option represents linear scale for the Y-axis. • The minimum and maximum value depend on the Auto Scale option.
	**Auto Scale**	This option allows the whole sampling data to be displayed on the graph. This is done by correcting maximum value for linear scale and logarithmic scale during sampling. • When this option is enabled, the Auto Toggle button on the graph appears pressed (activated).

Table 7-2. Buttons and fields in **Trend Channels** area of **Graphs** tab on **Display Setup** screen

Image	Name	Description
	Maximum Value	The maximum value (with a format 00,000,000) for linear and logarithmic scale when the Auto Scale option is Off. • This field is only active when the Auto Scale option is Off.
	Minimum Value	The minimum value (with a format 00,000,000) for linear scale when the Auto Scale option is Off. This field is only active when the Auto Scale option is Off.

Table 7-2. Buttons and fields in **Trend Channels** area of **Graphs** tab on **Display Setup** screen

Histogram Tab

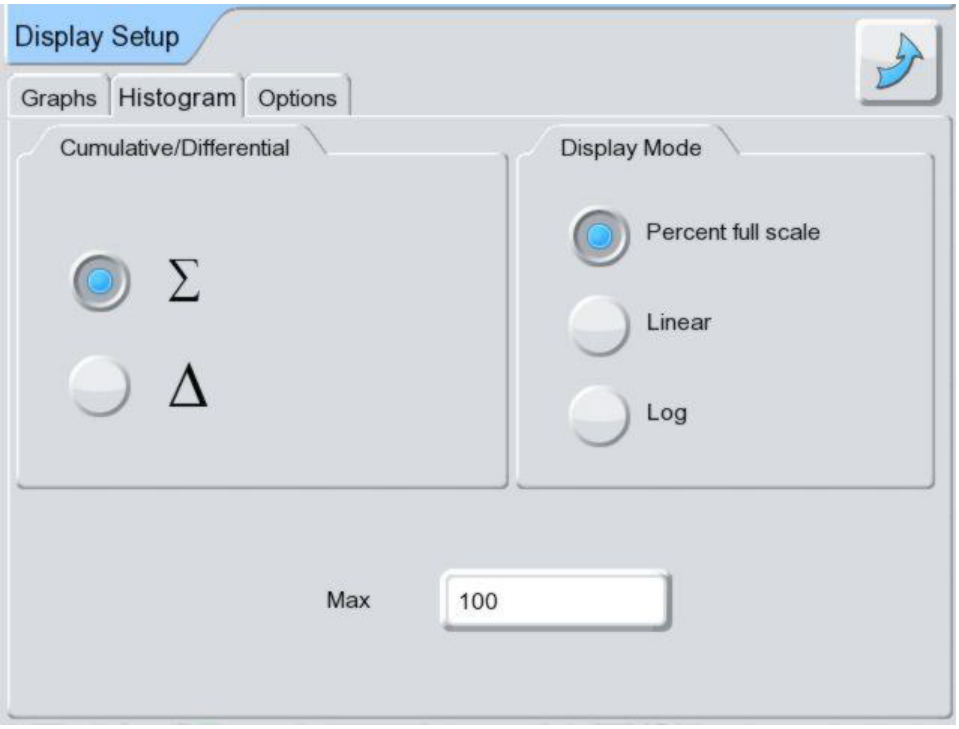


Figure 7-2. Histogram tab of the **Display Setup** screen

The Histogram tab is for setting the data type and display options for the histogram, which can be displayed on the Main Display screen.

The following tables describe each user-specified option within this tab.

Cumulative/Differential

Image	Name	Description
	Cumulative Data	Sets cumulative as the type of data to be used for the histogram graph. Cumulative Count is a number of particles of certain size and bigger that are found in one sample.
	Differential Data	Sets differential as the type of data to be used for the histogram graph. Differential Count refers to a number of particles of certain size that are found in one sample.

Table 7-3. Options in **Cumulative/Differential** area of **Histogram** tab on **Display Setup** screen

Display Mode

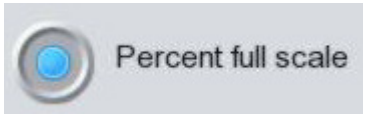
Image	Name	Description
	**Percent full scale**	Sets the histogram to show the percentages for all enabled channels. • The minimum setting is 0 and the maximum setting is 100.
	Linear	Represents linear scale for the Y-axis. • The minimum value is 0 and cannot be changed.
	Log	Represents the logarithmic scale for the Y-axis. The minimum value is 1.

Table 7-4. Options in **Display Mode** of **Histogram** tab on **Display Setup** screen

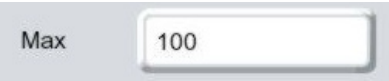
Image	Name	Description
	**Max**	Represents the maximum Y-axis value for Percent full, linear and logarithmic scale. • When the Percent Full scale is On, this field displays the maximum value (5-100) for this display mode. • Initially, the default value is 100, with subsequent default values reflecting the last used value. • When the Linear or Log scale mode is On, the field displays the maximum value (with a format of 00,000,000) for these modes. • The factory default value for these modes is 100,000, with subsequent default values of the last used value.

Table 7-4. Options in **Display Mode** of **Histogram** tab on **Display Setup** screen

Options

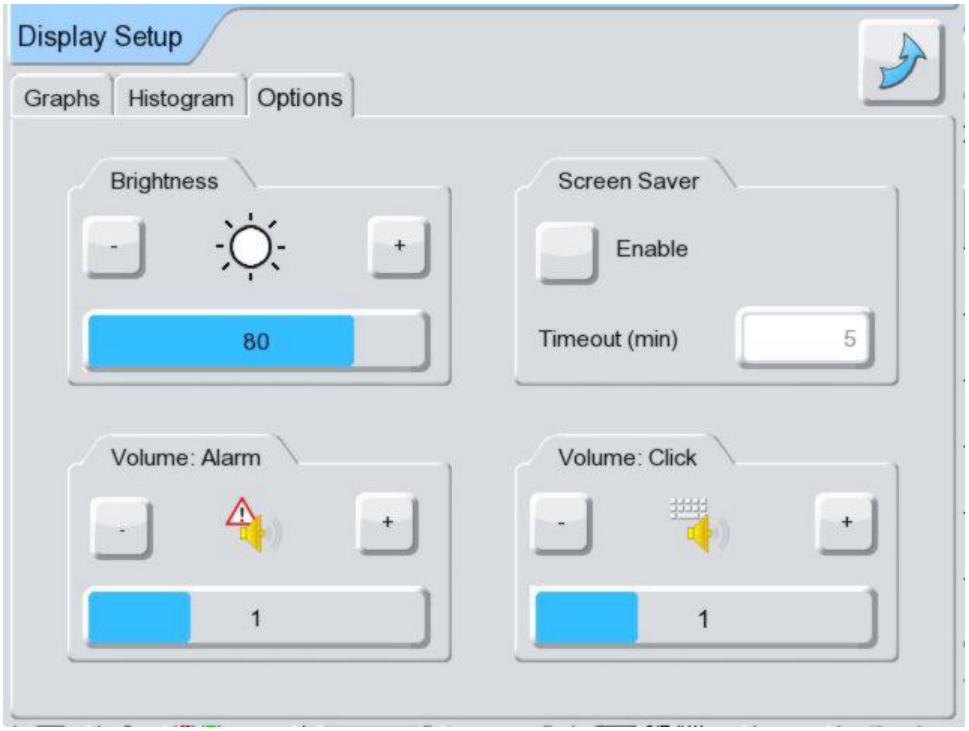


Figure 7-3. Options tab of the **Display Setup** screen

Use the Options tab to adjust the display brightness, screen saver, alarm signal volume, and click button volume.

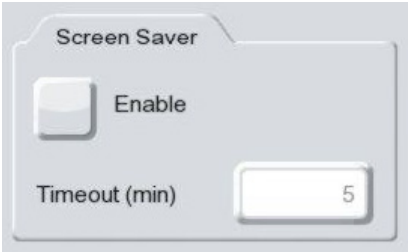
Image	Name	Description
	Brightness	Use the minus and plus buttons to decrease and increase the brightness of the LCD display. As you decrease or increase the brightness, the blue bar and number (ranging from 0 to 100 in increments of 5) indicate the amount of brightness. **NOTE:** This setting affects battery life.
	**Screen Saver**	Press the Enable button to activate or deactivate the screen saver feature. • When activated, a check mark appears on the button. Press the Timeout (min) button to access a touch keyboard for entering the number of minutes (1-60) of inactivity required before the screen saver is automatically activated. • The screen saver option saves the device power by turning off the backlight, while the device continues working. • To reactivate the screen, touch any area of the screen.

Table 7-5. Buttons and fields in **Options** tab on **Display Setup** screen

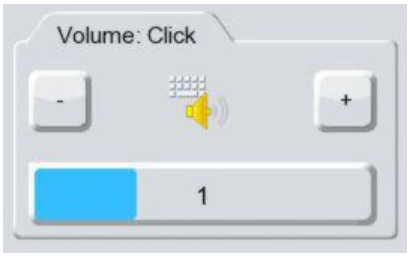
Image	Name	Description
	Volume: Alarm	Use the minus and plus buttons to decrease and increase the volume of the alarm signal. • As you decrease or increase the volume, a blue bar and number (ranging from 0 to 3) (percentage) indicate the volume level. For units with the optional Alarm Siren, the volume bar graph is from 0 – 4 levels. The 4th level is used to activate the 100 dB alarm siren.
	**Volume: Click**	Use the minus and plus buttons to decrease and increase the volume of the beep generated with each click. As you decrease or increase the volume, a blue bar (0-3) indicates the amount of volume.

Table 7-5. Buttons and fields in **Options** tab on **Display Setup** screen

System Setup Screen

From the Navigation panel, locate the SETUP group and press System. Use the System Setup screen to set general system options such as device ID, Date format, and Language. Other options available include All Channels mode or Pharmaceutical Two-Channel mode (0.5 & 5.0 µm**)** using the Channels tab of this screen.

The System Setup screen is comprised of three tabs:

- **Options Tab** on page 7-12
- **Channels Tab** on page 7-17
- **Calibration Warning Tab** on page 7-18

Options Tab

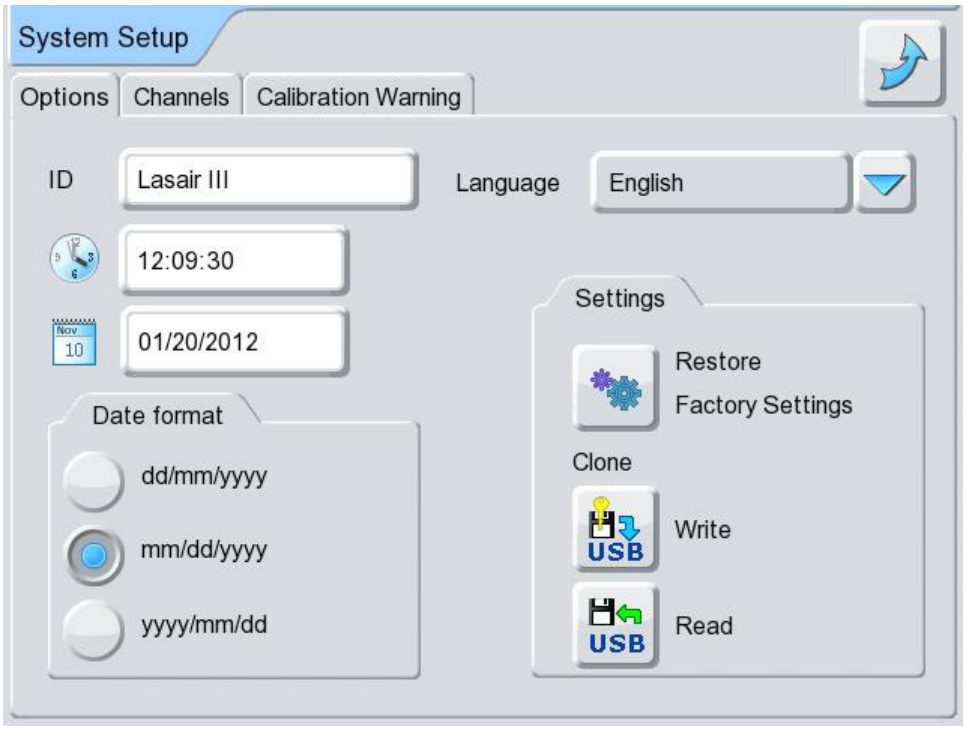


Figure 7-4. Options tab of the **System Setup** screen

NOTE: The GUI now supports Asian characters. Input an Asian-character via the Web Browser. See **Appendix G** for instructions on how to enter Asian characters.

Use the Options tab to set miscellaneous system options, such as:

- Current Date
- Current Time
- Device ID
- Language
- Cloning
- Restore Factory Defaults

Image	Name	Description
	Device ID	Name assigned to the Lasair III particle counter (up to 16 alphanumeric characters).
	Current Time	Set the current time for your time zone. The time displays in a format of HH:MM:SS for hours, minutes, and seconds.
	Current Date	Set the current date. You can change the format for the date display in the Date format section.

Table 7-6. Buttons and fields in **Options** tab on **System Setup** screen

Image	Name	Description
	Language	Select one of the following languages: • English (default) • Français • Deutsch • Italiano • Español • 日本語 • 한국어 • 简体中文 • 繁體中文 • Русский • Português • Polski This language setting affects field names, prompts, and user messages. • Data remains in English.
	Previous Screen	Returns you to the previous screen.

Table 7-6. Buttons and fields in **Options** tab on **System Setup** screen

Date Format

Image	Name	Description
	dd/mm/yyyy or **mm/dd/yyyy** or **yyyy/mm/dd**	You can select one of the following formats: • dd/mm/yyyy • mm/dd/yyyy • yyyy/mm/dd • yyyy is year, mm is month, and dd is day.

Table 7-7. Button options in **Date** format area of **Options** tab on **System Setup** screen

Settings and Clone

Image	Name	Description
	Restore Factory Settings	Purges all data and settings on the device and loads the factory default settings. The system displays a confirmation message before completing the action.

Table 7-8. Buttons on **Settings and Clone** area of **Options** tab on **System Setup** screen

Image	Name	Description
	Write	Clones the following device parameters into a file that can be transferred to another Lasair III particle counter: • Channel settings • Sampling parameters • Statistics settings • Security settings • Comm/port setup • Location names • Recipes • Location/recipe relations • Language settings • Analog channel setting • Display/volume setting • Graph settings • Unit ID
 	Read and **Warning/ Confirmation Message**	Allows instrument to read and load a clone file from the USB key. A warning/confirmation message (shown left) appears. • Enter a name for the file in the File Name field. Also select or deselect the following options, as needed: • Read Comm Parameters– Overwrites current communication parameters with those on the file. • Read Unit ID – Overwrites current Unit ID with those on the file.

Table 7-8. Buttons on **Settings and Clone** area of **Options** tab on **System Setup** screen

Channels Tab

Use the Channels tab to support some pharmaceutical applications. The Lasair III particle counter can be configured to use 0.5 µm and 5.0 µm channels only.

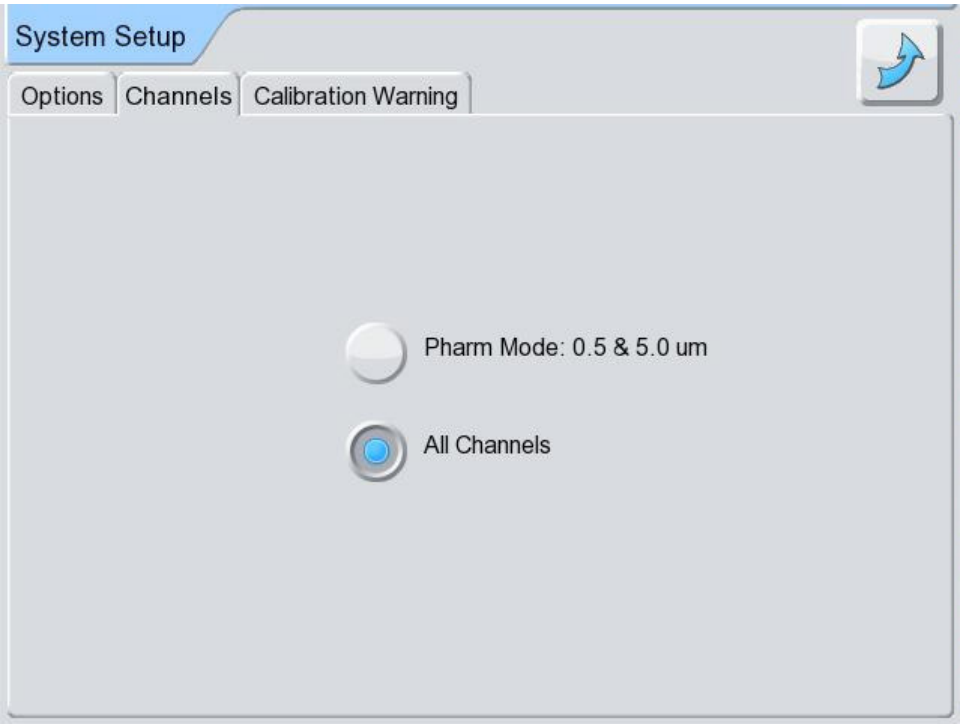


Figure 7-5. Channels tab of the **System Setup** screen

NOTE: Changing between Pharm mode and All Channels mode will cause the unit to reboot. The unit will reconfigure itself and all existing data is DELETED.

NOTE: All recipes must be manually exported (via USB or the Web Server) before changing modes, and then re-imported after the mode change is made. If this is not done, alarm settings in sample recipes will be incorrect, and channel sizes for statistics recipes will be incorrect.

Serial Number Output to Pharmaceutical Net

The Lasair III particle counter serial number is sent to Pharmaceutical Net during initial communications over TCP/IP. Note that it is not stored.

Calibration Warning Tab

Figure 7-6. Calibration Warning tab of the System Setup screen

Use the Calibration Warning tab to set up a reminder when it is time to re-calibrate the Lasair III.

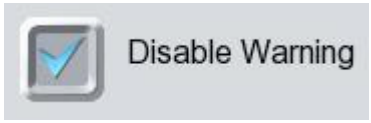
Image	Name	Description
	6 Month	Set warning based on 6 month calibration cycle.
	12 Month	Set warning based on 12 month calibration cycle.
	**Disable Warning**	Prevents pop-up warning message when the instrument boots. The warning message will be re-enabled automatically after a calibration.

Table 7-9. Buttons on the **Calibration Warning** tab in the **System Setup** screen

Security Setup Screen

From the Navigation panel, locate the OTHER group and press Security. Use the Security Setup screen to enable security for limiting or disabling access to the instrument functionalities by setting up to 16 users/passwords and 3 group levels.

Non-password holders will not be able to conduct any actions, such as sampling, view data and status screens. Specific information about group level security is available in **Table 7-10**.

NOTE: The below security configuration instruction and details are valid for all Lasair III particle counters running firmware version 2.3.XXX or newer.

NOTE: Contact Particle Measuring Systems for information about how to get your instrument firmware upgrade.

Security Overview

User Name

The instrument can manage up to 16 customizable user names with a maximum length of 16 characters.

Password

The password has a maximum length of 16 characters.
Valid characters are 0-9, A-Z, a-z, “-” and “_”. Passwords have a minimum length of 6 characters. The firmware will store passwords in an encrypted form, and does not store unencrypted passwords to prevent users or Particle Measuring Systems from displaying or exporting unencrypted passwords.

Access Levels

The firmware will allow for three levels of security access: “Operator”, “Supervisor” and “Administrator”, as shown in **Table 7-10**.

Name	Description
View Only	This access level supports viewing the Main Display screen only.
Operator	This access level supports operating basic instrument function on a day-to-day basis.
Supervisor	This access level supports modifying some instrument settings at a management level.
Administrator	This access level supports all instrument capabilities.

Table 7-10. Security levels of access

A summary of the accessible instrument screen/menu for each access level is provided in **Table 7-11**.

Screen	View Only	Operator	Supervisor	Administrator
Main Screen	❐	✓	✓	✓
Sample Setup Screens				
Sample Setup	X	❐	✓	✓
Alarm Setup	X	X	✓	✓
Statistic Setup	X	❐	✓	✓
Recipes	X	X	✓	✓
Setup Screens				
Display	X	X	✓	✓
Report	X	✓	✓	✓
System	X	X	❐	✓
Comm	X	X	✓	✓
Other				
Data	X	❐	❐	✓
Status	X	✓	✓	✓
Security/Login	❐	❐	❐	✓
✓ Full Access		❐ Limited Access		X No Access

Table 7-11. Accessible screens by access level

The Security Setup screen is comprised of three tabs:

- **Login/Logout Tab** on page 7-21
- **Advanced Tab** on page 7-22
- **User Tab** on page 7-24

Login/Logout Tab

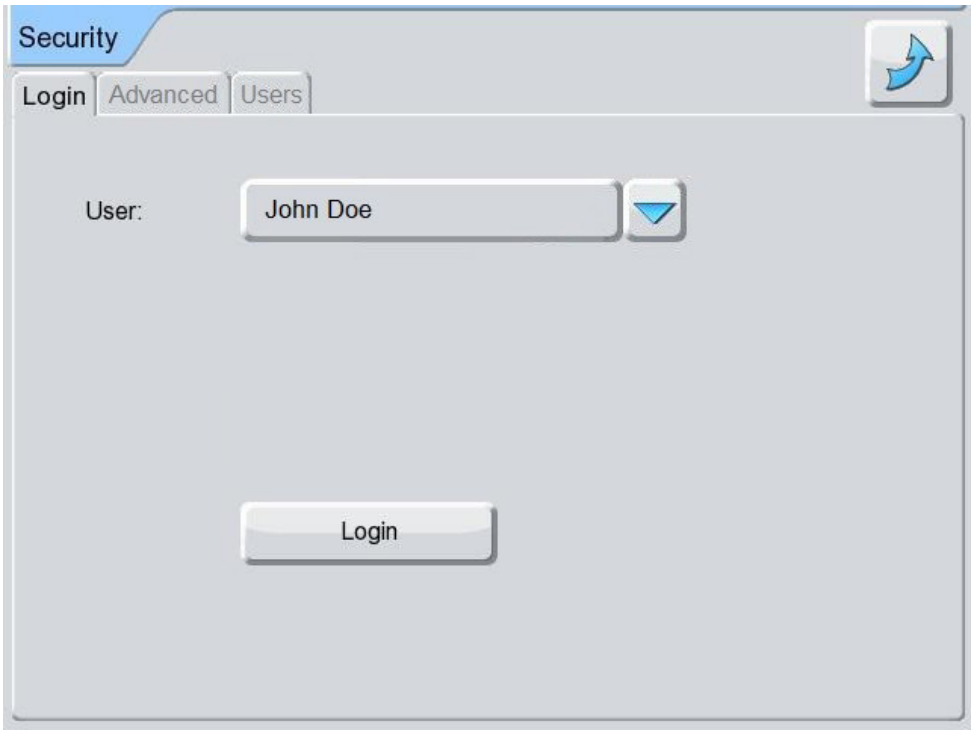


Figure 7-7. Login tab of the **Security** screen

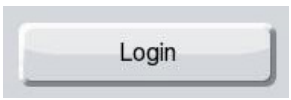
Image	Name	Description
	User	This drop down selection box shows the available users for the instrument.
	**Login/ Logout**	This button allows users to login or logout.

Table 7-12. Login tab field details

Advanced Tab

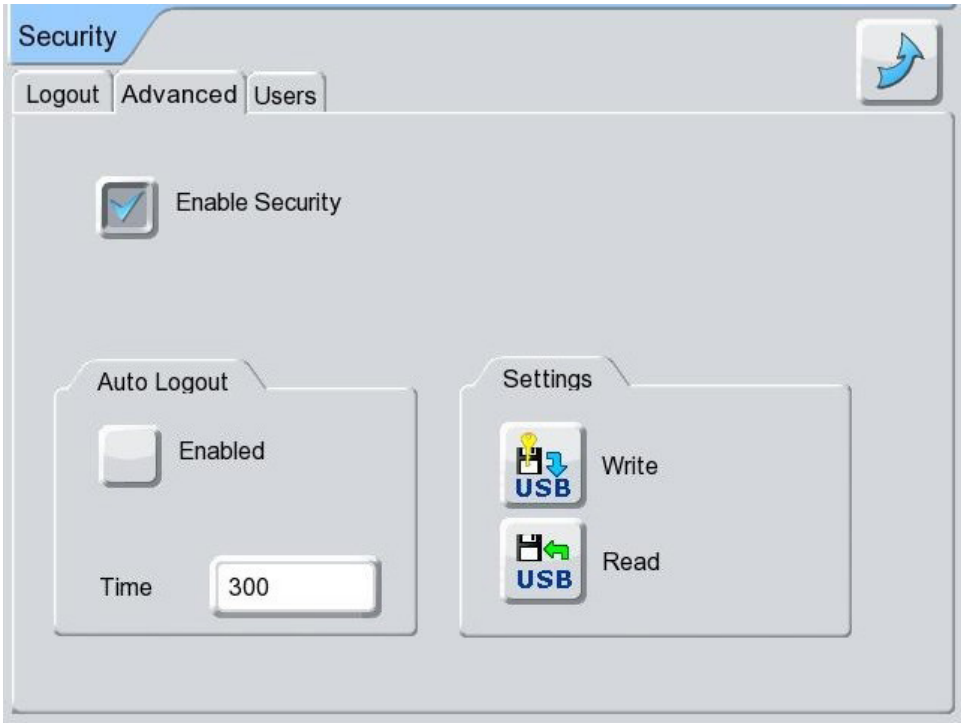


Figure 7-8. Advanced tab of the **Security** screen

The Advanced tab allows an administrator to enable or disable security, enable or disable the auto-logout feature, set the auto-logout timeout period in minutes, and manage the user name/groups configuration.

The Advanced tab appearance is limited to Administrator accounts only.

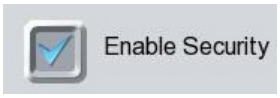
Image	Name	Description
	**Enable Security**	This control allows disabling or enabling all security on the instrument. The firmware prevents security from being enabled if there is no administrator account. Similarly, the firmware has controls to ensure that at least one administrator account exists and is enabled if security is enabled.
Auto Logout Group Box		
	Enabled	Automatically logs the user out at the end of a specified time period. When this button is enabled, it displays a checkmark.
	Time	This sets the minutes before the auto-logout feature is activated. The default value for this control is 5 minutes. Can be set between 1 and 1440.
Settings Group Box		
	Write	This button allows all security settings to be written onto a USB FLASH key for easy security configuration transfer across multiple instruments.
	Read	This button allows all security settings from a USB FLASH key to be read by the instrument.

Table 7-13. Advanced tab field details

User Tab

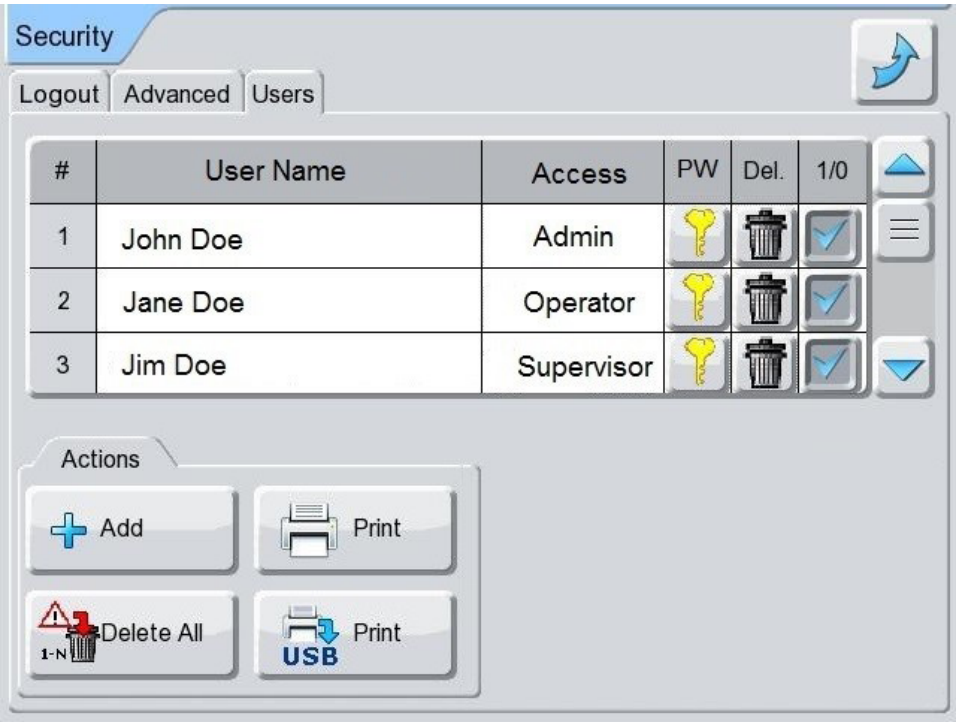


Figure 7-9. Users tab of the **Security** screen

The primary feature of this tab is a table with all entered usernames. The table allows the editing of user names and the deletion of user accounts. The notebook tab includes controls to add user accounts, print the user name and access level list to either the thermal printer or a USB MHT file, and delete all accounts. The table has the following columns:

- **User Name:** Allows the administrator to edit the user name.
  Each user name is unique. When adding or editing a username, the firmware will prevent duplicate entries.
- **Access:** Allows the administrator to edit the user's access level.
- **PW:** Allows the administrator to modify a user password.
- **Del.:** Allows the administrator to delete a user account.
- **1/0:** Allows the administrator to enable or disable specific users of the instrument (1 = Enable, 0 = Disable).

Enable/Disable Users

The enable/disable user button allows the administrator to disable (but not delete) a user account on the instrument.

NOTE: When security is enabled, the instrument firmware prevents the disable of the Administrator account currently logged into the instrument.

NOTE: User accounts cannot be enabled until the Administrator assigns a password to the specific user.

NOTE: When security is enabled, the instrument firmware prevents an administrative user from disabling their own account. In order to disable the current administrative account, security must be disabled or another administrative user must login to the instrument.

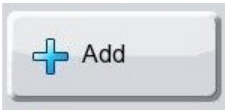
Image	Name	Description
	**Add**	**Add a User:** The Administrator user can add up to 16 user names by pressing the Add button. A virtual keyboard will be displayed for the Administrator to enter in the user name. After a user is added, the administrator must press the password button in the user's table for the virtual keyboard to appear. The Administrator must then enter in the user's password twice to confirm adding the user. If there are no available user entries on the machine, the firmware will display an error dialog when the Administrator presses the Add button.

Table 7-14. Actions box of the **Users** tab (**Security**)

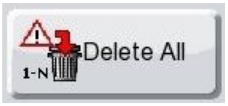
Image	Name	Description
	**Delete All**	**Delete a User:** The delete user button allows the administrator to delete a user from the instrument. To delete a specific user, select it by touching the user name line prior to clicking the “delete” button. **NOTE:** When security is enabled, the instrument prevents the removal of the Administrator account currently logged in the instrument.
	Print	**Print Security Configuration:** The print buttons allow the Administrator to print on thermal printer or the USB memory stick. Use these buttons to print the summary of the Security Configuration, which includes the list of configured users, the membership group, and enable status. **NOTE:** In order to save space on the printed report, the report represents access levels with chess symbols. The report will indicate administrative users using a king symbol, supervisor users using a queen symbol, and operators using a pawn symbol.
	Print to USB	

Table 7-14. Actions box of the **Users** tab (**Security**)

Select Access Level

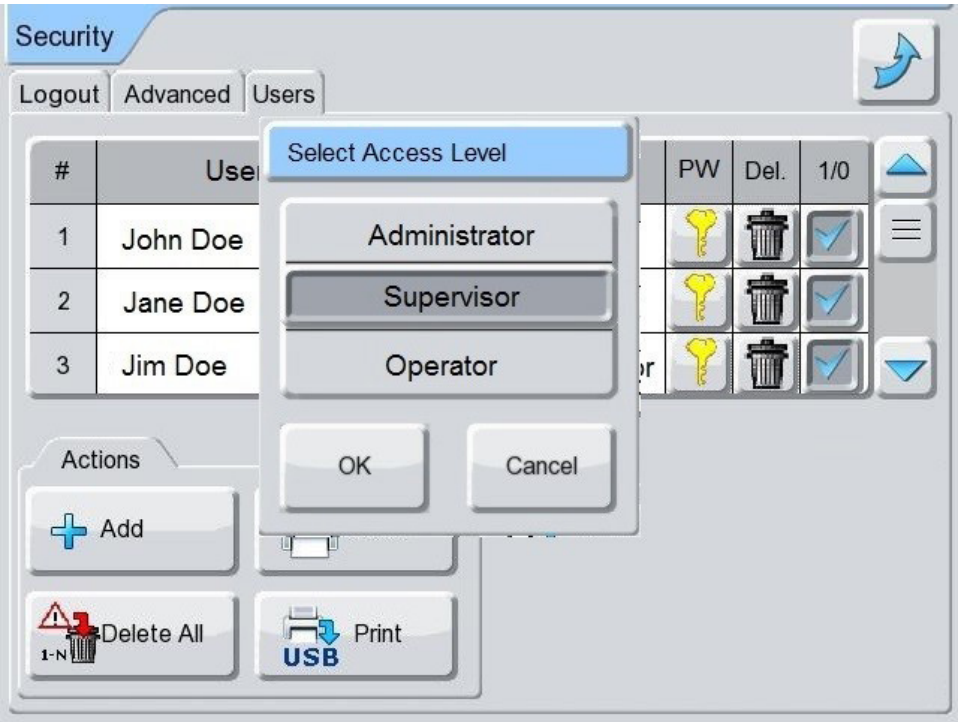


Figure 7-10. Select Access Level window

The user's access level is selected by pressing a user's associated Access box, and choosing the appropriate group as shown in the above image.

