



**PARTICLE  
MEASURING  
SYSTEMS®**  
a SPECTRIS company

Without measurement there is no control



# *Lasair® Pro* *Aerosol Particle Counter*

## OPERATIONS MANUAL

# Lasair® Pro Aerosol Particle Counter Operations Manual



**PARTICLE  
MEASURING  
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## Lasair® Pro Aerosol Particle Counter Operations Manual

Part Number (P/N) 1000025871 Rev D

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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.



The graphic banner features the Particle Measuring Systems logo (a stylized sun/sunrise over waves) and the text "PARTICLE MEASURING SYSTEMS® spectris company". Below this, the Science Based Targets logo (a stylized wave icon) and the text "SCIENCE BASED TARGETS" and "DRIVING AMBITIOUS CORPORATE CLIMATE ACTION" are displayed. The main text on the banner is "Committed to Net Zero" in large green letters, followed by "View our Net Zero Roadmarks and Targets" in black text. At the bottom, it says "BUSINESS AMBITION FOR 1.5°C" with a green arrow icon. The background of the banner is light blue with a graphic of green trees and stylized buildings.

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## 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 Pro 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 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](http://www.call2recycle.org). In Europe, contact the European Portable Battery Association. (EPBA) [www.epbaeurope.net](http://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 Pro particle counter pending.

## Wireless Radio Designators

FCC = **FCC ID: 2BCDH-LPRO** Contains FCCID: SQG-60SIPT  
IC = **IC: 31142-LPRP** Contains IC: 3147A--60SIPT

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## 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.

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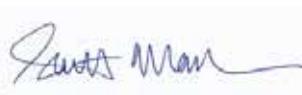
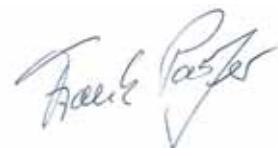
**NOTE:** A note in the text is used to highlight an item that is of operational importance to the user.

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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**

Use next page as a template for revising this page as we need to add the UKCA declaration to the manuals.

<b>Application of Council Directive(s):</b>	2014/30/EU, 2014/35/EU, 2014/53/EU, RoHS 2011/65/EU and 2015/863		
<b>Standard(s) to which Conformity is Declared:</b>	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	
<b>Manufacturer's Name:</b>	Particle Measuring Systems, Inc.		
<b>Manufacturer's Address:</b>	5475 Airport Boulevard, Boulder, CO 80301 USA		
<b>Manufacturer's Telephone/FAX:</b>	+01 303 443 7100 / +01 303 449 6870		
<b>Distributor's Name:</b>	Particle Measuring Systems, S.R.L.		
<b>Distributor's Address</b>	Via di Grotte Portella 34 00044 Frascati (Roma) ITALY		
<b>Distributor's Telephone/FAX:</b>	+ 39 06 90530130 / + 39 06 9051315		
<b>Type of Equipment:</b>	Particle Counter		
<b>Model No:</b>	Lasair Pro		
I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s) and Standard(s).			
<b>Signature:</b>	 		
<b>Full Name:</b>	Scott MacLaughlin	<b>Full Name:</b>	Frank Panofen
<b>Position:</b>	Director of Engineering	<b>Position:</b>	Marketing Manager, Life Sciences
<b>Place: Boulder</b>	Date: April 13, 2023	<b>Place: Rome</b>	Date: April 13, 2023

**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.

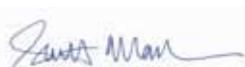
If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

**CE and UKCA Declaration of Conformity**

<b>Application of Council Directive(s):</b>	CE	2014/30/EU, 2014/53/EU, 2014/35/EU, RoHS 2011/65/EU, <b>2015/863</b>
	UKCA	Electromagnetic Compatibility Regulations 2016, Electrical Equipment (Safety) Regulations 2016 Radio Equipment Regulations 2017 The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012
<b>Standard(s) to which Conformity is Declared:</b>	EMC	EN 61326-1:2013  S.I. 2016 No. 1091, S.I. 2016 No. 1101, S.I. 2017 No. 1206, S.I. 2017 No. 1206, BS EN 63000:2019
	Safety	EN61010-1: 2010, 3rd, Ed., EN 60825-1: 2014
	RED	<b>ETSI EN 300 330, 300 328, 301 893, 301 489-17, 301 489-3</b>
	RoHS	EN 63000:2019
<b>Manufacturer's Name:</b>	Particle Measuring Systems, Inc.	
<b>Manufacturer's Address:</b>	5475 Airport Boulevard Boulder, CO 80301 USA	
<b>Manufacturer's Telephone/FAX:</b>	+ 1 3034437100 / + 1 3034496870	
<b>Distributor's Name:</b>	Particle Measuring Systems, S.R.L.	
<b>Distributor's Address</b>	Via di Grotte Portella 34 00044 Frascati (Roma) ITALY	
<b>Distributor's Telephone/FAX:</b>	+ 39 06 90530130 / + 39 06 9051315	
<b>Type of Equipment:</b>	Particle Counter	
<b>Model No:</b>	Lasair Pro	

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s) and Standard(s).

**Signature:**



**Signature:**



**Full Name:** Scott MacLaughlin

**Full Name:** Frank Panofen

**Position:** Director of Engineering

**Position:** Marketing Manager, Life Sciences

**Place: Boulder** **Date: TBD**

**Place: Rome** **Date: TBD**

**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.

## **Federal Communication Commission FCC Compliance Statements**

### Compliance Statement (Part 15.19)

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and

2. This device must accept any interference received, including interference that may cause undesired operation.

### Warning (Part 15.21)

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

To comply with FCC RF exposure limits for general population / uncontrolled exposure, the antenna must be installed to provide a separation distance of at least 20cm from all persons and operating in conjunction with any other antenna or transmitter, except in accordance with FCC multi-transmitter product procedures.

## **Industry Canada (IC) - Compliance Statements**

### Section 8.4 of RSS-GEN

This Device complies with Industry Canada License-exempt RSS standard(s). Operation is subject to the following two conditions: 1) this device may not cause interference, and 2) this device must accept any interference, including interference that may cause undesired operation of the device.

Cet appareil est conforme aux normes RSS exemptes de licence d'Industrie Canada. Son fonctionnement est soumis aux deux conditions suivantes : 1) cet appareil ne doit pas causer d'interférences et 2) cet appareil doit accepter toute interférence, y compris les interférences susceptibles de provoquer un fonctionnement indésirable de l'appareil.

### Section 8.3 of RSS-GEN

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

En vertu des réglementations d'Industrie Canada, cet émetteur radio ne peut fonctionner qu'avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvés pour l'émetteur par Industrie Canada.

Pour réduire les interférences radio potentielles avec d'autres utilisateurs, le type d'antenne et son gain doivent être choisis de manière à ce que la puissance isotrope rayonnée équivalente (e.i.r.p.) ne soit pas supérieure à celle nécessaire pour une communication réussie.

### Radiation Exposure Statement:

This equipment complies with Canada radiation exposure limits set forth for an uncontrolled environment.

This equipment should be installed and operated with minimum distance of 20 cm between the radiator & body extremities.

### Déclaration d'exposition aux radiations:

Cet équipement est conforme Canada limites d'exposition aux radiations dans un environnement non contrôlé. Cet équipement doit être installé et utilisé à distance minimum de 20 cm entre le radiateur et votre corps.

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# FAQS

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):

<http://www.pmeasuring.com/en/service-and-support/automated-hardware-software-support>



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# Chapter 1

## Quick Guide

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Portable, lightweight, and durable, the Lasair® Pro Aerosol Particle Counter is for applications where portability is crucial, such as cleanroom monitoring, facility certification, and trending analysis.



The particle counter's touchscreen 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



## Assembly

1. Remove the protective cap from the particle counter's sample inlet.
2. Press tubing or ISP over the sample inlet base.
3. If using tubing, insert the free end of the tubing into one end of an adapter (supplied with each ISP).
4. Place the sample probe on the other end of the adapter. The adapter's O-ring will hold the sample probe securely to the adapter.



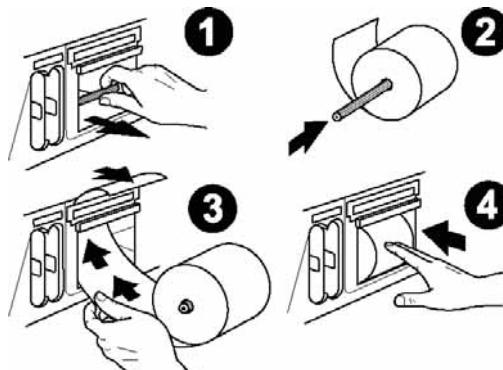
5. Mount the adapter using the two 1/4-inch screw holes as necessary.

**NOTE:** If sampling particles greater than 1  $\mu\text{m}$ , use the minimum length required to reach the sampling area. In pharmaceutical applications, tubing length should be a maximum of 2 m (about 6.5 ft).

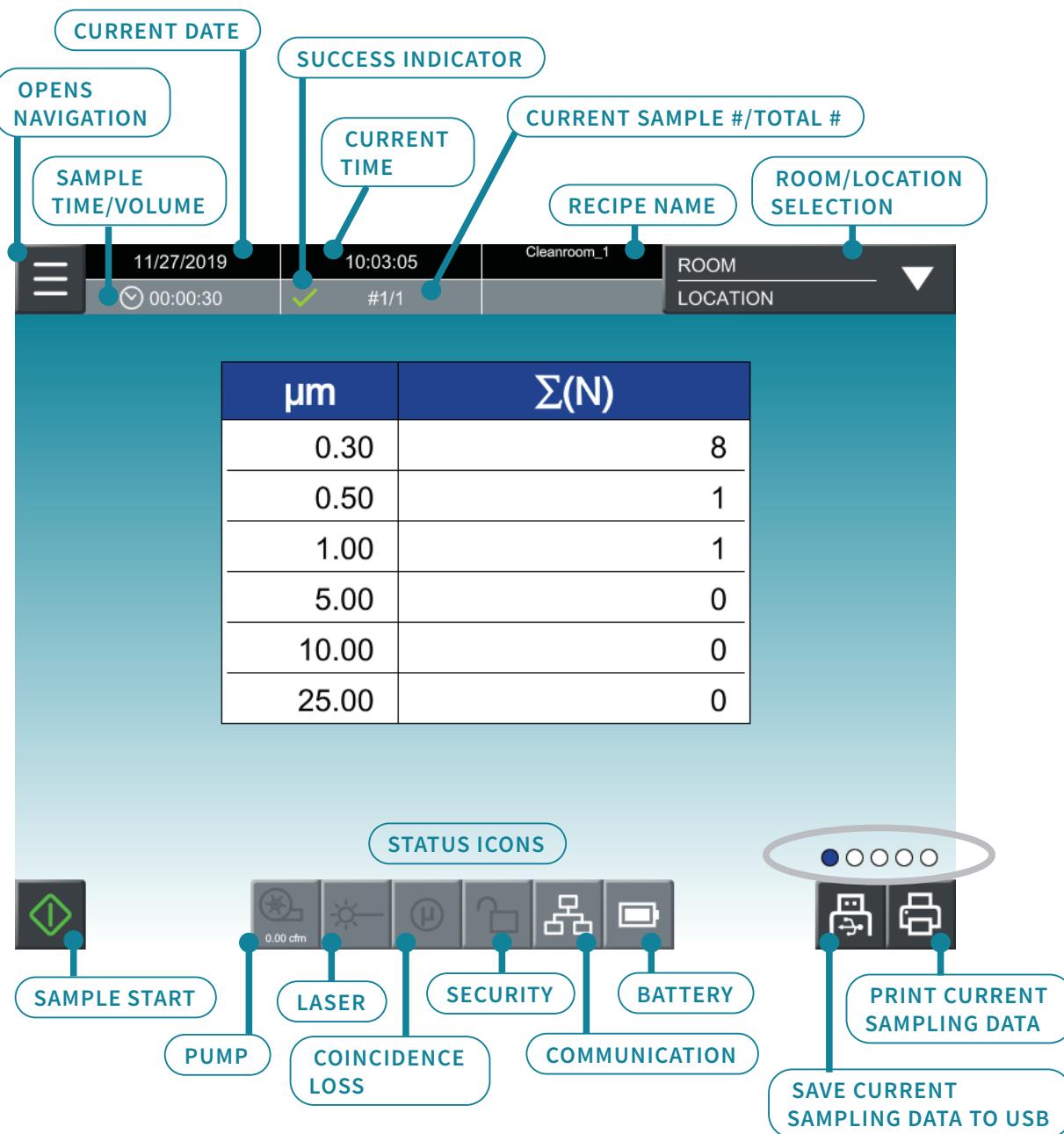
## Printer Roll Installation

Pull the right case cover out with the finger notch, as shown on page 1-2.

1. Turn on the Lasair Pro and remove the printer roll holder.
2. Insert the printer roll holder into the printer roll's center.
3. Thread the paper into the top of the interior cavity as shown until the automatic feed is engaged. The cutter will automatically snip a small portion of the roll.
4. Roll the paper so that it fits snug inside the interior cavity. Close the case and restart the Lasair Pro.



# HOME Screen



**Figure 1-1.** Details of the **HOME** screen, swipe left to change the display (circled)

## Sampling

1. Press the **POWER** button.
2. On the **HOME** screen, press .
3. The Lasair Pro takes a sample with default settings. To adjust these settings,

navigate to  >  > **SETTINGS**. The font for the current tab you are on will be enlarged and bold.

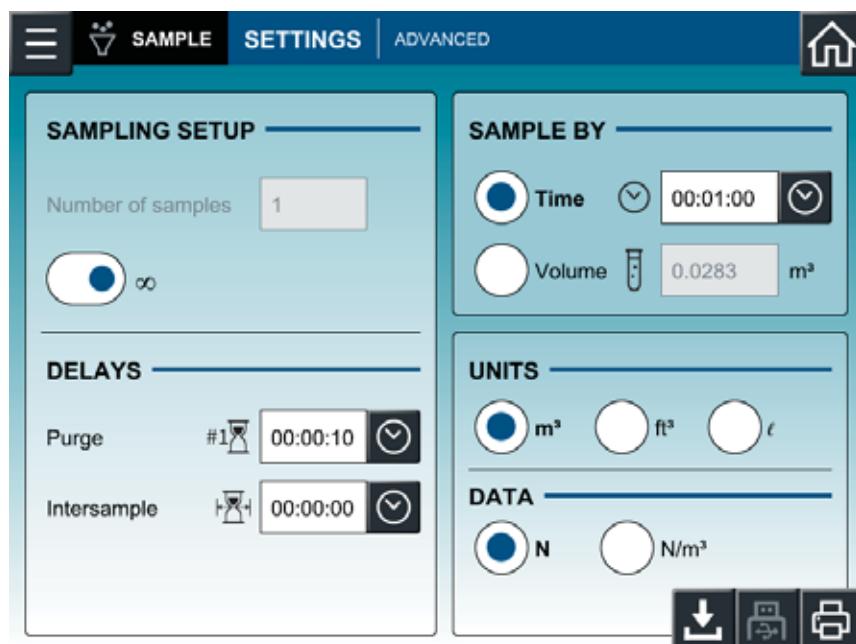


Figure 1-2. **SETTINGS** tab, **SAMPLE**

- **Sampling Setup:** Choose a number of samples or activate unlimited samples ( $\infty$ ).
- **Sample By:** Choose the sample time or sample volume.
- **Delays:** Choose time before first sample (Purge) and time between samples (Intersample).
- **Units:** Choose volume units ( $m^3$ ,  $ft^3$ , or  $l$ ).
- **Data:** Choose raw (N) or normalized ( $N/m^3$ ).

## Saving a Recipe

1. After adjusting sampling settings, press  .
2. Enter the Recipe Name using the keyboard.
3. Press **OK**.
4. You can view, select, and assign saved recipes by navigating to  >  .
5. Assigned Statistics and Monitoring recipes can be accessed by selecting the room they are assigned to from the main screen pull-down location selection box.