Access Level privileges contained in the Actions box are described in **Table 7-11**.

Web Server Security

The web server includes a web page for administrating all users, similar to the instrument user interface. This provides administrators with a means of accessing the security administration remotely as well as provide controls for the administrators to enter in Unicode user names. The web server web page contains a table and controls similar to the table and controls on the instrument display GUI.

Chapter 8
Setting Data and Reporting Parameters

This chapter describes the screens and buttons used in the setup of the Data screen and Report Setup screen.

- **Data Screen** on page 8-1
- **Report Setup Screen** on page 8-12

Data Screen

From the Navigation panel, locate the OTHER group and press Data.

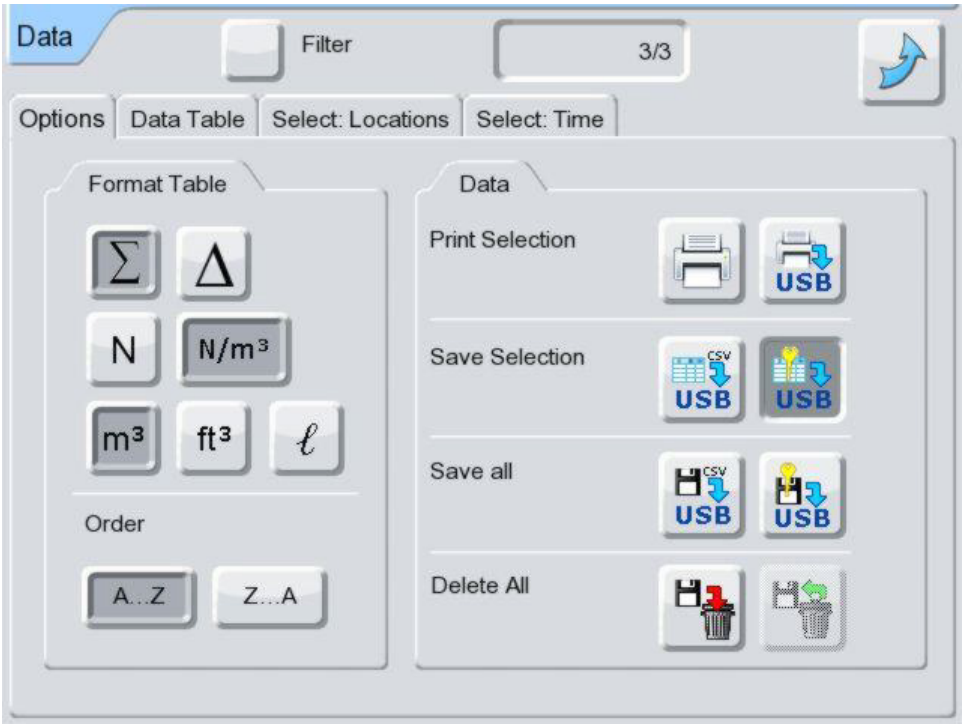


Figure 8-1. Options tab of the **Data** screen

Use the Data screens to set up the parameters for the format, order, and export of sampling data.

The Data screen is comprised of four tabs:

- **Options Tab** on page 8-2
- **Data Table Tab** on page 8-6
- **Select: Locations Tab** on page 8-9
- **Select: Time Tab** on page 8-10

Options Tab

The Options tab is comprised of Format (**Table 8-1**) and Data (**Table 8-2**) sections.

Image	Name	Description
	Cumulative Count	Bases alarms on cumulative particle counts. Cumulative Count is a number of particles of certain size and bigger that are found in one sample.
	Differential Count	Bases alarms on differential particle counts. Differential Count refers to a number of particles of certain size that are found in one sample.
	Raw Data	Selects raw data as the data type for the sample.
	Normalized Data	Selects normalized data as the data type for the sample.
	Cubic Meter	Selects cubic meter (m^3) as the unit of measure for the sample.

Table 8-1. Buttons in **Format Table** section of the **Options** tab on the **Data** screen

Image	Name	Description
	Cubic Foot	Selects cubic foot (ft^3) as the unit of measure for the sample.
	Liter	Selects Liter (L) as the unit of measure for the sample.
	Displaying Order A-Z	Displays data in ascending A-Z order (oldest data first).
	Displaying Order Z-A	Displays data in descending Z-A order (newest data first).

Table 8-1. Buttons in **Format Table** section of the **Options** tab on the **Data** screen

Data

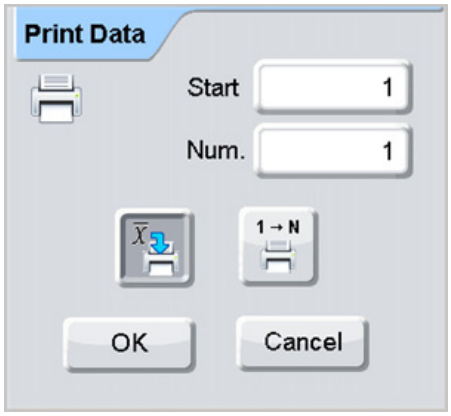
Image	Name	Description
  	Print and Print Data dialog box	Prints selected sampling data to the Lasair III thermal printer. Number of first record to be printed. Number of records to be printed. Prints the selected record averages. Prints selected records.
	Save Selection to CSV	Stores selected sample data (data which passed through the filter) in CSV format. Please refer to **Appendix E** for a full CSV format description.

Table 8-2. Buttons in **Data** section of the **Options** tab on the **Data** screen

Image	Name	Description
	Save Selection to Secure USB	Stores selected sample data (data which passed through the filter) in a secure 21 CFR 11 compliant format for DataAnalyst.
	Save Data File to CSV USB	Stores all collected sample data in CSV format.
	Save Secure Data File to USB	Stores all collected sample data in a secure 21 CFR 11 compliant format for DataAnalyst.
	Erase Data	Erases all stored sample data. This button is disabled when Statistics Mode is enabled.
	Recover Data	This button is displayed ONLY after data has been erased. It allows recovery of data that is erased in error with the Erase Data button. This data recovery function will work even after the Lasair III has been powered off and back on. However, once a new sample has been taken, old data cannot be recovered. In this case, the button is disabled.

Table 8-2. Buttons in **Data** section of the **Options** tab on the **Data** screen

Data Table Tab

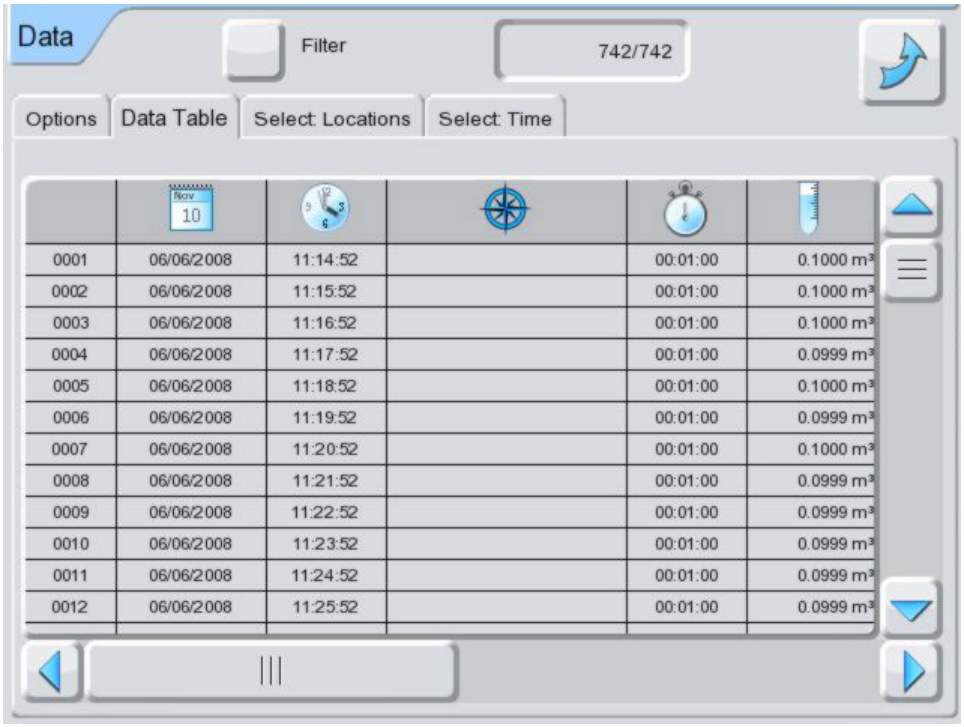


Figure 8-2. Data Table tab of the **Data** screen

Stored data is viewed in your Lasair III particle counter on the Data Table tab, which automatically updates each time a new sample is completed. All stored data displays unless filters have been set. You can set these filters using the **Select: Locations** and **Select: Time** tabs.

Each row represents one collected sample. Additionally there can be up to four columns for environment data. The headings of these columns are the names given for environment channels (during the setup process) using the Environmental tab.

You can determine the order of the data by choosing an ascending A-Z or descending Z-A order. All information displayed on this tab is view only.

There is a vertical and/or horizontal scroll bar (displays only when data extends beyond the screen), as well as page up and page down arrows (on the top and lower right) to reveal additional rows and columns.

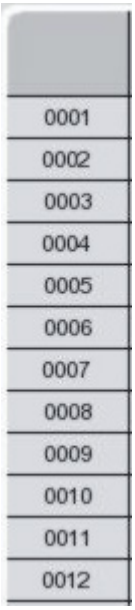
Image	Name	Description
	Enable Location Filtering	Allows applying filtering data by location. A check mark displays on the button when selected. When selected, only the data gathered from the filtered location displays.
	Sample Number	Represents the number of samples out of the total number.
	**Row Index**	The first column on the left (no heading) contains the number of the current row (1-3000).
	Date	Represents the date the sample was completed. The date displays in one of the following formats (as set on the System Setup > Options tab): • YYYY/MM/DD • MM/DD/YYYY • DD/MM/YYYY • YYYY is year, MM is month, and DD is day
	Time	The time the sample was completed. The time displays in a format of HH:MM:SS for hours, minutes, and seconds.

Table 8-3. Buttons and fields in the **Data Table** tab on the **Data** screen

Image	Name	Description
	Location	Name of the Location associated with the sample data.
	Sample Duration	The length of the sample duration, expressed as HH:MM:SS for hour, minutes, and seconds.
	Sample Volume	The volume of air expressed in the unit selected on the Sample Setup screen. The format for volume is 0.0000 m^3 or 0.00 ft^3 or 0.0 L, depending on the current units.
(Not shown)	**Particle Data**	These fields show the particle count data. The data display and headings vary according to the settings on the Standards tab of the Statistics Setup screen. For example, data display may be set to include: • Analog 1, Analog 2, Analog 3, Analog 4 and • 0.5 µm, 1.0 µm, 2.0 µm, 5.0 µm, 10.0 µm, 25.0 µm

Table 8-3. Buttons and fields in the **Data Table** tab on the **Data** screen

Select: Locations Tab

Use this tab to filter the data to be displayed on the Data Table tab by location. A button displays for each location in the system. You can select or deselect one or more locations in the location list to be used in the filtering process.

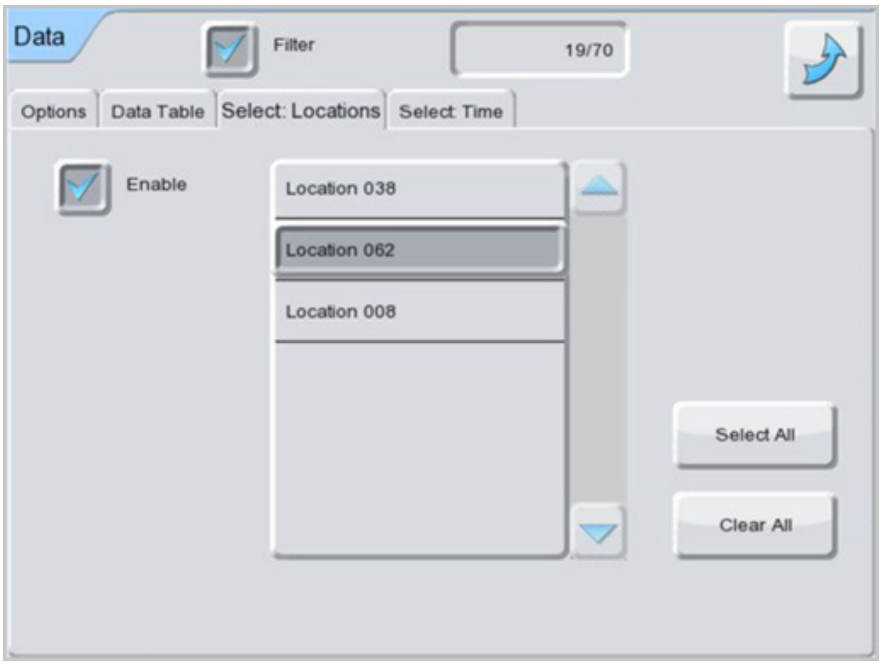


Figure 8-3. Select: Locations tab of the **Data** screen

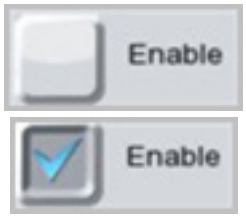
Image	Name	Description
	Enable Location Filtering	Applies a filter to data to display data for ONLY those locations selected on this tab. A check mark displays on the button when the filter is currently selected.
	Location	Press one or more location buttons to include in the filtering process. The button appears darker when selected. Press again to deselect.

Table 8-4. Buttons in **Format Table** section of the **Options** tab on the **Data** screen

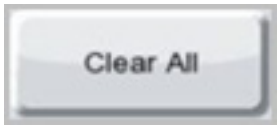
Image	Name	Description
	Select All	Includes all locations in the Location List for the location filter. Therefore, all data for all locations will be displayed.
	Clear All	Deselects all selected records in the Location List.

Table 8-4. Buttons in **Format Table** section of the **Options** tab on the **Data** screen

Select: Time Tab

Use this tab to filter the data to be displayed on the Data Table tab by start and end times.

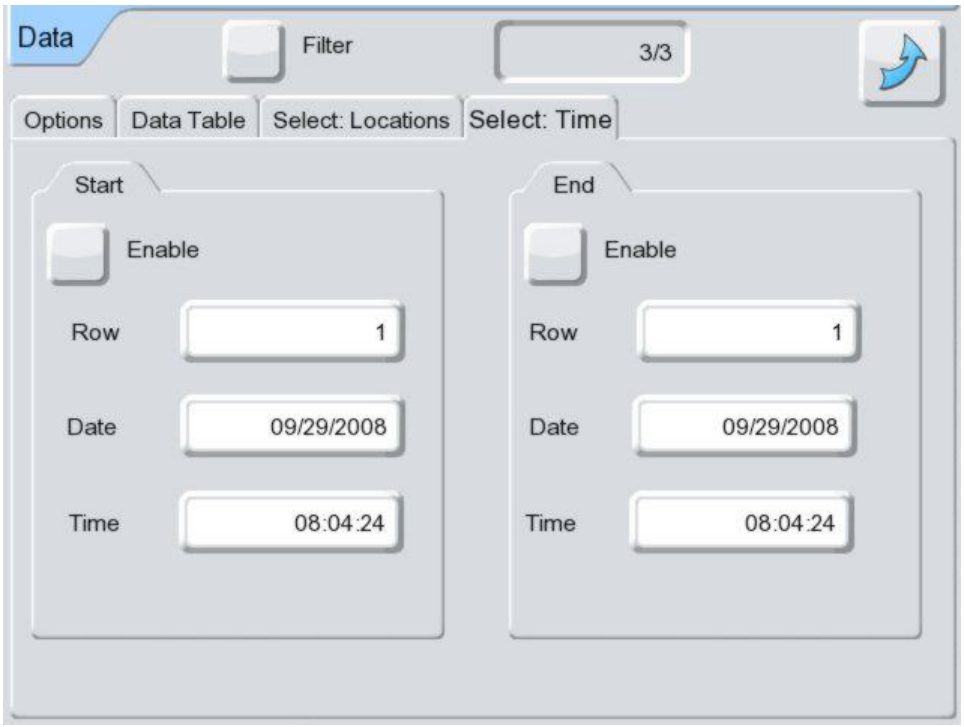


Figure 8-4. Select: Time tab of the **Data** screen

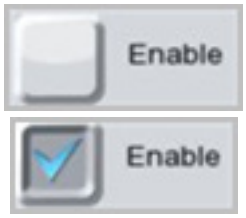
Image	Name	Description
	Enable Start Time Filtering	Applies a filter to data for displaying ONLY data that meets the start Date and Time criteria entered on this tab. A check mark displays on the button when it is selected.
	Start Row	The record (0-3000) that the filtering will start from. This field overrides the Date and Time field settings.
	Start Date	The beginning date of the sample record files to include in the filtering process. The date displays in one of the following formats (as set on the System Setup > Options tab): • YYYY/MM/DD • MM/DD/YYYY • DD/MM/YYYY • YYYY is year, MM is month, and DD is day
	Start Time	The beginning time of the sample record files to include in the filtering process. The time displays in a format of HH:MM:SS for hours, minutes, and seconds.

Table 8-5. Buttons and fields in the **Start** section of **Select: Time** tab on the **Data** screen

End Section

The buttons and fields that comprise the End section of the Select: Time tab are identical to the Start section (see **Table 8-5**) but for the added filtering to a desired End Row, Date and Time.

Report Setup Screen

From the Navigation panel, locate the SETUP group and press Report.

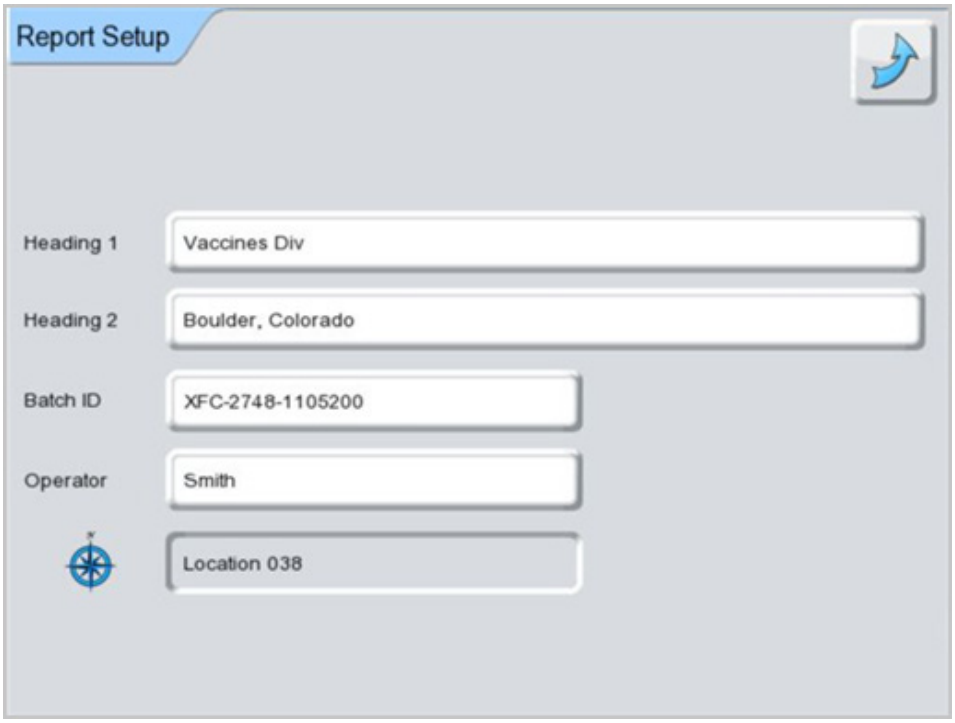


Figure 8-5. Report Setup screen

NOTE: The GUI now supports Asian characters. Input an Asian-character via the Web Browser. See **Appendix G** for instructions on how to enter Asian characters.

Use the Report Setup screen to configure the report layout for .MHT files generated from the system.

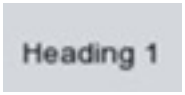
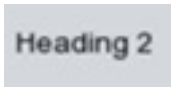
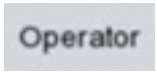
Image	Name	Description
	Heading 1	Heading to display on the first line of the reports (maximum 42 alphanumeric characters).
	Heading 2	Heading to display on the second line of the reports (maximum 42 alphanumeric characters).
	Batch ID	Batch identifier (maximum 16 alphanumeric characters) to display on the reports.
	Operator Name	Name of the operator (personnel) to display on the reports (maximum 16 alphanumeric characters). The Operator ***Name*** can also be entered or edited in the Report Setup screen. The ***Operator Name*** field is automatically disabled and shows the current logged user when the instrument security is active.
	Room or Location Name	Name of the active sampling location. This field is view only and automatically displays. The Room Name prints on the reports. You can change the active sampling location on either the Sampling Setup or the Statistics Setup screen.
	Previous Screen	Returns you to the previous screen.

Table 8-6. Fields on **Report Setup** screen

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Chapter 9
Creating Recipes

A recipe is a set of sampling or statistical parameters which can be saved and recalled by name or by location. Recipes not only save time and effort, but add a quality control measure to ensure consistency between locations and among employees. Additionally, password protection can be added to restrict changes to the settings.

Recipes can be created and retrieved using:

- the touchscreen panel on the Lasair III particle counter
- a PMS control software
- the Web browser interface

This chapter describes the Recipe screens and functionality for the Lasair III particle counter.

Recipe Database

The recipe database can hold any combination of fifty samples or statistics recipes. You can associate a recipe to one or more locations.

Sample Recipe Data

The following is a list of all the parameters saved in a sample recipe:

- Recipe Name
- Sample Type (volume or time)
- Sample Size (volume or time)
- Initial Purge Delay (seconds)
- Start by Time Of Day, ON/Off (Overwrites Purge Delay if ON)
- Inter-Sample Delay (seconds)
- Number of Samples
- Continuous Sampling (ON/OFF)
- Group Repeat Mode (ON or OFF)
- Sample Units (ft^3, m^3, or l)
- Data Display (raw or normalized)
- Auto-Print Sample
- Auto-Print Sample Average (for two or more samples)
- Auto-Print to USB Key (Beep mode on/off)
- Alarms On/Off
- Alarm Buzzer On/Off
- Particle Alarm Type (Differential/Cumulative)
- **For Each Particle Size:**
    - Alarm Setting
    - Alarm On/Off
- **For Each Analog Channel:**
    - Min Alarm Setting
    - Max Alarm Setting
    - Min Alarm On/Off
    - Max Alarm On/Off

Statistics Recipe Data

The following is the list of all parameters saved for a statistics recipe:

- Recipe Name
- Room Name
- **Statistics Type:**
    - ISO-14644-1:2015
    - ISO 14644-1:1999
    - EU GMP
    - EU GMP and ISO
    - China GMP
    - FS-209E
- Average of Locations
- Purge Delay (seconds)
- Inter-Sample Delay (seconds)
- Auto-Track Mode (On/Off)
- Confirm Sample Mode (On/Off)
- Units (ft./m) Valid for FS-209E or Average only
- **Class:** (Except for Average)
- Auto-Increment Location (On/Off)
- Sample Acknowledge (On/Off)
- Sample Location Type (Names/Numbers)
- Particle Sizes
- **Flow:** (Uni-directional/multi-directional) (FS-209E only)
- Room Area (Except Average)
- Number of Locations to Sample
- Volume per Sample
- Number of Samples per Location

Statistics Recipe Data not saved:

- Statistics User Name
- Sampling Setup Screen Parameters – The number of samples is automatically set when statistics are enabled, except for average mode. In average mode, the current sample count is used.
- Alarm settings – Default alarms are disabled during statistics.
- Lasair II to Lasair III Recipes – Lasair II recipes can be saved in the Lasair III particle counter, however Lasair III recipes cannot be saved in the Lasair II particle counter.

Recipe Setup Screen

From the Navigation panel, locate the SAMPLE group and press Recipes.

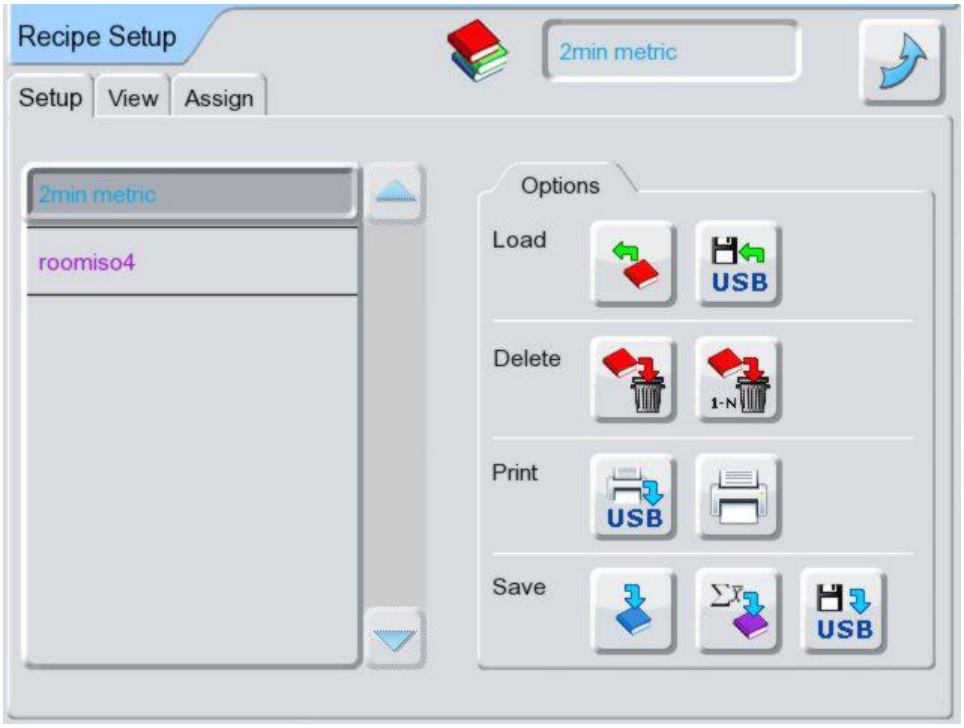

Figure 9-1. Setup tab of the **Recipe Setup** screen

The Recipe Setup screen has three tabs:

- **Setup Tab** on page 9-5
- **View Tab** on page 9-8
- **Assign Tab** on page 9-9

Recipe Names

Recipe names can include up to 16 characters. The following characters are not valid in recipe names:

- \
- /
- *
- ?
- “
- <
- >
- :
- |

Setup Tab

A selection list of stored recipe names displays on the left of the Setup tab. Sample recipe names display in a blue color and Statistics recipe names display in a purple color. The last loaded recipe is the selected default. Use the scroll bar located at the right of the list to select another recipe name.

NOTE: Enter your selections carefully. There is NO un-delete functionality.

Image	Name	Description
	Load	Loads selected recipe into current (default) settings for the Lasair III particle counter.

Table 9-1. Buttons in the **Options** section of the **Setup** tab on the **Recipe Setup** screen

Image	Name	Description
	Read Names from USB	Loads stored recipes, locations and links from the USB device to a single file. • The recipe name must be unique or the information will not transfer. **NOTE:** If loading a recipe from a Lasair particle counter containing a non-supported particle size, the particle counter will auto-assign the next smallest particle size that is supported.
	Delete Recipe	Erases the selected recipe from the Lasair III particle counter. **NOTE:** A recipe cannot be erased if it is attached to one or more locations. The location attachments must first be deleted.
	Delete All Recipes	Erases all recipes from the Lasair III particle counter. • A warning/confirmation prompt is displayed before the recipes are erased. **NOTE:** If locations are attached to recipes, then either the attachments must be deleted, or the locations must be deleted before the recipes can be deleted.
	Return to Main Display	Returns to Main Display.

Table 9-1. Buttons in the **Options** section of the **Setup** tab on the **Recipe Setup** screen

Image	Name	Description
	Print to USB Key	Prints selected recipe to the USB key. • The button is enabled only when a USB key is attached.
	Print	Prints the selected recipe to the Lasair III thermal printer
	Save Recipe	Saves the current sampling parameters to a recipe. • The default name is whatever recipe currently selected. • If an existing recipe name is used, that recipe name is replaced with the new parameters. • A statistics recipe may be rewritten with a sampling recipe, and vice-versa.
	Save Statistics Recipe	Saves the current statistics parameters to a recipe. • The default name is whatever recipe is currently selected. • If an existing recipe name is used, the recipe is replaced with the new parameters. • A statistics recipe may be re-written with a sampling recipe, and vice-versa.
	Save to USB	Saves all recipes, locations and associations to a Lasair III recipe file on the USB key. • The button is enabled only when the USB key is attached.

Table 9-1. Buttons in the **Options** section of the **Setup** tab on the **Recipe Setup** screen

NOTE: Enter your selections carefully. There is NO un-delete functionality.

View Tab

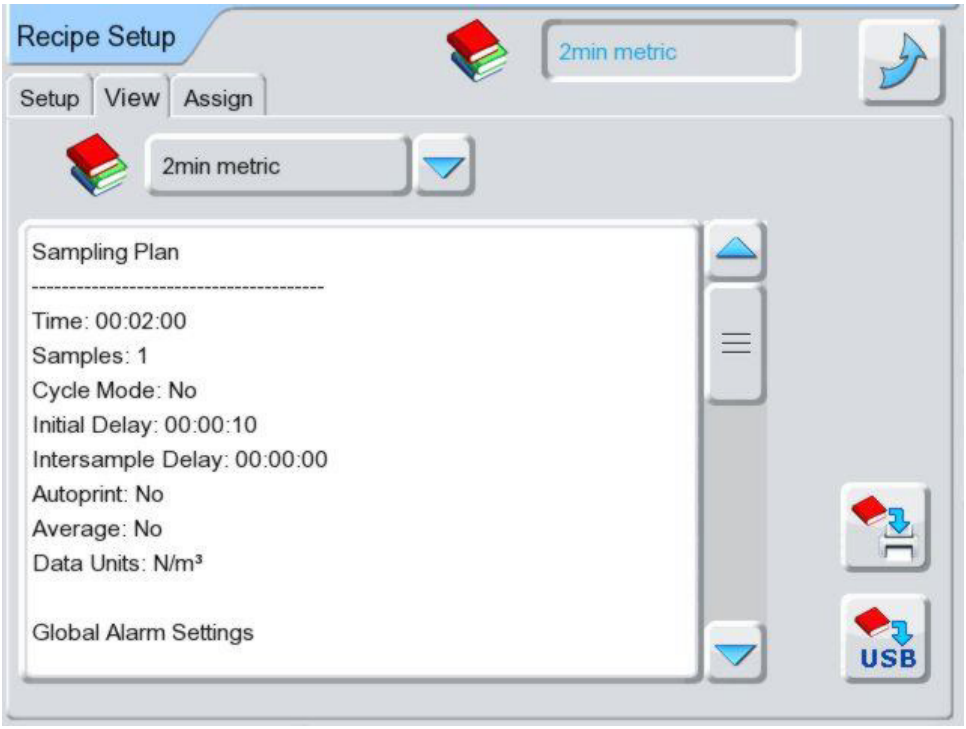

Figure 9-2. View tab of the **Recipe Setup** screen

Use the View tab to view the contents of the selected recipe.

Image	Name	Description
	Loaded Recipe Names	Press this button to display a list of recipes loaded in the particle counter. The name of the selected recipe displays to the left of this button. Press a name in the list to display the contents of the selected recipe in the view area.
	Print to USB Key	Prints selected recipe to the USB key. The button is enabled only when the USB key is attached.
	Print to Default Printer	Prints the selected recipe to the Lasair III thermal printer.

Table 9-2. Buttons and fields in the **Vie**w tab on the **Recipe Setup** screen

Assign Tab

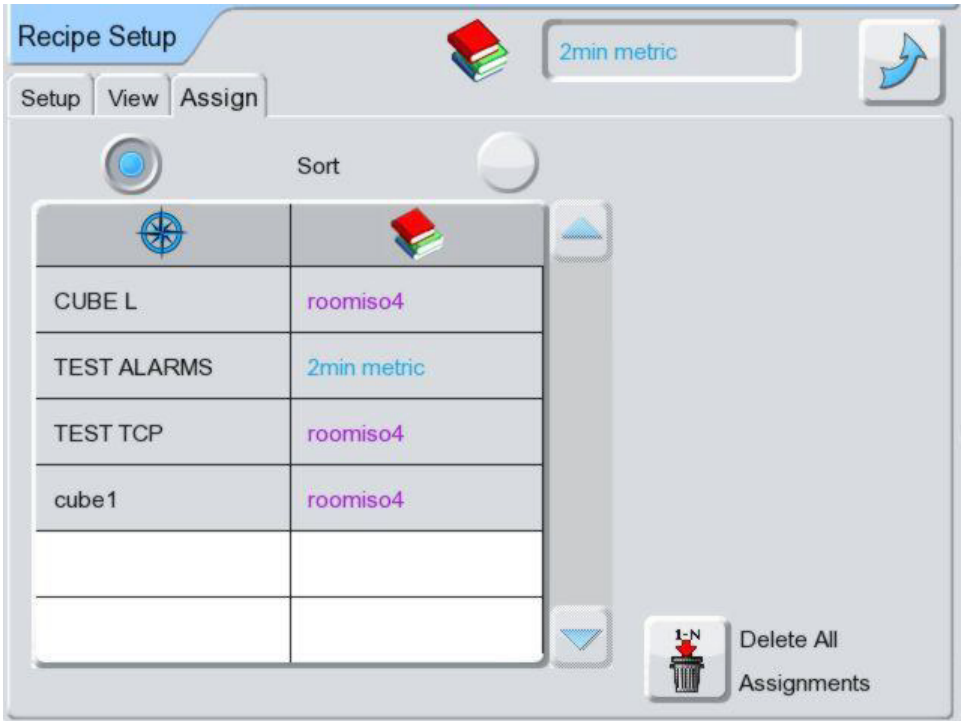

Figure 9-3. Assign tab of the **Recipe Setup** screen

Use the **Assign** tab to associate a recipe to a location or locations. When a recipe is associated to a location, whenever you select that location the associated recipe always loads.

NOTE: If password protection is enabled, the recipe automatically loads. Otherwise, without password protection, the system displays a dialog box prompting the user whether or not to load the recipe.

All locations automatically display on this screen. To assign a recipe to a location, click a location and then select a recipe from the drop-down list. The Location and its associated Recipe will display next to each other on the same line. Select the blank entry from the drop down list for a location where no recipe is associated with it.

Image	Name	Description
	Sort	Press the button on the left to sort the list by Location Name or press the button on the right to sort the list by Recipe Name.
	Location Name	Sort using this parameter by clicking the button to the top-left of the list.
	Recipe Name	Sort using this parameter by clicking the button to the top-right of the list.
	Delete All Associations	Erases the association between the selected location and recipe for all locations listed.

Table 9-3. Buttons and fields in the **View** tab on the **Recipe Setup** screen

Recipe Importing and Exporting Information

The Lasair III recipe feature allow importing and exporting of recipes between different instrument types.

When importing and exporting recipes, note the following:

1. Moving a recipe between instruments with different flowrate may result in unexpected sample times or sample volumes. The Lasair III can sample by time or by volume, and this information is recorded in sample recipes.
   - For example, if a one minute sample recipe is exported from a 310C and imported to a 5100, then the sample volume on the 5100 will be 100 liters rather than 1 ft^3, in order to keep the time the same.
2. Moving a recipe between instruments with different channel sizes may result in missing alarms.
   - For example, a recipe created on a 310C, with an alarm of 1000 counts @ 0.3 µm, will be unable to import that alarm setting properly on a 5100, since there is no 0.3 µm channel.
3. Moving a statistics recipe between instruments with different channel sizes may result in some adjustments to the statistics, if the channel size is not supported in the new instrument.
4. Recipes, locations, and location assignment files from a Lasair II may be imported intoa Lasair III. This can only be done via the Web Server interface. See **Appendix G** for additional details on this feature. Recipes cannot be exported from a Lasair III back to a Lasair II.

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Chapter 10
Statistics Mode

This chapter describes setup and operation of the Lasair III particle counter for use with certification statistics. When used for this purpose, it is said to be in the Statistics Mode.

Depending on the chosen certification standard and other variables, the Lasair III particle counter will determine the minimum requirements to certify a cleanroom.

Lasair III particle counter supports the following standards:

- ISO 14644-1-1999
- ISO 14644-1-2015
- EU GMP Annex 1
- China GMP (when in Chinese language)
- Simultaneous EU GMP Annex 1 and ISO 14644-1-1999
- FS-209E

In addition, the Average mode (standard mode) calculates simple statistics on data from one or more locations.

The settings that may be changed vary with the Average mode. If the selected standard does not allow change to a variable, that variable is disabled in the setup screen.

Features

The Lasair III particle counter provides the following features while in Statistics mode:

- Auto-Increment to Auto Track
- Automatic calculation of valid parameter ranges
- **Room name saved as part of the data set:** This is useful for performing certifications of several areas at one time, then downloading Comma Separated Value (CSV) data at a later time for off-line calculations.
- **A Sample Acknowledge mode:** This mode allows you to verify each sample before accepting it as valid data. Rejecting the sample results will prevent its use in the statistical calculations.
- **An Auto-Location-Increment mode:** In this mode, the system automatically selects the next location number, without the user manually setting it.
- **An Auto-Track mode:** This mode enables the system to auto increment names/ numbers of the next location to be selected for sampling.

Screens

- **Statistics Setup screen:** Select the type of statistics to collect, set the appropriate parameters for the statistical method, and enable or disable the Lasair III particle counter Statistical mode.
- **Statistics Summary screen:** View on-the-fly statistics as each sample is completed as well as a location by location data table. This screen is available only in Statistics Mode.
- **Sampling Setup screen:** Select the correct location name, and to set initial and intersample delays.

Screen Detail

The following screens are functionally changed when the Statistics mode is enabled. The differences for each screen in the Statistics mode are provided below.

Sample Setup Screen

- Sample size is locked when the Statistics mode is enabled. Also, samples are listed by volume, not time.
- You can only display normalized counts, not raw counts.
- Units cannot be changed while Statistics mode is enabled.
- Continuous sampling cannot be selected.
- Group repeat mode cannot be selected.
- The # Samples range is restricted depending on the standard selected. If Sample Acknowledge is ON, only one sample may be taken at a time.
- When numeric locations are used, the location list is replaced by an Integer box.

Main Display Screen

Figure 10-1. Main Display screen in **Statistics** mode

In Statistics mode, some buttons and fields are different in the Main Display screen:

- The Statistics Off button replaces the Trend or Histogram button. Press this button to exit Statistics Mode.
- The Summary Statistics button replaces the Change Display button. Press this button to view summaries of statistics results, data, and environment.
- The Differential Counts column is replaced with a Concentration Limit Target column or, if the Average mode is selected, a Mean Value column.
- The standard and class is printed above the data table.

Results Tab

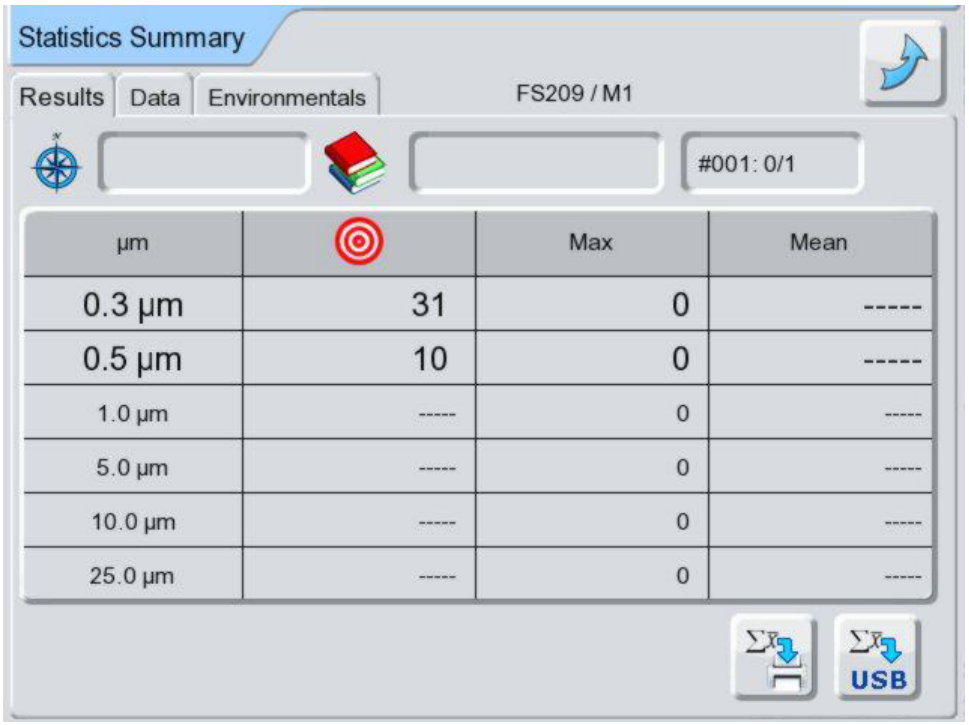


Figure 10-2. Results tab of the **Statistics Summary** screen

Use the Results table to view statistics summary data. Any out-of-range values that would cause the statistics certification to fail are shown in red in the table. The Results table has the following columns:

- Particle size
- Target maximum value concentration (except for average mode)
- The maximum concentration of all sampled locations
- Mean value (for average mode only)

Data Tab

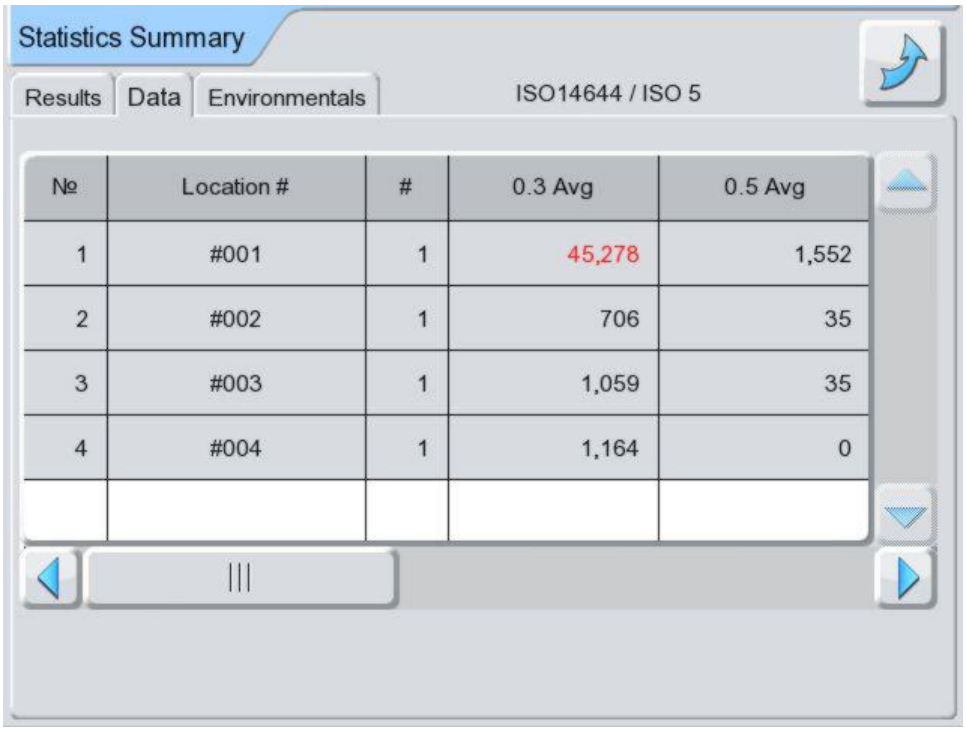


Figure 10-3. Data tab of the **Statistics Summary** screen

Use the Data table to view statistics data at specific locations. The Data table has the following columns:

- **No:** Represents the row number
- **Location #:** Represents the given Location
- **#:** Number of samples taken, displayed in red if the value is greater than 1 but less than the number of samples needed in the plan.
- **0.3 Avg or 0.5 Avg:** Represents the particle counts by particle size, displayed in red if they are above the statistical target.

Cleanliness Standards

The standards tables are reproductions of the targets for each of the international standards supported by the Lasair III particle counter. The blank areas of the tables represent invalid settings. For example, the ISO 14644-1 standard does not allow certification of a Class 1 cleanroom using a 0.3 µm or greater particle size.

ISO 14644-1:2015 Standard

The document, ISO 14644-1:2015(E), was used when designing the ISO 14644-1:2015 module. This module supports all classes as well as intermediate X.5 classes. As per the standard, the Class ISO 5 is supported at 5.0 µm only if a smaller particle size is also used.

Class	0.1 µm	0.2 µm	0.3 µm	0.5 µm	1.0 µm	5.0 µm
ISO 1	10					
ISO 1.5	32					
ISO 2	100	24	10			
ISO 2.5	316	75	32			
ISO 3	1,000	237	102	35		
ISO 3.5	3,160	748	322	111		
ISO 4	10,000	2,370	1,020	352	83	
ISO 4.5	31,600	7,480	3,220	1,110	263	
ISO 5	100,000	23,700	10,200	3,520	832	29*
ISO 5.5	316,000	74,800	32,200	11,100	2,630	
ISO 6	1,000,000	237,000	102,000	35,200	8,320	293
ISO 6.5	3,160,000	748,000	322,000	111,000	26,300	924
ISO 7				352,000	83,200	2,930
ISO 7.5				1,110,000	263,000	9,240
ISO 8				3,520,000	832,000	29,300
ISO 8.5				11,100,000	2,630,000	92,400
ISO 9				35,200,000	8,320,000	293,000
**ISO 5 at 5 µm requires a smaller particle size to be used as well.*						

Table 10-1. ISO 14644-1:2015 Standard Class Details

ISO 14644-1:1999 Standard

The document, ISO 14644-1 (1999-05-01), was used when designing the ISO 14644-1:1999 module. Only the classes specified in the document's tables have been implemented. The Lasair III particle counter does not support intermediate class sizes or intermediate particle sizes.

Maximum Particles per M^3						
Class	**0.1 µm**	**0.2 µm**	**0.3 µm**	**0.5 µm**	**1.0 µm**	**5.0 µm**
ISO 1	10	2				
ISO 2	100	24	10	4		
ISO 3	1,000	237	102	35	8	
ISO 4	10,000	2,370	1,020	352	83	
ISO 5	100,000	23,700	10,200	3,520	832	29
ISO 6	1,000,000	237,000	102,000	35,200	8,320	293
ISO 7				352,000	83,200	2,930
ISO 8				3,520,000	832,000	29,300
ISO 9				35,200,000	8,320,000	293,000

Table 10-2. Maximum Particles - ISO 14644-1 Standard

Use the following sources for more information about ISO 14644-1:

International Standards Organization
Web Site: www.iso.org

Institute of Environmental Sciences and Technology
940 East Northwest Highway
Mount Prospect
Illinois, 60056 USA

Tel: 0101 708 255 1561
Fax: 0101 708 255 1699
E-mail: Publicationsales@iest.org or iest@iest.org
Web Site: www.iest.org

EU GMP Annex 1 Standard and China GMP

The EU GMP Annex 1 standard is based on the document “EC Guide to Good Manufacturing Practice; Revision to Annex 1.” This document is based on the current ISO-14644 standard and describes modifications to the standard for EU GMP Annex 1 classifications.

The China-GMP standard follows the same requirements as the EU-GMP requirements and is covered in this section.

As a derivative of the ISO standard, the EU GMP Annex 1 standard uses most of the ISO rules. However, a comparison of maximum particle counts between the two standards shows that the EU GMP Annex 1 is slightly different. The minimum sample volume is also different between the two standards. For Grade A, the sample volume is a minimum of 1 m^3 for each location of all samples taken.

Simultaneous EU GMP Annex 1 and ISO

The EU GMP Annex 1 & ISO mode allows the user to sample the cleanroom one time, then generate reports for both the EU GMP Annex 1 and the ISO 14644-1:1999 standards.

Table 10-2 shows EU GMP Annex 1 and corresponding ISO classes that can be calculated concurrently with the Lasair III particle counter.

EU GMP Annex 1 Grade	At Rest	In Operation
A	ISO 5	ISO 5
B	ISO 5	ISO 7
C	ISO 5	ISO 8
D	ISO 8	N/A

Table 10-3. EU GMP Grade and ISO classes

Maximum Particles per M^3				
	At Rest		In Operation	
Grade	**0.5 µm**	**5.0 µm**	**0.5 µm**	**5.0 µm**
A	3,520	29	3,520	20
B	3,520	29	352,000	2,900
C	352,000	2,900	3,520,000	29,000
D	3,520,000	29,000	Not Defined	Not Defined

Table 10-4. Maximum Particles - Simultaneous Standards

FS-209E Standard

The document, FED-STD-209E (11 September 1992), was used when designing the FS-209 module, and only the classes specified in the document's tables have been implemented.

If the number of locations is less than five, the number of samples required at each location is increased to a minimum of five samples. This may result in more samples being taken so that the Lasair III particle counter will accept the result.

Maximum Particles Per Unit Volume											
Class		0.1 µm		0.2 µm		0.3 µm		0.5 µm		5.0 µm	
SI	English	m^3	ft^3	m^3	ft^3	m^3	ft^3	m^3	ft^3	m^3	ft^3
M1		350		75.7		30.9		10.0			
M1.5	1	1,240	35.0	265	7.50	106	3.00	35.3	1.00		
M2		3,500		757		309		100			
M2.5	10	12,400	350	2,650	75.0	1,060	30.0	353	10.0		
M3		35,000		7,570		3,090		1,000			
M3.5	100			26,500	750	10,600	300	3,530	100		
M4				75,700		30,900		10,000			
M4.5	1,000							35,300	1,000	247	7.00
M5								100,000		618	
M5.5	10,000							353,000	10,000	2,470	70.0
M6								1,000,000		6,180	
M6.5	100,000							3,350,000	100,000	24,700	700
M7								10,000,000		61,800	

Table 10-5. Maximum Particles Per Unit Volume

Use the following sources for more information about ISO-14644-1 (which has replaced the FS-209E standard):

Institute of Environmental Sciences and Technology
940 East Northwest Highway
Mount Prospect, Illinois, 60056 USA

Tel: 0101 708 255 1561
Fax: 0101 708 255 1699
e-mail: Publicationsales@iest.org or iest@iest.org
Web Site: www.iest.org

Alarms in Statistical Mode

When the Statistics mode is enabled, global alarms are automatically disabled as well as the Alarm Setup screen. You must exit Statistics mode to change alarm parameters.

When the Statistics mode is disabled, global alarms will not be automatically re-enabled. If the global alarms function is desired, it must be manually enabled.

Communications in Statistics Mode

When the Statistics mode is enabled, TCP/IP is disabled.

Statistics Setup

From the Navigation panel, locate the SAMPLE group and press Statistics.

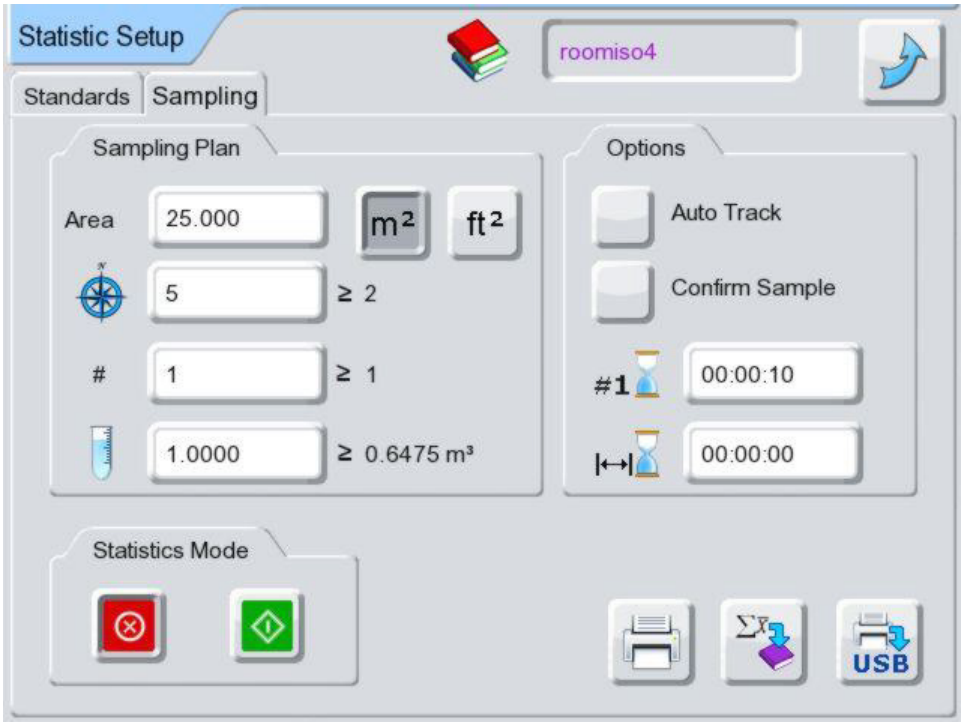


Figure 10-4. Sampling Plan section in the **Sampling** tab of the **Statistics Setup** screen

Use the Statistic Setup screen to enter settings for the area where sampling will take place. The Statistics Setup screen has two tabs:

- **Sampling Tab** on page 10-13
- **Standards Tab** on page 10-15

Enter the appropriate information on both tabs, and then press the green Enable button on the Sampling Mode/Statistics Mode tab.

Sampling Tab

Image	Name	Description
	Area	Input the area of the room to be certified in m^2 or ft^2. You cannot change this parameter once Statistics Mode is enabled.
	Location Count	The minimum number of the locations to be sampled. You can increment, but not decrement, this value once statistics is enabled.
	Samples Count	Number of samples to be taken at each location.
	Sample Volume	The minimum sample volume collected at each location.

Table 10-6. Sampling Plan buttons, **Sampling** tab on the **Statistic Setup** screen

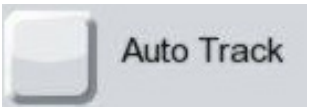
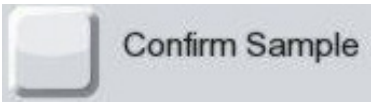
Image	Name	Description
	**Auto Track**	Enable to auto increment numbers of the next location to be selected for sampling.
	**Confirm Sample**	Enable to prompt user for an acknowledgement after each sample.

Table 10-7. Sampling Plan buttons, **Sampling** tab on the **Statistic Setup** screen

Image	Name	Description
	Disable	Use to go back to Particle Counting mode.

Table 10-8. Statistics Mode buttons, **Sampling** tab on the **Statistic Setup** screen

Image	Name	Description
	Enable	Use to switch to the Statistics mode.

Table 10-8. Statistics Mode buttons, **Sampling** tab on the **Statistic Setup** screen

Image	Name	Description
	Print to Default Printer	Automatically prints sampling results after each sample to the Lasair III thermal printer. This button is selected by default.
	Save Statistics Recipe	Saves the current statistics setup as a recipe.
	Auto Print USB	Prints sampling results to a USB key. This button is only activated when a USB key is inserted.

Table 10-9. Buttons in the **Sampling** tab on the **Statistic Setup** screen

Standards Tab

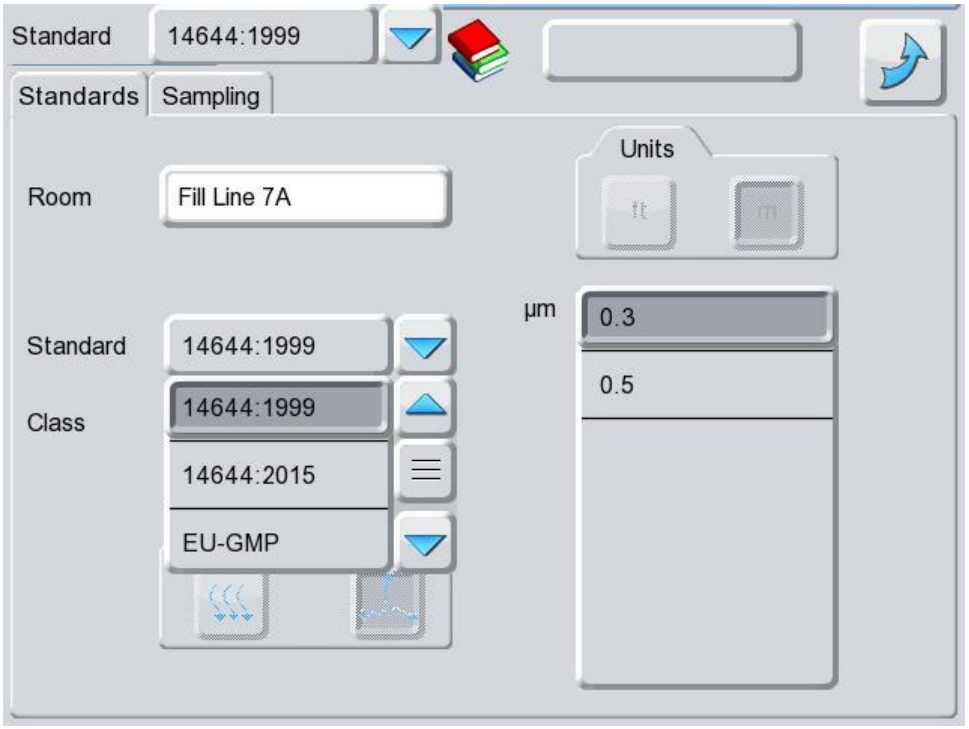


Figure 10-5. Standards tab of the **Statistic Setup** screen

Image	Name	Description
	Room	Name of room to sample.
	Standard	Title of cleanliness standard (ISO 14644:1999, ISO 14644:2015, EU GMP, etc.)
	Class	Available classes for the selected standard.

Table 10-10. Buttons and fields in the **Standards** tab on the **Statistic Setup** screen

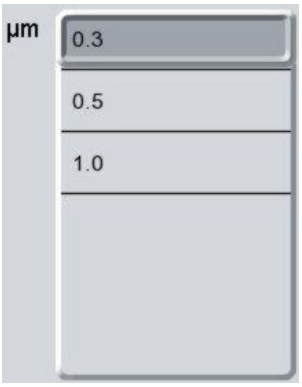
Image	Name	Description
	**Channels**	Selectable particle size

Table 10-10. Buttons and fields in the **Standards** tab on the **Statistic Setup** screen

Flow

Image	Name	Description
	Unidirectional Airflow	Defines the type of airflow as unidirectional. **NOTE:** FS-209E only.
	Multidirectional Airflow	Defines the type of airflow as multidirectional. **NOTE:** FS-209E only.

Table 10-11. Buttons in the **Flow** section of the **Standards** tab on the **Statistic Setup** screen

Units

Image	Name	Description
	Unidirectional Airflow	Selects feet as the unit of measure.
	Multidirectional Airflow	Selects meters as the unit of measure. **NOTE:** Settings for ISO-14644-1 and EU GMP standards force the use of meters.

Table 10-12. Buttons in the **Units** section of the **Standards** tab on the **Statistic Setup** screen

µm

Image	Name	Description
	Channels	For the FS-209 and ISO-14644-1 standards settings or for the Averaging function, you can select the particle size for the certified room. The Channels controls is a multi-selection vertical list with scroll bar. **NOTE:** For EU GMP, China-GMP, and EU GMP and ISO standards, the list contains only 0.5 and 5.0. The control is disabled if any other standard is chosen.

Table 10-13. Buttons in the **µm** section of the **Standards** tab on the **Statistic Setup** screen

About Location Numbers

In Statistics mode, you select locations by number rather than name.

Printing a Statistics Report

Press the Print button on the Lasair III particle counter, to print a report with details of the sampling results, or download the data to a computer for viewing and analysis.

Printout and Legend

The following is an example of the Lasair III particle counter's Statistics Report generated when a room is certified to the ISO 14661-1 standard. The lines have been numbered to allow a more comprehensive description of the information provided below the printout.

Sample Statistics Report

1	**Cleanroom Certification Report**			
2	Heading One			
3	Heading Two			
4	Instrument ID:			Lasair III
5	Serial Number:			82217
6	Calibrated:			01/01/2016
7	Batch ID:			Batch ID
8	Operator:			Operator Name
9	Location:			#001
10	Recipe:			Recipe Name
11	Date & Time:			01/01/2016 06:23:42
12	Certification Standard			
13	Standard:			ISO 14644
14	Class:			ISO 7
15	Particles Sizes:			0.5 µm
16	Certification Results: FAIL			
17	Sampling Plan			
18		Min	Plan	Actual
19	Area (m^2):	--	1.0	--
20	Locations/Rooms:	2	2	2
21	Samples/Locations:	1	1	2
22	Total Samples:	2	2	2
23	Min. Volume (m^3):	0.0283	0.0283	0.0283
24	Particle Data			
25		µ		(N/m^3)
26	Target:	0.5		352000.00
27	Max:	0.5		925124.00
28	95% U.C.L.:	0.5		0.00
29	Mean:	0.5		925124.00
30	S.D.	0.5		0.00
31	Location Averages			
32	Location		#	µ	∑(N/m^3)
33	#001		2	0.5	925124.00
33	#002		2	0.5	925124.00

Figure 10-6. Example Statistics Printout

Line No.	Displayed Text	Description
1	Cleanroom Certification Report	Title of Report.
2	Heading One	Heading 1 text specified in the Report Setup screen. Not shown if Heading One field is blank.
3	Heading Two	Heading 2 text specified in the Report Setup screen. Not shown if Heading Two field is blank.
4	Instrument ID	Name/ID of the particle counter that produced the data.
5	Serial Number	Serial number of the particle counter that produced the data.
6	Calibrated	Date on which the particle counter was last calibrated.
7	Batch ID	Batch ID text specified in the Report Setup screen. Not shown if Batch ID field is blank.
8	Operator	Operator text specified in the Report Setup screen or Security screen. Not shown if Operator field is blank.
9	Location	Location as specified by user.
10	Recipe	Name of the recipe used, if any. This field is not saved with data, and will only print from the Main screen, not from the saved Data Table. Sample Data that has been collected with a recipe will not indicate the recipe if the data is printed from the Data Table screen. If there is no recipe, this line is blank.
11	Date & Time	Date and time at which the first statistics were taken.
12	Certification Standard	Header for the certification standard information that follows.
13	Standard	The certification standard chosen. Possible values: • ISO 14644-1 • EU GMP Annex 1 • Simultaneous EU GMP Annex 1 and ISO 14644-1 • FS-209E

Table 10-14. Statistics Printout legend

Line No.	Displayed Text	Description
14	Class	The classification the room is being tested to meet.
15	Particle Sizes	Particle size of interest.
16	Certification Results	Results of certification. Possible values: • **PASS:** Sampling met certification standards. • **FAIL:** Sampling did not meet certification standards. • **INCOMPLETE:** Sampling was not completed.
17	Sampling Plan	Header for sampling plan that follows.
18	Min Plan Actual	Number of samples to be taken. • **Min:** Minimum number of samples to be taken • **Plan:** Number of samples planned to be taken • **Actual:** Actual number of samples taken.
19	Area	The area of cleanroom being certified.
20	Locations/Rooms	The number of locations to be sampled. For column definitions, see line 18 above.
21	Samples/Locations	Number of samples taken at each location. For column definitions, see line 18 above.
22	Total Samples	Total number of samples taken.
23	Min. Volume	Minimum volume to be sampled.
24	Particle Data	Header for the particle data that follows.
25	µ (N/m³)	Column headers: • **µ:** Particle size in microns. • **N/m³:** Normalized particle counts per cubic meter.
26	Target	The particle size of interest. For column definitions, see line 25 above.
27	Max	The maximum value of the samples averaged.
28	95% U.C.L.	Statistical Upper Confidence Limit (for 2–9 locations only). For column definitions, see line 25 above. Only for ISO 14644-1:1999.
29	Mean	Mean of all locations. For column definitions, see line 25 above.

Table 10-14. Statistics Printout legend

Line No.	Displayed Text	Description
30	S.D.	Standard Deviation of all location means. For column definitions, see line 25 above.
31	Location Averages	Header for the location data that follows.
32	Location # µ ∑(N/m³)	Column headers for data that follows. • Location – Location of sample • # – Number of samples taken at location. • µ – Particle size sampled. • ∑(N/m³) – Number of particles detected and normalized per cubic meter.
33	#001 2 0.5 925124.00	Summary of sample at each location for the particle size chosen. For column definitions, see line 32 above.
Not shown	Deleted Samples	Number of samples removed from statistical summary.

Table 10-14. Statistics Printout legend

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Chapter 11
Performing Routine Maintenance

This chapter describes the maintenance you can perform at your location, and includes information for:

- **Cleaning and Disinfecting the Enclosure** on page 11-1
- **Replacing the Printer Paper Roll** on page 11-3
- **Reconditioning the Battery** on page 11-4
- **Calibration Reminder** on page 11-5
- **Other Maintenance** on page 11-5

NOTE: There are no user-serviceable parts inside the Lasair III particle counter case.

Cleaning and Disinfecting the Enclosure

The Lasair III particle counter is streamlined design minimizes particle traps and makes the unit easy to clean. The enclosure case is made of polycarbonate. The tempered glass display screen is sealed around its edges to IP65.

CAUTION
Although the Lasair III particle counter is resistant to liquids, it is NOT liquid proof. Do not submerge the particle counter in any liquid or apply large amounts of liquid to the instrument to prevent ingress of liquid. Always wipe away free standing liquid and wet wipe the particle counter after applying a cleaner. Never put liquids into the air intake port. Never wipe the display screen with anything that is hard or sharp.

Recommended Cleaning Agents

The following cleaning agents are recommended to clean and disinfect the enclosure case of the particle counter:

- Bleach, typically 0.5%-1% concentration
- Ethyl/isopropyl alcohol (in a solution of less than 70 percent)
- Peroxide/quaternary ammonium solutions

Call Instrument Service and Support at Particle Measuring Systems (1-800-557-6363) for advice about other cleaning chemicals.