## Enabling Security

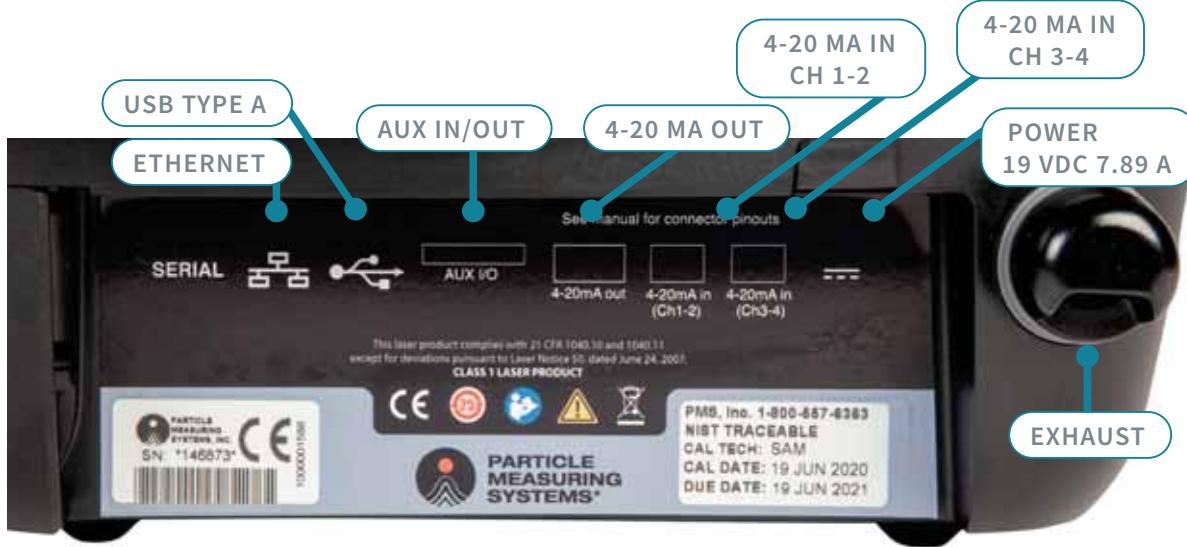
1. Press  >  > **USERS** .
2. Press  .
3. Add the desired amount of users. Ensure an administrator user is created and ON before proceeding. The minimum required length for usernames is 3 characters, and 8 characters for passwords.



Figure 1-3. Keyboard

4. Navigate to **SETTINGS**.
5. Press **Enable Security** to move the dot from left to right.
6. Select the administrator account. You will now be able to log in.

## Connections



### BACK PANEL

- **(1) Ethernet** – Use to connect to control software (i.e., Facility Net, FacilityPro, Pharmaceutical Net Pro). PMS software stores data, provides additional analysis, and reports results that are 21 CFR Part 11 compliant for one or more Lasair Pro particle counters.
- **(2) USB Type A** – There are two USB ports, one on the side and one on the back panel, for transferring data from the Lasair Pro particle counter to your computer.
- **(1) Aux I/O** – Use to connect to external signal equipment for instrument start/stop.
- **(4) 4-20 mA OUT** – Use to read particle data on a separate device, such as Programmable Logic Controller (PLC).
- **(4) 4-20 mA IN** – Connect up to four analog environmental sensors using the Lasair Pro particle counter's 4-20 mA input connectors.
- **Power** – Use to power the instrument and charge the removable lithium batteries.
- **Exhaust** – Air discharge from instrument.

## Using NFC

NFC cards can store one user's credentials or one recipe configuration for ease of use. To enable NFC:

1. Press , then  (COMM).
2. Go to the **NFC** tab and press the **Enable Security**, **Enable Locations/Recipes**, and **Enable Write NFC** indicators. A gray dot indicates the setting has not been enabled.
3. When on the **USERS** tab of the **SECURITY** screen, and the **ASSIGNMENTS** tab of the **RECIPES** screen, the **NFC** icon  and options will be activated.

The Lasair Pro 310 is available in a non-RF emitting configuration (PMS PN: 101410X2X) which will not be equipped with the hardware or internal firmware that would enable any wireless communication.



This sticker on the exterior of the unit indicates the non-RF model. The **NFC** icon on the GUI will be not be enabled on this model.

## Data Export and Import

The Lasair Pro system and data can be cloned and copied to another Lasair Pro instrument. You can export a clone file or import an existing one. Settings in the clone file include:

- All **SYSTEM** screen parameters
- All **SAMPLE** screen parameters
- All **STATISTICS** screen parameters
- All **SECURITY** screen parameters (including all user data)
- TCP/IP communication parameters
- All **COMM** screen parameters
- IP addresses (selectable with Comm Settings)
- Area, Room, Locations and assignments
- Recipes
- All **IN/OUT** screen parameters
- All **DISPLAY** screen parameters
- All **DATA** screen parameters
- Clone file encryption

1. Press  **(SYSTEM)**.

2. Go to the **SETUP** tab.



Figure 1-4. Clone Export and Import buttons, **SETUP** tab, **SYSTEM**

3. Press either of the following buttons:

	<b>Clone Export</b>	Choose <b>Clone Export</b> , press inside the <b>File Name</b> field to open the keyboard, or press  to select a file to overwrite. Select the options to be included in the export file and press <b>OK</b> .
	<b>Clone Import</b>	Choose <b>Clone Import</b> , press inside the <b>File Name</b> field to open the keyboard to type the name of the import file, or press  to select a file to import. Select the options to be imported and press <b>OK</b> . The Lasair Pro will logout any users and restart with the imported options. Note that security is automatically disabled when importing security settings.

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## Chapter 2

# Specifications

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	MODEL		
	310	350	5100
<b>Channels</b>	Up to 8 configurable channels from 0.3 to 25.0 $\mu\text{m}$	Up to 8 configurable channels from 0.3 to 25.0 $\mu\text{m}$	Up to 8 configurable channels from 0.5 to 25.0 $\mu\text{m}$
	Optional 2-channel pharmaceutical mode available. See <b>CHANNELS Tab</b> on page 12-14.		
<b>Flow Rate</b>	1.0 CFM $\pm$ 5% (28.3 LPM)	50 LPM $\pm$ 5%	100 LPM $\pm$ 5%
<b>Calibration</b>	Meets ISO 21501-4:2018 requirements. Optional ISO 17025 compliance available.		
<b>Maximum Concentration<sup>a</sup></b>	$> 42,924,662 / \text{m}^3$	$> 28,209,736 / \text{m}^3$	$> 21,354,726 / \text{m}^3$
<b>Counting Efficiency</b>	50% $\pm$ 20% for most sensitive threshold. ISO 21501-4:2018 compliant.		
<b>Zero Count</b>	< 7.07 counts/ $\text{m}^3$	< 4.00 counts/ $\text{m}^3$	< 2.00 counts/ $\text{m}^3$
<b>Tubing Length</b>	Maximum 8 meters		
<b>Compressed Gas Compatibility</b>	Air (CDA), argon (Ar), nitrogen (N), and carbon dioxide (CO <sub>2</sub> )		
<b>Data Storage</b>	10,000 complete data sets. Data cannot be edited or altered meeting 21 CFR Part 11 compliance.		
<b>Communication Modes</b>	<ul style="list-style-type: none"><li>• Ethernet</li><li>• USB data downloading</li><li>• NFC tag for user login and recipe configuration<ul style="list-style-type: none"><li>• Units with P/N (10141010X2X) will not have NFC or Wifi enabled</li></ul></li></ul>		
<b>Table 2-1.</b> Specifications			

	MODEL		
	310	350	5100
<b>Remote Operation</b>	<ul style="list-style-type: none"> <li>Real-time download to Facility Net, Pharmaceutical Net Pro, FacilityPro SCADA NG, and FacilityPro SMART NG</li> <li>USB download</li> <li>Automatic clock adjustment with NPT server configuration</li> </ul>		
<b>Reports</b>	<ul style="list-style-type: none"> <li>Encrypted PDF exports</li> <li>Cleanroom certification reports for ISO, EU GMP, China GMP, and FS209E</li> <li>Cleanroom monitoring reports</li> </ul>		
<b>Digital and Analog Input/Output</b>	<ul style="list-style-type: none"> <li>Four (4) 4-20 mA inputs (&lt; 0.5% of Span), and (4) 4-20 mA outputs (&lt; 1.0% Span)</li> <li>One (1) 5 V pulse output</li> <li>Status/Alarm Output: 24 VDC, 1 A maximum</li> </ul>		
<b>Languages</b>	International keyboard with English, French, German, Italian, Japanese (Kanji), Mandarin Chinese (Traditional or Simplified), Portuguese, Russian		
<b>Display and Printer</b>	<ul style="list-style-type: none"> <li>8.4-inch color SVGA display</li> <li>P-cap with finger swipe and gesture control</li> <li>Optional built-in thermal printer with paper cutter compatible with thermal and cleanroom paper</li> </ul>		
<b>Audit Trail</b>	21 CFR Part 11 compliant with 30,000 recorded activities		
<b>Security</b>	Up to 100 configurable users with 3 privileges group (Administrator, Supervisor, Operator). Unlimited users can be configured using NFC access cards on applicable models.		
<b>Location</b>	Up to 1,000 dynamic locations, organizable within Area, Room and Location hierarchy. Up to 50 locations configurable with NFC recipe cards on applicable models.		
<b>Recipes</b>	Up to 100 configurable recipes unlimited when using NFC cards		
<b>External Surface</b>	Polycarbonate (PC)		

**Table 2-1.** Specifications

	MODEL		
	310	350	5100
<b>Enclosure Cleaning Materials</b>	<ul style="list-style-type: none"> <li>Alcohol, 70% or 99.5%</li> <li>Hydrogen peroxide 6%</li> <li>Phenol or other phenolics</li> <li>Quaternary ammonium salts</li> <li>Hypochlorites/sodium hypochlorite 0.5% detergent</li> <li>Peracetic acid and hydrogen peroxide combination</li> </ul>		
<b>Sample Tubing ID<sup>b</sup></b>	3/8-inch 8 m max. length	1/2-inch 8 m max. length	3/4-inch 8 m max. length
<b>Sample Output Filtering</b>	Internally filtered to > 99.97% at 0.3 µm		
<b>External AC to DC Power Supply</b>	<ul style="list-style-type: none"> <li>Input: 100 – 240 V, 50/60 Hz, 2.5 A</li> <li>Output: 19 VDC, 7.89 A</li> <li>AC input voltage fluctuation shall not exceed + 10%. (Requires a grounded electrical supply for safety.)</li> </ul>		
<b>Optional Battery</b>	<ul style="list-style-type: none"> <li>Rechargeable Lithium Ion battery pack NH2054QE34</li> <li>Estimated continuous operation is: <ul style="list-style-type: none"> <li>4 hr (single) and 8 hr (dual) for 1 CFM unit</li> <li>4 hr (single) and 8 hr (dual) for 50 LPM and 6 hr for 100 LPM (dual)</li> </ul> </li> </ul> <p>This is estimated for operations where the LCD screen is at 50% brightness, the printer is not printing, there is no WiFi connection, NFC is powered but not active, and no tubing is attached.</p>		
<b>Dimensions (H x W x D)</b>	24.6 x 25.7 x 25.6 cm (9.7 x 10.1 x 10.1 in)		
<b>Weight</b>	<ul style="list-style-type: none"> <li>11.9 lb (5.4 kg) without batteries</li> <li>14.2 lb (6.4 kg) with two optional batteries</li> </ul>		
<b>Operating Environment</b>	<ul style="list-style-type: none"> <li>Temperature: 0 – 32 °C (32 - 89.6 °F)</li> <li>Humidity: 5 – 95% RH non-condensing</li> </ul>		
<b>Table 2-1.</b> 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 Pro particle counter:

<b>Operating Temperature Range</b>	0 – 32 °C (32 - 89.6 °F)
<b>Humidity Range</b>	5 – 95% RH non-condensing
<b>Storage and Transportation Temperature</b>	-20 – 50 °C (4 - 122 °F)
<b>Maximum Altitude</b>	6,562 ft (2000 m)
<b>Installation Requirements</b>	<ul style="list-style-type: none"><li>• Indoor use only</li><li>• Pollution degree 2</li><li>• Over voltage category I</li><li>• Ordinary protection (not protected against harmful ingress of moisture)</li><li>• External AC to DC Power Supply:<ul style="list-style-type: none"><li>• Overvoltage Category II</li><li>• Class I Equipment (Electrical grounding from the main power source to the product input is required for safety.)</li></ul></li></ul>
<b>Laser Classification</b>	Class 1, complies with US 21 CFR 1040.10 and EN60825-1.  An internal, enclosed Class 4 laser is used per EN60825-1.
<b>Table 2-2.</b> Environmental conditions	



## Chapter 3

# Your System

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## Recycling

As a global leader in contamination monitoring, Particle Measuring Systems (PMS) has also been actively monitoring and reducing our environmental contamination over the last few years.

*We are Strongly Committed to Net Zero*

We have set a clear ambition

**Our operations:**

- Net Zero by 2030 (Scope 1 and 2 emissions)
- Our value chain: Net Zero by 2040 (Scope 3 emissions)

**Our science-based targets support this ambition**

- The 85% absolute reduction in Scope 1 and 2 emissions by 2030
- The 42% absolute reduction in Scope 3 emissions by 2030

Both targets have been set across the Spectris group and are aligned to a 1.5 degree warming scenario and have been validated by the Science Based Targets initiative.

With your shipment, you receive packaging materials that can be 100% recycled. For up to date, detailed information about recycling the specific materials in your shipment, see our website by scanning the QR below or clicking on [this link](#).



## How Lasair Pro Works

The Lasair Pro takes in air at a set flowrate of 28.3, 50, or 100 LPM dependent on the model (310, 350, and 5100, respectively) through the sample inlet to the sample chamber. In this chamber, a laser projects a beam against particles in the sample and causes light to scatter. Scattered light is picked up by the built-in optics collection system 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 to the appropriate size channel for counting differential and cumulative counts. Once the air is sampled, it is pumped from the sampling chamber to the HEPA-filtered exhaust port.

## Standalone or Portable Use

The Lasair Pro 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 sample air in a remote location, such as a cleanroom or isolator. As a portable device, you can carry the Lasair Pro from one location to another to sample multiple areas.

## Firmware

The internal firmware for collecting, displaying, analyzing, storing, and reporting data is 21 CFR Part 11 compliant. The software stores up to 10,000 samples, 100 sampling recipes and 1,000 locations to reduce labor time and potential errors.

## Memory

The Lasair Pro particle counter has the memory capacity to store 10,000 complete data sets, which cannot be edited or altered, meeting 21 CFR Part 11 requirements. Once this memory is full, the instrument automatically erases memory in order to add additional sampling data. The oldest data is erased first.



## **Communication**

Data can 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 communication, and/or connected to control software.

NFC cards can be used to upload user and recipe data for quick use. This feature is not available on Lasair Pro 310 models that do not have NFC and Wifi capability (1014102X2X).

## **Control Software**

Facility Net and FacilityPro software stores data from the Lasair Pro particle counter and provides additional analysis and reporting options that are 21 CFR Part 11 compliant. For more information on configuring PMS software to work with Lasair Pro particle counters, see the software's user guide.

## Touchscreen

The particle counter has a large 8.4-inch color touchscreen that displays intuitive and easy-to-use navigation. Information can also be entered using a USB keyboard. The display can be configured to display information in 1 of 9 languages (see **SETUP Tab** on page 12-2).

The navigation panel allows you to quickly access any screen in the system. To open, press

the  button on any screen. Press the  button to close the panel.