To Clean the Enclosure Case:

WARNING
Always wear eye protection when working with cleaning chemicals.

WARNING
Disconnect the power cord from its power source.

1. Turn the particle counter off, unplug the power cord from the power source and particle counter, and remove the battery.
2. Disconnect all other cables and tubes.
3. Remove the sample probe and cover the sample inlet.
4. Dampen a cleanroom wipe or other cloth with the cleaning solution and then wipe the enclosure case. You can also wipe the printer cover and sample probes in this manner.
5. Follow this cleaning solution wipe, with a wipe or cloth damped with water.

CAUTION
Although we recommend the wipe method, you can use a spray solution on the front, sides, and top of the enclosure. However, do NOT use a spray on the back of the case to avoid reaching the electrical connections.

Replacing the Printer Paper Roll

To load the paper roll:

1. With one hand, grasp the printer enclosures by the two top tabs on each side, and while pushing down pull out to flip the cover open.
2. Remove the old paper roll and insert a new roll of paper, with the end of the paper coming toward you off the top of the roll.
3. Ensure that about one inch (2.5 cm) of paper extends beyond the cutter at the top of the paper enclosure and that the paper roll is not crooked in the enclosure.
4. While holding the end of the paper in place against the instrument case, close the cover until it clicks to ensure that it is completely closed.
5. Press the Print key to test the paper installation and that the paper advances correctly.

NOTE: The paper rolls have a pink indicator strip near the end of the roll. When you see the pink strip, you have only a few feet of paper remaining on the roll. Replace the expended roll to ensure that you have enough paper for the next printing.

Reconditioning the Battery

Over time, the battery charge level indicator will cease to accurately indicate the actual battery charge. This can also be indicated with a B1E, B2E, or BBE message on the instrument status screen.

To maintain the accuracy of the charge indicator:

1. The external battery charger should be used to condition the battery.
2. Press and hold the button on the external batter charger to begin a conditioning cycle. This cycle can take from 1-8 hours.

Reconditioning of the battery can also be done directly with the Lasair III. To accomplish this, the battery should be fully charged to 100% and then discharged completely without shutting the unit off or any recharging of the battery. This can be accomplished by running the unit only on battery power without the main power connected until the unit automatically shuts off.

Once the battery is fully discharged, recharge the battery to 100% without turning the unit on. This can be accomplished by charging the unit for 6-8 hours.

Battery Disposal

At end-of-life, batteries should be recycled or discarded safely. The batteries used can typically be disposed in municipal waste. However, you need to follow your local guidelines for battery disposal. Your local waste authority will have information on return and collection systems in your area.

Calibration Reminder

Calibration should be performed once each year. Particle Measuring Systems provides calibration services at our Boulder, Colorado facility. You can schedule your calibration in advance to ensure that you can use your instrument up to the scheduled servicing.

- Turnaround time for calibration is typically five business days when service work is scheduled at least four 4 weeks in advance.
- The calibration reminder can be set for either a 6 month notification or a 12 month notification, or it can be disabled and no notification is provided.

Schedule the calibration online at http://www.pmeasuring.com/services or call Instrument Service and Support 1 (800) 557-6363 or (303) 443-7100.

Other Maintenance

For other maintenance needs, including ALL servicing inside the instrument, contact Instrument Service and Support at Particle Measuring Systems at 1 (800) 557-6363 or (303) 443-7100.

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Appendix A
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 deprocédures 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 posso 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 pveligrosa.

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

Warnschilder

Die, an dem Gerat 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:

Symbolo	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 B
Electrical Connections

Electrical Connections

There are three USB ports on the Lasair III particle counter for exporting sampling data and/or connecting a USB keyboard:

- One on the front panel
- Two on the back panel

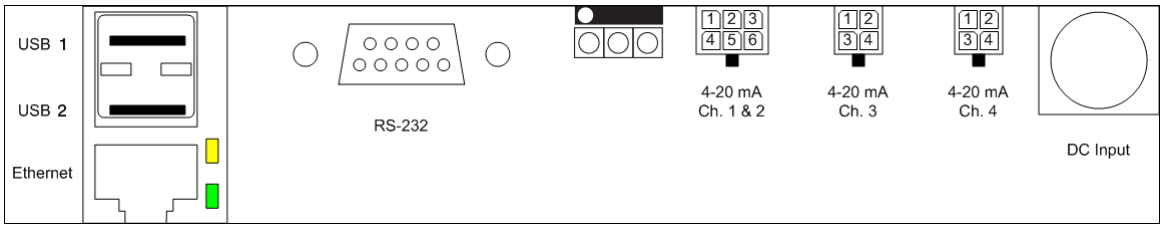


Figure B-1. Electrical connections - back panel

NOTE: The Lasair III particle counter DOES NOT support USB hub devices or memory card readers.

Electrical connections are located on the back panel of the unit, and include:

- Ethernet port
- Two (2) USB connections
- RS-232 connection
- Two (2) – single channel 4-pin 4-20 mA connections
- One (1) – dual channel 6-pin 4-20 mA connection
- DC Input (+20VDC 120 watts)

CAUTION
This is a LOW POWER DEVICE. Connect ONLY low voltage power accessories to the auxiliary power output to avoid damage to the unit.

Cable Pin-outs

Following is the cable pin-out information for the Lasair III particle counter.

RS-232	
Pin Number	**Signal**
1	NC
2	TxD
3	RxD
4	NC
5	Gnd
6	NC
7	CTS
8	RTS
9	NC

4-20 mA Ch1 & 2	
Pin Number	**Signal**
1	+24 VDC
2	Ch 1 In
3	Gnd
4	+24 VDC
5	Ch 2 In
6	Gnd

4-20 mA Ch3	
Pin Number	**Signal**
1	+24 VDC
2	Ch 3 In
3	Gnd
4	Gnd

4-20 mA Ch4	
Pin Number	**Signal**
1	+24 VDC
2	Ch 4 In
3	Gnd
4	Gnd

Input Power DIN	
Pin Number	**Signal**
1	+20 VDC
2	+20 VDC
3	Gnd
4	Gnd

Appendix C
Configuring Communications

This appendix includes information for configuring communications for:

- PMS Software and Communication Protocols
- 3rd Party Serial Communication Interfaces

Use the Comm/Port Setup screens on the Lasair III particle counter to set addressing parameters, and to enable/disable various network communication protocols (described in **Comm/Port Setup** on page C-2).

The fixed parameters that cannot be adjusted are described in **Fixed Parameters** on page C-5. The Comm/Port Setup screens are also used for configuring a Web Browser and TouchRAM. However, directions for configuring these options are covered in separate appendices to allow for inclusion of more extensive information specific to these options. Refer to the following appendices for additional information:

- Web Browser – **Appendix G**
- TouchRam – **Appendix F**

Comm/Port Setup

From the Navigation panel, locate the SETUP group and press **Comm/Port**. Use the **Comm/Port Setup** screen to set up the COMM port.

There are four setup tabs in the **Comm/Port Setup** screen:

- **Network Tab** on page C-2
- **Serial Tab** on page C-4
- **Environmental Tab** on page C-6
- **TouchRAM Tab** on page F-2 (**Appendix F**)

Network Tab

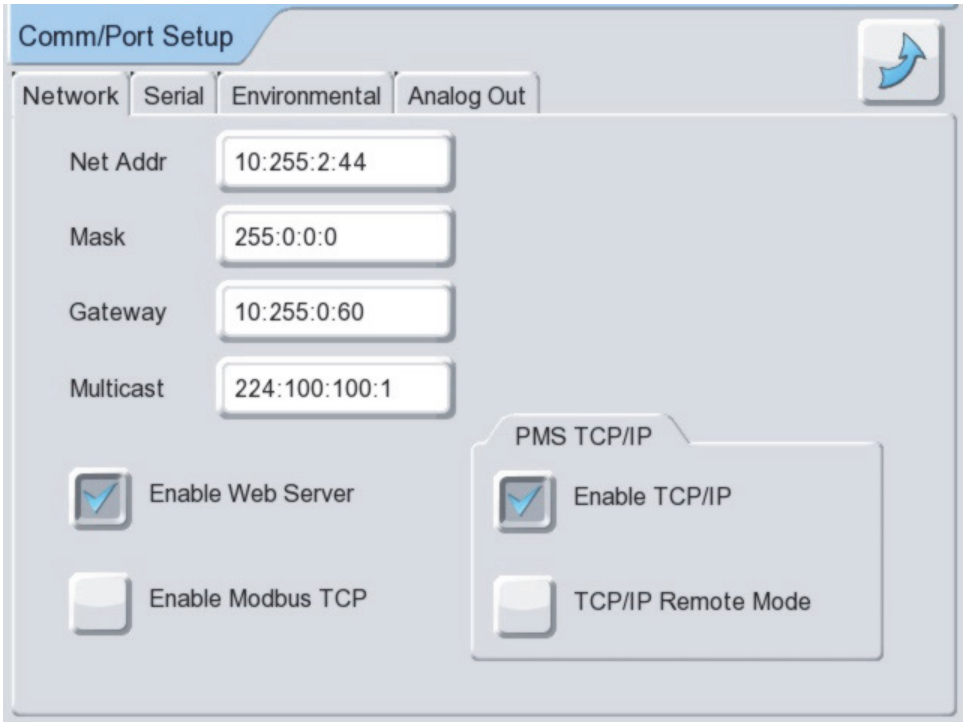


Figure C-1. Network tab of the **Comm/Port Setup** screen

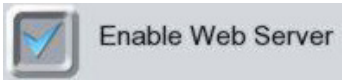
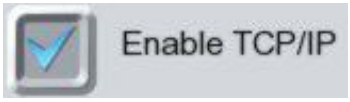
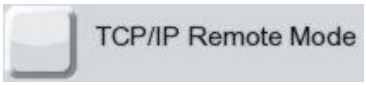
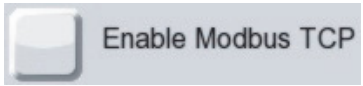
Image	Name	Description
	Net Address	Unique IP address of the Lasair III particle counter in the form of **aaa.bbb.ccc.ddd**. Each 3-digit series is a value of 0–255, separated by a colon (:).
	Net Mask	The mask that separates the network address from the host address, allowing the instrument to communicate outside of its local network. Enter as **aaa.bbb.ccc.ddd**. Each 3-digit series is a value of 0–255, separated by a colon (:).
	Gateway	Gateway used when communicating across networks. Enter as **aaa.bbb.ccc.ddd**. Each 3-digit series is a value of 0–255, separated by a colon (:).
	Multicast	Used when using PMS control software (DataAnalyst, Facility Net, or Pharmaceutical Net). Enter as in a form of **aaa.bbb.ccc.ddd**. Each 3-digit series is a value of 0–255, separated by a colon (:).
	**Enable Web Server**	Allows connection to from a Web browser such as Internet Explorer or Firefox. (Disabling this function prevents remote control and data viewing.)
	**Enable PMS TCP/IP Protocol**	Enables the PMS TCP/IP protocol that attaches the instrument to PMS control software. Disabling this function prevents the use of these applications.
	**Enable Remote Mode**	Enables the particle counter for temporary use as a Remote instrument away from PMS control software. When connected back to the control software, it will download data collected and stored in the particle counter. Enable TCP/IP must also be checked.
	**Enable Modbus TCP**	Enables Modbus TCP protocol for communicating with the instrument using third-party tools. See **Appendix H**.

Table C-1. Network tab of the **Comm/Port Setup** screen

For more information:

- Refer to **Appendix O** and **Appendix P**

Serial Tab

Figure C-2. Serial tab of the **Comm/Port Setup** screen

Use the Serial tab of the Comm/Port Setup screen to select the RS-232 port interface protocol, as well as set additional parameters associated with serial communications. For information on basic details, refer to **Appendix P**.

NOTE: When the serial interface mode is changed, the changes happen immediately.

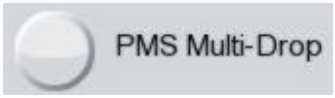
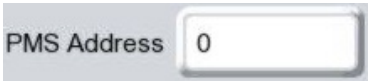
Image	Name	Description
	Lasair	Allows starting and stopping the instrument, collecting data, and setting various configuration parameters.
	PMS Multi-Drop	Requires a unique address for each instrument.
	PMS Address	Unique address for each instrument in the form of a 2-digit number. The PMS Multi-Drop mode must first be enabled to activate this field.
	Service	Service mode reserved for use by PMS Service personnel.
	SIO Baud	Baud rate for serial I/O port.

Table C-2. Fields in the **Serial** tab of the **Comm/Port Setup** screen

Fixed Parameters

The following communication parameters are fixed, and cannot be adjusted:

- **Parity:** none
- **Stop bits:** 1
- **Data bits:** 8

Flow Control: depends on protocol. “Lasair III” mode uses software flow control (CTRLQ/CTRL-S). “PMS Multi-Drop” mode does not have flow control.

Environmental Tab

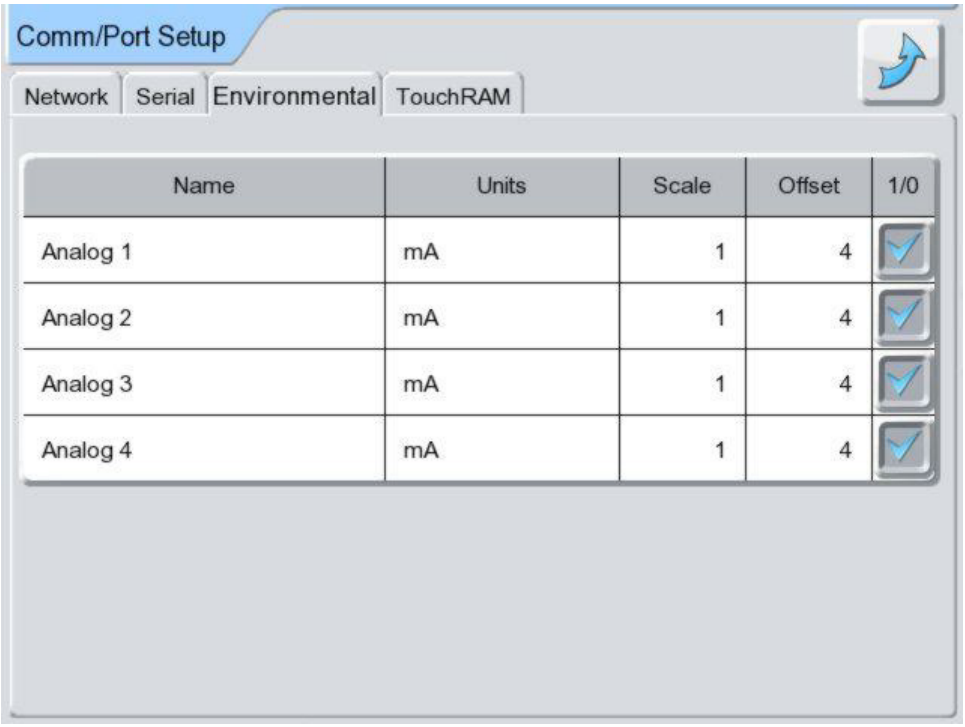


Figure C-3. Environmental tab of the **Comm/Port Setup** screen

Use the of the Comm/Port Setup screen to assign the Lasair III particle counter the ability to attach up to four (4) sensors and set the parameters for these analog input channels. These parameters are used to convert input analog signal to a readable value. For more information refer to **Appendix L**.

Each row of **Table C-3** defines the parameters for an input channel.

Image	Name	Description
	Name	Name for the analog channel (up to 16 alphanumeric characters). The default value is “AnalogN,” where N is the number of the analog channel.
	Units	Measurement units that will print for analog channel (up to 10 alphanumeric characters). The default value is mA.
	Scale	Scaling factor for analog channel. The field is initially 1. **NOTE:** Scale = Total sensor range / 16.
	Offset	Individual sensor is disabled. (Default) **NOTE:** Offset = Minimum sensor value.
   	I/O **Checkbox Disabled** **Checkbox Enabled**	Individual sensor is enabled. If the sensor is enabled, its measurements will be displayed on the screen, included in the printouts and the data record or output, and can be used to trigger alarms.

Table C-3. Fields in the **Environmental** tab of the **Comm/Port** Setup screen

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Appendix D
Downloading to PMS Control Software

Data on a Lasair III particle counter can be downloaded to PMS control software, including DataAnalyst, Facility Net, or Pharmaceutical Net, by means of either a Real-Time-Station or a Network Station.

Consider the following two cases when planning for downloads:

- **Case A** – The Lasair III particle counter is used as a mobile monitor; data may come from multiple locations.
- **Case B** – The Lasair III particle counter is in a fixed monitoring position; all data comes from the same location.

Preparations for Setup

- Verify that the particle counter ID for each Lasair III particle counter used is unique.
- Verify that each location name is unique.
- Obtain a unique, static IP address, Subnet Mask, and Gateway from your IT Department.
- If using Facility Net or Pharmaceutical Net, ensure that you are using version 3.1 or later.

Configuring Communication

Verify that the Lasair III particle counter is not already connected to the PMS control software (or to any other communications or control network).

To verify the Lasair III is not already connected to PMS control software:

1. Set the Lasair III particle counter to the unique IP address, Net Address, and Mask provided by your IT Dept.
2. Verify that the Lasair III particle counter is set to the standard Multicast number: 224.100.100.1 or as set by end user.
3. Enable the following options on the Comm/Port Setup screen, Network tab:
    - Case A – For mobile monitoring:
      1) Enable TCP/IP
      2) TCP/IP Remote Mode
    - Case B – For fixed monitoring:
      1) Enable TCP/IP ONLY.
4. Reboot the particle counter.

Downloading Data

Case A: Mobile monitoring from multiple locations

1. Manually collect sample data with the Lasair III particle counter.
2. Connect the Lasair III particle counter to the PMS control software via Ethernet ports on the particle counter and the computer.
3. Configure the control software for the Lasair III particle counter.
4. The system creates automatic sampling points for all Lasair III particle counter location names, and the data is automatically downloaded to the PMS control software.
5. The system prompts you with the option to either automatically or manually erase all historical data in the Lasair III particle counter.
6. The PMS software automatically disconnects from the particle counter.

Control Software Configuration

Refer to the DataAnalyst User's Manual (or User's Manual for the PMS control software you are using) for information on configuring the control software.

Case B: Fixed collection from a single location

1. Connect the particle counter to the PMS control software via Ethernet ports on the particle counter and the computer.
2. Configure the PMS control software for the Lasair III particle counter.

The PMS control software directs the Lasair III particle count to periodically/continuously sample, and automatically download to the software in real time.

NOTE: Historical data in the particle counter must be erased manually.

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Appendix E
Comma Separated Value (CSV) Format

With this file format, you can properly label the value headings. The following items are numbered in the order that they will appear in the CSV file. The CSV file, however, will not include the order numbers. The CSV file output is in the UTF8 text format. Value Headings are printed in the language selected for instrument operation.

Ref. No	Value Heading	Data Description
1	Sample Date	Formatted YYYY/MM/DD
2	Sample Time	Formatted HH:MM:SS (End of Sample)
3	Sensor Name	User entered name. Up to 16 characters. Name is delimited by quotation (“) marks.
4	Sensor Type	Hard-coded value. Example: “Lasair-III-310C”
5	S/N	Sensor serial number. This value programmed during initial calibration.

Table E-1. CSV value format and description

Ref. No	Value Heading	Data Description
6	**Statistics**	This field is empty quotation marks (“”) if statistics are not used. If they are used, then the field contains both the name of the room in which the statistics were taken and, the type. The type can be FS-209E, ISO-14644-1, EU GMP, ISO and EU GMP, or AVERAGE. The room name is prepended before the statistics type with a “--” separating the two. • An example is “BallroomA--FS209E”. Maximum room name length is 16 characters, thus the maximum string length is less than 32 characters.
7	**Location Changed**	When outputting a CSV block, this field will be set to an asterisk “*” if the location has changed from the last record printed. Otherwise, this field will be a period mark (.).
8	**Location**	User location name. Up to 16 characters. The name will be delimited by quotation (“) marks. Non-standard ASCII characters and Asian characters are printed in UTF8. This may use up to three 8 bit characters for a 16 bit character. Therefore, character names may be up to 48 characters when printed.
9	**Manifold**	The manifold position. The value will be zero (0) if no manifold exists. With a manifold, lowest number will be one (1).
10	**Laser OK**	1 = OK, 0 = bad. (Language independent)
11	**Flow OK**	1 = OK, 0 = bad. (Language independent)
12	**Sample Valid**	The sample will be declared invalid if the laser current is bad during the sample, or if the sample flow falls outside the 5% ISO limit, or if the user invalidates the sample manually (only under statistics mode).
13	**Sample Interval**	Time display. Format is HH:MM:SS
14	**Volume Units**	CF, CM, or L

Table E-1. CSV value format and description

Ref. No	Value Heading	Data Description
15	**Sample Volume**	Floating point value. In “Volume Units” given above.
16	**Number of Channels**	6 or 2. Normal output has 6 channels. If Pharmaceutical Two-Channel mode is enabled, (00.5 and 5.0 only), then output has 2 channels. If Pharmaceutical Two-Channel mode is enabled, data output will be different than the Lasair II particle counter.
17	**<10% Coinc.**	Coincidence error <10%
18	**Size 1**	Particle size for channel 1.
19	**Counts 1**	The total differential raw count value.
20	**Size 2**	See Size 1.
21	**Counts 2**	See Counts 1.
22	**Size 3**	See above. Not used in 2 channel mode.
23	**Counts 3**	See above. Not used in 2 channel mode.
24	**Size 4**	See above. Not used in 2 channel mode.
25	**Counts 4**	See above. Not used in 2 channel mode.
26	**Size 5**	See above. Not used in 2 channel mode.
27	**Counts 5**	See above. Not used in 2 channel mode.
28	**Size 6**	See above. Not used in 2 channel mode.
29	**Counts 6**	See above. Not used in 2 channel mode.
30	**Number Analogs**	This can vary from 0 to 4. • In USB or Web file downloads, the value will be between 0 and 4 depending upon the number of analog channels use. The Lasair III particle counter has 4 analog channels.
31	**Name 1**	User defined name (16 char max) for the analog channel. If the first character of the name is a “?,” that indicates the name has changed since the data sample was saved. (The data sample only has an index to the name.)
32	**Units 1**	User name (10 char max) for sensor units. If the first character of the units is “?,” that indicates the units has changed since the data sample was saved. (The data sample only has an index to the units.)

Table E-1. CSV value format and description

Ref. No	Value Heading	Data Description
33	**Average 1**	Average value for channel. Internally, the box will save the data as a 10 bit integer, and then apply the scale and offset when dumping the data.
34	**Min. 1**	Minimum value for channel. Stored internally as a 10 bit integer.
35	**Max. 1**	Maximum value for channel. Stored internally as a 10 bit integer.
36	**Name 2**	Same as Name 1
37	**Units 2**	Same as Units 1
38	**Average 2**	Same as Average 1
39	**Min. 2**	Same as Min. 1
40	**Max. 2**	Same as Max. 1
41	**Name 3**	Same as Name 1
42	**Units 3**	Same as Units 1
43	**Average 3**	Same as Average 1
44	**Min. 3**	Same as Min. 1
45	**Max. 3**	Same as Max. 1
46	**Name 4**	Same as Name 1
47	**Units 4**	Same as Units 1
48	**Average 4**	Same as Average 1
49	**Min. 4**	Same as Min. 1
50	**Max. 4**	Same as Max. 1
51	**Alarm Reason**	Text detailing the alarm reason. See **Chapter 6** for information on Alarm Reasons. The field is only provided if Alarm Reasons are enabled on the instrument, or if Alarm Reason data is stored in the database, even with the feature turned off. To eliminate this field, turn Alarm Reasons off and delete all data from the instrument. To add this field, turn Alarm Reasons on and configure the settings.

Table E-1. CSV value format and description

Appendix F
TouchRAM

The Lasair III particle counter can be used with an optional Touch RAM wand to add the convenience of accessing pre-programmed sampling recipes specific to various facility locations.

A small memory button is programmed with sampling parameters and a location name. The button can be permanently attached to the wall near a sample point location.

When the button is read with a special wand reader, the sampling parameters and location information are loaded into the Lasair III particle counter, eliminating the need to manually enter the data. This helps to eliminate operator entry errors, and prevents an operator from mistakenly using a recipe for the wrong location.

The memory button is programed by setting the desired sampling plan in the Lasair III particle counter, and then using the touch-wand to write this information to a memory chip in a data storage button.

NOTE: TouchRAM supports the use of most but not all Lasair III particle counter features. Statistical standards settings, for example, are not compatible with To uch RAM.

NOTE: Asian and other non-standard ASCII characters are not supported in the TouchRAM.

Comm/Port Setup

From the Navigation panel, locate the SETUP group and press Comm/Port.

TouchRAM Tab

Use the TouchRAM tab of the Comm/Port Setup screen to set up the COMM port for accessing pre-programmed sampling recipes.

Write	Enables TouchRAM functionality, including activating the Quick tab on the Sampling setup screen.
Write TCP/IP Address	Writes the current TCP/IP address of device to TouchRAM buttons. When a TouchRAM button contains a TCP/IP Address, data sampled from various locations can be conveniently downloaded to Pharmaceutical Net, and then analyzed and archived. In large facilities with several Pharmaceutical Net installations, it may be beneficial to be able to automatically change the TCP/IP address of the LASAIR when it is moved from one Pharmaceutical Net area to another. **NOTE:** The Enable TouchRAM Write option must be activated before you can enable this Write TCP/IP Address option.

Table F-1. Fields in the TouchRAM tab of the Comm/Port Setup screen

Setup for TouchRAM Wand Operation

1. On the Lasair III Comm/Port Setup screen, enable the Write mode on the TouchRAM tab.
2. Attach the TouchRAM wand to the to any connection (depending upon your setup) located on the back or front of the Lasair III particle counter.

3. Transfer the recipe from the wand to the TouchRAM button (typically mounted to a wall in a sampling point location). The TouchRAM button is now ready to be read, as needed, when sampling is in the corresponding area.
4. Position and hold the TouchRAM wand over the TouchRAM button to retrieve the sampling recipe for that particular area.

TouchRAM Button Data Format

The following data is written on Lasair III particle counter buttons:

Item	Name	Comments
Sample Parameters		
1	Location Name	Standard ASCII characters only. Non-ASCII location names may be truncated.
2	Sample Volume	Sample Time is not saved. Consequently, units with different flowrates will be programmed for the same volume, but not the same time.
3	Sample by volume or time	
4	Purge Delay (in sec)	Also sets Sample By Time of Day
5	Inter-Sample Delay (in sec)	This value programmed during initial calibration.
6	Volume Units (ft,m,l)	
7	Normalized or Raw Data Setting	
8	Group Repeat (on/off)	On/Off
9	Number of Samples	Also sets continuous sampling

Table F-2. TouchRAM value format and description

Item	Name	Comments
10	Print Sample Average (on/off)	
11	Auto Print Thermal Report (on/off)	Thermal print report
12	Trh Units	Not used in the Lasair III. Written for Lasair II compatibility. Set to degC, if sample volume is in m. Otherwise written as degF.
General Alarm Settings		
13	Global Alarms (on/off)	
14	Alarm Buzzer (on/off)	
15	Particle Alarms differential/ cumulative	
16	Particle Alarm, Channel 1	For the 310C and 350L, this channel is the 0.3 µm channel. For the 5100, this channel is the 0.5 µm channel for the 5100. In Pharma mode (2 channels) alarm channels 1 and 2 are used. This is the 0.5 channel alarm in two-channel pharma mode.
17	Particle Alarm, Channel 2	This channel used for 5.0 µm Channel Alarm in two-channel pharma mode.
18	Particle Alarm, Channel 3	
19	Particle Alarm, Channel 4	

Table F-2. TouchRAM value format and description

Item	Name	Comments
20	Particle Alarm, Channel 5	This channel used for 5.0 µm Channel Alarm in two-channel pharma mode.
21	Particle Alarm, Channel 6	
22	Chan 1 Alarm on/off	This channel used for 5.0 µm Channel Alarm in two-channel pharma mode.
23	Chan 2 Alarm on/off	This channel used for 5.0 µm Channel Alarm in two-channel pharma mode.
24	Chan 3 Alarm on/off	
25	Chan 4 Alarm on/off	
26	Chan 5 Alarm on/off	
27	Chan 6 Alarm on/off	
Analog Alarm Settings		
28	Rh High Alarm on/off	Not read in the Lasair III. Written for Lasair II compatibility only. Set to off.
29	Rh Low Alarm on/off	Not read in the Lasair III. Written for Lasair II compatibility only. Set to off.
30	Temp High Alarm on/off	Not read in the Lasair III. Written for Lasair II compatibility only. Set to off.
31	Temp Low Alarm on/off	Not read in the Lasair III. Written for Lasair II compatibility only. Set to off.
32	Temp Low Alarm Value	N/a - Lasair II only
33	Temp High Alarm Value	N/a - Lasair II only
34	RH Low Alarm Value	N/a - Lasair II only
35	RH High Alarm Value	N/a - Lasair II only

Table F-2. TouchRAM value format and description

Item	Name	Comments
36	Analog1 Low Alarm Value	
37	Analog1 High Alarm Value	
38	Analog2 Low Alarm Value	
39	Analog2 High Alarm Value	
40	Analog3 Low Alarm Value	
41	Analog3 High Alarm Value	
42	Analog4 Low Alarm Value	
43	Analog4 High Alarm Value	
44		
45	Analog 1 Low Alarm on/off	
46	Analog 1 High Alarm on/off	
47	Analog 2 Low Alarm on/off	
48	Analog 2 High Alarm on/off	

Table F-2. TouchRAM value format and description

Item	Name	Comments
49	Analog 3 Low Alarm on/off	
50	Analog 3 High Alarm on/off	
51	Analog 4 Low Alarm on/off	
52	Analog 4 High Alarm on/off	
Pharm-Net Communications		
53	Multi-Drop Serial Protocol Address	
54	TCP/IP Address	Optionally written if “Write TCP/IP TouchRAM” is set.
55	Network mask	Optionally written if “Write TCP/IP TouchRAM” is set.
56	TCP/IP Remote Mode (on/off)	Optionally written if “Write TCP/IP TouchRAM” is set.
57	Checksum	

Table F-2. TouchRAM value format and description

Model Compatibility

When reading a TouchRAM button, ensure that the button was written with the same model of Lasair III particle. Particle alarms are written and read in the buttons for each channel. The particle counter alarms are set on a channel by channel basis. For example, the first channel alarm on a Lasair III-510 particle counter (0.5 µm) is read as the first channel alarm on the Lasair III-310 particle counter (i.e., 0.3 µm).

Therefore, TouchRAM buttons written and read on different models may not give the expected results. TouchRAM buttons do not contain any information about the particle sizes and flowrate of the instrument.

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Appendix G
Working with a Web Browser

Using Browser Software

You can use your Web browser software to control the Lasair III particle counter from a separate computer through one of two kinds of connections:

- A direct cable connection to a computer
- A connection over an Ethernet network to a computer

Web Browser Interface Advantages

Using a computer-browser to access and control a Lasair III particle counter has the following advantages:

- The Lasair III particle counter can be accessed and controlled from a separate location.
- A keyboard and mouse can be used for data entry and editing.
- More data can be displayed on a larger screen.
- Data can be copied from the particle counter directly to the computer's hard drive, spreadsheet software, or database software.
- Asian and accented characters may be used when entering location names, recipe names, alarm reasons, Report fields (Heading 1, Heading 2, Batch ID, Operator), and the device ID found on the ***System Setup*** screen.
- Asian/Unicode user name support

Web Browser Interface Functions

- Display the particle and analog data from the Lasair III particle counter
- Configure the setup screens for sampling
- Start or stop sampling
- Download, save, or delete sample data
- Detect alarms
- Print reports
- Import and export recipes
- Import recipes from a Lasair II

Establishing Communications

The same steps will be used to connect with a Lasair III particle counter whether connecting over an Ethernet network or directly from a computer.

NOTE: Leaving the Lasair III particle counter edit screens active can also interfere with a remote connection. The Lasair III particle counter should always be left with the ***Main Display*** screen open.

NOTE: If someone else has control of the Lasair III particle counter either directly or from a Facility Management System (FMS) or computer, you will be unable to gain control of the particle counter.

To establish communications:

Follow these steps to establish communications between a computer and the Lasair III particle counter.

1. Start the particle counter and the computer.
2. If communicating directly to a computer, connect the Lasair III particle counter to the computer's Ethernet connection.
3. Open the browser software.

4. Click on the IP address field to select the entire address.
5. Type the Lasair III particle counter's IP address into the IP address field, and press ***Enter***. The ***Enter Network Password*** window displays.

You do not need to type "http://" or the non-significant zeros in the IP address. The address will be similar to the following example:

Figure G-1. Enter Network Password window

6. The ***User Name*** and ***Password*** fields must be filled with the appropriate credentials configured in the instrument security. Refer to **Security Setup Screen** on page 7-19.

NOTE: If the instrument security is enabled, user name and password credentials must be used to access the web browser interface.

NOTE: New sample startup is automatically disabled if a user is currently logged into the instrument.

Operating from a Web Browser

You can now navigate to Lasair III Setup pages, start or stop a sampling run, display the current or previous data for display, and refresh the display.

Like the touch screen of the Lasair III particle counter, the Sample and Setup pages of and the Web browser are intuitive to use. However, unlike the data displayed on the Lasair III instrument, the data displayed on the Web browser is not real-time. While sampling, the data on the Main Display is updated every 10 seconds.

Web Page Encoding

The Lasair III V1.3.xxx firmware uses UTF8 (a form of Unicode) for all web pages. Safari and Firefox work without any Encoding issues. Internet Explorer has the capability of “Auto-Select” Encoding. If this is enabled, it may cause character translation issues.

Incorrect character translation results in accented characters, Asian characters and mathematical symbols showing up as pairs or triplets of accented, meaningless characters. If this occurs, manually select “UTF8” character encoding for your browser.

Saving Sample Data File

Using Lasair III’s Save feature , the data file for a sample can be copied to another file so it can be saved for long-term retention or for data analysis.

To save sample data to another file:

1. On the ***Data*** page, click the ***Download Data*** (Save) icon to open the sample data file. The data displays in the following format:

```
“Sample Date”,  ”Sample Time”,  ”Sensor Name”
1970/01/01,  04:17:48, ””, “LasairIII-310C”,  0000
1970/01/01,  22:20:10,  ””,  “LasairIII-310C”,  0000
1970/01/04,  02:24:37,  ””,  “LasairIII-310C”,  0000
```

NOTE: The data starts with a header line. Each line after the header line is one sample record.

NOTE: The entire file is created in a Comma Separated Value (CSV) format with the date stored in a year/month/day format. For details about this format, see **Appendix E**.

2. Click on ***File*** > ***Save As*** in the browser's menu bar.
3. Complete the file name and file location information, and click Save.
4. Navigate to the file to verify that the save was completed.

Deleting Sample Data Records

After saving the data records using a Web browser, make sure to delete those same records from the Lasair III particle counter's memory to avoid duplication of data.

Recipe Importing and Exporting

The Web Server feature has two separate screens that allow importing and exporting recipes. On the ***Recipe Setup*** screen (see **Figure G-2** on this page), recipes may be saved as an all-in-one file. This file contains all recipes, locations and associations in a single file.

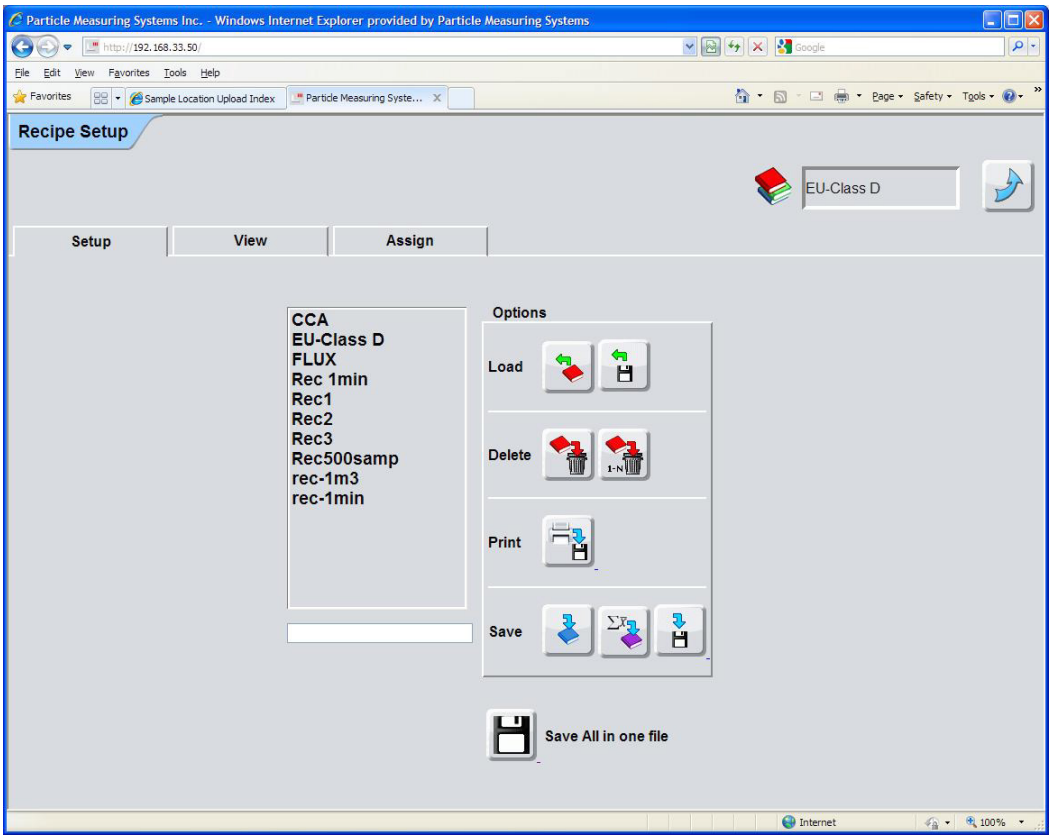

Figure G-2. Recipe Setup screen

Figure G-3 shows the second method for importing and exporting recipes. This screen is accessed via the ***System Setup***. Recipes, Locations, and recipe-location association files may be imported and exported individually to a PC using this screen.

The individual import feature supports importing the recipes, locations and associations previously saved from a Lasair II. Note that the recipes exported on this screen cannot be imported back to a Lasair II.

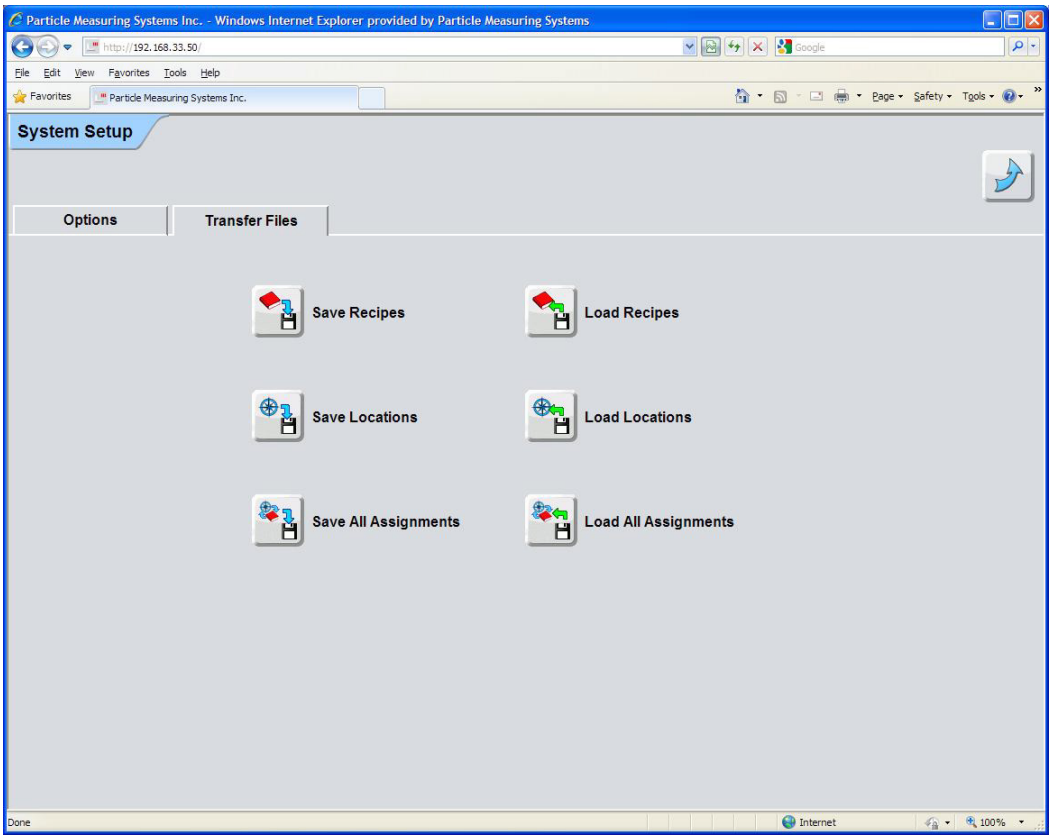

Figure G-3. Second method for importing and exporting recipes

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Appendix H
Modbus

Communications with the Lasair III particle counter are available via Modbus TCP. The instrument presents a single TCP/IP Ethernet connection at port 502 using the standard Modbus protocol. Two specification documents were used in the development of the Modbus interface:

- “MODBUS MESSAGING ON TCP/IP IMPLEMENTATION GUIDE V1.0b”
- “MODBUS APPLICATION PROTOCOL SPECIFICATION V1.1b”

The portable Lasair III particle counter unit allows the operator to enable/disable the Modbus interface on the communications screen.

Modbus Overview

Each register in the Modbus map is defined to be 16 bits. The map can contain three distinct 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
3	Read Holding Registers
4	Read Input Registers
5	Write Single Coil
6	Write Single Holding Register
15	Write Multiple Coils
16	Write Multiple Holding Registers
22	Mask Write Holding Register
23	Read/Write Multiple Holding Registers

- 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.

The map delineates three types of register assemblies:

1. **Unary** an individual register
2. **Dual** a register pair used for a 32 bit representation
3. **String** a group of registers containing ASCII bytes

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.

Even though the Modbus protocol itself is standard, the contents of the registers are application-specific. A description of the register map is the definitive specification for that application interface.

The following Modbus register map has comments and notes to help with its intended use.

Input Registers

The input registers are in two sections: Configuration and Data.

- The **Configuration** section description begins on this page.
- The **Data** description begins on page H-6.

Configuration

This section contains:

- Modbus Map Version
- Sensor Firmware Version
- Product Name
- Flow Rate and Volume Scale Factors
- Flow Rate
- Number of Channels (Particle and Analog)
- Particle Channel sizes

30001: **Modbus Map Version**	This is a fixed value representing the version number of the Lasair III Modbus map multiplied by 100. The version can change if/when the structure of the map is adjusted. **NOTE:** Additions and/or definitions to the spare entries will not generally require a version change.
30002: **Sensor Firmware Version**	This is a value representing the firmware version as follows: Main * 10000 + Major * 1000 + Minor (e.g. Version 1.9.006 would become a value of 19006).

Table H-1. Configuration descriptions

30003 - 30010: **Product Name**	Product name entered using ASCII bytes and positioned as shown in the map.
30011: **Flow Rate Scale Factor**	The power of 10 multiplied to the flowrate and then entered into registers 30013/30014 and 30222/30223. Used when the floating-point representation is disabled. The Lasair III uses a value of 3 to represent a fixed scaling factor of 1000 for flowrate.
30012: **Volume Scale Factor**	The power of 10 multiplied to the volume and then entered into registers 30224/30225. Used when the floating-point representation is disabled. The Lasair III uses a value of 4 to represent a fixed scaling factor of 10000 for volume.
30013 - 30014: **Flow Rate**	Dual-register representation of the nominal flowrate in cubic feet per minute. Can be integer or float depending on mode selected. The integer representation uses scale factor from register 30011.
30015: **Number of Particle** **Channels**	Processed as a variable but fixed to a value of six for the Lasair III.
30016: **Number of Analog** **Channels**	Processed as a variable but fixed to a value of four for the Lasair III.
30017 - 30028 **Dual-Register** **Representation of the Particle Channel Sizes in Nanometers**	The LasairIII channel sizes will vary depending on the specific model.The channel sizes for a LasairIII-350 are shown in **Figure H-1** on page H-19**.**

Table H-1. Configuration descriptions

Input Registers		Description (Configuration)	Comment	Notes
30001	unary	Modbus Map Version	Version 1.00 (Static 100)	
30002	unary	Sensor Firmware Version	Encoded Firmware version	
30003	unary	Product Name: Char 00, 01	Product Name	
30004	string	Product Name: Char 02, 03	Product Name	
30005	string	Product Name: Char 04, 05	Product Name	
30006	string	Product Name: Char 06, 07	Product Name	
30007	string	Product Name: Char 08, 09	Product Name	
30008	string	Product Name: Char 10, 11	Product Name	
30009	string	Product Name: Char 12, 13	Product Name	
30010	string	Product Name: Char 14, 15	Product Name	
30011	unary	Scale: Flow Rate	Multiplier in fixed: Flow Rate	3 (1000)
30012	unary	Scale: Volume	Multiplier in fixed: Volume	4 (10000)
30013	dual	Flow Rate (high)	Flow * 10 Scale cfm	Float Mode
30014	dual	Flow Rate (low)	Flow * 10 Scale cfm	Float Mode
30015	unary	Number of Particle Channels	Fixed number of sizes	6 fixed
30016	unary	Number of Analog Channels	Fixed number of analogs	4 fixed
30017	dual	Channel 1 Size (high)	nanometers	
30018	dual	Channel 1 Size (low)	nanometers	300
30019	dual	Channel 2 Size (high)	nanometers	
30020	dual	Channel 2 Size (low)	nanometers	500
30021	dual	Channel 3 Size (high)	nanometers	
30022	dual	Channel 3 Size (low)	nanometers	1000
30023	dual	Channel 4 Size (high)	nanometers	
30024	dual	Channel 4 Size (low)	nanometers	5000
30025	dual	Channel 5 Size (high)	nanometers	
30026	dual	Channel 5 Size (low)	nanometers	10000
30027	dual	Channel 6 Size (high)	nanometers	
30028	dual	Channel 6 Size (low)	nanometers	25000

Table H-2. Configuration section of the Input Register

Data

The Data section starts with what would have normally been considered configuration information - calibration date and serial number. This was added to allow for a single contiguous read when this particular information was desired along with the regular sample data. If not desired, then start reading at register 30212.

The following table contains:

- Calibration Date
- Serial Number
- Device Status
- Device State
- Number of data samples in queue
- Sample Data information
- Location Identifier

30201: **Calibration Date (Month)**	A value between 1 and 12.
30202: **Calibration Date (Day)**	A value between 1 and 31.
30203: **Calibration Date (Year)**	A value representing the year (e.g. 2012)
30204 - 30211: **Serial Number**	Serial number entered using ASCII bytes and positioned as shown in the map.
30212 - 30213: **Device Status**	Dual-register representation of device status. Integer bit mask matching the current coil selections for convenience. The host can use this to check for data availability, data format, etc while reading the data. A separate coil read would not be required. Values are defined in **Table H-9** on **Page H-12**.

Table H-3. Data descriptions

30214: **Device State**	Least Significant byte (LSB) is State. Most Significant Byte (MSB) is sub-state. Values are defined in **Table H-9** on page H-18.
30215: **Number of Data Samples** **in the Queue**	The queue size is selectable. A value of zero is identical to no data available (coil 00/02 read as zero). If the buffer size setting has been set to zero, the sample data will always represent the last real-time data packet and the queue value will be set to one if there is a data packet available. If the buffer size setting is not set to zero, the queue will be identical to the amount of stored data in the unit. This interface was designed for “in-line” or “portable download” operations. The “in-line” operation is intended to control and collect data in a continuous monitoring environment. The “portable download” operation is intended to unload stored data that was collected while the instrument was used in a portable environment. The two operations are supported by the same Modbus register map and are delineated by how the host system processes the register/coil fields and the instrument “buffer” setting. The data register section can be forced to show real-time data by setting the buffer size to zero or to show the entire set of queued data by setting the buffer size to something other than zero (i.e., the buffer size value is not utilized other than as a switch). Queued data is always presented oldest first. The buffer size command is “set buffer #” where # is a value between 0 and 10000. See **Appendix P** for more information about serial commands.
30216 - 30217: **Time Stamp**	Dual-register representation of data packet time stamp. Integer value representing start date/time in seconds since January 1, 1970.
30218 - 30219: **Sample Time**	Dual-register representation of data packet sample time. Can be integer or float depending on mode selected. The integer representation represents seconds multiplied by 100.
30220- 30221: **Data Packet Status**	Values are defined in **Figure H-1** on page H-19.

Table H-3. Data descriptions

30222 - 30223: **Flow Rate**	Dual-register representation of the data packet flowrate in cubic feet per minute. Can be integer or float depending on mode selected. The integer representation uses scale factor from register 30011.
30224 - 30225: **Volume**	Dual-register representation of the data packet volume in cubic feet. Can be integer or float depending on mode selected. The integer representation uses scale factor from register 30012.
30226: **Location**	Index of location value associated with data packet. Value set to -1 if not valid.
30227: **Number of Particle** **Channels**	Processed as a variable but fixed to a value of six for Lasair III.
30228: **Number of Analog** **Channels**	Processed as a variable but fixed to a value of four for Lasair III.
30229 - 30240 **Cumulative Particle Data**	Dual-register representation of particle size counts.
30249 - 30248 **Analog Data**	Dual-register representation of the data packet analog value. The integer value represents the scaled 4-20 mAmp input multiplied by 10000. Integer representation limited to a value between -214748.3648 to 214748.3647.
30249 - 30272 **Location**	Location entered using UTF-8 encoded ASCII bytes and positioned as shown in the map. Locations are normally associated with data taken using “portable download” operations.

Table H-3. Data descriptions

Input Registers		Description (Data Packet)	Comment	Notes
30201	unary	Calibration Date (Month)	Calibration Date	
30202	unary	Calibration Date (Day)	Calibration Date	
30203	unary	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	unary	Device Status (high)	Device Status Mask	
30213	unary	Device Status (Low)	Device Status Mask	
30214	unary	Device State	Device State	
30215	unary	Number of data samples in queue	Fixed number of sizes	
30216	dual	Time Stamp (high)	time_t	
30217	dual	Time Stamp (low)	time_t	
30218	dual	Sample Time (high)	Seconds * 100	Float
30219	dual	Sample Time (low)	Seconds * 100	Float
30220	dual	Data Packet Status (high)	Bit Mask	
30221	dual	Data Packet Status (low)	Bit Mask	
30222	dual	Flow Rate (high)	Flow * 10 Scale cfm	Float
30223	dual	Flow Rate (low)	Flow * 10 Scale cfm	Float
30224	dual	Volume (high)	Volume * 10 Scale cf	Float
30225	dual	Volume (low)	Volume * 10 Scale cf	Float
30226	unary	Location	Location value	N/a
30227	unary	Number Particle Channels	Variable across types	8 fixed
30228	unary	Number Analog Channels	Variable across types	4 fixed
30229	dual	Particle Channel 1 (high)	Cumulative Raw Ch1	
30230	dual	Particle Channel 1 (low)	Cumulative Raw Ch1	
30231	dual	Particle Channel 2 (high)	Cumulative Raw Ch2	

Table H-4. Data section of the Input Register

Input Registers		Description (Data Packet)	Comment	Notes
30232	dual	Particle Channel 2 (low)	Cumulative Raw Ch2	
30233	dual	Particle Channel 3 (high)	Cumulative Raw Ch3	
30234	dual	Particle Channel 3 (low)	Cumulative Raw Ch3	
30235	dual	Particle Channel 4 (high)	Cumulative Raw Ch4	
30236	dual	Particle Channel 4 (low)	Cumulative Raw Ch4	
30237	dual	Particle Channel 5 (high)	Cumulative Raw Ch5	
30238	dual	Particle Channel 5 (low)	Cumulative Raw Ch5	
30239	dual	Particle Channel 6 (high)	Cumulative Raw Ch6	
30240	dual	Particle Channel 6 (low)	Cumulative Raw Ch6	
30241	dual	Analog Channel 1 (high)	Analog 1 * 10000	Float Mode
30242	dual	Analog Channel 1 (low)	Analog 1 * 10000	Float Mode
30243	dual	Analog Channel 2 (high)	Analog 2 * 10000	Float Mode
30244	dual	Analog Channel 2 (low)	Analog 2 * 10000	Float Mode
30245	dual	Analog Channel 3 (high)	Analog 3 * 10000	Float Mode
30246	dual	Analog Channel 3 (low)	Analog 3 * 10000	Float Mode
30247	dual	Analog Channel 4 (high)	Analog 4 * 10000	Float Mode
30248	dual	Analog Channel 4 (low)	Analog 4 * 10000	Float Mode
30249	string	Location: Char 00, 01	Location	
30250	string	Location: Char 02, 03	Location	
30251	string	Location: Char 04, 05	Location	
30252	string	Location: Char 06, 07	Location	
30253	string	Location: Char 08, 09	Location	
30254	string	Location: Char 10, 11	Location	
30255	string	Location: Char 12, 13	Location	
30256	string	Location: Char 14, 15	Location	
30257	string	Location: Char 16, 17	Location	
30258	string	Location: Char 18, 19	Location	
30259	string	Location: Char 20, 21	Location	
30260	string	Location: Char 22, 23	Location	
30261	string	Location: Char 24, 25	Location	
30262	string	Location: Char 26, 27	Location	
30263	string	Location: Char 28, 29	Location	

Table H-4. Data section of the Input Register

Input Registers		Description (Data Packet)	Comment	Notes
30264	string	Location: Char 30, 31	Location	
30265	string	Location: Char 32, 33	Location	
30266	string	Location: Char 34, 35	Location	
30267	string	Location: Char 36, 37	Location	
30268	string	Location: Char 38, 39	Location	
30269	string	Location: Char 40, 41	Location	
30270	string	Location: Char 42, 43	Location	
30271	string	Location: Char 44, 45	Location	
30272	string	Location: Char 46, 47	Location	

Table H-4. Data section of the Input Register

Holding Registers

Like the coils, spares are in place between the “standard” registers and those that are specific/optional. There are no specific/optional coils defined for the Lasair III particle counter.

40001 - 40002: **Real Time Clock**	Dual-register representation date & time. Integer value representing date/time in seconds since January 1, 1970. The Lasair III particle counter has a built-in real time clock and may make the use of these registers unnecessary.
40003: **Sample Interval/ Sample Volume**	This register representation depends on the Sample Volume Mode setting (coil 00/09). When the Sample Volume Mode is disabled - this register represents the number of seconds to run a sample. When the Sample Volume Mode is enabled - this register represents the volume in cubic feet multiplied by 100. This creates a limit of 655.35 cubic feet for a single sample volume - approximately 11 hours of sample time. This amount of resolution is required to get the nearest second, sample interval, when requesting a cubic meter.
40004: **Hold/Tare Time**	Time, in seconds, processed prior to sampling but with the pump running.
40005: **Repeat Count**	Number of samples to process. A value of zero will command continuous processing.
40006: **Delay Time**	Time, in seconds, processed between each sample.
40007 - 40032: **Spare**	

Table H-5. Holding Registers description

Holding Registers		Description (Setup)	Comment	Notes
40001	dual	Real Time Clock (high)	time_t	
40002	dual	Real Time Clock (low)	time_t	
40003	unary	Sample Interval/Volume	Seconds	
40004	unary	Hold/Tare Time	Seconds	
40005	unary	Repeat Count	Repeat Count	
40006	unary	Delay Time	Seconds	
Spare	unary	26 spare registers	Reserve future “common” registers	

Table H-6. Holding Registers section of the Modbus Map

Coils

Like the holding registers, spares are in place between the “standard” coils and those that are specific/optional. There are no specific/optional coils defined for the Lasair III.

00/01:	The data collection coil will enable/disable sampling. It will start a sequence of samples if the repeat count is non-zero. Read: 1=Sampling Enabled, 0=Sampling Disabled. Write: 1=Sampling Enabled, 0=Sampling Disabled.
00/02:	The data available coil is used to both inform the host that data is now available and to delete the queued data packet (if present). Read: 1=Data Available, 0=No Data Available. Write: 0=Delete queued data element, 1=No effect, • If the buffer size setting has been set to zero, the sample data will always represent the last real-time data packet and the data deleted will only be the copy of the last sample taken. • If the buffer size setting is not set to zero, the queue will be identical to the amount of stored data in the unit and the oldest data packet in the stored data will be deleted.
00/03:	The data clear coil will delete all data in the queue. Read: Always 0 Write: 1=Delete all queued data, 0=No effect • If the buffer size setting has been set to zero, the sample data will always represent the last real-time data packet and the data deleted will only be the copy of the last sample taken. • If the buffer size setting is not set to zero, the queue will be identical to the amount of stored data in the unit and all the stored data will be deleted.

Table H-7. Holding Registers description

00/04:	The reset sensor coil will reset the sensor. Read: Always 0 Write: 1=Reset sensor, 0=No effect
00/05 - 00/07	Unused on Lasair III-310 instrument. Read: Always 0 Write: No effect
00/08:	IEEE-754 Float. The float control will change the specified registers from a dual-register. Integer with fixed scaling to a dual-register IEEE-754 float representation. The IEEE-754 version is likely to yield better resolution but it is not part of the official Modbus specification. This value can also be set into non-volatile storage via the setup interface command “set instrument float”. Read: 1=Float mode enabled, 0=Float mode disabled Write: 1=Float mode enabled, 0=Float mode disabled
00/09:	Sample Volume Mode. The sample volume control will change how the unit controls sampling. If set, holding register 40003 will contain the sample volume to be processed multiplied by a factor of 100. If clear, holding register 40003 will contain the sample interval to be processed in seconds. This value can also be changed from the display. It is recommended that the coil selection be set every-time the holding registers are sent. Read: 1=Sample Volume, 0=Sample Interval Write: 1=Sample Volume, 0=Sample Interval
00/10 - 00/32:	Spare. Read: Always 0 Write: No effect

Table H-7. Holding Registers description

Coils	Description (Coils)		Comment	Notes
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	Unused			
00/06	Unused			
00/07	Unused			
00/08	IEEE-754 Float	On/Off	Modbus Float representation	
00/09	Volume Mode	On/Off	Sample Volume or Interval	
Spare	23 spare coils		Reserve “common” coils	

Table H-8. Coils section of the Modbus Map

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 (00/02) will be set on a read if there is data in the queue. The data available coil (00/02) can be cleared and written (i.e., set coil to zero) 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 (00/02) will be set again right away. If there is no more data in the queue, the data available coil (00/02) will only be set again once the next sample is completed.

- If the buffer size setting has been set to zero, the sample data will always represent the last real-time data packet. The data shown is always the last data processed and is representative of real-time data only.
- If the buffer size setting is not set to zero, the queue will be identical to the amount of stored data in the unit. The data shown will always be the oldest data taken.

Queued data will always be available - even when not sampling. This will allow data taken by the instrument at prescribed locations during portable use to be downloaded at a later time.

If there is no data available - the input registers (associated with the actual sample collected) 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 (i.e., current coil settings), in one command.

Processing of 32 Bit Register Value

Some parameters such as particle counts are 32 bit values.Modbus does not natively support 32 bit data;however, it is common in industry to use two 16 bit registers to create a single 32 bit value. Here are two methods for doing this:

- Add the value as two unsigned numbers.
  Example:

  [32-Bit Unsigned Reg]= [16 Bit Low Unsigned] + 65536 * [16 Bit High Unsigned]
- Use arithmetic OR and left- shift operation.
  Example:
  [32-Bit Unsigned Reg] =
  ([16 Bit High Unsigned] << 16-bit left-shift)
  {arithmetic OR} [16 Bit Low Unsigned]

Never combine the values as signed integers or floating point value.If the final value is signed, convert the 32-Bit Unsigned value to a 32-Bit signed value after combining the unsigned 16 bit values. If the final value is a floating point value, interpret the final 32-Bit value as floating point after combining the numbers as unsigned 16 bit integers.

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	
	0x0080	IEEE Float mode	
	0x0100	Volume Mode	
Device State Entries (LSB)	0	Idle	
	1	Sampling	
Device SubState Entries (MSB)	0	Idle	N/a
	0	Sampling	N/a
	1	Sampling	Tare
	2	Sampling	Delay
Data Packet Status Entries	0x0001	Laser Good	
	0x0002	Flow Good	

Table H-9. Associated values for specific registry entries

Modbus Processing Example

The following flowchart provides a basic example of controlling the Lasair III using Modbus protocol. The flowchart is meant to be a starting point. It does not detail error handling and does not provide other functionalities which may be desired.

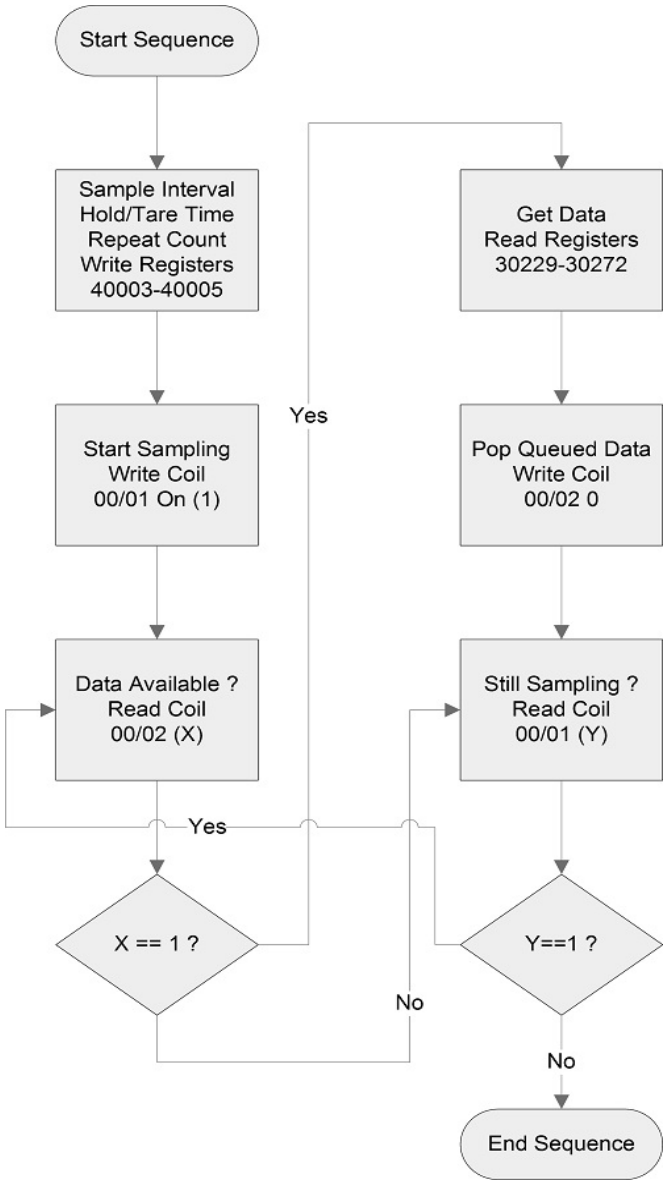

Figure H-1. Modbus flowchart for Lasair III 310

Modbus Dequeuing Example

The following flowchart provides a basic example of dequeuing data using Modbus protocol. The flowchart is meant to be a starting point. It does not detail error handling and does not provide other functionalities which may be desired.

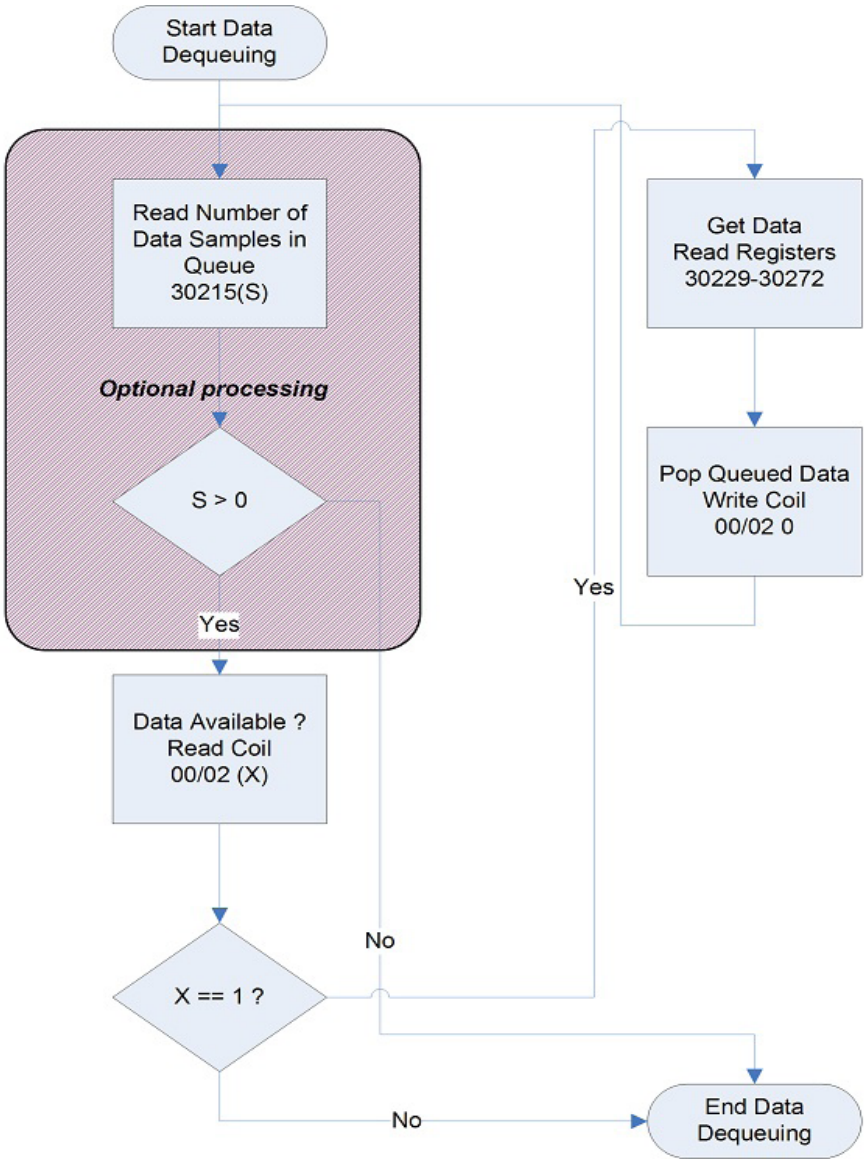

Figure H-2. Modbus dequeuing flowchart for Lasair III 310

Appendix I
Serial Service Commands

Definitions of serial service commands are provided in the following sections:

- **General Serial Service Commands** on page I-2
- **User Selectable Channel Setup Commands** on page I-5

Serial Service Command Legend

Items enclosed within curly braces “{ }” denote optional parameters.