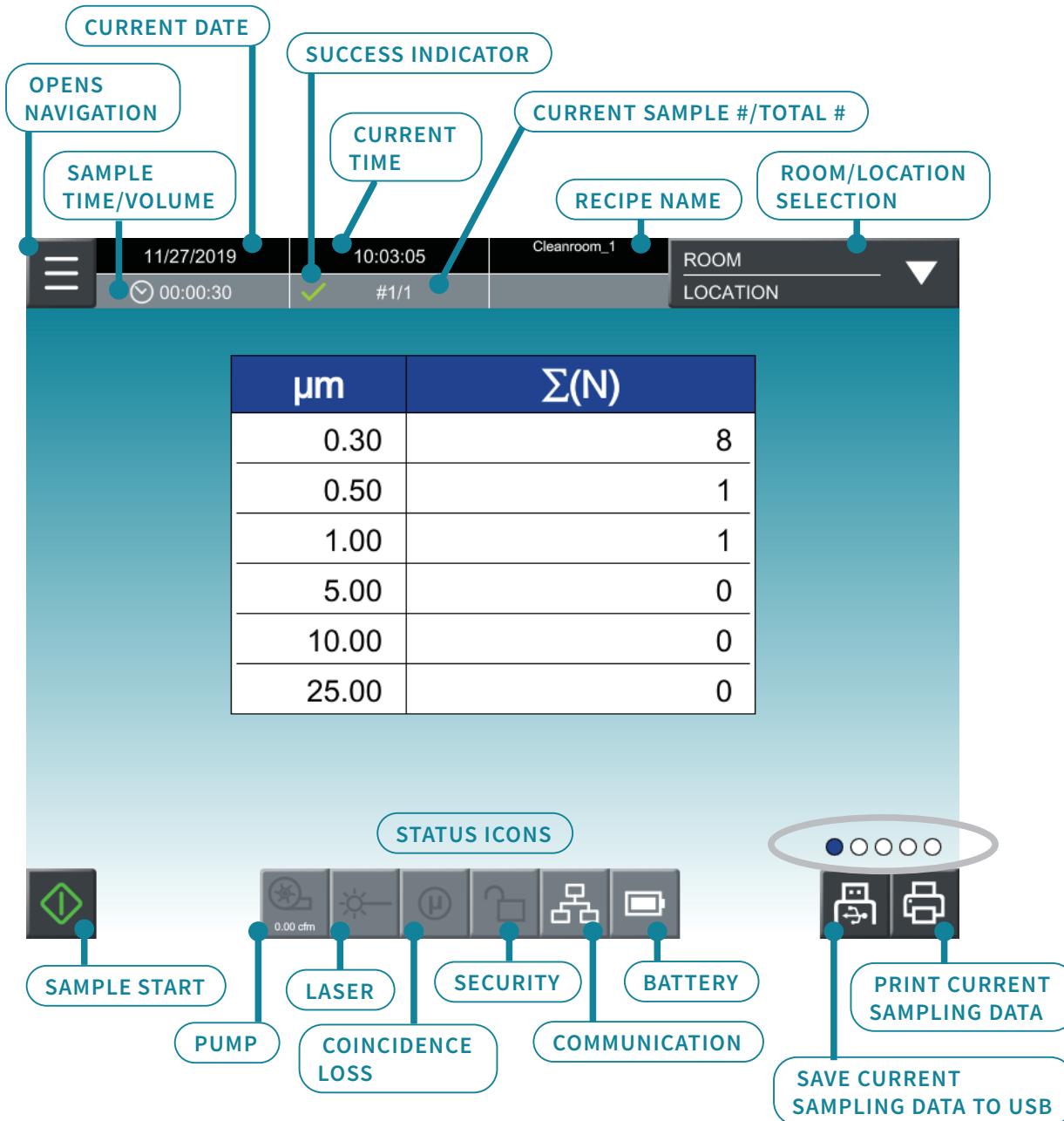


**Figure 3-1.** Navigation options

## HOME Screen

When you first turn on the Lasair Pro particle counter, the **HOME** screen displays. You can

also navigate to this screen any time by pressing  and then  (**HOME**).



**Figure 3-2.** Default sampling display (Cumulative Normalized Counts)

Use the **HOME** screen for viewing sampling data in a variety of formats. All data formats can be viewed by swiping across the screen to the left or right. The screen position dots, circled in **Figure 3-2**, indicate which of the five total formats you are viewing.



Figure 3-3. Other data formats

In **Figure 3-3**, the following formats will display by swiping left once:

- **A.** Differential and Cumulative Normalized Counts
- **B.** Environmental Data Table
- **C.** Cumulative Normalized Counts Real-Time Graph
- **D.** Cumulative Raw Counts Bar Graph

**Differential count ( $\Delta$ )** refers to the number of particles of a specific size that are found in one sample. **Cumulative count ( $\Sigma$ )** refers to the number of particles of a certain size and larger that are found in one sample. **Normalized counts** refer to the total particle data counted in a unit of volume. **Raw counts** refer to the total number of particles counted during sampling and are unitless.

## Environment Data Table

Use the **Environment Data Table** on the **HOME** 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:** Average calculated value for the channel

## Sampling Configuration

Use the tabs on the **SAMPLE** screen to set up the parameters that will be used for collecting sample data. These sampling parameters are assigned to specific sampling locations.

- **SETTINGS Tab** on page 5-2
- **ADVANCED Tab** on page 5-6

## Icons and Buttons of the HOME Screen

The **HOME** screen displays data collected from the current sample. Data remains on the screen until a new sample is started. All data is automatically saved and stored in the Lasair Pro counter's internal memory. You can access previous sampling data by navigating to **DATA** from the navigation panel.

The **HOME** screen is what first appears after instrument startup and is the only screen available if security has been enabled. Every other screen has the **HOME** icon for easy, one-button access. Users can also return to the **HOME** screen with the navigation panel.



Figure 3-4. **HOME** icon

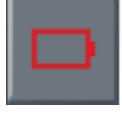
The full list of **HOME** screen display icons and buttons are listed in **Table 3-1**. Some icons may only appear under certain conditions.

Image	Name	Description
	<b>Start Sample</b>	Starts the sampling process.
	<b>Stop Sample</b>	Stops the sampling process.
	<b>Start Pump</b>	Available when Continuous Pump mode has been enabled. See <b>ADVANCED Tab</b> on page 5-6.
	<b>Stop Pump</b>	Available in Continuous Pump mode after the Start Pump button has been pressed.
	<b>Room and Location List</b>	Selectable list of stored rooms, areas, and locations. Use to associate a location to a particular sample.
	<b>Acknowledge Alarm</b>	Only displays when an alarm has occurred. Press to acknowledge the alarm and set an alarm reason. For more information, see <b>Chapter 7</b> .
	<b>Beep</b>	Allows the user to select the number of particle counts before an audio cue occurs. Configured in the <b>ADVANCED</b> tab of the <b>SAMPLE</b> screen.  Press this button to close the list of particle count options.
	<b>Terminate</b>	Terminates Monitoring Mode and Statistics Mode. <ul style="list-style-type: none"> <li>For more information on Monitoring Mode, see <b>Monitoring Mode</b> on page 5-8.</li> <li>For more information on Statistics Mode, see <b>Chapter 11</b>.</li> </ul>

**Table 3-1.** **HOME** screen icons and buttons

Image	Name	Description
<b>Lasair Pro Status</b>		
	<b>Pump Status: Ok</b>	Indicates the status of the pump. When pressed, a dialog box gives the following information: <ul style="list-style-type: none"> <li>• Flowrate (in CFM)</li> <li>• Status (Ok, Unstable, Failure)</li> <li>• Mode (On or Off)</li> </ul>
	<b>Pump Status: Unstable</b>	
	<b>Pump Status: Failure</b>	
	<b>Laser</b>	Indicates the status of the laser. When pressed, a dialog box gives the following information: <ul style="list-style-type: none"> <li>• Status (Ok, Bad)</li> <li>• Mode (On or Off)</li> </ul>
	<b>Coincidence Loss</b>	Indicates the coincidence loss (% error) of the current sampling data. This number increases as multiple particles pass through the sensor, resulting in an overall decrease in counts. Ideally, the number is 0.  When pressed, a dialog box gives the following information: <ul style="list-style-type: none"> <li>• Status (Ok, Bad)</li> <li>• Description (&lt; or &gt; 0.10 %)</li> </ul>

**Table 3-1. HOME** screen icons and buttons

Image	Name	Description
<b>Security</b>		
	<b>Security Enabled, Administrator</b>	
	<b>Security Enabled, Supervisor</b>	Indicates the security of the Lasair Pro counter. When pressed, a dialog box gives the following information: <ul style="list-style-type: none"> <li>• Status (Enabled, Disabled)</li> <li>• User (Username or Not logged in)</li> <li>• Access level (Administrator, Supervisor, Operator, View Only, N/A)</li> </ul>
	<b>Security Enabled, Operator</b>	
	<b>Security Enabled, No Login</b>	
	<b>Security Disabled</b>	
	<b>Comm</b>	Indicates the communication status. <ul style="list-style-type: none"> <li>• When active (white), the device is connected to FacilityPro or Facility Net.</li> <li>• If the indicator is gray, no connection is present.</li> </ul>
<b>Battery</b>		
	<b>Low Battery</b>	The red battery icon will flash when the battery is low and not charging.

**Table 3-1. HOME screen icons and buttons**

Image	Name	Description
	<b>Discharging/ Not Charging</b>	Indicates the status of the battery. When pressed, a dialog box gives the following information:
	<b>Plugged In/ Fully Charged</b>	
	<b>Plugged In/ Charging</b>	
	<b>Battery Not Installed</b>	
<b>External Data Save Options</b>		
	<b>Print</b>	Prints sampling results to thermal printer. A number in the top-right corner indicates the number of items to print in the queue.
	<b>Save to USB</b>	Saves sampling results to a USB key. A number in the top-right corner indicates the number of items to save to USB in the queue.
	<b>Print on Alarm</b>	When the alarm symbol is displayed on the top left of the icon, sampling data will print when an alarm is triggered. See the <b>GENERAL Tab</b> on page 7-2 to configure this setting.
<b>Sampling Status</b>		
	<b>Success Indicator</b>	When displayed, indicates the previous sampling was successful.
	<b>Failure Indicator</b>	When displayed, indicates the previous sampling failed.
<b>Table 3-1. HOME screen icons and buttons</b>		

Image	Name	Description
	<b>Alarm</b>	<p>When displayed, indicates alarms have been enabled in the <b>GENERAL</b> tab of the <b>ALARMS</b> screen.</p> <p>The background of the <b>HOME</b> screen turns red and audio cues may start if configured. Alarms cease after acknowledgement.</p> <p>To configure alarm limits, see <b>Chapter 7</b>.</p>
	<b>Audible Alarm</b>	<p>When displayed, indicates alarms will be audible. See the <b>GENERAL Tab</b> on page 7-2 to configure this setting. Volume can be configured in the <b>DISPLAY</b> tab of the <b>DISPLAY</b> screen.</p>
	<b>Warning</b>	<p>When displayed, indicates warnings have been enabled in the <b>GENERAL</b> tab of the <b>ALARMS</b> screen. Audio cues may start if configured. Warnings cease after acknowledgement.</p> <p>To configure alert limits, see <b>Chapter 7</b>.</p>
	<b>NTP Server Not Connected</b>	<p>When displayed, indicates the NTP server for updating the Lasair Pro's time and date is not connected. See <b>DATE/TIME Tab</b> on page 12-12.</p>
	<b>NTP Server Connected</b>	<p>When displayed, indicates the NTP server for updating the Lasair Pro's time and date is connected. See <b>DATE/TIME Tab</b> on page 12-12.</p>
	<b>NFC Location/ Recipes Enabled</b>	<p>When displayed, indicates locations and recipes can be assigned to an NFC card. See <b>Locations and rooms may have more than one recipe associated with them. In this case, when the location (or room) is selected, the operator will have the option of choosing one of the assigned recipes to load and run.</b> on page 9-5.</p>

**Table 3-1. HOME screen icons and buttons**

Image	Name	Description
	<b>NFC Security Enabled</b>	When displayed, indicates users can be assigned to an NFC card. See <b>Creating NFC Users</b> on page 6-7.
	<b>Sample by Volume Enabled</b>	When displayed, indicates sample will terminate after a specified volume is reached. See <b>SETTINGS Tab</b> on page 5-2.
	<b>Sample by Time Enabled</b>	When displayed, indicates sample will terminate after a specified time is reached. See <b>SETTINGS Tab</b> on page 5-2.

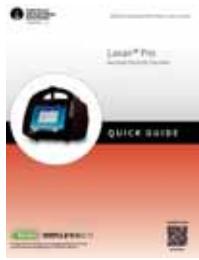
**Table 3-1. HOME screen icons and buttons**

## Shipkit List

Review the list of items included with your shipment. If any items are missing, contact Particle Measuring Systems Customer Service Center at 1-877-475-3317 or email [info@pmeasuring.com](mailto:info@pmeasuring.com).

The list included with your shipment will be specific to your order and Lasair Pro model (310, 350 or 5100).

	310	350	5100
<b>Lasair Pro Particle Counter</b> <b>Quantity: 1</b>			
	P/N: 101410-XX1X	P/N: 101420-XX1X	P/N: 101430-XX1X
<b>Note:</b> X refers to variances in part numbers specific to your order.			
<b>Ultem Isokinetic Sampling Probe and Plug</b> <b>Quantity:</b> <b>1 Probe</b> <b>1 Plug</b>			
	ISP: P/N 1000012579  Plug: P/N 1000001023	ISP: P/N 1000012578  Plug: P/N 1000009426	ISP: P/N 1000012577  Plug: P/N 1000013174
<b>Table 3-2.</b> Default shipkit list			

	310	350	5100
<b>Lithium Ion Battery</b>  <b>P/N 1000025008</b>			
	Quantity: 1	Quantity: 1	Quantity: 2
<b>Power Supply</b>  <b>Quantity: 1</b>			
			P/N 1000024952
<b>Power Cord</b>  <b>Quantity: 1</b>			
			P/N CMP-X (dependent on country)
<b>Lasair Pro Quick Guide</b>  <b>Quantity: 1</b>			
			P/N 1000026654
<b>Table 3-2.</b> Default shipkit list			

## Accessory List

The following is the list of accessories available for the Lasair Pro particle counter. Contact your local sales representative, call 1-877-475-3317, or email [info@pmeasuring.com](mailto:info@pmeasuring.com) to order.

	310	350	5100
<b>Tripod Adapter</b> <b>Quantity: 1</b>			
	P/N 1000012955	P/N 1000012956	P/N 1000012957
<b>Stainless Steel Isokinetic Sampling Probe</b> <b>Quantity: 1</b>			
	P/N 1000012952	P/N 1000012953	P/N 1000012954
<b>Sample Tubing 10 ft (3.05 m)</b> <b>Quantity: 1</b>			
	P/N 1016726	P/N MI153 (1 CFM)	P/N 1000012960 (100 LPM)
<b>Zero-Count Filter</b> <b>Quantity: 1</b>			
	P/N 90104050	P/N 90104052	P/N 90104057
<b>Table 3-3. Accessory list</b>			

	310	350	5100
<b>Handheld ISP</b> <b>Quantity: 1</b>			
	P/N 90101036	P/N 90101037	P/N 90101038
<b>Temperature and Relative Humidity (TRH) Probe</b> <b>Quantity: 1</b>			
			P/N 501050-01
<b>Thermal Printer Paper</b> <b>Quantity: 1</b>			
			P/N 1000024998
<b>Cleanroom Thermal Printer Paper</b> <b>Quantity: 1</b>			
			P/N 1000024977
<b>Table 3-3. Accessory list</b>			

	310	350	5100
<b>USB Micro B Serial Service Cable</b>			
		P/N 1000025093	
<b>External Battery Charger</b> <b>Quantity: 1</b>			
	P/N 90101118-10, One Bay, 115 V P/N 90101118-20, One Bay, 230 V	P/N 90101119-10, Four Bay, 115 V P/N 90101119-20, Four Bay, 230 V	
<b>Pelican Wheeled Transport Case</b> <b>Quantity: 1</b>			
		P/N 90101292	

**Table 3-3. Accessory list**

	310	350	5100
<b>Tabletop Tripod</b> <b>Quantity: 1</b>			
		P/N 1000000979	
<b>316L Stainless Steel Table Stand</b> <b>Quantity: 1</b>			
		P/N 1000023413	
<b>NFC Card</b> <b>Quantity: Dependent on order</b>			
		P/N 1000025099	
<b>Table 3-3. Accessory list</b>			

	310	350	5100
<b>USB Storage Jump Drive and Cap</b>			
<b>Quantity:</b>			
<b>Jump Drive: 1</b>		<b>Jump Drive</b>	<b>USB Cap</b>
<b>USB Cap: 1</b>		P/N 1000026003	P/N 1000013021
<b>Connector Kit</b>			
<b>Quantity: 1</b>			P/N 1000024980
<b>Connector Kit with Crimp Pliers (Optional)</b>			
<b>Quantity: 1</b>			P/N 1000024981
<b>Table 3-3. Accessory list</b>			

	310	350	5100
<b>Crimp Pliers</b> <b>Quantity: 1</b>			
		P/N 1000024982	
<b>Lasair Pro Validation Manual</b> <b>Quantity: 1</b>			
		P/N 90510015	
<b>Lasair Pro IQOQ Test Protocol</b>			
		P/N 1000026652	
<b>Lasair Pro Operations Manual</b> <b>Quantity: 1</b>			
		P/N 1000025871	
<b>Table 3-3. Accessory list</b>			

## 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 Pro 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 Pro 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.