A vertical bar “|” is used to separate options which may be entered. For example “0 | 1”, indicates type a “0” or a “1”.

Text that is qualified by square brackets “[ ]” is used to indicate variable parameters to be entered. For example “[index]” means to type a numerical index.

Text that is not qualified by square brackets is a literal option. Commands are case-sensitive. Type command in lower case, as shown.

General Serial Service Commands

Command	Description
chkdsk	Run a DOS CHKDSK command to verify the installed USB FLASH key is OK
default	Sets the network addressing parameters to factory defaults.
dir	Directory of installed USB FLASH key
get batt data	Display a table of battery status parameters for all four batteries
get batt status	Display a summary of battery information.
get buffer	Shows the size of the TCP buffer. This buffer value is used for setting the PMS TCP and Modbus buffers. In Modbus, a 0 turns off buffer capability, and any other value enables buffer capability. In PMS TCP, the buffer setting determines the number of data samples that are resent to the PC when a communication lapse is eliminated.
get inst float	Shows the float setting for Modbus TCP communications. When set to a 1, volume and other appropriate data is floating point. When set to a 0, all data is in integer format. The default is 0.
help	Print a list of common commands.
reboot	Reboot the instrument.
save securefile [filename] **Range Limits** **Filename length < 128 characters**	Saves a securefile (i.e., a file formatted for DataAnalyst) to the specified filename. If no filename is given, the default file "/bd0/default.sec" is written. (The prefix "/bd0" is for the USB FLASH key.) The filename if provided must be prefixed with "/bd0/" in order to write to the USB FLASH key.

Table I-1. General Serial Service Commands

Command	Description
set buffer [buffer_size] **Range Limits** **0 – 10000**	Set the buffer size for network protocol communications. This sets the number of samples which will be retransmitted by PMS TCP protocol in the event of a network outage. Default is 60 samples. Setting a large number may result in unexpected large amounts of network traffic in the event multiple sensors lose network communications simultaneously. Samples are only retransmitted if the instrument is not rebooted during the network outage, and the instrument is reattached to the same host. • This buffer setting is also used for Modbus TCP. If set to 0, no buffer is used for Modbus registers. Otherwise, all instrument samples (10000) are available.
set gate aaa.bbb.ccc.ddd **Range Limits** **0 – 255**	Set the instrument network gateway in standard dot notation. This setting is not activated until a write command is issued.
set instrument float 0 | 1	Turn the Modbus float mode on or off. When the float mode is on, some Modbus registers (such as sample volume) are interpreted as floating point values. If the mode is off, all register values are integers.
set ip aaa.bbb.ccc.ddd **Range Limits** **0 – 255**	Set the insrument IP address in standard dot notation. This setting is not activated until a **write** command is issued.

Table I-1. General Serial Service Commands

Command	Description
set mask aaa.bbb.ccc.ddd **Range Limits** **0 – 255**	Set the instrument network mask in standard dot notation. This setting is not activated until a write command is issued.
set multicast aaa.bbb.ccc.ddd **Range Limits** **0 – 255**	Set the instrument Multicast address in standard dot notation. This setting is not activated until a write command is issued.
sta	Show the general network status of the instrument. Also show any Modbus TCP or PMS TCP clients that are attached to the instrument.
sta full	Show a detailed listing of the instrument status. This command shows networking, laser, blower, battery and sampling status parameters.
write	Write the communication settings to EEPROM and reboot the instrument.
write ipconfig	Write the communication settings to EEPROM and reboot the instrument. This command is identical to the "**write**" command.

Table I-1. General Serial Service Commands

User Selectable Channel Setup Commands

Command	Description
clean channels {index1, index2, ...} **Range Limits** **1-8**	Clear one or more new channel size settings that have been made. This command does not change the current channel settings. An optional list of one or more channel indexes may be specified in the command. If no specific channels are provided, all the new channel size settings are cleared.
get channels	Display the list of current and new channel settings.
get channels table {[index]} **Range Limits** **1-8**	Display the list of available particle sizes for each channel. An optional channel index may be entered to limit the scope to a single channel.
help channels {get | set | clean | examples}	Display the help for the variable channel size configuration. The optional “get”, “set” “clear” and “examples” parameter may be used to display only that subsection of the help.
set channels [chan1] [size1] {[chan2] [size2]...} **Range Limits** **Chan 1-8** **Size 100-5000**	Set new sizes for one or more channels. Each setting consists of a channel number (from 1 to 8) and a size for the channel in nm. Sizes available for each channel may be displayed using the “get channels table” command. The “write channels” command must be given to enable the channels.
set channels all [size1] [size2] [size3] [size4] [size5] [size6] [size7] [size8] **Range Limits** **100-5000**	Set all eight channels to the sizes provided in nm. • The “**write channels**” command must be given to enable the channels.

Table I-2. User-selectable channel setup commands

Command	Description
set channels default	Sets the list of new channel sizes to factory defaults. • The "**write channels**" command must be given to enable the channels.
set channels units um | nm	Set the channel units to either nm or µm. • The "**write channels**" command must be given to enable the new units.
write channels	Write the variable channel configuration to EEPROM and reboot the instrument. All data must be removed from the instrument.

Table I-2. User-selectable channel setup commands

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Appendix J
PMS Multi-Drop Protocol

This protocol is designed to be used on an RS-485 based system, with multiple individually addressable instruments. All communications are polled with a sensor address. The host program must take care of querying the unit for data.

RS-485 communications require an external RS-232 to RS-485 converter. The converter must support automatic send data control. Older converters that require CTS control (hardware flow control) will not work properly.

Tested RS-232/RS-485 Converters

Both of these models have been tested with the Lasair particle counter in MiniLaz emulation mode connected to Pharmaceutical Net.

NOTE: A null modem is required to connect between these models and the Lasair III particle counter.

- **RS-232 to RS-485 converter with automatic send-data control and opto isolation:** P/N 485OT9L
- **RS-232 to RS-485 Converter with automatic send-data control and quick-disconnect terminal block:** P/N 485PTBR

Both of the preceding models are available from:
B & B Electronics
707 Dayton Rd.
P. O. Box 1040
Ottawa, IL 61350

Phone: (815) 433-5100
Web: http://www.bb-elec.com

Both models require external 12 VDC power @100 mA. One solution is the 120 VAC to 12 VDC supply P/N 485PS2.

The Lasair particle counter provides an extended version of the command set used in the obsolete MiniLaz instrument, and offers backward compatibility. This protocol allows a Lasair particle counter to be a drop-in replacement for a MiniLaz on a Facility-View installation.

Multi-Drop Command Coding

Commands in the PMS protocol are formatted in the manner described below. For users wishing to write their own drivers, basic communication routines are available from Particle Measuring Systems.

Formatting Command Codes

To properly format a command code:

1. Add the address of the instrument to the beginning of the command string.
    - The address is an unsigned 16-bit integer between 0 and 99.
2. Add a 16-bit checksum of the data and address to the end of the packet.
    - The checksum is an unsigned sum of every address and data byte.

The packet should appear as follows:

ADDR_HIGH_BYTE | ADDR_LOW_BYTE | DATA_1 | DATA_2 | ... |

DATA_N | CHECKSUM_HIGH_BYTE | CHECKSUM_LOW_BYTE

3. ASCII characters not in the range of 0x20 to 0x7E must be converted to a 2-byte sequence using the following table:

Original BYTE	Transmitted BYTES
byte < 0x20	0x7B, byte+0x20
0x7B <= byte < 0x80	0x7C, byte-0x5B
0x80 <= byte < 0xC0	0x7D, byte-0x60
0xC0 <= byte	0x7E, byte-0xA0

4. Pre-append an ASCII <STX> character (0x02) to the data stream, and post-append an ASCII <ETX> character (0x03) to the data stream.
5. Data is ready to transmit.

Multi-Drop Commands

CCAL	Response: “RCAL yyyy/mm/dd” Returns the last calibration date. (The Lasair III particle counter should be calibrated at least once a year).
CCONT n	Response: “RCONT m”
CDT **yy mm dd hh mm ss**	Response: “RDT” Set date and time. Either two-digit or four-digit year is okay
CES	Response: “RES 1” (success) or “RES 0” (failure). End Sampling.
CFQ	Response “RPQ 1” or “RPQ 0” Flush data queue—erase all data. **NOTE:** The particle counter can un-erase data from this command if no samples are taken, and locations are not erased.
CID name	Response: “RID name” Set sample ID (location) to given string. This command translates all characters to upper case. The only legal characters in this command are A–Z, a–z, and 0–9. Other characters that are legal for Lasair particle counter location names are not legal here.
CISDELAY sec	Response: “RISDELAY sec” Set inter-sample delay in seconds. Delay is from end-to-start.

Table J-1. Multi-Drop Commands

CKB n	Response: “RKB m” Lock/unlock the keyboard (1/0). If the keyboard is not locked, the instrument can be stopped or controlled from front panel.
CNOS nnn	Response “RNOS mmm” Set total number of samples. Setting to -1 causes continuous sampling. If the operation is successful, nnn = mmm.
CPDELAY sec	Response: “RPDELAY sec” Set purge delay in seconds.
CPQ	Response “RPQ 1” or “RPQ 0” Pop oldest sample off of data queue. This command will un-erase the oldest sample data if no samples are taken, and locations are not erased.
CQC	Response “RQC nnn m” Get number of samples in queue, and 0/1 for sampling (1) or not sampling (0).
CSN	Response: “CSN s_n” Returns the Lasair particle counter’s serial number.
CSR	Response “RSR” Causes instrument to reboot about 1.5 seconds after receiving the command. It takes several seconds to recover communications.
CSS	Response: “RSS 1” (success) **or** “RSS 0” (failure) Start Sampling.
CTD	Response “RTD data_packet” Transmit data in MiniLaz compatible format. Only 5 particle channels are sent. The extra channel is merged in as well as possible. Only temp/rh analog channels sent. Additional Lasair particle counter analog channels are not reported. The time stamp in the data packet is at the sample’s start. The normal Lasair particle counter time stamp is at the end of the sample.

Table J-1. Multi-Drop Commands

CTD2	Response: “RTD2 data_packet” or “RND2” if no data available Transmit Lasair III particle counter CSV packet. The packet is broken into several lines. The time stamp is at the end of the sample.
CTIM secs	Response “RTIM secs” Set sample time in seconds. Sets sampling to “by time”. Does not change sample units. Maximum value = 86399 Minimum value = 6
CVER	Response “RVER LasairIII-model firmware_version” Get Lasair particle counter model and firmware version.
CVOL nnnn.n	Response “RVOL” Set sample volume to nnnn.n in feet3 (CF). Causes the Lasair particle counter to sample by CF and to sample by volume. Maximum value is 1439 CF Minimum value is 0.1 CF

Table J-1. Multi-Drop Commands

Multi-Drop CTD Command Data Format

This data format is identical to the MiniLaz output. The six particle counter channels are converted to 5 channels for this report. The largest two data channels are merged. In two-channel mode the last three reported channels will be reported as 0s (zeroes).
See the **CDT** command description page J-3 for additional details.

RTD	Description
TI hh:mm:ss	Time (Start of sample)
DA yy/mm/dd	Date (Start of sample)
ID Loc_str	Sample Location
SN s/n	Sensor Serial Number
LS #	Laser Status (1 = good / 0 = bad)
FR ###.##	Flow Rate (cfm)
VL ###.##	Sample Volume (cfm)
C1 ########	Channel 1 Raw Differential Counts
C2 ########	Channel 2 Raw Differential Counts
C3 ########	Channel 3 Raw Differential Counts
C4 ########	Channel 4 Raw Differential Counts
C5 ########	Channel 5 Raw Differential Counts **NOTE:** The last two channels are merged.

Multi-Drop CTD2 Command Data Format

The data format for the CTD2 command is essentially the CSV format. All analog data channels are printed regardless of how many are enabled. Unused analog channels will print “Nan”. To maintain compatibility with the Lasair II, six analog channels are always printed.

In pharma mode only two particle channels are reported. See **Appendix E**.

RTD2
Date, Time, Sensor_Name, Sensor_Type, Sensor_S/N
Statistics, Loc_chg, Location, Manifold_Index
Laser_OK, Flow_OK, Sample_Valid, Sample_time, Volume_Units, Volume
Num_Particle_Channels, Size_1, Counts_1, S2, C2, S3, C3, S4, C4, S5, C5, S6, C6
Num_Analog_Chan
A_Name1, A_Units1, A_Avg1, A_Min1, A_Max1
A_Name2, A_Units2, A_Avg2, A_Min2, A_Max2
A_Name3, A_Units3, A_Avg3, A_Min3, A_Max3
A_Name4, A_Units4, A_Avg4, A_Min4, A_Max4
A_Name5, A_Units5, A_Avg5, A_Min5, A_Max5
A_Name6, A_Units6, A_Avg6, A_Min6, A_Max6

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Appendix K
Native Serial RS-232 Communications

The Lasair III particle counter's native communications mode is a simple RS-232 point-to-point protocol, with no addressing or checksum overhead. It can be used with a simple terminal emulator program, or as a basis for instrument control. It is an upgrade path for users with older Lasair particle counters.

Pin	Pin Function
2	TX
3	RX
5	GND

Native Serial Protocol Fundamentals

- All characters are echoed.
- Software flow control (CTRL-Q/CTRL-S) is used.
- A command prompt of ">" is output between commands and data packets.
- Automatic data output is generated.
- All commands return either an "OK" or an error response followed by a <CR>.
- All commands except Lasair "C" commands return current parameter values. This can be used for sanity checking.
- Many commands are similar to older Lasair serial commands.

Serial (RS-232) Output Format

The data output via the serial port are identical in content and order to those output in CSV format. See **Appendix E** for details.

Native Serial Protocol Error Messages

Error -- No C Command	The “C” command was given with no arguments.
Error -- Not Supported	An invalid or unsupported “C” command was sent.
Error -- Parameter	A command was sent with an insufficient number of parameters.
Error	A command failed due to other circumstances. The most likely cause is that the serial interface did not execute the “KB 1” command to lock-out keyboard control, and someone is using the front panel controls. This message can also be caused by a parameter out of range.
Error -- Range	The following commands have a parameter out-of- range: • TN • ANID • AUTOSTART • C 10

Upgrade Information

For users upgrading their own software, the following information is provided regarding fundamental interface changes. The following is a quick list of supported commands from the Lasair particle counter, with notes about any differences.

SS	Start Sampling.
ES	End Sampling.
SN	Set to continuous sampling.
C	Change/setup command (see additional information below).
KB	Keyboard lockout command. This is retained through a power cycle.
KG	Keyboard lockout until power cycle.
TI	Set sample interval.
TD	Set time/date.
ID	Set instrument ID.

Table K-1. Commands supported from the Lasair Particle Counter

The following command is not supported:

R Retransmit sample in last group.

C Commands

Supported C Commands	
C 0 yy	Set Date-Year. Two-digit year.
C 1 mm	Set Date-Month.
C 2 dd	Set Date-Day.
C 3 hh	Set Time-Hour. Use 24-hour format.
C 4 mm	Set Time-Minute.
C 5 sec	Set Time-Second.
C 6 id_string	Set Instrument ID.
C 7 num	Set Number of Samples.
C 8 hh	Set Sample Time-Hour. Set sample time in order of hours, minutes, and seconds to avoid problems.
C 9 min	Set Sample Time-Minutes. Set sample time in order of hours, minutes, and seconds to avoid problems.
C 10 sec	Set Sample Time-Seconds. Set sample time in order of hours, minutes, and seconds to avoid problems. This command returns a Range Error if sec < 6, and min = 0, and hours = 0.
C 11 [1/0]	Set Sample Print on/off.
C 12 hh	Set Delay Time-Hours. Set delay between samples.
C 13 min	Set Delay Time-Minutes. Set delay between samples.
C 14 sec	Set Delay Time-Seconds. Set delay between samples.
C 16 [1/0]	Set continuous (repeat) mode on/off. When turned off, the number of samples is set to 1.
C 21 chan name	Set Analog ID Label. Set name for user analog channel 1-4
C 22 chan min	Set Analog 4 mA value. Set user analog channel minimum engineering unit value.
C 23 chan max	Set Analog 20 mA value. Set user analog channel maximum engineering unit value.
C 24 chan units	Set Analog Units. Set name for analog channel units.
C 25 chan [1/0]	Enable/disable analog channel.

Supported C Commands	
C 32 hh	Set Purge Delay Time-Hours.
C 33 min	Set Purge Delay Time-Minutes.
C 34 sec	Set Purge Delay Time-Seconds.
C 38 [1/0]	Start sampling on Power Up.

C commands dealing with alarms and manifold control are not supported. (Manifold control with the Lasair particle counter requires an AM-II and Ethernet control.)

Unsupported C Commands	
15	Group print
17	Count Alarm Enable
18	Count Alarm Print Enable
19	Count Alarm Size
20	Count Alarm Value
27	Manifold Sequence
28	Mixed-air Alarm Value
29	Search Alarm Value
30	Search Length Minutes
31	Search Length Seconds
37	Audible Alarm On/Off
39	Power Interrupt Print
41	Count Alarm Diff/Accum
43	Count Alarm Conc
44	Analog Avg On/Off
45	Analog Alarm Enable
46	Analog Alarm Max Value
47	Analog Alarm Min Value
48	Analog Alarm Print On/Off
50	Laser Warning Print
52	Flow Error Print
54	Time Series Channel
56	Manifold Sequence Enable
57	Manifold Sequence Length
58	Alarm Count Port Num.

59	Search Length Hours
60	Mixed Air Alarm Enable
61	Mixed Air Alarm Print
63	Search Alarm Print On/Off

C Command Table Format

These commands are from the C command above. All of these commands are redundant, and are provided for users of existing Lasair particle counters who want to simplify their upgrade path. Some of these commands split internal variables into several pieces. For instance “C 0” through “C 6” are used to set date and time.

Because of the variable split, unexpected results can be obtained if the user is not careful with software coding. For instance, setting the date and time in multiple parts has the possibility of time-rollover in-between settings. In other words, if the Lasair particle counter’s seconds rolls over from 59 to 0, then at a minimum the minutes will also change, and if this occurs right after setting the minutes, then the expected time will be wrong. See the following command format:

C nn sssssssssss

where:

C nn = command # (0-38)

sssssssssss = any alphanumeric entry appropriate to the parameter being defined.

Command List

All commands are case-insensitive. Text variables in commands do retain capital and lowercase letters.

AALARM [n],min, **[1/0],max,[1/0]**	Set analog alarm for specified channel. Channel is 1–4 for user analog inputs. **min** is a floating point value for alarm minimum, and **max** is a floating point value for the alarm maximum. The min and max alarms are enabled or disabled individually.
ANID n,name_string	Set name for user analog channel n. Channel is 1–4, **name_string** is maximum of 16 characters.
ANENABLE n,[1/0]	Enable or disable data collection for analog channel. Channel is 1–4.
ANLIMITS n,min,max	Set calibration parameters for 4–20 mA analog input channel. Min value is engineering units value at 4 mA, and max is engineering units value at 20 mA.
ANSCALE n,scale	Set 4–20 mA scale for analog input channel.
ANOFFSET n,offset	Set 4–20 mA offset for analog input channel.
ANUNITS n, units_ string	Set units title for analog channel. Channel is 1–4, units string is maximum of 8 characters.
AUTOSTART [1/0]	Enable or disable autostart feature. When enabled, the instrument will begin sampling when it powers up.
BATCH ID ccccccc	Set Batch Name ID string using maximum of 16 characters.
BUZZER [1/0]	Enable/disable buzzer during alarms.
C nn	Change setup parameter. See separate table below for details.
CLEARALL	Deletes all sample data and all location names. This command should be used with caution. If the command is executed while the instrument is running, it will return an error. This command may be used to facilitate an interface to a barcode reader.
DS	Get number of data samples.
ERASEDATA	Erase all data samples in instrument.
ES	End sampling.

GALARM [1/0]	Enable or disable global alarm setting. When disabled, all alarms are off. When enabled, individual alarm settings are in effect.
ID ccccccccc	Set instrument identification using maximum of 16 characters.
ISAVAIL	Check if instrument control is available. The Lasair III particle counter has multiple methods of communications, as well as the front panel control. To prevent confusion, only one user is allowed to control the instrument at a time. This command will return a 0 if the serial communications is unable to take control of the instrument. This can be used as a check if an error occurs while executing another command. Using the KB or KG commands ensures that the serial communications will have control of the instrument.
ISDELAY secs	Set inter-sample delay. This is the delay between the end of one sample, and the start of the next. The maximum value is 86399 seconds (23:59:59).
ISON	Return the sampling state of the box (1/0).
ITYPE	Return the instrument model.
IVER	Return the instrument firmware version.
KB [1/0]	Keypad lockout enable/disable. Lockout is retained through a power cycle. If this lockout is disabled with the “KG 0” command, it will be re-enabled when the power is cycled.
KG [1/0]	Keypad lockout enable/disable. Lockout lasts until “KG 0”, “KB 0”, or a power cycle.
LOCID name	If needed, creates and sets the current location ID to name. If name already exists, the front panel screen will change the ID. If the name does not exist, and there are less than 200 names currently defined, then the new name will be created, and the current location will be set to this string. If the instrument is taking a sample, this command will return an error. This command is used to facilitate an interface to a barcode reader.
OPER name	Set operator name using maximum of 16 characters.
NORMDATA [1/0]	Set normalized/raw particle display. If particle display is set to 0, then data is shown in raw counts on the display. In addition, if particle alarms are used, the alarms automatically change with sample time changes.

PALARM chan,value,[1/0]	Set particle alarm for specified channel. Channel is 1–6. Alarm value is any number greater than or equal to 0. **NOTE:** If the value is set to 0, the channel must be disabled. An error will be returned if setting is to enable a channel with 0 as the value. Particle alarms are internally modified depending on sampling parameters. If the box displays data in a normalized output, then this is not an issue. Otherwise, changing the sample size (either by time or volume) will ratio-metrically change the alarm setting.
PALARMTYPE [C/D]	Select particle alarm type. This is either cumulative or differential.
PDELAY secs	Set the purge delay. This is the time to wait before the beginning of the first sample. The maximum value is 86399 seconds (23:59:59). (Even if this is set to 0, there will be some delay before a sample for the pump to spin up.
POP	This command erases the oldest sample in the data buffer. The command may be used in conjunction with the TF command to send the complete data buffer, sample by sample.
PRALARM [1/0]	Enable or disable print on alarm feature. When enabled, the following conditions will cause an immediate printout: analog alarm, particle alarm, pump error, laser failure. The printout lists the alarm condition, the location, and date/time.
SS	Start sampling.
SN	Set to continuous sampling, with group size = 1.
SPRINT [1/0]	Enable/disable the print at end of sample feature.
SVOL cf_volume	Set sample volume in feet3. This command does not change the display units from cm, if they are set that way. The smallest sample volume is 0.1. The largest sample volume is 1439.98.
TI secs	Set sample interval to nnn seconds. maximum interval is 86399 seconds (23:59:59). Smallest interval is 6 seconds.
TIME	Print the current date and time. Output format is “YYYY/MM/DD hh:mm:ss.”

TD yy/mm/dd hh:mm:ss	Set the date and time. Any non-digit is considered a delimiter. Years can be entered as either two digits or four digits. The seconds may be omitted, and will default to 0.
TF	Transmit first data sample (i.e. earliest time). The data is transmitted in standard CSV format. This command may be used with the POP command to systematically transmit all the stored data on a Lasair particle counter.
TL	Transmit the last data sample (i.e. latest time). Data is sent in standard CSV format.
TN n	Transmit data sample n. Sample n must be a valid sample. The variant “TN 1” is equivalent to TF. Data is sent in standard CSV format.
UNITS [F/M]	Set particle volume units to either ft^3 (F) or m^3 (M). This affects displaying normalized data on the LCD, and setting alarms in normalized data mode. This command is independent of the SVOL command which always sets volume in ft^3.

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Appendix L
4-20 mA Input

Overview

Up to four optional sensors can be connected to a Lasair III particle counter's 4-20 mA connectors (type DB15F) on the rear of the case.

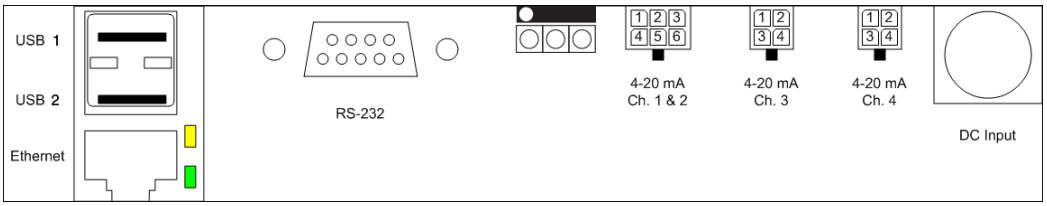

Figure L-1. Connectors on back panel of the Lasair III particle counter

Use this appendix to determine how to set up the analog input values in the Environmental tab of the Comm/Port Setup screen.

From the Navigation panel, locate the SETUP group and press Comm/Port.

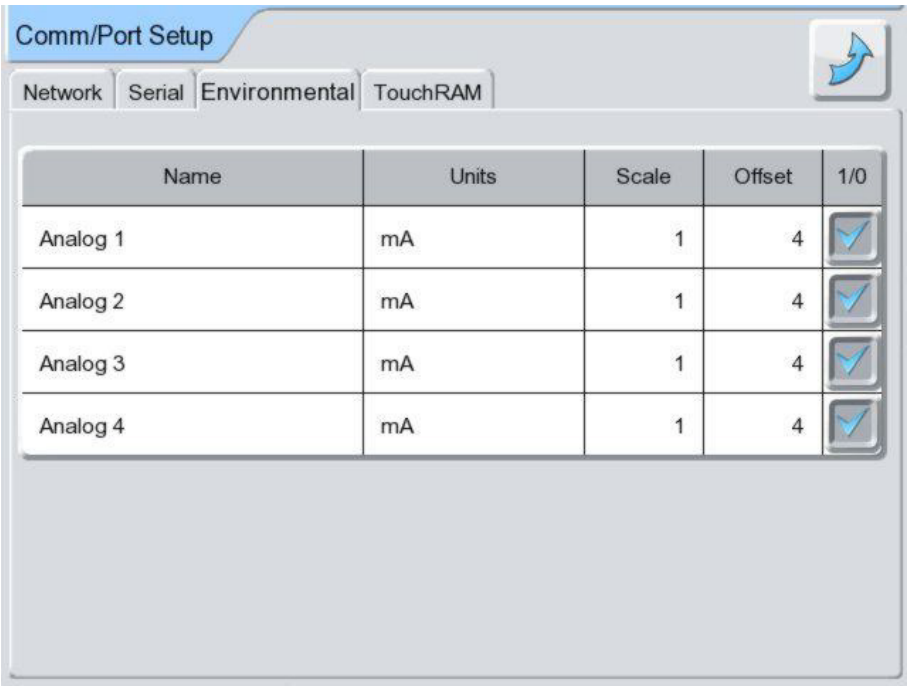

Figure L-2. Environmental tab of the **Comm/Port Setup** screen

Each analog input can have a different value of the Scale and Offset values. These values are determined by the range of the sensors that are being used.

4-20 mA Input Setup Values

Name	Can be changed to name of the sensor such as Temperature or Humidity.
Units	Can be used to identify the units of measure related to the 4-20 mA value, such as degrees C or percent (%) humidity.
Scale	Is the total measurement range ÷ 16. 16 is the number of mAs between 4 and 20 that will be used to create the measurement range.
Offset	Is the minimum value of the measurement device. For example, if the lowest value of a temperature probe is 32, the value of 32 would be entered into the Offset field.
I/O	A selection box to activate or de-activate this analog input.

Examples of Setup of the TRH Accessory for the Lasair III

For our example, we will be setting up the TRH accessory for the Lasair III particle counter with the following specifications:

- **Temperature range of measurement:** 32 – 122 °F
- **Relative humidity range:** 0 – 100%

The scale and offset values are calculated as follows.

To calculate the temperature settings for the scale value:

1. The range of temperature measurement is 122 - 32 = 90 degrees of measurement between 32 and 122.
2. The value of 90 ÷ 16 = 5.625 scale.
    - This value is to be entered into the Scale field of the Environmental tab of the Comm/Port Setup screen.

For the offset value:

3. The Offset value should be 32, since the probe begins measurements at 32 °F.

To calculate the humidity settings for the scale value:

4. The range of humidity is 100 - 0 = 100 degrees of measurement between 0 and 100.
5. The value of 100 ÷ 16 = 6.25 scale.
    - This value is to be entered into the second Scale field of the Environmental tab of the Comm/Port Setup screen.

For the offset value:

6. The Offset value should be 0, since the measurement begins at 0% humidity.

All other types of 4-20 mA inputs should be configured in a similar fashion for the remaining sensors.

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Appendix M
Configuring the Lasair III Wi-Fi Adapter

Overview

This document explains the Lasair III Wi-Fi adapter hardware and the configuration of that hardware. It is important to understand the hardware architecture before attempting to configure the adapter. In addition, please review the **Troubleshooting** on page M-10 section if there are problems with configuring the adapter.

Wi-Fi Adapter Hardware

The Wi-Fi adapter consists of a separate microprocessor controlled electronics module inside the Lasair III instrument. This module must be configured with a web browser running on a laptop (or desktop) computer.

A switch on the back of the Lasair III allows Ethernet communications to be set in different modes. These modes are detailed in **Table M-1**.

Switch Position	Description	Icon
1 (left)	Normal Lasair III wired Ethernet communications. The RJ-45 connector LEDs will only work in this mode.	
2	**Wi-Fi operation** In this mode, the Lasair III network settings are used when communicating wirelessly.	
3	**Wi-Fi setup** In this mode the Wi-Fi adapter is physically attached to the Lasair III Ethernet port. A laptop attached to the Ethernet port is used to setup the Wi-Fi adapter. The RJ-45 connector LEDs will not function in this mode.	
4 (right)	**Wi-Fi reset** This position will allow the WiFi microprocessor controller to be reset to the Factory settings. To prevent accidental reset, this function only works during power-up.	
Table M-1. Wi-Fi module configuration switch		

The connector panel describes the switch operation as shown below in **Figure M-1**.

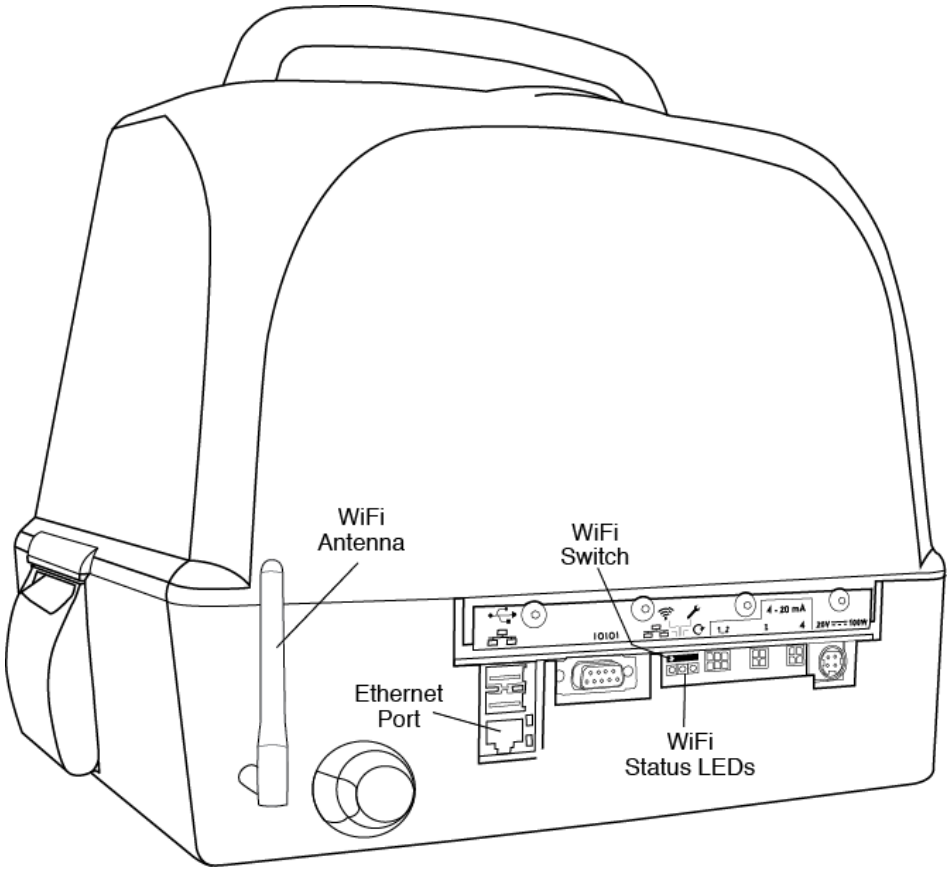

Figure M-1. Back panel of Lasair III with Wi-Fi adapter

Below the switch on the back panel are three status LEDs to help debug communication issues. The operation of these LEDs is detailed in **Table M-2**.

LED 1 (Left)	LED 2 (Center)	LED 3 (Right)	Description
Switch is in normal wired communication mode.			
OFF	OFF	OFF	Ethernet port is connected to instrument. (LED 3 may be dim red.)
Switch is in Wi-Fi mode.			
OFF	GREEN	GREEN	Wi-Fi is attached to access point.
OFF	RED	YELLOW	Wi-Fi is searching for access point. The center LED (red) will blink when searching.
OFF	OFF	RED	Wi-Fi adapter failed Power On Self-Test.
OFF	OFF	OFF	Wi-Fi adapter is not powered.
Switch is in module configuration mode.			
YELLOW	YELLOW	YELLOW	Ethernet port is connected to Wi-Fi.
Switch is in module reset position.			
RED	RED	RED	Unit will reset user parameters such as wireless SSID and password. This will occur during power up operation only.

Table M-2. Wi-Fi status LEDs

Wi-Fi Adapter Configuration

The Lasair III wireless adapter has numerous configuration settings. However, the parameters that need to be changed for attaching to a wireless network are relatively limited.

Equipment

- Laptop with Ethernet configured as DHCP or fixed IP at 192.168.2.5
- Ethernet cable

Required Setup Information

The parameters below are in addition to the network addressing information which must be configured in the Lasair III.

- **Wireless SSID:** _____
- **Wireless Security:** _____
- **Wireless Password:** _____
- **Country of Operation (WLAN region):** _____

Procedure

This procedure explains the basic process of configuring the Lasair III Wi-Fi module using a PC with a Web Browser. The Wi-Fi module is pre-configured by Particle Measuring Systems to operate in a bridge mode with MAC address cloning. This allows the network IP address parameters to be set via the Lasair III front panel. The Wi-Fi module must be properly configured for the country of operation (outside of the United States of America), and it must also be configured for wireless access and security. The Wi-Fi module does not require any network IP address settings.

1. Attach Ethernet cable between Lasair III and laptop.
2. Set Wi-Fi mode switch on back of Lasair III to “Setup”. See **Table M-1**. When the Lasair III is powered on, and the switch is in the correct position, all the status LEDs on the back panel will be yellow.
3. Power cycle the Lasair III and wait 30 seconds.

4. Open a web browser on the laptop to the address: http://192.168.2.100:8080. See the figure below.
   a. **Username**: dpac
   b. **Password**: dpac
5. The alternative IP address 192.168.2.1:8080 may be used.

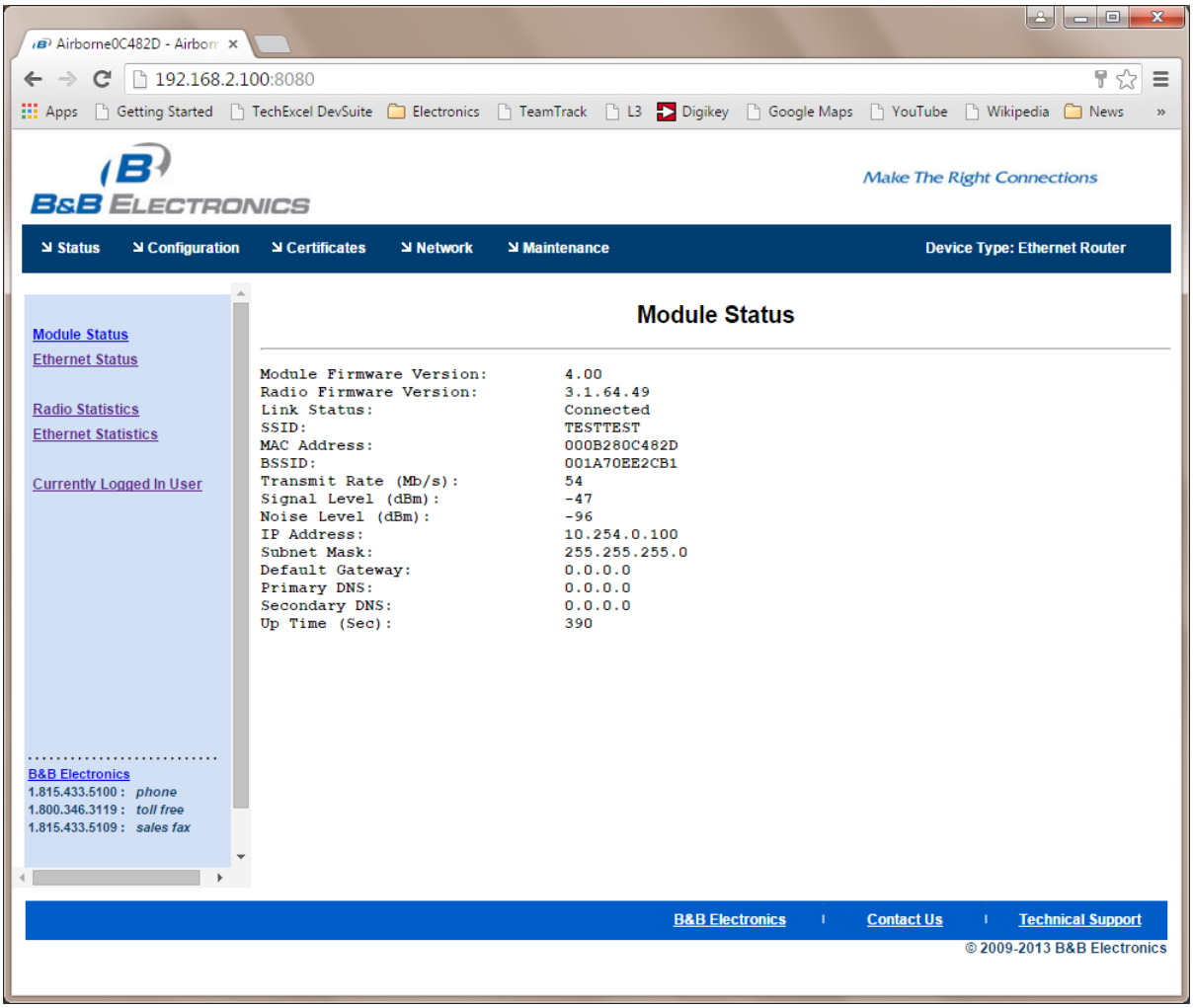

Figure M-2. Wi-Fi browser connection

6. In the web browser, click on “Configuration”.
7. Click on “WLAN Setup”. This will bring up a browser page similar to **Figure M-1**.
8. Select the WLAN Region. This sets the wireless channels to conform to the proper ones for the area.

9. Enter the SSID name of the WiFi network in order to connect to the Lasair III particle counter.

- Refer to the company IT department/responsible party to identify the correct SSID value.

10. Click on the “Commit” button at the bottom of the page.

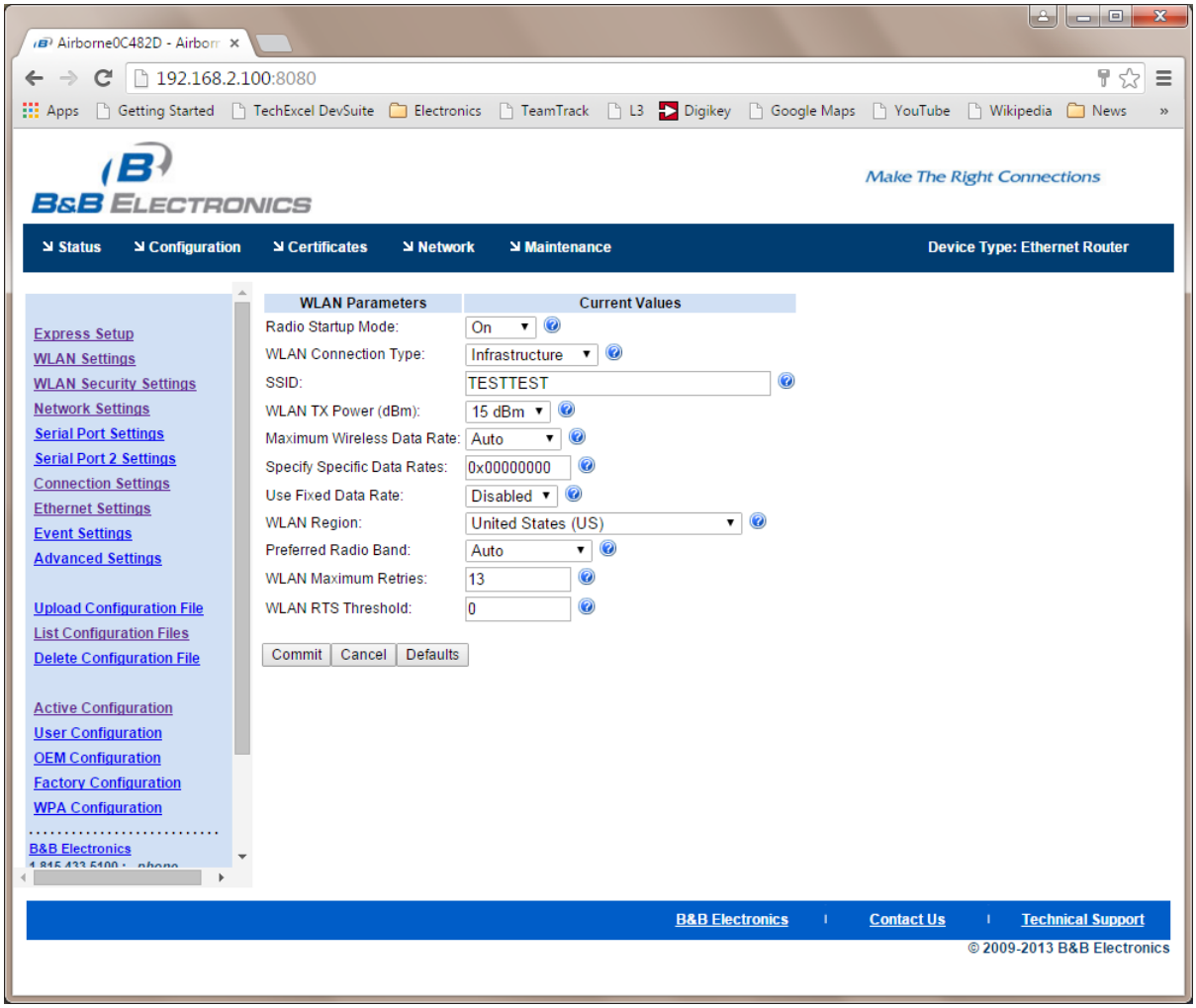

Figure M-3. Wi-Fi WLAN settings

11. Navigate to the WLAN Security Settings page as shown in **Figure M-1**.

12. Enter the wireless security settings as required.

a. Until the security type is selected, the page will not show all the settings.

b. Enter the type of security.

c. Enter the wireless password. Refer to the company IT department/ responsible party to identify the specific Security type and password value

13. Click the “Commit” button at the bottom of the page.

14. Click “Restart” to load the new security settings.

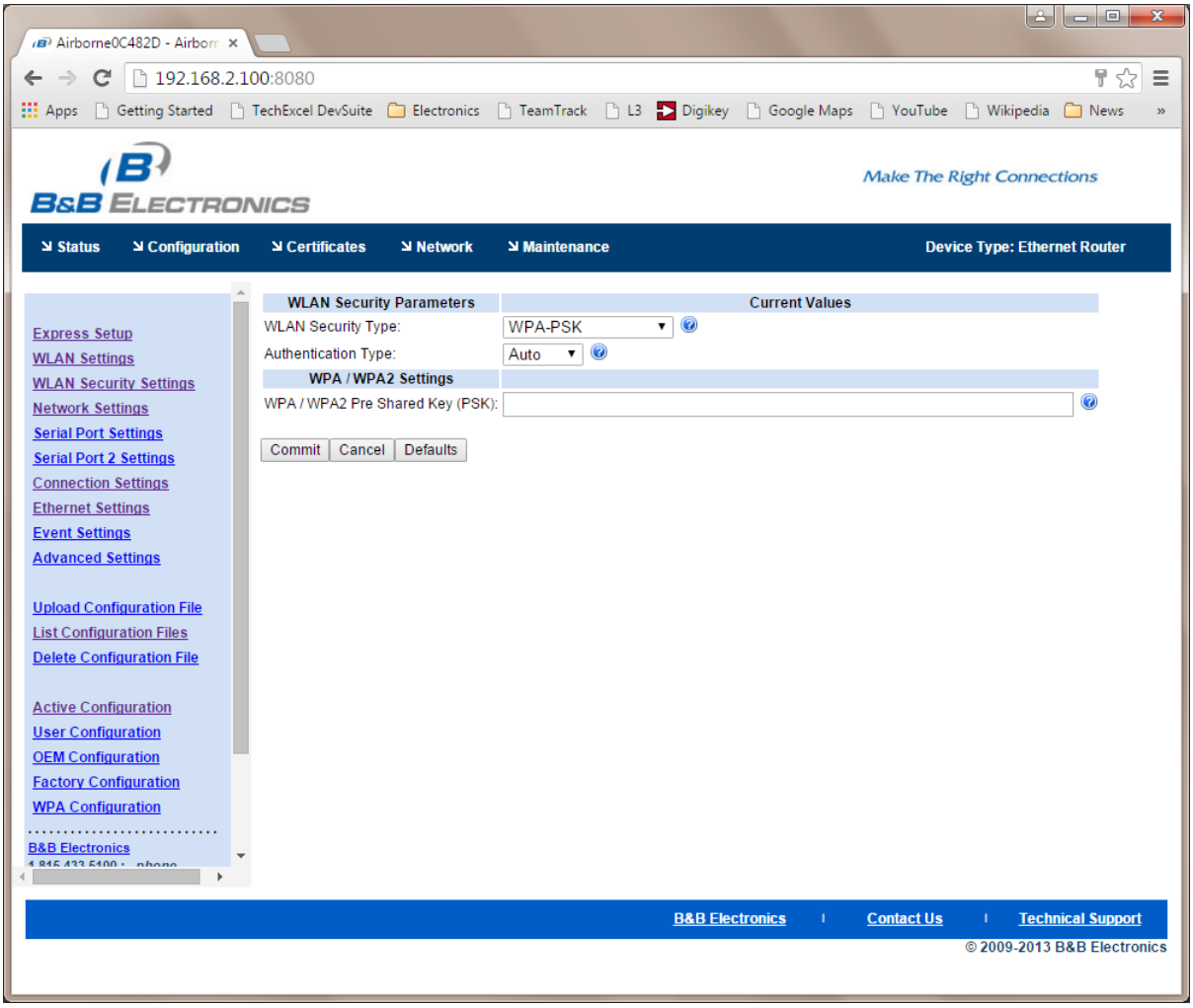

Figure M-4. Wi-Fi WLAN security settings

Verify Setup

Once the wireless configuration has been loaded, it is helpful to verify that the settings are correct before putting the Lasair III into operation.

1. Allow the Wi-Fi module to reboot from the setup procedure above.
2. Once the browser page is active again, navigate to the “Status” page. See **Figure M-1**.
3. Verify the Link Status is “Connected”.
4. Verify the Signal Level is above the noise level.

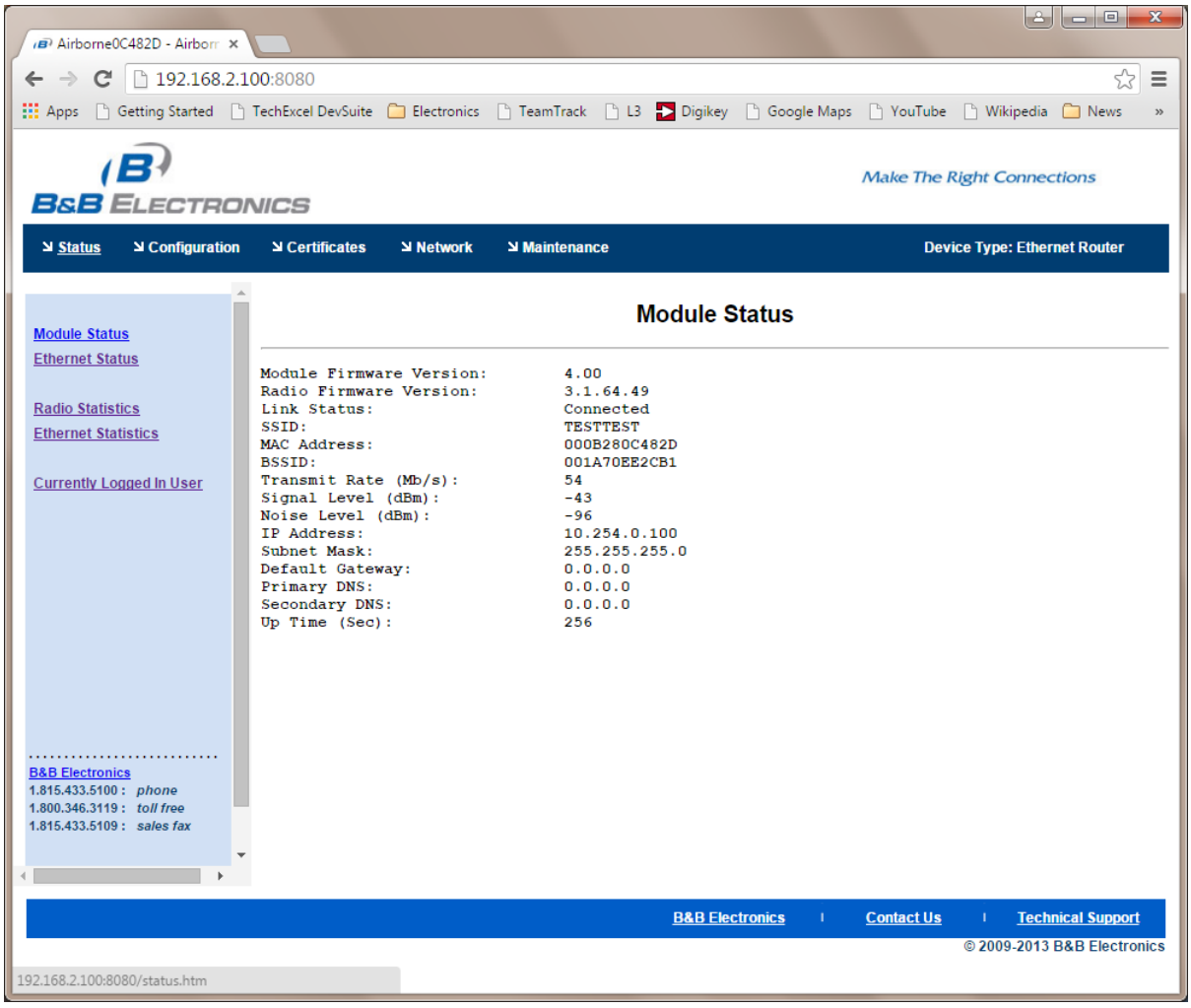

Figure M-5. Wi-Fi module status verification

Enable Lasair III Wi-Fi Operation

1. Set the Wi-Fi mode switch on the back of the Lasair III to “Wi-Fi”. See **Table M-1**.
2. Power the Lasair III off and then on. If this is not done, the Wi-Fi module and Lasair III may not connect properly.

Troubleshooting

Problem: Unable to attach laptop to Wi-Fi module for configuration.

- Verify Wi-Fi mode switch is in “Setup” position.
- Power cycle the Lasair III and wait at least 30 seconds.
- **Verify that port 8080 is being used (i.e use “:**8080” suffix on IP address).
- Set laptop to a fixed IP address of 192.168.2.5 with a network mask of 255.255.255.0. Doing this may eliminate problems where the laptop has defaulted to a 169.254.xxx.yyy address via APIPA. APIPA or Automatic Private IP Addressing is a fallback mode that occurs on Windows PCs when there is a valid Ethernet cable connection, but there is no DHCP server to assign an address.

Problem: Cannot communicate with Lasair III wirelessly.

- Check that the Wi-Fi mode switch is in the “Wi-Fi” position.
- Check the Wi-Fi status LEDs on the back of the instrument. The right two LEDs will be green if the module is wirelessly connected. See **Table M-2** for additional LED indications.
- Power cycle Lasair III and wait 30 to 60 seconds.
- Run **Verify Setup** on page M-9 procedure with a PC as described above.
- Double check the security type (WPA-PSK etc.). There are numerous similar settings. If this is not configured correctly, the wireless will not connect to the access point.
- Refer to the company IT department/responsible party to identify the specific Security type and password value
- Set PC to the same network settings as the Lasair III. Check wireless communications with PC attached to the Wi-Fi module. Test wireless connectivity of the PC in this test mode.
- Verify that the WLAN region is set correctly. This is typically applicable outside the United States.

Problem: Cannot communicate directly to the Lasair III with Ethernet cable.

- Verify Wi-Fi mode switch is in the left-most position.
- Verify the Ethernet connector link LED is lit. Verify all status LEDs are off. See **Table M-2**.

Problem: Spotty or inconsistent wireless operation.

- Wireless operation may be affected by interference and signal strength.
- Additional wireless access points may be necessary to obtain good coverage.
- **In case of Wireless signal coverage issues, verify the signal level is above the Signal noise level:** See **Verify Setup** on page M-9.
- Refer to the company IT department/responsible party to evaluate the needs of additional access points in specific areas, to increase the WiFi signal level and quality.

Default Configuration

The following text file shows an approximation of the OEM configuration stored on the Wi-Fi device. These OEM settings are restored when the Wi-Fi reset is used. The OEM settings are not protected and may be overwritten for individual circumstances.

```
#!/bin/qtsh
# /var/etc/config/oem_config.txt
#
# The default Wi-Fi Configuration Settings in this file
# allow telnet, FTP and Web page capability to
instruments
# via Wi-Fi.  The wired side of the unit is configured as
an
# Ethernet bridge.  Mac address cloning is enabled.
#
# The Wi-Fi module should operate as a pass-through
device.
#
# The user will need to configure the SSID and security
for
# their specific network.  No address adjustments should
# be required.

radio-startup on
wl-http-port 0x1F90
wl-telnet-port 0x0913
wl-mac-clone 1
ftp-server-listen-port 0x0849
eth-dhcp-server disable
eth-role bridge
```

Figure M-6. Sample OEM configuration file

Additional Resources

The “Airborne Management Center” configuration program may be downloaded from http://www.bb-elec.com. Additional documentation is also available for the Wi-Fi module.

IoC Certification

American Certification Body Inc.
6731 Whittier Ave, McLean, VA 22101

REF No. ► ATCB013819

TECHNICAL ACCEPTANCE CERTIFICATE / CERTIFICAT D'ACCEPTABILITÉ TECHNIQUE

CERTIFICATION No. / No. DE CERTIFICATION	►	**3913A-WLNN551 (New Family)**
ISSUED TO / DÉLIVRÉ A	►	**B&B Electronics 707 E. Dayton Road Ottawa, IL 61350 USA**
TYPE OF EQUIPMENT / TYPE DE MATÉRIEL	►	**Local Area Network (LAN) Device, Modular Approval, Spread Spectrum/Digital Device (2400-2483.5 MHz), Spread Spectrum/Digital Device (5725-5820 MHz) & Wi-Fi Device**
TRADE NAME AND MODEL / MARQUE ET MODELE	►	**9768, 9373 & WLNN-AN-CE551**
FREQUENCY RANGE / BANDE DE FRÉQUENCES	►	**21412 - 2462 MHz, 5180 - 5700 MHz & 5745 - 5825 MHz * See Annex 1 for Complete Detail ***
EMISSION DESIGNATION / DESIGNATION D'ÉMISSION	►	*** See Annex 1 for Complete Detail ***
R.F. POWER RATING / PUISSANCE NOMINALE H.F.	►	*** See Annex 1 for Complete Detail ***
ANTENNA / ANTENNE	►	**PCB antenna w/ 3 dBi & 5 dBi max. gain in 2.4 & 5 GHz bands, Dipole w/ 3.8 dBi & 5.5 dBi max. gain & Stub w/ 4.1 dBi & 4.7 dBi max. gain**
TEST LABORATORY / LABORATOIRE D'ESSAI	►	**LS Research, LLC W66 N 220 Commerce Court Cedarburg, WI 53012 USA Tel: (262)421-4991, Fax: (262) 364-2649 email: twhite@lsr.com**
SITE NUMBER / NUMÉRO DE SITE	►	**3088A-2**
CERTIFIED TO / CERTIFIÉ SELON LE	►	SPECIFICATION / CAHIER DES CHARGES **RSS-210** ISSUE / ÉDITION **8**

Certification of equipment means only that the equipment has met the requirements of the above noted specification. License applications, where applicable to use certified equipment, are acted on accordingly by the Industry Canada issuing office and will depend on the existing radio environment, service and location of operation.

This certificate is issued on condition that the holder complies and will continue to comply with the requirements of the radio standards specifications and procedures issued by Industry Canada. The equipment for which this certificate is issued shall not be manufactured, imported, distributed, leased, offered for sale, or sold unless the equipment complies with the applicable technical specifications and procedures issued by Industry Canada.

I hereby attest that the subject equipment was tested and found in compliance with the above-noted specification.

La certification du matériel signifie seulement que le matériel a satisfait aux exigences de la norme indiquée ci-dessus. Les demandes de licences nécessaires pour l'utilisation du matériel certifié sont traitées en conséquence par le bureau de délivrance d'Industrie Canada et dépendent des conditions radio ambiantes, du service et de l'emplacement d'exploitation.

Le présent certificat est délivré à condition que le titulaire satisfasse et continue de satisfaire aux exigences et aux procédures d'Industrie Canada. Le matériel à l'égard duquel le présent certificat est délivré ne doit pas être fabriqué, importé, distribué, loué, mis en vente ou vendu à moins d'être conforme aux procédures et aux spécifications techniques applicables publiées par Industrie Canada.

J'atteste par la présente que le matériel a fait l'objet d'essai et jugé conforme à la spécification ci-dessus.

ORIGINAL DATE OF ISSUE: May 2, 2013
REVISED DATE OF ISSUE: N/A

Page 1 of 2

Michael F. Violette
Director

041013-22i (w/ Annex 1)

IoC Certification (continued)

American Certification Body Inc.
6731 Whittier Ave, McLean, VA 22101

REF No. ► ATCB013819

TECHNICAL ACCEPTANCE CERTIFICATE (ANNEX 1)

Technical Features and Characteristics

The device includes the following features and characteristics:

Frequency Band (MHz)	Modulation Method	Minimum RF Output Power Level (in Watts)	Maximum RF Output Power Level (In Watts)	Emission Designator
2412 - 2462	11b	0.066	0.100	12M9G1D
2412 - 2462	11n(20)	0.035	0.052	16M0G7D
5180 - 5240	11n(20)	0.013	0.022	17M6G7D
5260 - 5320	11a	0.011	0.026	16M5G7D
5260 - 5320	11n(20)	0.008	0.021	17M6G7D
5500 - 5580	11a	0.014	0.022	16M5G7D
5660 - 5700	11a	0.014	0.022	16M5G7D
5500 – 5580	11n(20)	0.013	0.016	17M6G7D
5660 - 5700	11n(20)	0.013	0.016	17M6G7D
5745 - 5825	11a	0.055	0.078	16M4G7D
5745 - 5825	11n(20)	0.033	0.049	17M6G7D

ORIGINAL DATE OF ISSUE: May 2, 2013
REVISED DATE OF ISSUE: N/A

Page 2 of 2

041013-22i (w/ Annex 1)

Grant of Equipment Authorization

TCB **TCB**

GRANT OF EQUIPMENT AUTHORIZATION

Certification
Issued Under the Authority of the
Federal Communications Commission
By:

ACB, Inc.
6731 Whittier Avenue Suite C110
McLean, VA 22101

Date of Grant: 05/01/2013
Application Dated: 04/30/2013

B&B Electronics
707 E. Dayton Road
Ottawa, IL 61350

Attention: Paul Harrington

NOT TRANSFERABLE

EQUIPMENT AUTHORIZATION is hereby issued to the named GRANTEE, and is VALID ONLY for the equipment identified hereon for use under the Commission's Rules and Regulations listed below.

FCC IDENTIFIER: F4AWLNN551
Name of Grantee: B&B Electronics
Equipment Class: **Digital Transmission System**
Notes: **Zonda 801.11 a/b/g/n WLAN**
Modular Type: **Single Modular**

Grant Notes	FCC Rule Parts	Frequency Range (MHZ)	Output Watts	Frequency Tolerance	Emission Designator
CC	15C	2412.0 - 2462.0	0.1		
CC	15C	5745.0 - 5825.0	0.078		

Modular Approval. Output Power listed is Conducted. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter except in accordance with FCC multi-transmitter product procedures. OEMs and installers must be provided with antenna installation and transmitter operating conditions for satisfying RF exposure compliance.

CC: This device is certified pursuant to two different Part 15 rules sections.

Japan Radio Type Certification

SIEMIC

CONSTRUCTION DESIGNED CERTIFICATE FOR

JAPAN RADIO
TYPE APPROVAL

We hereby certify that the equipment has been granted Certification for Construction Design as described above based on regulations in Radio Law Article 38, Section 24.

Construction Designed Certificate No.:	208-150044
Certificate Holder :	B&B Electronics
Manufacturer / Factory :	B & B ELECTRONICS MFG., CO.
Equipment / Category:	Radio Equipment according to Certification Ordinance, Article 2, Section 1, No. 19, 19-3, 19-3-2
Brand / Trade Name:	B&B Electronics
Model / Type Number(s):	9373
Emission Designator / Frequency and antenna Power of radio wave:	G1D (802.11b) , 2412-2472MHz (5MHz sp , 13 Chs) 3.5 mW/MHz D1D (802.11g/HT20) , 2412-2472MHz (5MHz sp , 13 Chs) 1 mW/MHz D1D (802.11a/HT20, W52) , 5180-5240MHz (20MHz sp , 4 Chs) 1 mW/MHz D1D (802.11a/HT20, W53) , 5260-5320MHz (20MHz Sp , 4 Chs) 1 mW/MHz D1D (802.11a/HT20, W56) , 5500-5700MHz (20MHz Sp , 11 Chs) 1.2 mW/MHz
Technical Specification:	Article 2, Section 1, No. 19, 19-3, 19-3-2
Note	DFS client without radar detection capability 1. Nanoblade Antenna, CAF 94505, Gain = 2 dBi (2.4G), 4 dBi (5G) 2. Dipole Antenna, FXP.830.07.0100C, Gain = 2.6 dBi (2.4G), 5 dBi (5G) 3. Dual-band Dipole Antenna, FXP.810.07.0100C, Gain = 2.4 dBi (2.4G), 5.1 dBi (5G) 4. Dipole Antenna , GW.71.5153, Gain = 3.8 dBi (2.4G), 5.5 dBi (5G) 5. PCB antenna, PC.11.07.0100A, Gain = 3 dBi (2.4G), 4.5 dBi (5G) 6. Multi-Band Swivel Antenna, T131AH-2.4/4.9/5.X-S, Gain = 2 dBi (2.4G), 2 dBi (5G) 7. Heavy Duty Screw Mount Antenna, WS.01.B, Gain = 4.12 dBi (2.4G), 4.74 dBi (5G)

Leslie Bai
Director of Certification

Issue date: May 12, 2015

775 Montague Expressway, Milpitas, CA 95035, USA
Tel: 408 526 1188 ; Fax : 408 5261088
Website: WWW.SIEMIC.COM , Email: Info@siemic.com

Please check the validation of this certificate at http://www.siemic.com/Pages/siemic_db/public/certverification.asp

Appendix N
HHIPA Accessory

For users who desire to use the Isokinetic Sampling Probe (ISP) remotely with a handheld accessory, there is the option of using a handheld isokinetic probe attachment (HHIPA). The HHIPA is ideally designed for filter scanner applications where the standard ISP is not suitable. The HHIPA meets the requirements of ISO 14644-3, Section B.6.2.4, “Determination of Probe Size”, and can be used for filter scanning applications.

Flowrate

The HHIPA probe is available in three different flowrate configurations, depending on the flowrate of your Lasair III Particle Counter. Those flowrates are:

- 28.3 LPM (1.0 CFM)
- 50 LPM
- 100 LPM

Depending on the flowrate of the Lasair III Particle Counter, the size and the shape of the HHIPA horn are slightly different as well as the size of the barb fitting and tubing ID.

Tubing

All units are supplied with the same ergonomic handle, a barb fitting to attach tubing and 10 feet of tubing to connect to the Lasair III Particle Counter. Each of the probes is supplied with 10 feet (3 meters) of tubing, but it can be replaced with tubing up to the maximum length allowed for the instrument (8 meters). The user should take into account particle transport losses when using longer lengths of tubing and should minimize the length of tubing between the HHIPA and the particle counter whenever possible.

Figure N-1. Hand-held Isokinetic Probe Attachment (HHIPA)

Application

Tubing is connected to the barb fitting located on the rear of the HHIPA. The other end of the tubing connects to the Lasair III Particle Counter's sample inlet.