# Chapter 4

## Connections

---

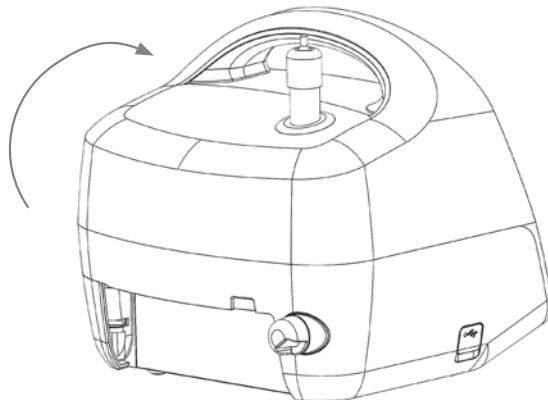
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This chapter describes the following types of connections:

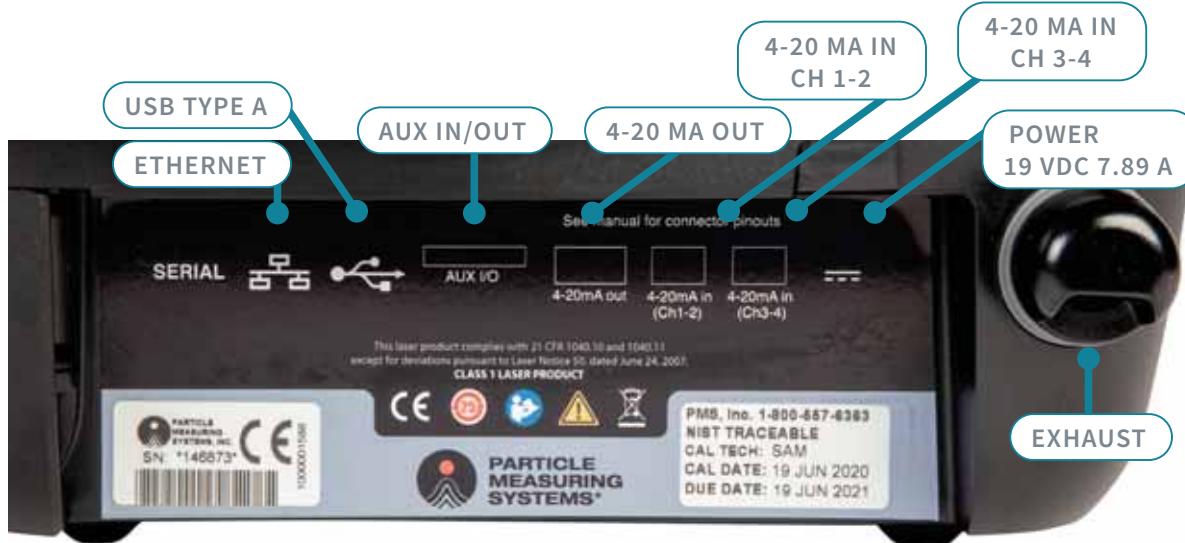
- **Power** on page 4-4
- **Analog** on page 4-6
- **Digital In/Out** on page 4-14
- **NFC Cards** on page 4-15
- **Computer Connections** on page 4-16

## Back Panel

Pinouts configurable by the user include AUX I/O, 4-20 mA IN, and 4-20 mA OUT.



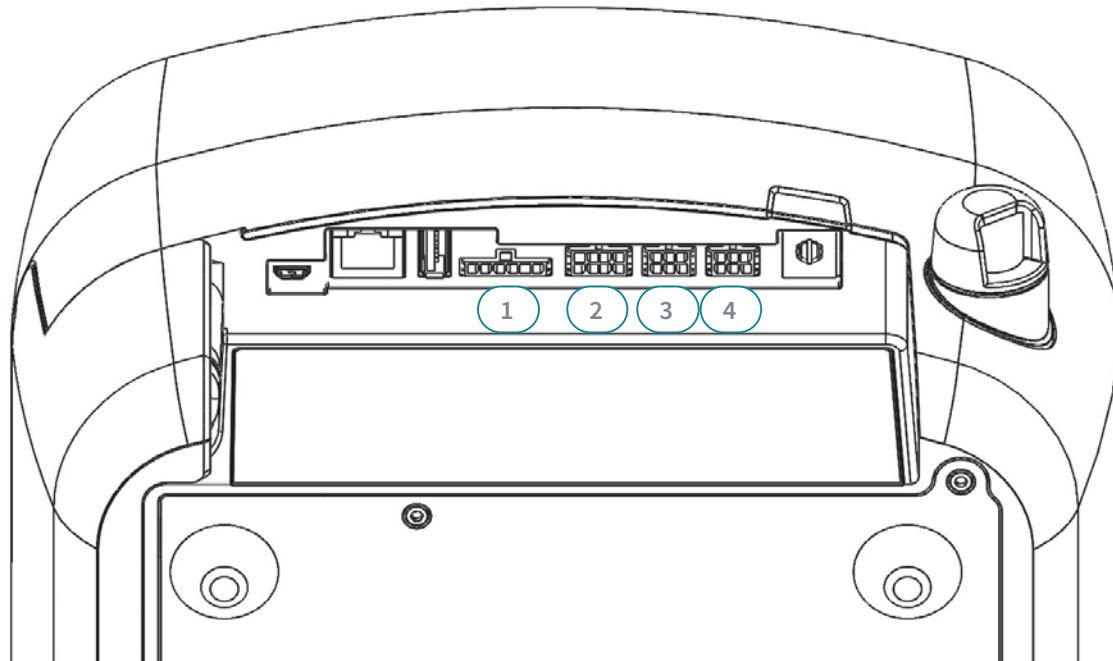
**Figure 4-1.** Positioning the Lasair Pro to see connections



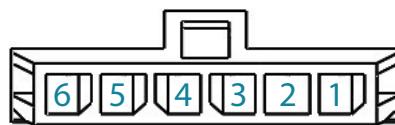
## BACK PANEL

- **(1) Ethernet** – Use to connect to control software (i.e., Facility Net). PMS software stores data, provides additional analysis, and reports results that are 21 CFR Part 11 compliant for one or more Lasair Pro particle counters.
- **(2) USB Type A** – There are two USB ports, one on the side and one on the back panel, for transferring data from the Lasair Pro particle counter to your computer or connecting a USB keyboard.
- **(1) Aux I/O** – Use to connect to external signal equipment and for Lasair Pro start/stop.
- **(4) 4-20 mA OUT** – Use to read particle data on a separate device, such as a Programmable Logic Controller (PLC) or Proportional-Integral-Derivative (PID) controller
- **(4) 4-20 mA IN** – Connect up to four analog environmental sensors using the Lasair Pro particle counter's 4-20 mA input connectors (see the next page).
- **Power** – Use to power the instrument and charge the removable lithium batteries.
- **Exhaust** – Sample stream discharge from instrument.

Lay the Lasair Pro so that its screen is against a flat surface. Pin numbering and description are given below:



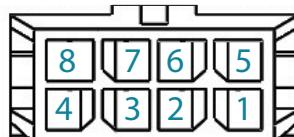
AUX I/O



Pin 6	Pin 5	Pin 4	Pin 3	Pin 2	Pin 1
GND	12V Dry Contact	GND	+5 VDC (PULSE)	+24 VDC GND	+24 VDC

1

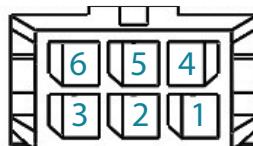
4-20 mA out



Pin 8	8	Pin 7	7	Pin 6	6	Pin 5	5
GND		GND		GND		GND	

2

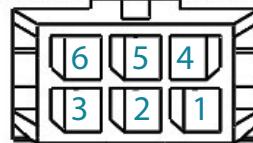
4-20mA in (Ch1-2)



Pin 6	6	Pin 5	5	Pin 4	4
GND		CH 2 IN		CH 2 POWER	
Pin 3	3	Pin 2	2	Pin 1	1
GND		CH 1 IN		CH 1 POWER	

3

4-20mA in (Ch3-4)



Pin 6	6	Pin 5	5	Pin 4	4
GND		CH 4 IN		CH 4 POWER	
Pin 3	3	Pin 2	2	Pin 1	1
GND		CH 3 IN		CH 3 POWER	

4

Customers may wish to build their own cabling to connect to the Lasair Pro. Each instrument is supplied with a mating connector kit (P/N 1000024980). The proper crimp tool must be used with the connector kit, available as P/N 1000024981.

## Power

### CAUTION

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

The Lasair Pro is rated at 19 VDC (150 W) and can be operated with the AC to DC power adapter or internal batteries. When using AC, the external power supply requires 100-240 V, 50/60 Hz AC power to produce 19 VDC.

## Batteries

Insert one or two lithium battery packs into the particle counter for portable operation. Charge internally before first use.

Optional lithium ion batteries and battery chargers are available from Particle Measuring Systems.

- Lithium Ion Battery – P/N 1000025008
- 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 four hours, and dual (using two) batteries run for approximately eight 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.

### WARNING

Ensure battery packs are not exposed to vaporized hydrogen peroxide (VHP).

## AC Power

Before connecting to an AC power source, ensure you have the following items:

Item	Comments
<b>External AC to DC power supply</b>	Standard U.S. Government Energy Information Administration (EIA) power input of 100-240 VDC, 50-60 Hz. Only use the included power supply to prevent damage and assure proper operation.
<b>U.S. power cord with plug</b>	Included with U.S. shipments only.
<b>International power cord (included with international shipments)</b>	The power cord for international shipments comes assembled with a plug configured for your country's voltage and frequency specifications.
<b>Surge protector (recommended)</b>	To protect the unit from any voltage spikes, use a good quality surge protector.

**Table 4-1.** Items required for AC power source connection

### WARNING

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

### 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.

### CAUTION

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

## Analog

Included in this section:

- **Environmental (Analog) Input** on page 4-6
- **Analog Output** on page 4-11

### Environmental (Analog) Input

You can connect up to four analog environmental sensors using the Lasair Pro particle counter's 4-20 mA input connectors. These input connectors are located on the back panel of the Lasair Pro counter (see **Back Panel** on page 4-1 for pinout information). Examples of 4-20 mA sensors include:

- Temperature/Relative Humidity (T/RH) sensor (P/N 501050-01)
- Air velocity sensor that provides 4-20 mA OUT
- Differential pressure sensor that provides 4-20 mA OUT

#### **To connect a 4-20 mA sensor:**

1. Locate the appropriate 4-20 mA input (see **Back Panel** on page 4-1).
2. Plug the sensor into the connector.
3. Turn on the Lasair Pro counter.
4. Go to  , then  (IN/OUT).
5. Ensure you are on the **ENVIRONMENTAL** tab. The font for the current tab you are on will be enlarged and bold.

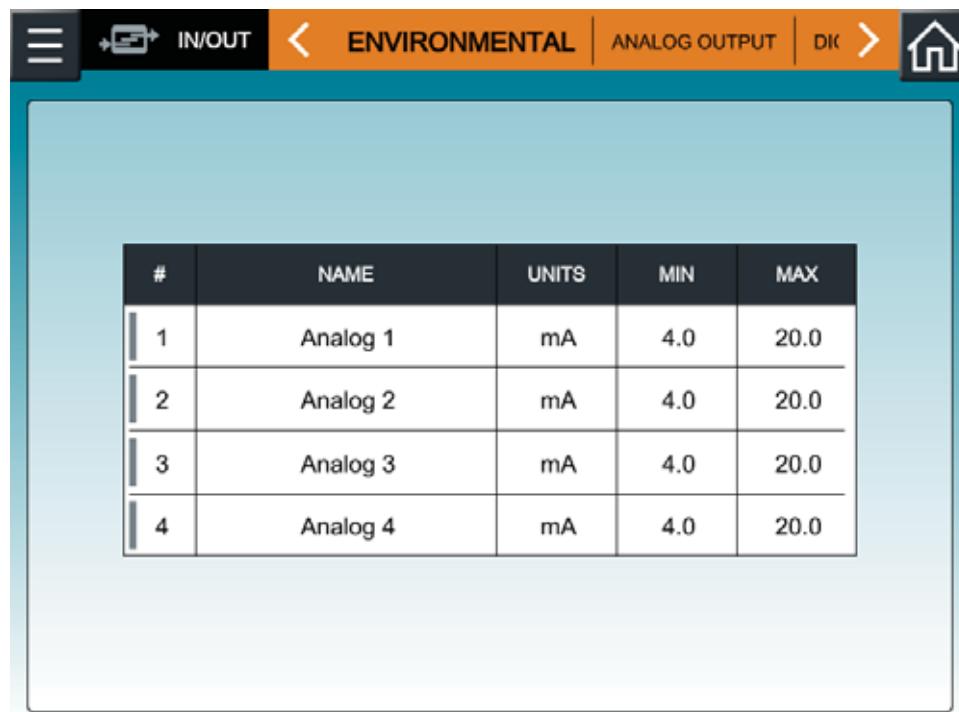


Figure 4-2. ENVIRONMENTAL tab, IN/OUT

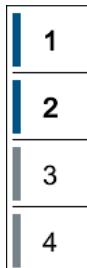
6. Each analog input can have a different value of the Scale and Offset values. These values are determined by the range of the sensors that are being used.

<b>#</b>	A selection box to enable or disable the analog input.
<b>NAME</b>	Can be changed to name of the sensor such as Temperature or Humidity.
<b>UNITS</b>	Can be used to identify the units of measure related to the 4-20 mA value, such as degrees C or percent (%) humidity.
<b>MIN</b>	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 this field.
<b>MAX</b>	Is the maximum value of the measurement device. For example, if the highest value of relative humidity probe is 100%, the value of 100 would be entered into this field.

As an example, we will be setting up a TRH accessory for the Lasair Pro particle counter with the following specifications:

- Temperature range: 32 – 122 °F
- Relative humidity range: 0 – 100%

7. Enable the #1 and #2 rows by pressing inside the appropriate # fields. When enabled, the vertical line beside the number will be blue in color:



**Figure 4-3.** Enabling/disabling sensors

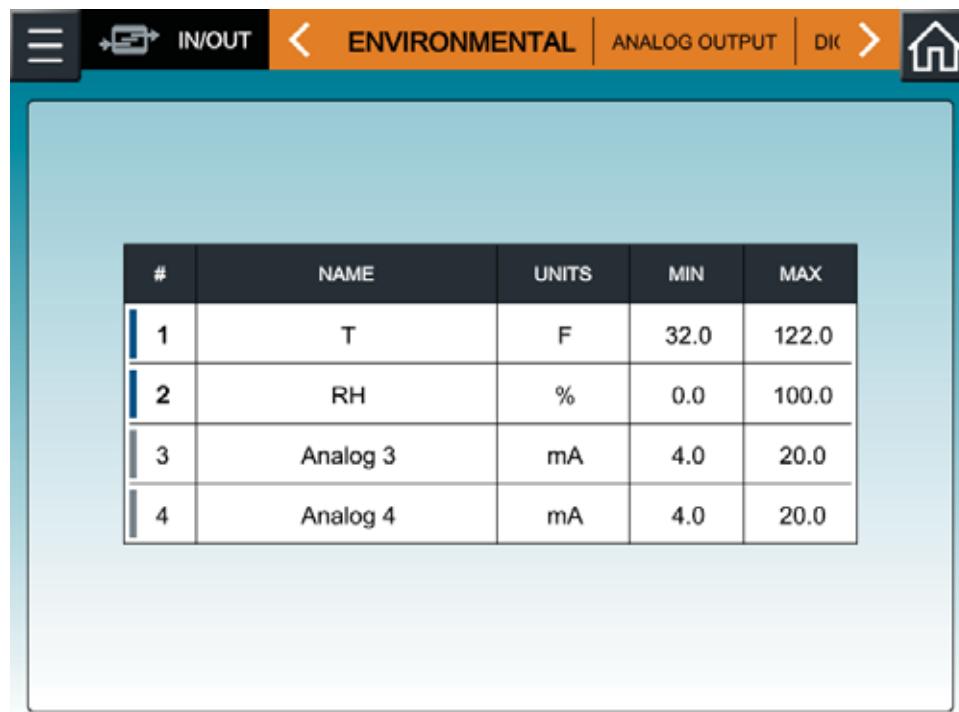
8. Press inside the **NAME** field to define the sensor name. For example, “T” for temperature.
9. Press inside the **UNITS** field to define the sensor units. For example, “%” for relative humidity.