For filter scanning applications it is most common to utilize the audio beep function of the Lasair III Particle Counter. This feature allows the user to scan a filter without looking at the screen of the Lasair III, and to hear an audio sound when particles are detected.

Additional setup information is located in **Chapter 6**. See **Figure 6-6** on page 6-13 for how to set up the audio beep function on the particle counter.

Ordering the optional 100 dB Alarm Siren for the Lasair III Particle Counter provides the loudest and easiest-to-hear sound during this type of use. It is highly recommended to order the Lasair III with this additional feature if you are going to be using the HHIPA accessory.

Appendix O
Ethernet Communications Overview

This appendix provides the following basic details on Ethernet communications:

- **Ethernet Addressing Basics** on page O-2
- **MAC Address** on page O-5
- **Static IP Addresses versus DHCP Addresses** on page O-5
- **Troubleshooting Ethernet Connectivity** on page O-6
- **Instrument to Laptop Ethernet Setup** on page O-8

IT Department

The Information Technology or IT department of an organization is responsible for configuring and controlling the corporate network. Any time an Ethernet enable instrument is attached to a corporate network, IT must be involved, since a static (i.e., fixed) IP address is required by the instrument. The IT department is responsible for assigning fixed addresses.

Ethernet Addressing Basics

Particle Measuring Systems instruments must be properly configured for Ethernet communications in order to work. There are multiple numeric parameters required to properly configure an instrument and a small error in one or more of these parameters can result in no communications, or worse—sporadic communications.

All instruments support the common IPv4 standard. Valid addresses are in the range of 0.0.0.0 to 255.255.255.255. The number 255 corresponds to the special value of 0xFF in hexadecimal. Numbers 256 or larger are not valid. Each number in the dot sequence is sometimes called an octet.

There are four different parameters to configure:

- **IP Address** on page O-2—Required
- **Network Mask** on page O-3—Required
- **page O-4**—Depends on network. May be blank or 0.0.0.0
- **Multicast Address** on page O-4—Used only in Facility Net. The default value is generally OK.

IP Address

The Internet Protocol (IP) address consists of two portions:

- a network portion
- a location portion

In the analogy of a telephone number, there is an area code and a phone number. Unlike a telephone number, the network (or area code) portion of an IP address can be set to different numbers of digits. It is not a fixed size like an area code. The location portion is the rest of the number – everything that is not part of the network portion. The definition of what is network and what is location is done by the network mask, described below.

Although there are a great many numbers in the range of 0.0.0.0 to 255.255.255.255, in almost all circumstances instruments are placed on a segregated private network that uses a greatly reduced set of numbers. The valid ranges are shown in the following table.

Address Class	Start	End
A (24 Bit Range)	10.0.0.0	10.255.255.255
B (20 Bit Range)	172.16.0.0	172.31.255.255
C (16 Bit Range)	192.168.0.0	192.168.255.255

Particle Measuring Systems provides a unique default address in the Class A range for every instrument. Whenever the instrument is set to default parameters or factory defaults, this address is restored.

Network Mask

The network mask is used to discern the network portion of the IP address from the location portion. From a telephone number analogy, it segregates the area code from the phone number. It is easy to set the mask incorrectly, and when it is incorrect, it can result in sporadic communication problems. For example, in Facility Net an instrument can be seen as available via a Multicast probe, but trying to control the instrument causes a communications error.

The mask is actually a 32 bit binary number consisting of some number of 1's followed by enough 0's to make 32 bits. The length of the 1's depends on the network Address Class (i.e., area code size) as well as sub-netting (i.e., something done by IT). The following table shows the default network mask for each address class.

Address Class	Default Network Mask
A (24 Bit Range) (e.g., 10.X.X.X)	255.0.0.0
B (20 Bit Range) (e.g., 172.16.X.X)	255.240.0.0
C (16 Bit Range) (e.g., 192.168.X.X)	255.255.0.0

When a Particle Measuring Systems instrument is set to default parameter or factory defaults, the network mask is set to 255.0.0.0. This corresponds with the 10.X.X.X address which is also set.

For large systems, IT personnel will dictate a network mask value, and the value may be different from what is shown in the table. Make sure the network mask is set as specified by IT. All PCs, routers and instruments on a network must use exactly the same network mask, or communication problems will arise.

Gateway Address

The gateway address is a special address used to allow communications outside of the local network. In the telephone analogy, it allows placing long distance calls. In many (if not most) situations, a gateway address is not required.

The default gateway address set when restoring defaults to a Particle Measuring Systems instrument is 10.255.0.60. This address should be set to whatever is required by IT.

Multicast Address

The multicast address is used by Facility Net and Pharmaceutical Net to query all instruments attached to a local network. The valid multicast address range is defined as 224.0.0.0 to 239.255.255.255. From a practical standpoint addresses in the 224.0.X.X range should not be used as many of them are reserved for other communications.

Particle Measuring Systems assigns a factory default multicast address of 224.100.100.1 to all instruments. This address generally does not need to be changed. The exception is when sensors are integrated into a large network. In this situation, IT may recommend an alternative multicast address to avoid network conflicts.

MAC Address

All Ethernet devices have a MAC (Media Access Control) address. This address may be thought of as an Ethernet serial number. It is unique for all devices. If an instrument needs to be replaced with a different instrument for either calibration or service, the service technician will duplicate the old instrument's IP address into the new instrument. However, the MAC address of the new instrument will be unique.

In Particle Measuring Systems instruments the MAC address is set during production. The value is permanently stored in non-volatile memory on the main processor circuit board. (The MAC address will change if the main circuit board is replaced.) The MAC address may be displayed via the HyperTerminal (i.e., RS-232 service interface) by using the status command.

Routers and switches keep track of which MAC address is attached where. For that reason, it is important for the instrument to tell a router or switch who is attached. For all Particle Measuring Systems instruments, this is done at least once when the instrument boots. In some newer instruments, the MAC address is announced to the switch or router every time a network connection is detected. Without this mechanism, it would be possible for routers to operate for an extended period of time without recognizing which MAC address is mapped to which IP address.

Static IP Addresses versus DHCP Addresses

All Particle Measuring Systems use a static IP address. This means the address is predefined. The address is used to identify the instrument when data is collected. In contrast, many computers use a dynamic IP address (i.e., DHCP or Dynamic Host Configuration Protocol). In order for dynamically configured devices and statically configured devices to be mixed on the same network, some mechanism must be used to segregate the DHCP address range from the static address range. This mechanism is a standard configuration parameter set in the router.

IT is typically responsible for delineating the address range. If static and dynamic addresses are not properly segregated, it may result in duplicate addresses, and unexpected network behavior.

Troubleshooting Ethernet Connectivity

These steps may be used to check communications to an Ethernet device.

1. Check for light on LEDs of the Ethernet connector. There should be at least one light lit solid to indicate a connection. If not, there is hardware connection problem

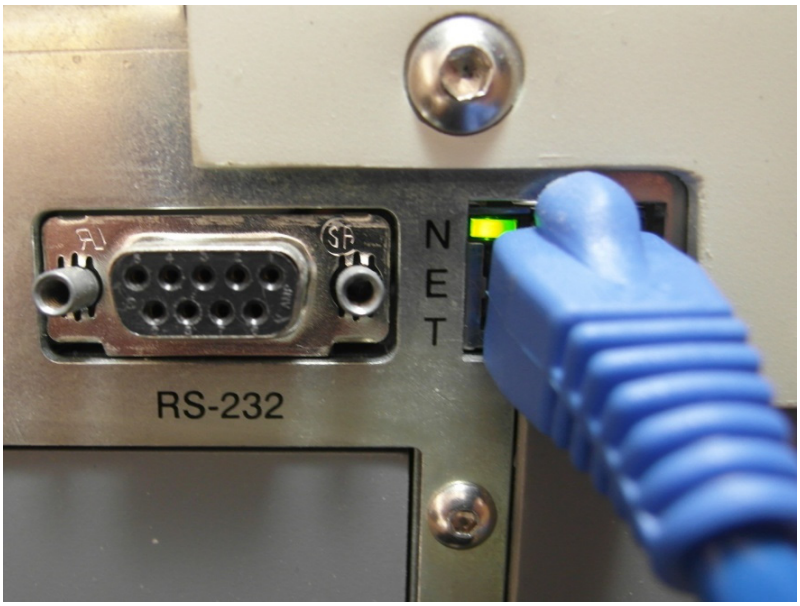

Figure O-1. Ethernet port connectivity LED

   a. Is the cable bad?
      i. Try a different cable.
      ii. If a direct laptop to instrument connection is being done, a cross-over cablemay be required. Cross-over cables are specially marked as such. Particle Measuring Systems p/n 1000011477 is a cross-over cable.
   b. Is the other end of the cable alive?
      Does a known good device work when connected instead?

2. Verify the device can talk using ping.
   a. a. Open a command shell on a PC, and type **ping aaa.bbb.ccc.ddd** where **aaa.bbb.ccc.ddd** is the address of the device.
      If there is no response, then there is an addressing problem.

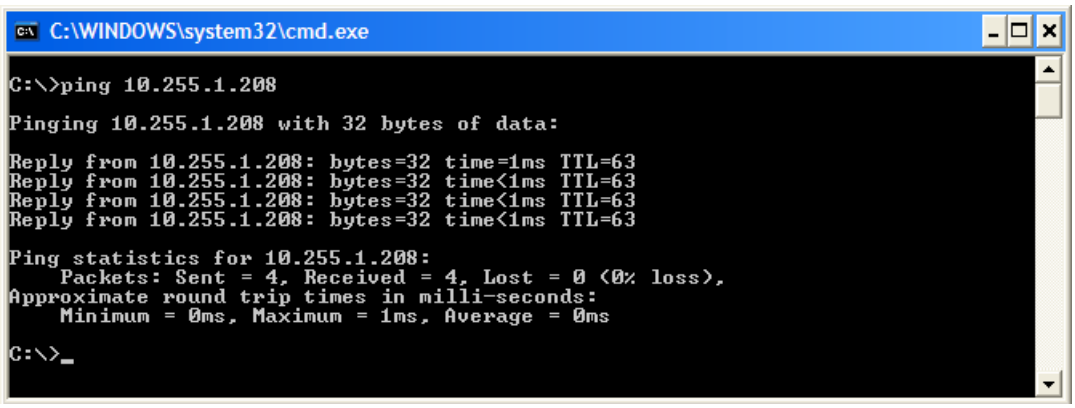

Figure O-2. Example for ping test

b. Make sure the PC and the device being talked to are on the same network.

c. Check the PC's address by opening a command shell and typing ipconfig.

i. Is the Mask the same on both the PC and the device?

ii. Is the network portion of the address the same on both the PC and the device?

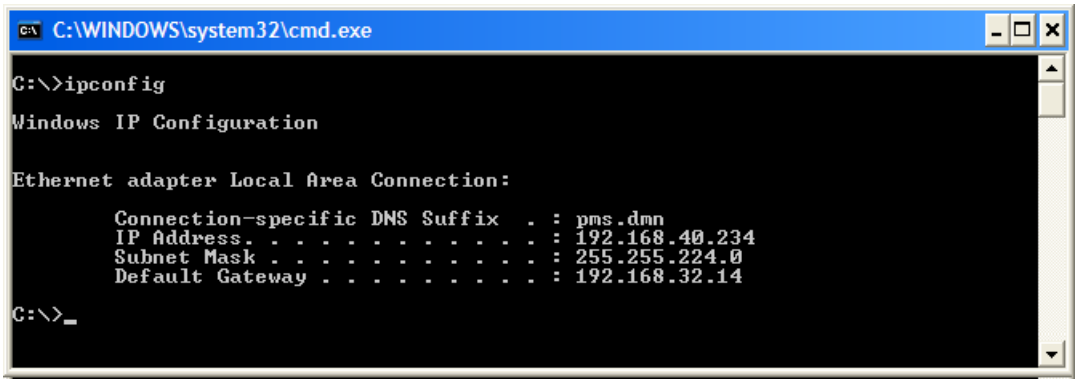

Figure O-3. Example for ipconfig command

d. Does an LED on the device's Ethernet connector blink when a ping is transmitted to it?
If not there may be an addressing error with the device, or a configuration problem with the router or switch the device is attached to.

i. Try repowering the device to re-establish communications with the router or switch.

Instrument to Laptop Ethernet Setup

There are two ways to establish a direct Ethernet link between a laptop (or other PC) and a Particle Measuring Systems instrument. The first way is to modify the PC Ethernet settings to work with the existing instrument settings. The second way is to modify the instrument settings to work with the existing PC settings. Since PCs are typically configured for DHCP, this method is less obvious; however for certain applications (such as demos or testing) this method may be advantageous.

Cabling between a laptop and instrument can often be done with a standard Cat 5 Ethernet cable. Older computers and older instrument designs may require an Ethernet cross-over cable to communicate properly. This is available from Particle Measuring Systems as p/n 1000011477. Newer computers use a mechanism called Auto-MDIX to do the cross-over within the computer or instrument automatically.

Method 1: Modifying the IP Settings on a PC

This method allows using the existing instrument address. At the end of the communications session, the laptop will contain an address that will prevent normal communications to the corporate network. The procedure must be undone after the session.

1. Retrieve the network address parameters from the instrument. This can be done using HyperTerminal serial link and the “status” command.
2. Determine a compatible network address and mask to set the PC. For example, an instrument has address **10.12.43.217** and mask value **255.255.0.0**. The PC must use exactly the same mask value (i.e., 255.255.0.0). The address can be selected as any valid address so long as the network portion is kept the same. Therefore, **10.12.43.216** would be acceptable, and **10.12.0.1** could also be used.
3. Configure the PC to talk at the selected address:
   a. Navigate to the Local Area Connection Properties window.

In Windows 7	In Windows 10
Start	Start
Control Panel	Settings
Network and Internet	Network & Internet
Network and Sharing Center	Change adapter options
Change Adapter Settings	

i. There may be more than one choice to select at this step. Choose the item labeled LAN or Local Area Connection.

NOTE: Do not select anything with the word “Wireless” or the word “Virtual”.

ii. Right click on the adapter, and then select Properties. A window similar to that shown below should be displayed.

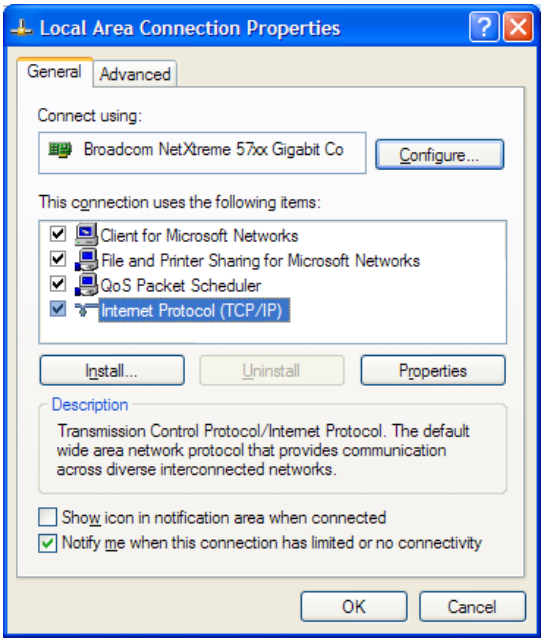

Figure O-4. Local Area Connection Properties window

b. Select the item Internet Protocol (TCP/IP). If given an option for Version 4 or Version 6, select the one titled Internet Protocol Version 4.

c. Click the Properties button.

d. Record the existing settings on the pop-up Internet Protocol (TCP/IP) Properties window. These settings will need to be restored after the instrument communication session is complete.

e. Change the settings on the Internet Protocol (TCP/IP) Properties window to use the network address and mask determined above. See **Figure O-5** for an example. The Default gateway and DNS server values should be left blank.

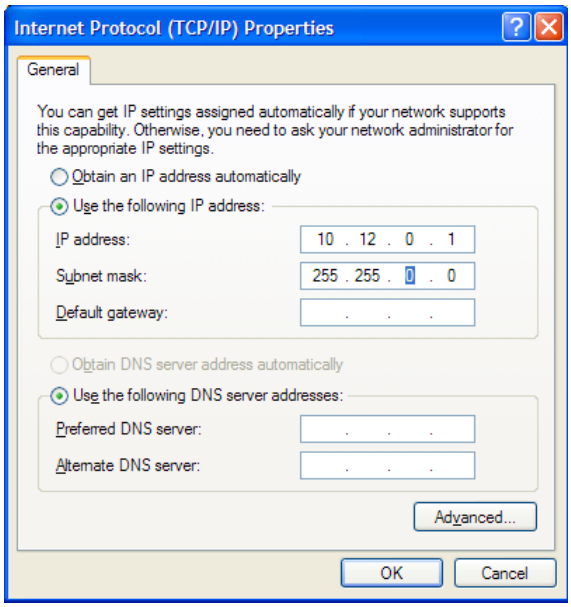

Figure O-5. IP address and subnet mask defined

f. Click the OK button to close the Internet Protocol (TCP/IP) Properties window.

g. Click the OK button to close the Local Area Connection Properties window.

4. The PC is now configured.

5. Attach a network cable between the PC and the instrument.

6. Use the procedure **Troubleshooting Ethernet Connectivity** on page O-6 to check the connection is functioning.

Method 2: Modifying the Settings on an Instrument

This method takes advantage of a Microsoft Windows feature called Automatic Private

IP Addressing or APIPA. APIPA allows a PC to automatically assign itself an IP address even when no DHCP server is present to provide an address to the PC. Translated this means that by assigning the right address to an instrument, it will talk one to one with a

Windows machine without setting an address on the Windows machine. The address range of 169.254.0.1 through 169.254.255.254 is reserved for APIPA.

1. Attach the instrument to a HyperTerminal link.
2. Set the instrument addresses as follows:

IP address	169.254.0.1
Mask	255.255.0.0
Gateway	0.0.0.0 (or blank)

3. After setting the addresses, use the write" command to save the addresses. The instrument will reboot and apply the new address settings.
4. Attach a network cable between the PC and the instrument.
5. Use the procedure **Troubleshooting Ethernet Connectivity** on page O-6 to check the connection is functioning.

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Appendix P
Serial Communications Overview

The elimination of a serial port on laptop computers and the elimination of HyperTerminal software pre-installed on Windows machines requires that service personnel prepare beforehand to have the right tools for serial communications.

This appendix includes the following sections that describe set up and troubleshooting for serial communications:

- **Adapters and Cables** on page P-2
  - **Useful Serial Adapters**
  - **USB Serial Port Adapter**
  - **Serial Cable**
  - **RJ-12 Cable and Adapter**
- **Connector Signals** on page P-6
- **Communication Software Options** on page P-7
  - **HyperTerminal**
  - **PuTTY**
  - **Tera Term**
- **Communications Configuration** on page P-10
  - **ENODE Specific Settings**
- **Troubleshooting Serial Communications** on page P-11
  - **No Communications**
  - **Dropped Characters or Strange Characters**
  - **Unexpected Characters**

Adapters and Cables

Several hardware items are needed for attaching PCs to various Particle Measuring Systems instruments. Not all the items are required all the time; however, having all the items shown will provide a reasonably complete serial connection tool suite.

The standard PC serial port is a male DE-9. The DE-9 is sometimes referred to as a DB-9 or DB9 in documentation. Historically PCs used a DB-25 connector with 25 pins. The “B” refers to the physical size of the connector. Current generation PCs use the smaller “E” size connector with 9 pins. Hence DE-9 is the correct name, but the term DB-9 is a common misnomer.

Useful Serial Adapters

All three adapters shown in **Table P-1** are useful in different situations. The complete set allows attaching to any DE-9 serial port regardless of gender or pinout.

DE-9 Female-Female Gender Changer L-Com p/n DGB9F or Similar	
DE-9 Male-Male Gender Changer L-Com p/n DGB9M or Similar	
DE-9 Null Modem L-Com p/n DMA060MF or Similar	

Table P-1. Recommended Serial Adapters

USB Serial Port Adapter

Newer computers (especially laptops) no longer include a serial port.
USB to Serial adapters are available to resolve this issue. The part number for the Particle Measuring Systems adapter is P/N 1000016655 (see **Figure P-1**).

Figure P-1. USB serial adapter

USB driver for Windows

Windows machines will require a driver to be installed for the USB serial adapter. The drivers are specific to the model of adapter used. Incorrect drivers can occasionally be a problem. If the adapter does not operate correctly, the driver is usually at fault.

Serial Cable

Serial cables are available in assorted varieties. The most useful version is a “straight” or “straight-through” cable with DE-9 male and female connectors.

Figure P-2. Serial cable

There are numerous variants on serial cables including null-modem (also called crossover) cables. In addition, some cables have DB-25 or other less useful connectors.

The recommended straight cable will not require m/m or m/f or null modem adapters for most Particle Measuring Systems instruments.

RJ-12 Cable and Adapter

Some Particle Measuring Systems instruments (usually those with smaller form factors) use an RJ-12 modular adapter for serial communication.

The adapter and cable may be purchased from Particle Measuring Systems as P/N PMSCD1995 (see **Figure P-3**). The DE-9 side of the adapter will attach directly to a PC serial port or a USB to serial adapter.

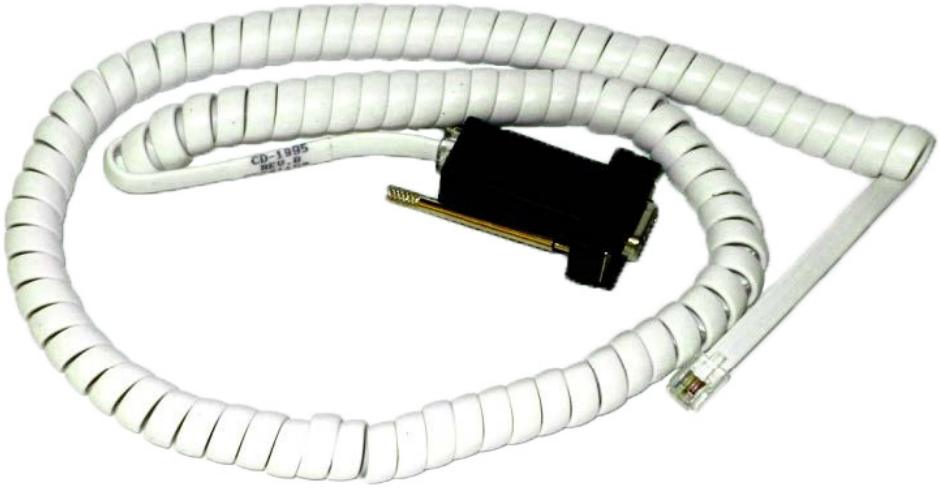

Figure P-3. RJ-12 adapter and cable

Connector Signals

Table O-2 shows the standard PC serial port connection. The highlighted signals (RX, TX and Ground) are required signals for Particle Measuring System instruments. The signals shown in italics are not used.

Pin	In/Out	Description
1	In	DCD (Data Carrier Detect)
2	In	RX (Receive)
3	Out	TX (Transmit)
4	Out	DTR (Data Terminal Ready)
5		Ground
6	In	DSR (Data Set Ready)
7	Out	RTS (Request to Send)
8	In	CTS (Clear to Send)
9	In	RI (Ring Indicator)

Table P-2. Standard PC Serial Port (DE-9)

Table P-3 shows the RJ-12 connector pinout for many Particle Measuring Systems instruments. Pins shown as instrument dependent are not usually available. On some instruments, the pins may be tied together to simulate hardware flow control. On other instruments, the pins are not used at all. See instrument-specific documentation to verify the details.

An adapter cable is provided with instruments that use this interface. Order P/N PMSCD1995.

Pin	In/Out	Description
1	In	DSR (instrument dependent)
2	Out	TX (Transmit)
3	In	RX (Receive)
4	Out	RTS (instrument dependent)
5	In	CTS (instrument dependent)
6		Ground

Table P-3. RJ-12 Instrument connector

Communication Software Options

Users of Windows XP can use the built-in program HyperTerminal for configuring serial communications. Windows 7 and later operating systems no longer include this program. See the following alternative utilities available as downloads:

- **HyperTerminal** on page P-7
- **PuTTY** on page P-8
- **Tera Term** on page P-9

HyperTerminal

HyperTerminal is a purchased download for Windows operating systems. It is available from Hilgraeve (http://www.hilgraeve.com) as well as other sites.

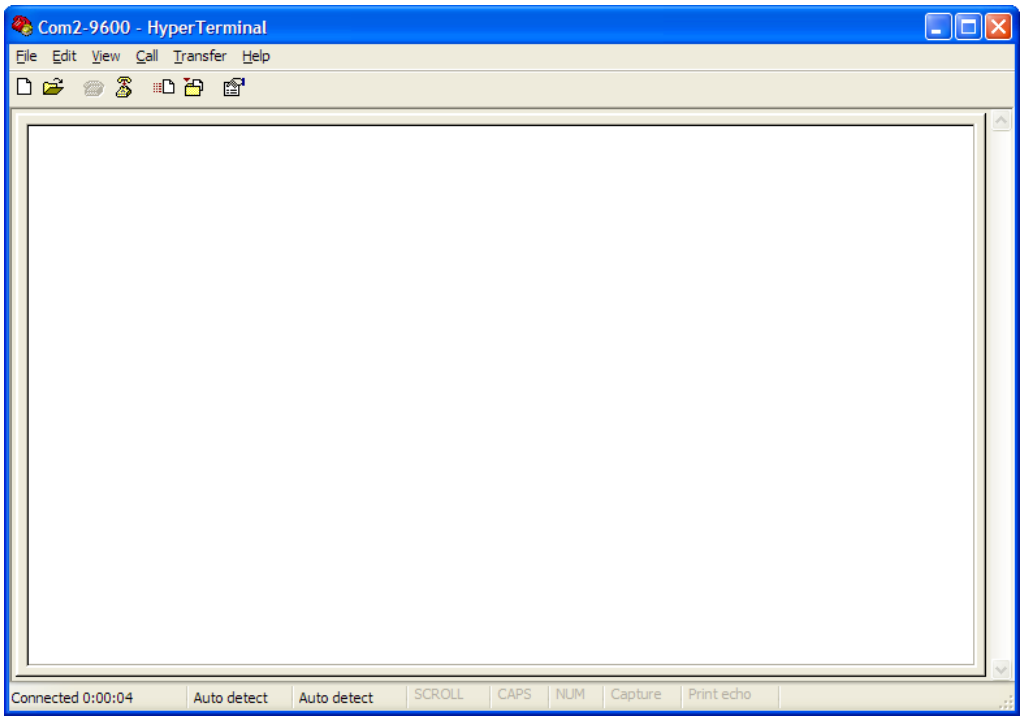

Figure P-4. HyperTerminal window

PuTTY

PuTTY is an open-source (i.e., free) terminal emulator for Windows. It is available at both of these hyperlinks:

- **http:**//www.putty.org
- **http:**//www.chiark.greenend.org.uk/~sgtatham/putty/download.html

PuTTY software interface screen shots are shown in **Figure P-5** and **Figure P-6**.

The default color scheme uses a black terminal window. This can be changed to a white terminal window by going to the “Colours” setup, and then clicking the box titled “Use system colours”.

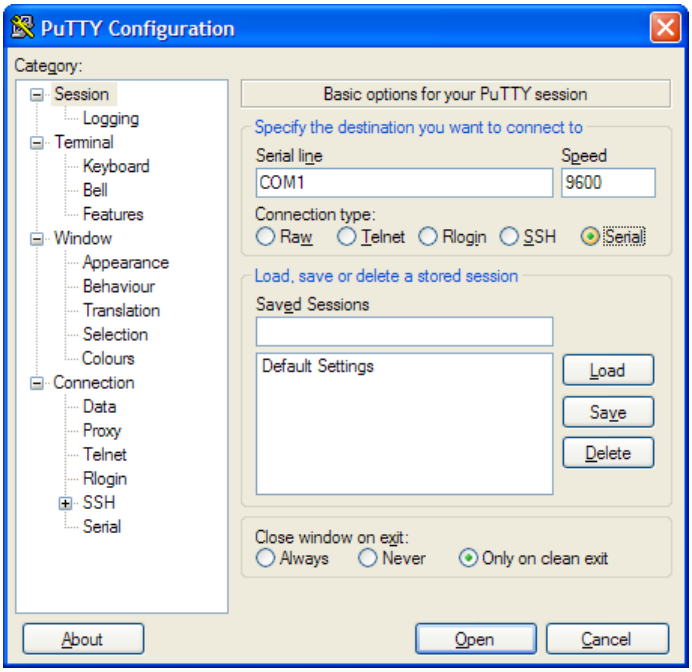

Figure P-5. PuTTY Configuration window

Figure P-6. PuTTY Main window

Tera Term

Tera Term is another free terminal emulator. It is a somewhat larger download than

PuTTY described above. It is available at:

- **http:**//en.sourceforge.jp/projects/ttssh2/releases/

Tera Term also uses a black main window. It can be reversed under the Setup -> Window option. Tera Term software interface screen shots are shown in **Figure O-7** and **Figure O-8**.

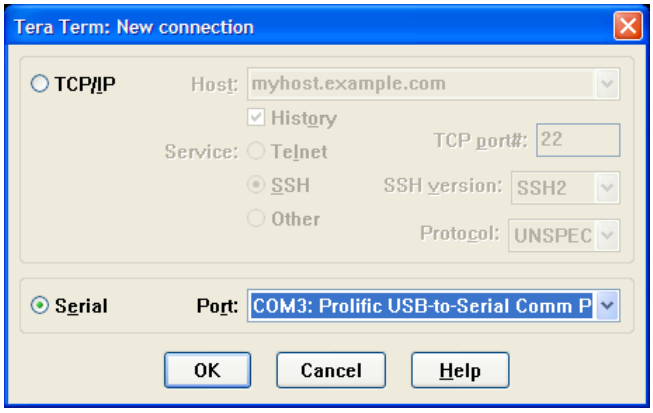

Figure P-7. Tera Term Setup window

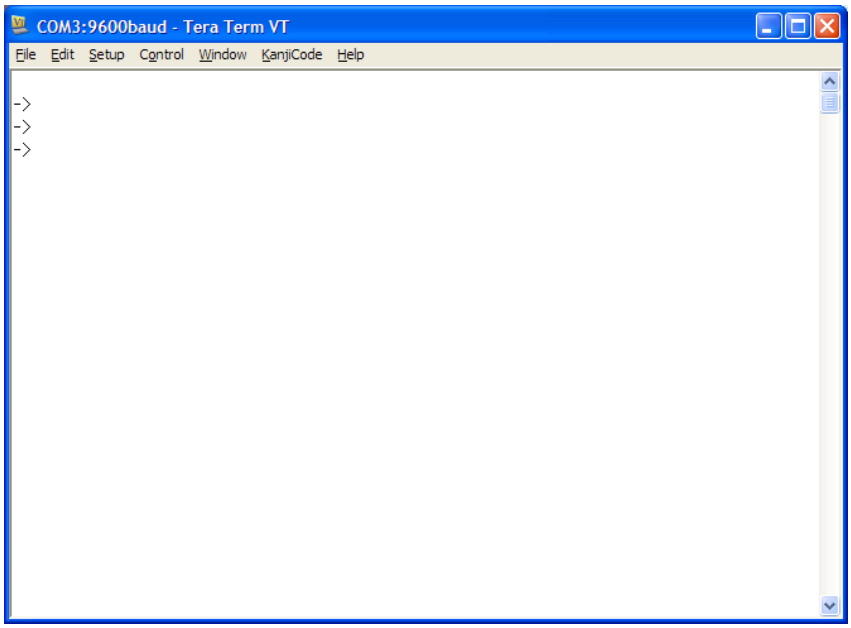

Figure P-8. Tera Term Main window (colors reversed)

Communications Configuration

The default communication parameters for all Particle Measuring Systems instruments are as listed in **Table P-4**:

Baud	9600 (This can be changed on the Lasair II and Lasair III front panels.)
Parity	None
Data Bits	8
Stop Bits	1
Control Flow	Xon/Xoff (none is also OK)

Table P-4. Communication parameters

ENODE Specific Settings

The ENODE requires additional settings for communications. These are not covered in this appendix. In addition, not all the settings are supported by PuTTY or Tera Term.

Troubleshooting Serial Communications

Here are some basic troubleshooting guidelines.

No Communications

- Is all the cabling correct? Add a null-modem adapter and see if that resolves the issue.
- Is the right COM port selected in the communication settings?
    - If using a USB to serial adapter, use the Windows Device Manager to find the correct COM port.
- Are the communication settings correct? Is the software set for 9600,N,8,1?
    - If the problem is with a Lasair II or Lasair III check the instrument's communications setup screen.
- Is hardware flow control enabled? If so, disable it.

Dropped Characters or Strange Characters

- Is the baud rate correct?
- Verify that hardware flow control is not enabled.
- Is there a problem with the serial port on the PC? Bad USB to Serial adapter drivers can cause issues.

Unexpected Characters

- If there are extra blank lines, check the <CR> and <LF> input translation.
- If characters are duplicated, half duplex mode may be enabled. Use full duplex mode.

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Appendix Q
有毒或有害的物质和元素

	有毒或有害的物质和元素					
Part Name 部件名称	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
机电	X	O	X	O	O	O
显示器	X	O	X	O	O	O
电池	X	O	X	O	O	O

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。

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。

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