---

**NOTE:** Press and hold the ‘5’ numeric keyboard key until the “%” sign appears in the text field.

---

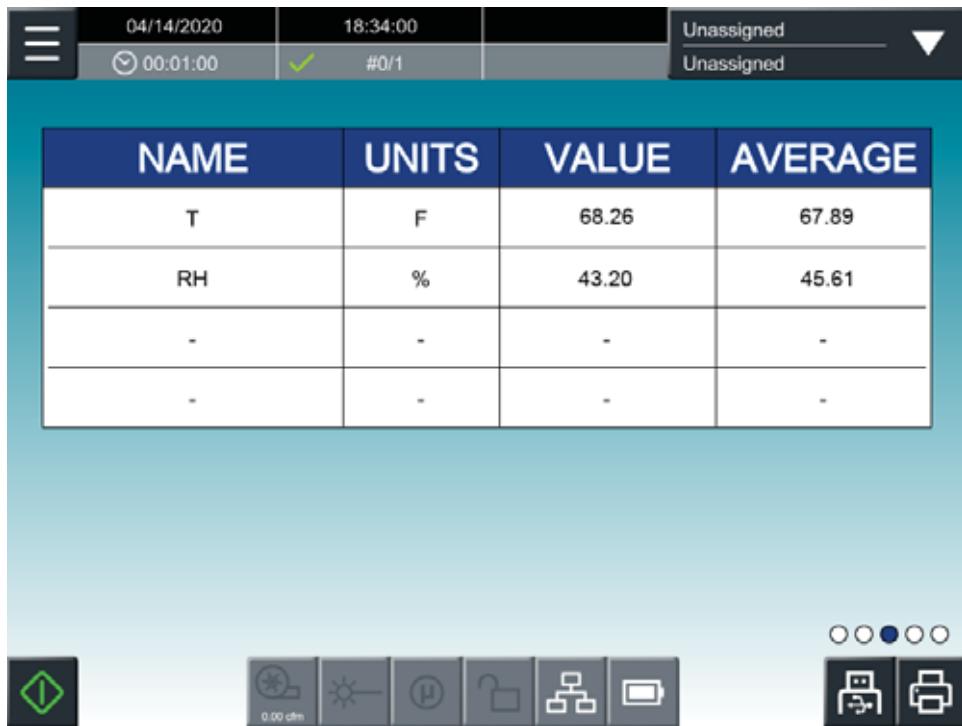
10. Enter the range of measurement for the sensor in the **MIN** and **MAX** fields:
  - Press inside the **MIN** field to enter the lowest value in the range. In this example, the minimum temperature is 32.
  - Press inside the **MAX** field to enter the highest value in the range. In this example, the maximum temperature is 122.
11. Your environmental sensors table should look similar to **Figure 4-4**.



#	NAME	UNITS	MIN	MAX
1	T	F	32.0	122.0
2	RH	%	0.0	100.0
3	Analog 3	mA	4.0	20.0
4	Analog 4	mA	4.0	20.0

**Figure 4-4.** Example environmental sensor table

12. You can find the data display for your environmental sensors on the **HOME** screen by swiping left twice. When the sensor is operating, the current value and average value will update every second. See **Figure 4-5**.



**Figure 4-5.** Environmental sensor data display, **HOME** screen

---

**NOTE:** Analog data cannot be assigned to a location. It is advisable to include location details in the **Name** field if applicable.

---

## Analog Output

The Lasair Pro counter can be enabled to generate a multichannel analog output for reading particle data on a separate device, such as a Programmable Logic Controller (PLC) or Proportional-Integral-Derivative (PID) controller. Analog outputs are generated using particle size channel limits. These limits are set in the **ANALOG OUTPUT** tab of the **IN/OUT** screen.

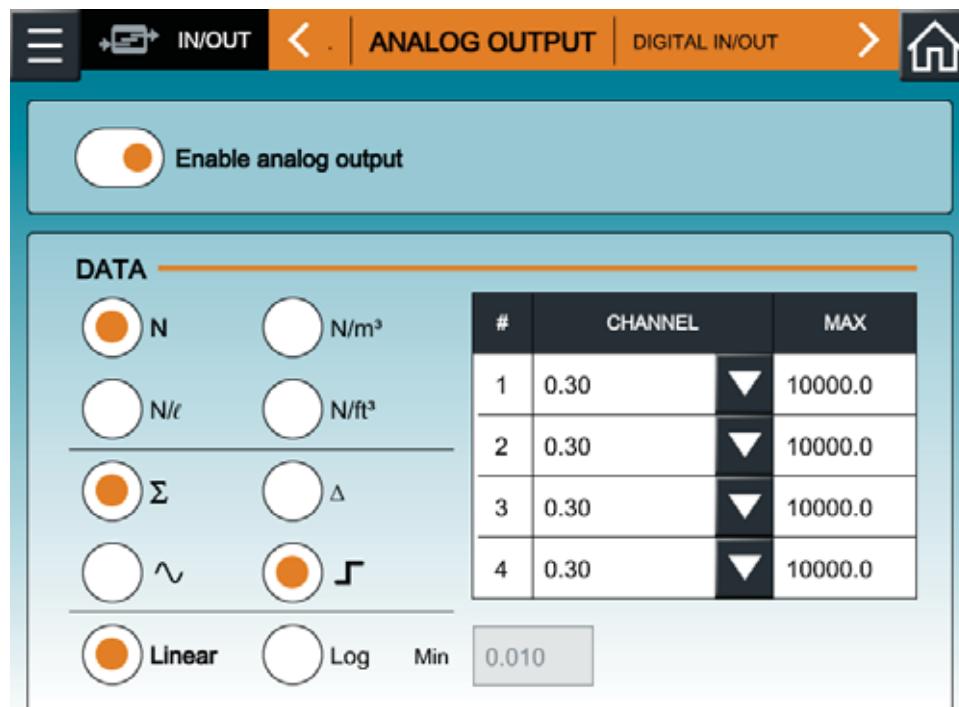


Figure 4-6. ANALOG OUTPUT tab, IN/OUT

Particle data can be configured with analog output in the following way:

- **Enable analog output:** Enable or disable analog output
- **Raw (N) or Normalized (N/m<sup>3</sup>, N/ft<sup>3</sup>, N/l) data:** Sets the units for the data.
- **Cumulative (Σ) or differential (Δ) data:** Sets the type of data to trigger the analog output. Cumulative refers to the sum of all particle counts of one size and larger in a sample. Differential refers to particle counts of a certain size in a sample.
- **Wave (Wave) or Step (Step):** Sets how the output will be updated. The Wave option sets the output to update once per second throughout the sample. The Step option sets the output to update at the end of the sample.
- **Linear or Log:** Sets the 4-20mA output to be generated as a linear or logarithmic value. See **Lasair Pro Analog 4-20 mA Output Log Mode** on page 4-13.

- **Min:** Sets the minimum x-axis value of the log graphical display.
- **CHANNEL:** Press the dropdown arrow to select the particle size to be used for analog output generation. Channel units are set in the **CHANNELS** tab of the **SYSTEM** screen.
- **MAX:** Press inside the field to define the maximum value for the particle size channel pertaining to 20 mA. The minimum number of counts (pertaining to the 4 mA signal) is assumed to be 0.

## Status Output

The status output channel can be used in either a simplified mode (i.e., good/bad) or in a more complex fashion, which allows you to discriminate between various errors. **Table 4-2** shows the various output status parameters and their associated value. In order to do a status check, verify the status channel reads more than 18 mA.

Status Parameter	Current (mA)
4-20mA Outputs Enabled	+3.00
Data Collection is On	+0.75
Blower/Flow is OK	+1.50
Laser is OK	+3.00
Alarms are Off	+6.00
Everything OK	18.25 (Total)

**Table 4-2.** 4-20 mA Analog Output Status Channel

More complex status testing will require an algorithm similar to the following:

1. If current < 7 mA, 4-20 mA system is off. Otherwise...
2. Test value\_float = (current - 7 mA) / 0.75 mA
3. Test value\_bits = Test value\_float rounded to nearest integer.
4. Interpret Test value\_bits as hexadecimal integer and interpret bits.
5. Data Collection On = 0x01
6. Blower/Flow is OK = 0x02
7. Laser is OK = 0x04
8. Alarms are Off = 0x08

## Lasair Pro Analog 4-20 mA Output Log Mode

The Lasair Pro allows scaling of 4-20 mA output data in a log format rather than a linear format. This is useful for encoding values with high dynamic ranges of particle counts as it provides an equal number of discrete values per decade. This improves resolution at lower count values and especially helps maximum output values of greater than 50,000. The resolution of the 16-bit converter is unable to discriminate between 0 and 1 count above this value. If overall system accuracy is also taken into account, a lower level than 50,000 is the more practical limit for linear scaling.

The log setting uses a global minimum particle count value. Particle counts below the minimum value will be clipped. The limits of this parameter are 0.001 to 100.0.

---

**NOTE:** Set the minimum value to less than 1 (e.g., 0.1) in order to differentiate between 0 and 1 particles. For example, when sending raw particle counts, if the minimum is set to 1, then if 0 particle counts are received, the system will output 1 count. This is an inherent limitation of logarithmic conversions.

---

Each channel has a maximum value output. The global minimum and channel-based maximum are used to calculate the output. The two equations in this section show the conversion used from mA to particle counts and back.

Particle counts are scaled to a normalized value, if that output option is selected, before the conversion.

### ***Equation 1: Particle counts to mA conversion***

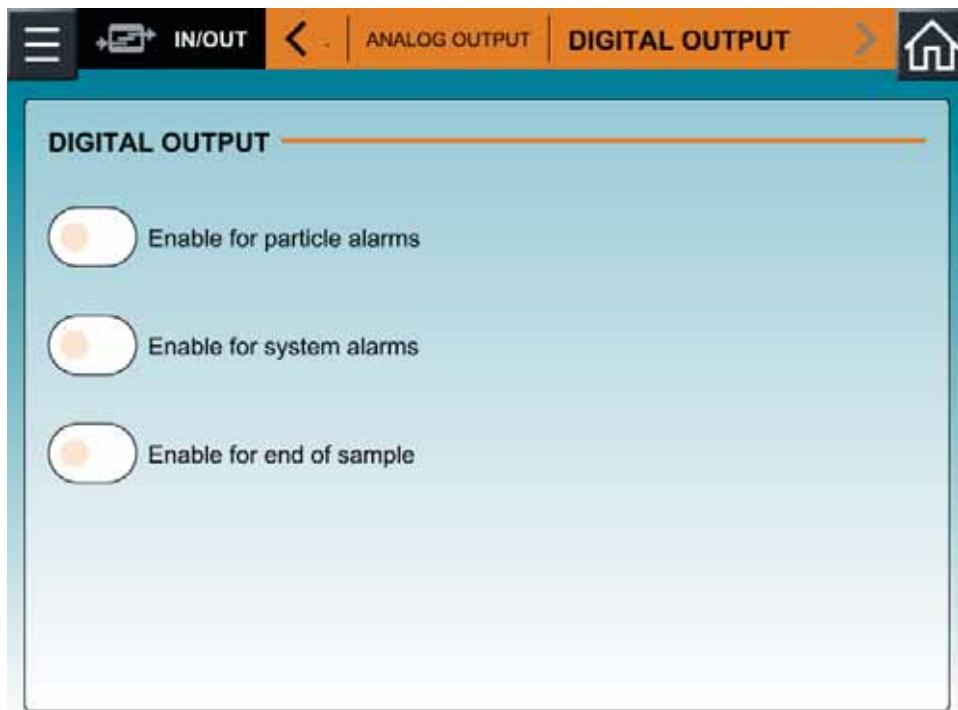
$$mA_{out} = \left( \frac{\log_{10} \frac{particleCounts}{min}}{\log_{10} \frac{max}{min}} \right) * 16 mA + 4 mA$$

### ***Equation 2: mA to particle counts conversion***

$$particleCounts = min * 10^{\left( \frac{mA_{out} - 4mA}{16mA} * \log_{10} \frac{max}{min} \right)}$$

## Digital In/Out

The Lasair Pro counter can be enabled for output for use with light tower and alarm devices. Alarms must be configured first (see [Chapter 7](#)).



**Figure 4-7. DIGITAL OUTPUT tab, IN/OUT**

Digital output can be configured in the following way:

- **Enable for particle alarms:** Enables digital output signals to be sent for every particle alarm that occurs on the Lasair Pro counter during sampling.
- **Enable for system alarms:** Enables digital output signals to be sent for every system alarm that occurs on the Lasair Pro counter (e.g., calibration alarms).
- **Enable for end sample:** Enables digital output signals to be sent when sampling is ended (automatically or manually).

## NFC Cards

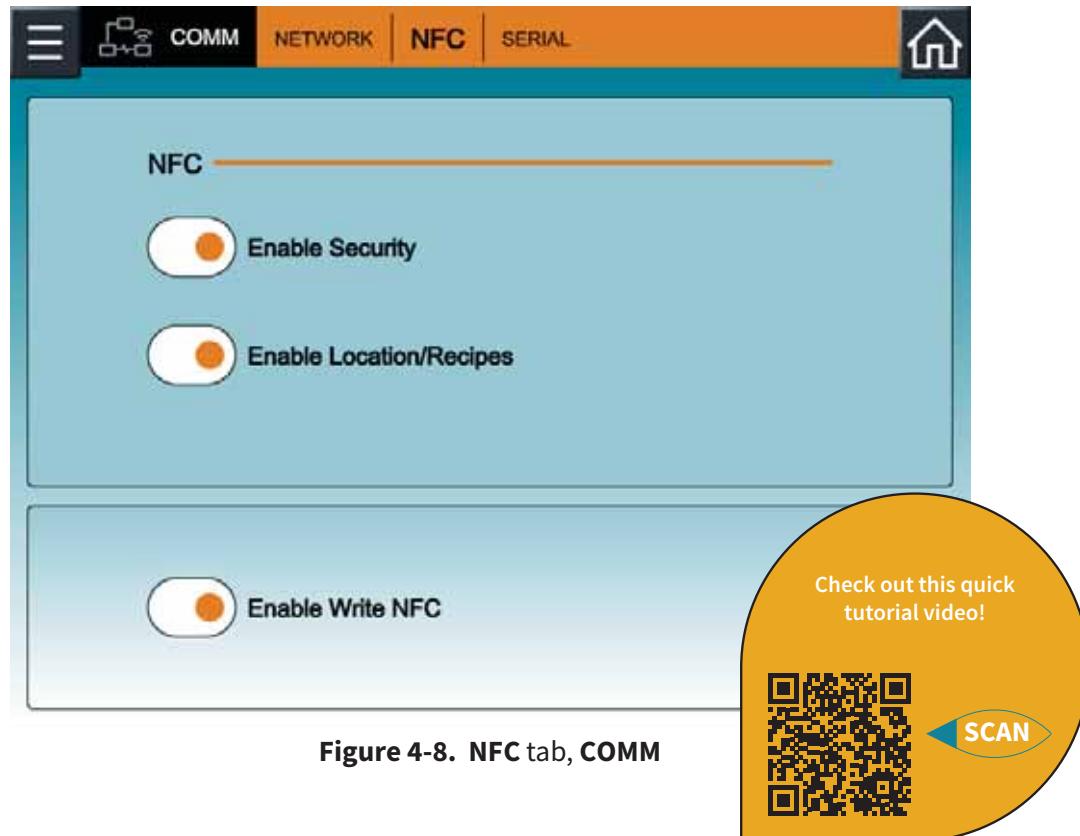
Near Field Communication (NFC) allows the Lasair Pro counter to read and write information stored on a portable card. The card can contain:

- User data to facilitate logging into the particle counter without entering the same information into the touchscreen. See **Creating NFC Users** on page 6-7.
- Recipe and location data to automatically populate sampling options on the touchscreen. See **Locations and rooms may have more than one recipe associated with them. In this case, when the location (or room) is selected, the operator will have the option of choosing one of the assigned recipes to load and run.** on page 9-5.

**Note:** This feature is not available on Lasair Pro 310 models that do not have NFC and Wifi capability (1014102X2X).

To enable NFC communications, press  , then  (COMM).

On the **NFC** tab, you will have the option to enable the NFC capabilities of the Lasair Pro counter. In **Figure 4-8**, all are enabled.



## Computer Connections

This section includes information for computer communications with the Lasair Pro particle counter. Although the Lasair Pro is a standalone instrument with its own built-in firmware, you can also control the instrument with optional software.

The Lasair Pro particle counter has the memory capacity to store 10,000 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 Pro 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.

You can optionally connect the particle counter to a computer using control software for long term memory storage, as well as data analysis. If connecting the Lasair Pro to a computer directly or indirectly, you will need one of the following:

- **Straight-through Ethernet cable:** Use when connecting indirectly to a computer through a hub or other device on an Ethernet network.
- **USB Micro B serial cable(P/N 1000025093):** Use for connecting the Lasair Pro counter directly to a PC with terminal emulation.

## Control Software and Data Interface

There are two (2) types of options for communicating with a computer from the Lasair Pro particle counter, including:

- PMS Software and Communication Protocols
- Third Party Control Software

## 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 with PMS instrumentation:

## ***PMS Data Management and Instrument Control***

- **DataAnalyst** – This software stores data from a Lasair Pro particle counter and provides additional analysis and reporting options that are 21 CFR Part 11 compliant. This application will support connecting to multiple Lasair Pro 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 Pro particle counters, see the DataAnalyst User's Manual. Note that Lasair Pro requires firmware version 1.1.011 or later and DataAnalyst Version.

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**NOTE:** Anywhere DataAnalyst is later mentioned in this manual, Facility Net or Pharmaceutical Net also apply.

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- **Facility Net or FacilityPro** – These control software systems (optional purchases from Particle Measuring Systems, Inc.) control the Lasair Pro 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 Pro particle counter.

## ***Communication Protocol***

Use PMS TCP/IP protocol to transmit data between the Lasair Pro particle counter to DataAnalyst or Facility Net via an Ethernet network. For more information, see the following section.

## ***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 Pro particle counter.

## **Configuring Network Outage Buffer**

The communications protocol used for FacilityPro and FacilityNet has a disconnect buffer. The buffer allows recovering data after a network or computer outage. By default, this buffer is set to 60 samples. If sampling is done on one minute intervals, then data will be recovered for up to one hour after communications have recovered. It is possible to adjust the size of this buffer via the serial interface on the instrument. Use the set buffer xxx command to change the buffer size if desired. You must reboot the instrument after making this change for it to take effect.

It is possible to set the buffer between 0 and 10,000. Do not set the buffer larger than necessary, or it may cause network delays as the instrument tries to download a large number of samples after a reconnect.

## **Third Party Control Software**

You can also export data collected with the Lasair Pro particle counter to your Facility Management System (FMS) using third-party software:

- **USB Port** – There are two USB ports, one on the front and two on the back panel, for transferring data from the Lasair Pro particle counter to your computer via USB mass storage device. PMS USB storage drive – P/N 1000026003

## **Network Configuration**

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.

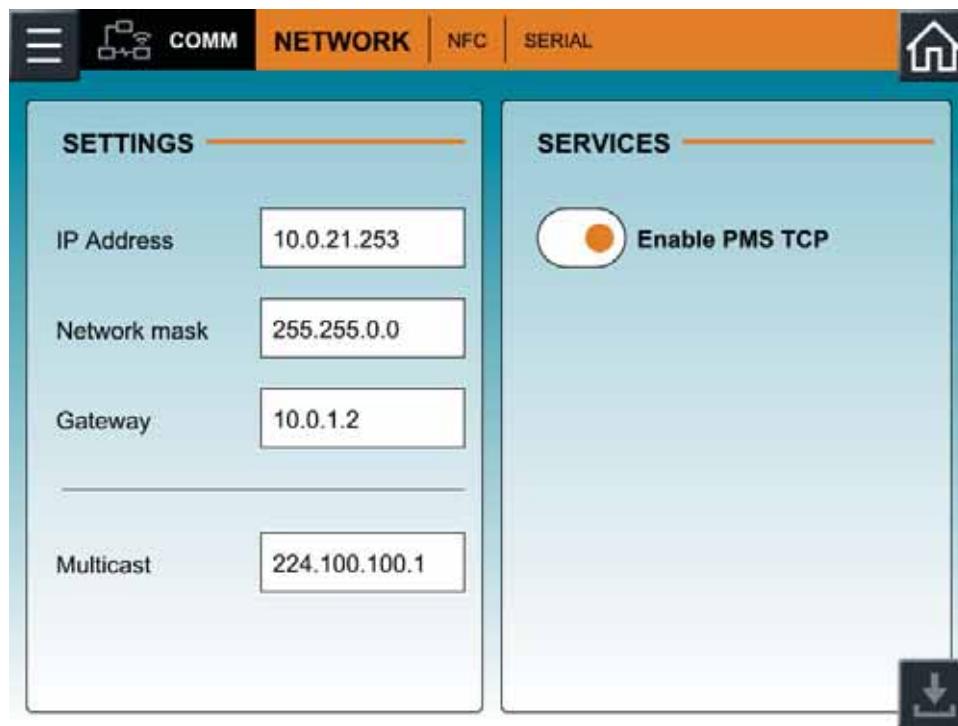


Figure 4-9. NETWORK tab, COMM

The **NETWORK** tab of the **COMM** screen allows for the following configurations:

- **IP Address**
- **Network Mask**
- **Gateway Address**
- **Multicast Address**
- **Enable PMS TCP**

## 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
<b>A (24 Bit Range)</b>	10.0.0.0	10.255.255.255
<b>B (20 Bit Range)</b>	172.16.0.0	172.31.255.255
<b>C (16 Bit Range)</b>	192.168.0.0	192.168.255.255

The Lasair Pro can be configured with a unique IP address in the form of **aaa.bbb.ccc.ddd**. Each 3-digit series is a value of 0–255.

## Network Mask

The network mask is used to discern the network portion of the IP address from the location portion, allowing the instrument to communicate outside of its local network. 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 ones followed by enough zeros to make 32 bits. The length of the ones 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
<b>A (24 Bit Range) (e.g., 10.X.X.X)</b>	255.0.0.0
<b>B (20 Bit Range) (e.g., 172.16.X.X)</b>	255.240.0.0
<b>C (16 Bit Range) (e.g., 192.168.X.X)</b>	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. Enter as **aaa.bbb.ccc.ddd**. Each 3-digit series is a value of 0–255.

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. Enter as **aaa.bbb.ccc.ddd**, where each 3-digit series is a value of 0–255. 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, but alternates may be entered in the form of **aaa.bbb.ccc.ddd**, where each 3-digit series is a value of 0–255. 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.

## Enable PMS TCP

Enables the PMS TCP/IP protocol that attaches the instrument to PMS control software such as Facility Pro and Facility Net. Disabling this function prevents the use of these applications.

## 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.

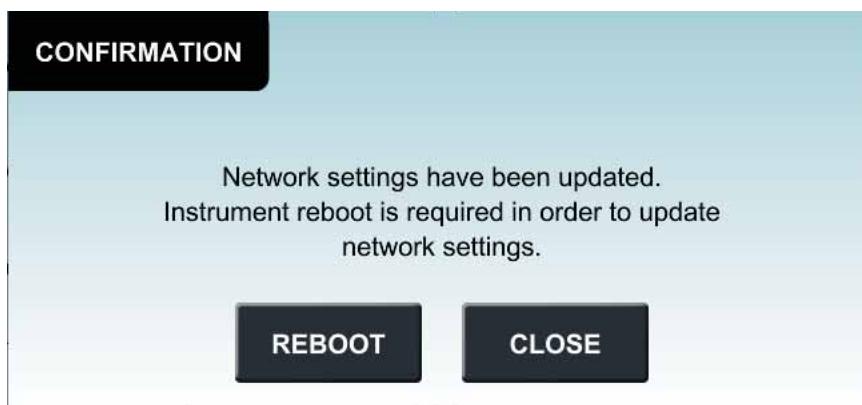
In Particle Measuring Systems instruments the MAC address is set during production. The value is permanently stored in non-volatile memory on the main processor circuit board. (The MAC address will change if the main circuit board is replaced.) The MAC address may be displayed via terminal emulation (i.e., USB Micro B 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.

## Saving Network Settings

After making changes to the IP Address, Network Mask, Gateway Address or Multicast

Address, press  to save settings. The Lasair Pro will reboot with the new settings after confirmation.



**Figure 4-10.** Confirm network settings

## 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 6 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. Use one of the following methods:
  - a. Use terminal emulation software such as **PuTTY** or **HyperTerminal**, the USB Micro B serial service interface, and the “sta” command.
  - b. From the **HOME** screen of the Lasair Pro, navigate to the **NETWORK** tab of the **COMM** screen. Note that parameters can be changed on this tab.
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 **Ethernet** or **Local Area Connection Properties** window.
    - i. In Windows 10, use the following navigation:
 

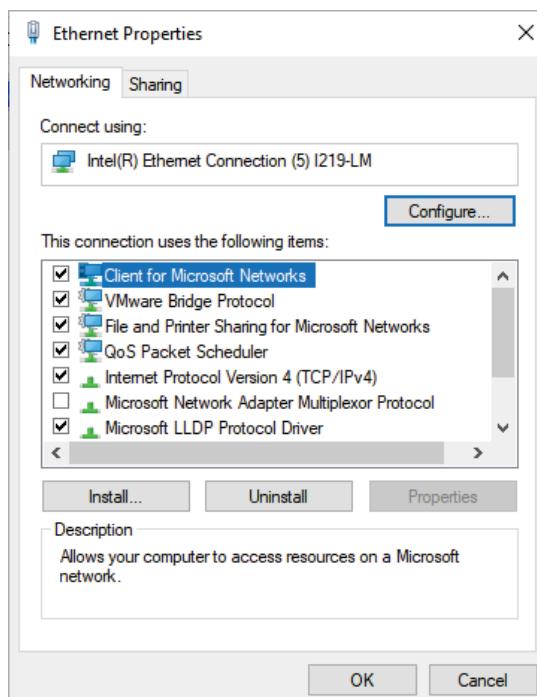
**NOTE:** If you don't see "Ethernet" as a network option, choose "LAN" or "Local Area Connection".

---

**NOTE:** Do not select anything with the word "Wireless" or the word "Virtual".

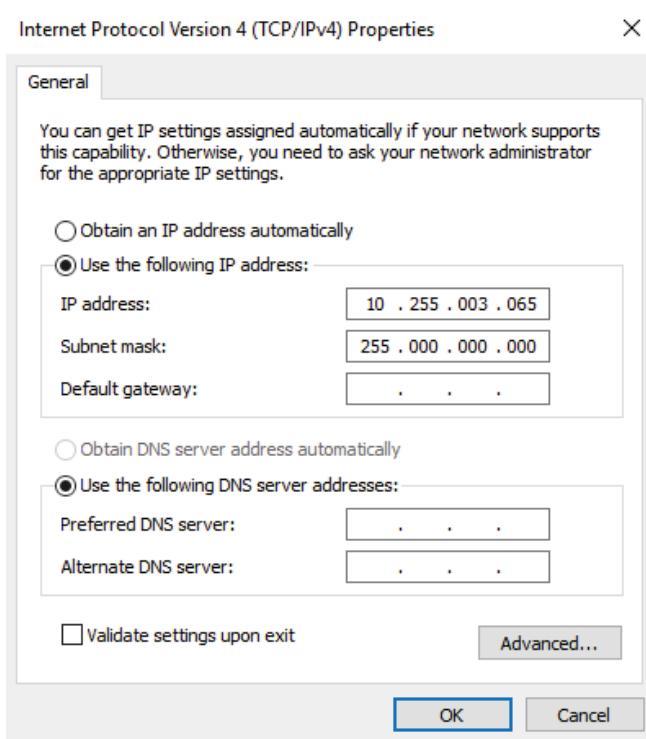
---

ii. You should see a window similar to the following:



**Figure 4-11.** Ethernet/LAN Properties window

- b.** Select Internet Protocol Version 4 (TCP/IPv4), and click **Properties**.
- c.** Record the existing properties, including IP address and Subnet mask. These settings will need to be restored later.
- d.** Change the IP address and Subnet mask as described in Step 2. The Default gateway and DNS server values should be left blank.



**Figure 4-12.** Adjusted Internet protocol properties

- e. Click the **OK** button to close the window. Click **OK** again to exit LAN configuration.

## Method 2: Modifying Network Settings with Serial Commands

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. Connect the Lasair Pro counter to a PC using a USB Micro B serial cable. Windows 10 should automatically load the appropriate driver for proper communication. If not, download the driver from here: <https://ftdichip.com/drivers/>.
2. On the PC, open your terminal emulation software (**PuTTY** or **HyperTerminal**).
3. Set the instrument addresses as follows:

IP address	169.254.0.1	Use command “set ip”
Mask	255.255.0.0	Use command “set mask”
Gateway	0.0.0.0 (or blank)	Use command “set gate”

4. After setting the addresses, use the **write** command to save the addresses. The instrument will reboot and apply the new address settings.

# Chapter 5

## Sampling Options

---

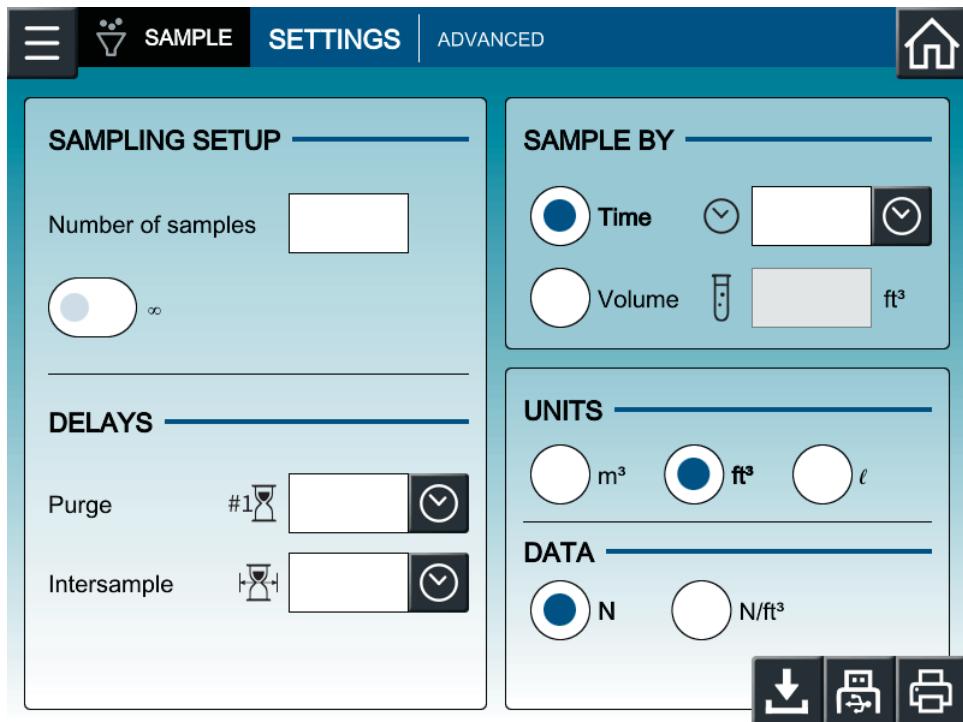
---

Default settings for sampling can be changed and applied to the next sample run. This chapter describes the general configuration options, with the following chapters contributing to operation, data display and collection:

- **Security** on page 6-1
- **Alarms** on page 7-1
- **Locations** on page 8-1
- **Recipes** on page 9-1
- **Display, Data and Reports** on page 10-1
- **Statistics** on page 11-1
- **System Configuration** on page 12-1

## SETTINGS Tab

Press  and then  (SAMPLE). You should now see the SETTINGS tab.



**Figure 5-1.** Sampling configuration settings

## Sampling Setup

The user can configure a set number of samples or enable continuous sampling ( $\infty$ ).

- **Number of samples:** The Lasair Pro will perform the number of samples indicated here without the user needing to press the **Start** or **Stop** button on the **HOME** screen.
- **Continuous sampling ( $\infty$ ):** Sampling will continue with the set configuration until the user presses the **Stop** button on the **HOME** screen. For a full list of **HOME** screen buttons, see **Icons and Buttons of the HOME Screen** on page 3-7.

## Delays

Time in the format of HH:MM:SS can be added at the start or between samples.

- **Purge:** Initial delay before the start of sampling.
- **Intersample:** Delay between samples if **Number of samples** is greater than one.

## Sample By

Sampling can be configured to stop after a certain duration of time or after a certain volume of sampling medium (e.g., air) has been sampled.

- **Time:** If selected, the Lasair Pro will sample for a set period of time. Press inside the field to adjust the sample time. The format is HH:MM:SS.
- **Volume:** If selected, the Lasair Pro will sample a set volume of sampling medium. Press inside this field to adjust the sample volume. The unit of volume can be changed just below this area of the screen.

## Units

Normalized particle counts can have the following volume units:

- Cubic meters (**m<sup>3</sup>**)
- Cubic feet (**ft<sup>3</sup>**)
- Liters (**L**)

## Data

Particle counts can be displayed as raw or normalized counts:

- **Raw (N):** Purely a numeric value of the particles counted by the sensor with no associated volume.
- **Normalized (N/m<sup>3</sup> or N/ft<sup>3</sup> or N/L):** The number of particles counted by the sensor within a unit of volume.

## Buttons

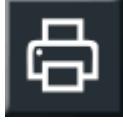
Image	Name	Description
	<b>Save as Recipe</b>	<p>Opens the keyboard to name the recipe configuration. For more information on recipes, see <b>Chapter 9</b>.</p>
	<b>Save to USB</b>	<p>Saves the Sampling Setup Report as a PDF to the USB key. This button is only activated when a USB key is inserted. Saved information includes:</p> <ul style="list-style-type: none"> <li>• Sampling Plan Data (Sample Time or Volume, Number of Samples, Units, Delays, Group Report Mode, Continuous Pump, Beep, Autoprint, USB Report)</li> <li>• Global Alarm Settings (Master, Beep, Autoprint)</li> <li>• Particle Alarm Settings</li> <li>• Environmental Alarm Settings</li> <li>• Trend Alarm Settings</li> </ul>
	<b>Print</b>	<p>Prints the Monitoring Setup Report to the thermal printer.</p>

Table 5-1. SETTINGS tab, SAMPLE

## Example Sampling Setup Report

 PARTICLE MEASURING SYSTEMS®  
a SPEC DTS company

21 CFR 11 Compliant 

### Sampling Setup Report

---

Instrument ID:	Lasair Pro
Serial Number:	PrePlot23BD75
Calibrated:	11/7/2019

---

Batch ID:	
Operator:	
Recipe:	-

---

#### Sampling Plan Data

Number of Samples:	5
Time:	00:01:00
Delays:	
Purge:	00:00:10
Intersample:	00:00:00
Sample Units:	ft <sup>3</sup>
Data Units:	N/ft <sup>3</sup>
Sampling Start:	Standard
Number of Locations:	1

---

#### Options:

Group Repeat Mode:	No
Continuous Pump:	No
Beep:	No
Print Averages:	Yes
Print Report:	Yes
Save USB Report:	Yes

---

#### Global Alarm Settings

Enable Alarms:	Yes
Enable Warnings:	No
Enable System Alarms:	Yes
Enable Alarm Reasons:	No
Enable Audible Alarms:	No
Print Report:	No
Save USB Report:	No

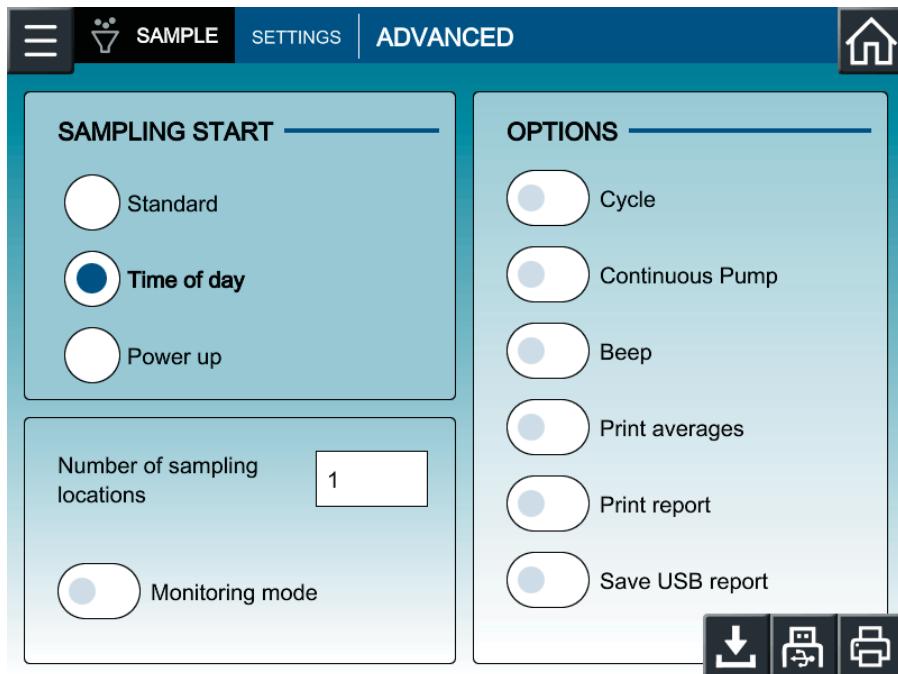
**Figure 5-2.** Example Sampling Setup Report (page 1)

The Sampling Setup Report summarizes the current user configuration of the following:

- **SETTINGS** and **ADVANCED** tab of the **SAMPLE** screen
- **GENERAL**, **PARTICLES**, **ENVIRONMENTAL**, and **TREND** tab of the **ALARMS** screen (see **Chapter 7**)

## ADVANCED Tab

Press **ADVANCED** at the top of the screen to access this tab.



**Figure 5-3.** Advanced sampling settings

### Sampling Start

The following choices determine how sampling will start on the Lasair Pro counter:

- **Standard:** Sampling start is determined with the **HOME** screen.
- **Time of day:** Sampling will automatically start based on the user-configured time. The time is set on the **HOME** screen. This setting will be disabled in Monitoring Mode or Statistics Mode.
- **Power up:** Sampling automatically starts after the Lasair Pro counter has been turned on. The sampling configuration is whatever was used prior to shutdown.

#### -- NOTICE --

Note that NFC users will be unable to log into the Lasair Pro if the **Power up** selection is chosen. Ensure a non-NFC user is enabled for logging in.

Additionally, this feature is not available on Lasair Pro 310 models that do not have NFC and Wifi capability (1014102X2X).

## Options

The following options can be enabled or disabled:

- **Cycle:** Enables the continuous collection of a finite number of samples without the user needing to press the **Start** button on the **HOME** screen after each sampling. The number of samples is set on the **SETTINGS** tab (**Number of samples**).
- **Continuous Pump:** Keeps the pump active outside of sampling operation.
- **Beep:** Enables the user to determine how many particles counted in a sample will trigger an audio cue. The pop-up in **Figure 5-4** appears on the **HOME** screen when enabled.



**Figure 5-4.** Particle count values to trigger an audio cue

- **Print averages:** Automatically includes average particle counts for each configured channel size in the printed report, the USB report, or both. If particle counts are given as raw data, the print averages feature will include both normalized and raw average counts.
- **Print report:** Automatically prints Final Sample Report using the thermal printer (if available).
- **Save USB report:** Automatically saves Final Sample Report to a PDF report. An example is shown in **Figure 5-5**. See **Final Sample Report Example** on page 10-11 for more details.


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### Final Sample Report

---

Instrument ID: Lasair Pro  
 Serial Number: PrePilot23BD75  
 Calibrated: 11/7/2019

---

Batch ID: -  
 Operator: -  
 Area: Area X  
 Room: Room X  
 Location: Location X  
 Recipe:

Started: 03/31/2020 13:57:07  
 Finished: 03/31/2020 13:57:17  
 Sample: 81  
 Sample status: VALID

**Particle Data**

μm	Δ N	Σ N
0.30	6,679	8,751
0.50	1,371	2,072
1.00	675	701
5.00	20	26
10.00	6	6
25.00	0	0

Volume: 0.0047 m<sup>3</sup>      Flow: 0.03 m<sup>3</sup>/min  
 Duration: 00:00:10

**Environmental Data**

	Avg	Min	Max	
Analog 1	mA	4.00	4.00	20.00
Analog 2	mA	4.00	4.00	20.00

Alarm: Alarm Title  
 Alarm Reason: Alarm Reason

**Figure 5-5.** Final Sample Report example

## Monitoring Mode

Monitoring mode uses preconfigured sampling plans for locations. When enabled, changes to sampling plans and their associated locations are restricted until the monitoring plan has been completed or canceled. This mode works best when sampling plans are saved as recipes and assigned to locations. The **HOME** screen displays maximum and average counts, and lists the particles broken down by size and location.

When Monitoring Mode is activated, or when a recipe is running in Monitoring Mode, sampling data is always normalized.

## Monitoring Mode Activation

To activate **Monitoring Mode**:

1. Deselect continuous sampling on the **SETTINGS** tab of the **SAMPLE** screen.
2. On the **ADVANCED** tab of the **SAMPLE** screen, press inside the **Number of sampling locations** field and increase the number to 2 or greater.

**NOTE:** The user can use previously created locations or virtual locations for their monitoring plan. These locations will appear in the particle count averages list on the **HOME** screen.

3. The **Monitoring Mode** slider will now be activated. Press for **Switch Mode** options.

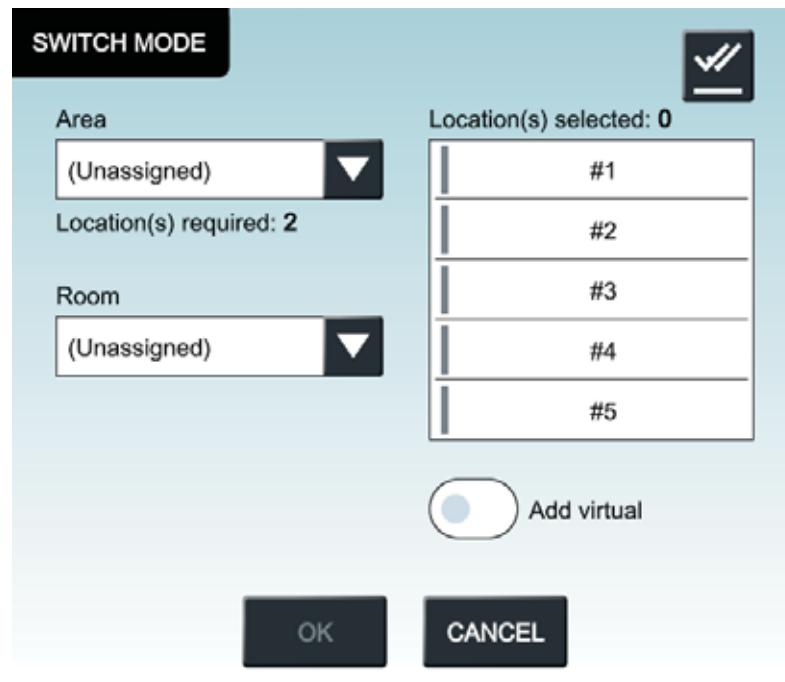


Figure 5-6. **Switch Mode** window

4. In the **Switch Mode** window, you must select the number of locations equal to those set in step 2. This can be done in two ways:

- a. Use the dropdown arrows for **Area** and **Room** to adjust the **Location(s) selected** area, and press on any of the locations listed to select. Selected locations will have an adjacent blue vertical bar. Previously made assignments will affect the locations listing. See **Checking Assignments** on page 8-5.
- b. You may also enable the **Add virtual** slider, which creates temporary locations to be used only for the sampling to be performed after enabling **Monitoring Mode**. These locations are labeled with the "Virtual loc #XXX" format, and are not stored by the system for later use.

5. When you have made a selection equal to the **Number of sampling locations**, you will be able to press **OK**.
6. You will be automatically taken to the **HOME** screen, which will display differently while **Monitoring Mode** is activated.
7. Check the selected location in the top right corner. If you would like to change the selected location, open the dropdown and double-press on the desired location.
8. Press  to start sampling.



Figure 5-7. HOME screen, Monitoring Mode

9. You can take multiple samples at each location as many times as desired. The maximum and average counts can be viewed by swiping from right to left once across the screen. Counts will always be normalized.



**Figure 5-8.** Maximum and average counts

10. You can also view average values for each location by swiping from left to right once more across the screen.

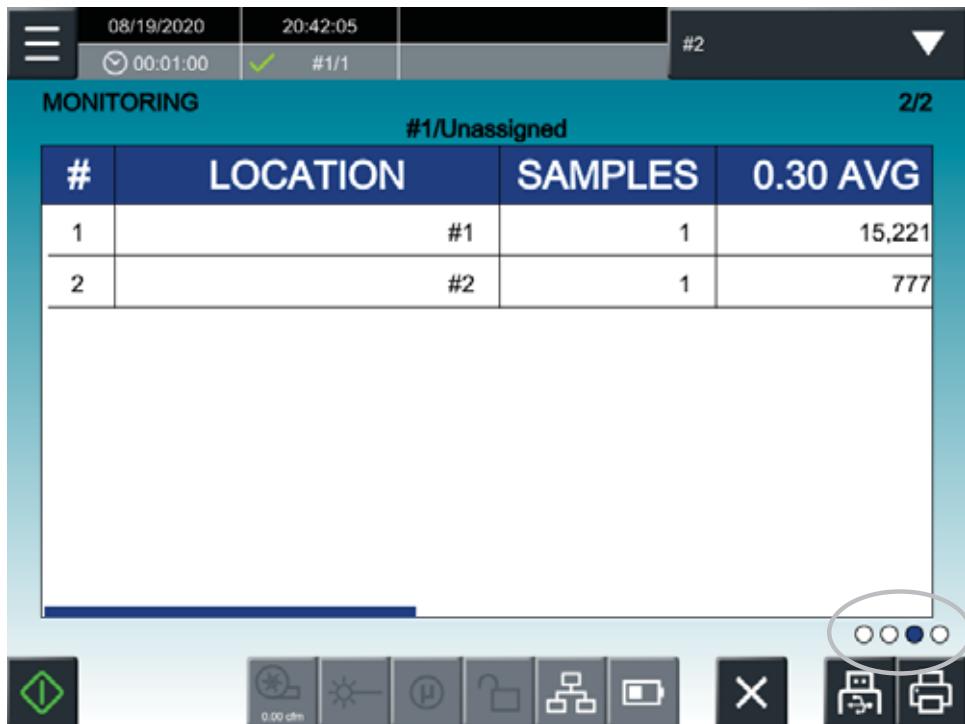


Figure 5-9. Average counts for each location

11. After each sample has completed, you will see the following message. Press **OK** to confirm.

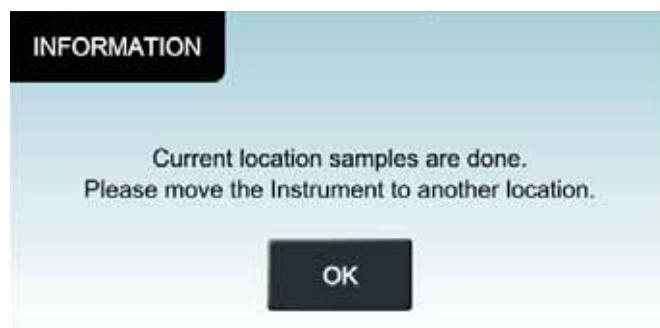


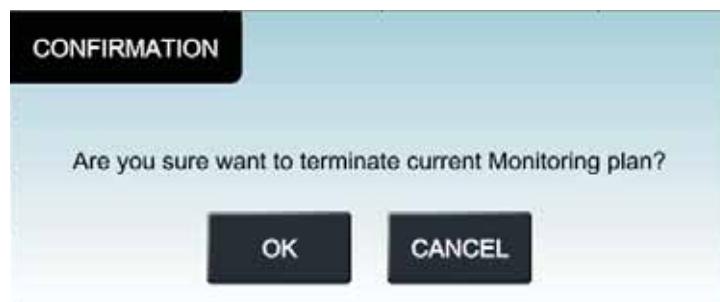
Figure 5-10. Sampling is complete at the selected location

12. After samples have been collected at all locations you will see the following message. Press **OK** to confirm.



**Figure 5-11.** Monitoring Mode sampling completed

13. You may continue to take as many samples at each location as desired.
14. After completing your sampling plan, navigate to the second display of the **HOME** screen (  ) and press  **(Print to USB)** or  **(Print to Thermal Printer)** to generate your Cleanroom Monitoring Report. See **Figure 5-13** for an example report. Monitoring Mode data is always normalized.
15. Press  to terminate **Monitoring Mode**. After confirmation, the **HOME** screen will adjust back to the default display.



**Figure 5-12.** Confirmation window to terminate **Monitoring Mode**

## Example Cleanroom Monitoring Report

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**Cleanroom Monitoring Report**

---

Instrument ID: Lasair Pro  
Serial Number: Pmfls0238075  
Calibrated: 11/17/2019

Batch ID:  
Operator:  
Area: #1  
Room: Unsigned  
Recipe:

**Particle Alarms:**

Particle Size (µm)	Value (N)
0.30	-
0.50	-
1.00	-
5.00	-
10.00	-
25.00	-

Monitoring Result: **COMPLETE**

**Sampling Plan**

	Plan	Actual
Locations	2	2
Samples per Location	1	2
Total Samples	2	4
Time	00:01:00	00:01:00
Volume (m³)	0.0283	0.0283

**Particle Data**

µm	Max	Average
0.30	983	796
0.50	35	35
1.00	18	8
5.00	18	8
10.00	18	8
25.00	18	8

**Location Averages**

Location	#	µm	Avg(8/m³)
#1	2	0.30	863

Page: 1

Page: 2

**Figure 5-13.** Cleanroom Monitoring Report example

**NOTE:** If you generate a Cleanroom Monitoring Report before all sampling locations have completed, you will see a general estimation ("0+") in the Samples per Location field on the report. Generate the report after all sampling has completed to ensure the field's specificity.

5-14

Lasair® Pro Aerosol Particle Counter Operations Manual

## Sampling Accessories

### 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)

### Positioning Accessories

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

### Tripods

- 316L Stainless Steel Table Stand – P/N 1000023413
- Table tripod – P/N 1000000979 (Not for use with the Lasair Pro 5100 unit)

## **Wall/Hand/Tripod Adapters**

A wall/hand/tripod adapter, specific to the particle counter model, is included and shipped with each Lasair Pro 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

## **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 90104057

## **Thermal Paper**

- Standard thermal paper – P/N 1000024998
- Cleanroom thermal paper – P/N 1000024977

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.

## **HHIPA Accessory**

### **Flowrate**

The HHIPA probe is available in three different flowrate configurations, depending on the flowrate of your Lasair Pro particle counter. Those flowrates are:

- 28.3 LPM (1.0 CFM)
- 50 LPM
- 100 LPM

Depending on the flowrate of the Lasair Pro 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 Pro 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 5-14.** 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 Pro Particle Counter's sample inlet.

For filter scanning applications it is most common to utilize the audio beep function of the Lasair Pro Particle Counter. This feature allows the user to scan a filter without looking at the screen of the Lasair Pro, and to hear an audio sound when particles are detected. Go to the **DISPLAY** tab of the **DISPLAY** screen for volume adjustment, and ensure audible alarms are enabled (see **GENERAL Tab** in **Chapter 7**).

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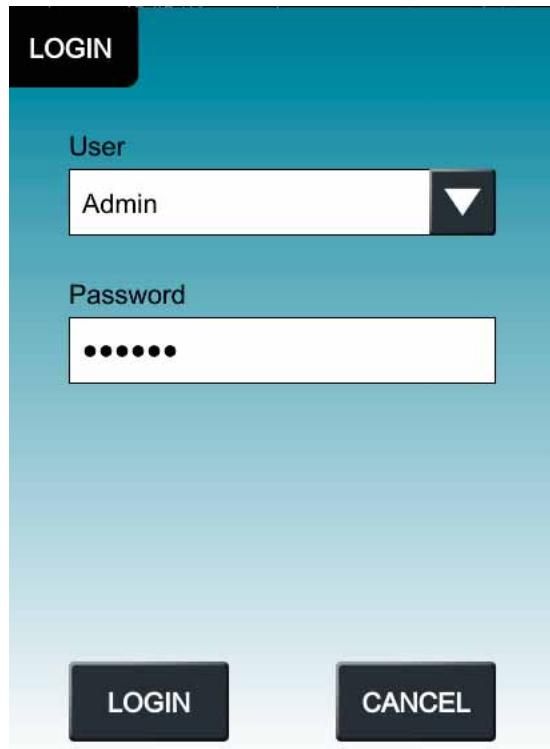
# Chapter 6

## Security

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The Lasair Pro particle counter is shipped without security enabled, allowing first-time users to access all screens and settings. Access can be made limited by creating users and enabling security. Once enabled, there are four tiers of accessibility: administrator, supervisor, operator, and no login.



**Figure 6-1. LOGIN window**

To configure security settings, press  and then  (SECURITY).

# Security Overview

See the following sections for information on individual **SECURITY** tabs:

- **Settings Tab** on page 6-10
- **Users Tab** on page 6-12
- **Audit Tab** on page 6-15
- **Audit Data Tab** on page 6-16

## Usernames

The Lasair Pro can manage and internally store up to 100 customizable usernames. Usernames can be a minimum of 3 characters, with a maximum of 32 characters in length. Each username must be unique. Once set, usernames cannot be changed.

## Passwords

Passwords must be at least 4 characters and no more than 16 characters in length. The Lasair Pro stores passwords in an encrypted form, and does not store unencrypted passwords to prevent users or Particle Measuring Systems from displaying or exporting unencrypted passwords.

Depending on configuration settings chosen by the administrator, passwords may have an expiration and be chosen by the user. They may also be required to have a minimum length longer than 6 characters.

## Access Levels

The Lasair Pro allows users to be associated with different access levels. Once security is enabled, **No Login** will be the default access level.

Name	Description
<b>No Login</b>	This access level supports viewing the <b>HOME</b> screen and logging in.
<b>Operator</b>	This access level supports operating basic instrument function on a day-to-day basis.
<b>Supervisor</b>	This access level supports modifying some instrument settings at a management level.
<b>Administrator</b>	This access level supports all instrument capabilities.

**Table 6-1.** Access levels

**NOTE:** Permissions are the same for NFC access levels. For example, Administrator and Administrator NFC have the same permissions.

A summary of the accessible instrument screen/menu for each access level is provided in **Table 6-2**.

Screen	No Login	Operator	Supervisor	Administrator
<b>SAMPLE</b>				
SAMPLE	X	<input type="checkbox"/>	✓	✓
ALARMS	X	X	✓	✓
LOCATIONS	X	X	✓	✓
STATISTICS	X	<input type="checkbox"/>	✓	✓
RECIPES	X	<input type="checkbox"/>	✓	✓
<b>SETUP</b>				
DISPLAY	X	<input type="checkbox"/>	✓	✓
SYSTEM	X	<input type="checkbox"/>	<input type="checkbox"/>	✓
SECURITY	X	X	<input type="checkbox"/>	✓
COMM	X	X	✓	✓
IN/OUT	X	X	✓	✓
<b>OTHER</b>				
DATA	X	<input type="checkbox"/>	<input type="checkbox"/>	✓
DIAGNOSTICS	X	X	✓	✓
LOGIN	✓	✓	✓	✓
HOME	<input type="checkbox"/>	✓	✓	✓
✓ Full Access		□ Limited Access	X No Access	
<b>Table 6-2.</b> Screen accessibility by access level				

The user's access level is selected when the user is created. Like the username, it cannot be changed at a later time. The only user data that can be changed is the password.

## Activate/Deactivate Users

User accounts can be activated and deactivated from the **USERS** tab by administrators. This is done by touching the ON/OFF column for a specific user. Orange indicates the user is enabled, while gray indicates it is disabled.

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

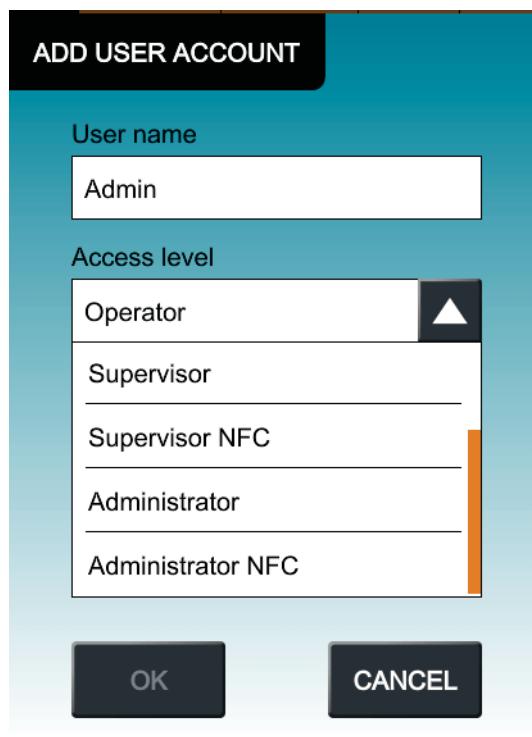
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**NOTE:** When security is enabled, the Lasair Pro prevents an administrator from disabling their own account. In order to disable the current administrative account, security must be disabled or another administrative user must log in to the instrument.

---

### **Enabling Security**

1. Go to the **USERS** tab and press .
2. Select **Administrator** from the **Access level** dropdown.
3. Press inside the **User name**, **Password**, and **Confirm Password** fields to open the keyboard screen and enter your chosen credentials.
4. Press **OK** to create the new user.



**Figure 6-2.** Access levels for a new user

5. You should now see the new user listed beneath the column headers. Select the portion of the row under the **ON/OFF** column to activate the user. The vertical line beside the row number will be orange when activated.

ON/OFF
1
2
3
4
5

**Figure 6-3. ON/OFF column**

6. Go to the **SETTINGS** tab and press the **Enable security** slider.
7. Select the Administrator user from the **User** dropdown on the **VERIFY USER** window.
8. Enter the Administrator password and press **OK**.
9. The indicator dot will change from gray to orange when enabled. The administrator user will automatically be logged out.

---

**NOTE:** On the **HOME** screen, press the  button to view status, username, and access level information. See **Security** on page 3-10 for more details.

---

### **Login and Logout**

1. Press  , then  (**LOGIN**).
2. Select your username from the **User** dropdown, and enter the user's password.
3. To log out of this user, press  , then  (**LOGOUT**).

### ***Disabling Security***

Security can only be disabled by an administrator.

1. Log in to an administrator account.

2. Press  , then  (SECURITY).

3. Go to the **SETTINGS** tab and press the **Enable Security** slider. The orange indicator will fade in color and move to the left side before the **HOME** screen automatically appears.

### ***Editing a User***

If security is enabled, the logged-in user will only be able to change their own password, not their Access level. Security must be disabled first and the user de-activated before the Access level can be changed.

1. Log in as the user with the password to be edited. If security has yet to be enabled, skip this step.



2. Go to the **USERS** tab and press .
3. If desired, change the Access level from the dropdown menu.
4. If desired, enter the new password twice (once to confirm).
5. The previously set Access level and password will be erased.

### ***Deleting Users***

While logged in as an administrator, any other user can be deleted. If security is not enabled, any user, including administrators, can be deleted.



1. On the **USERS** tab, select the user to be deleted and press .
2. You will be prompted for confirmation. Press **OK**.
3. If you want to delete all users, press  . Press **OK** for confirmation.

### Creating NFC Users

Specialized NFC cards can be programmed with user data for touch-free login to the Lasair Pro particle counter.

**Note:** This feature is not available on Lasair Pro 310 models that do not have NFC and Wifi capability (1014102X2X).

1. Press  , then  (COMM).

2. Go to the **NFC** tab and press the **Enable Security** and **Enable Write NFC** indicators.

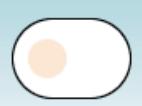
A light orange dot  indicates the setting has not been enabled.



Figure 6-4. NFC tab, COMM

3. Press  and then  (SECURITY).

4. Go to the **USERS** tab and press .



5. Select any type of NFC user (Operator NFC, Supervisor NFC, or Administrator NFC) from the **Access level** dropdown. Your username will generate automatically.
6. Press inside the **Password** and **Confirm password** fields to open the keyboard and enter your password.
7. Press **OK** to create the new NFC user.
8. You should now see the new user listed beneath the column headers. Select the portion of the row under the **ON/OFF** column to activate the NFC user. The vertical line beside the row number will be orange when activated (see **Figure 6-3** on page 6-5).

9. Press  to open the **Create NFC User Card** window.

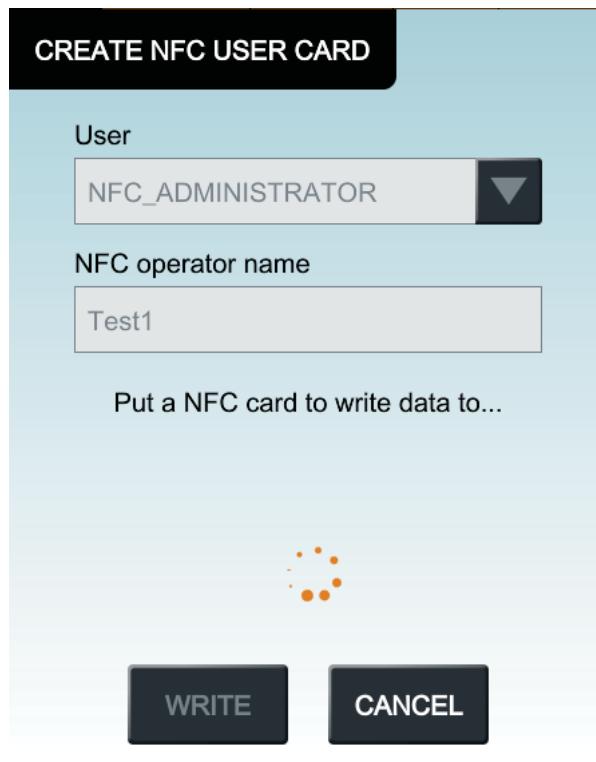
10. Select the recently created NFC user from the **User** dropdown.
11. Press inside the **NFC operator name** field and enter your personalized username.
12. Press **Write**.
13. Press your NFC card to the NFC card reader located on the right side of the Lasair Pro counter.



**Figure 6-5.** Internal NFC card reader location

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14. Wait as the user is written to the NFC card. Continue to hold the card in place.



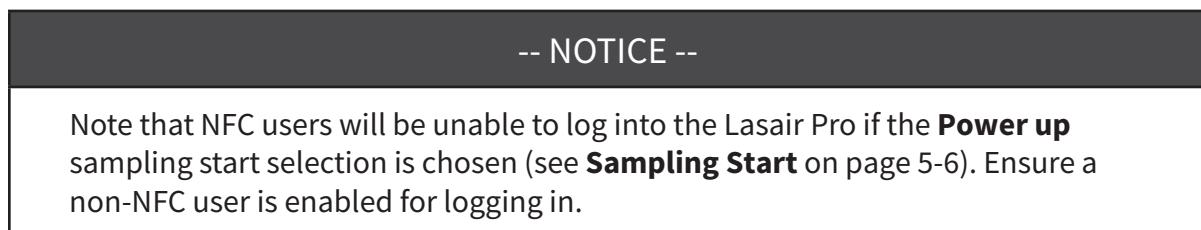
**Figure 6-6.** Orange circular waiting animation

15. Once complete, the message **NFC USER card is successfully written** will appear in green. The NFC user can now use this specific card to log into the Lasair Pro counter without using the keyboard.

---

**NOTE:** If user information has already been written to the NFC card, the older data will be automatically overwritten. Only one user can be written to an NFC card.

---



## Settings Tab

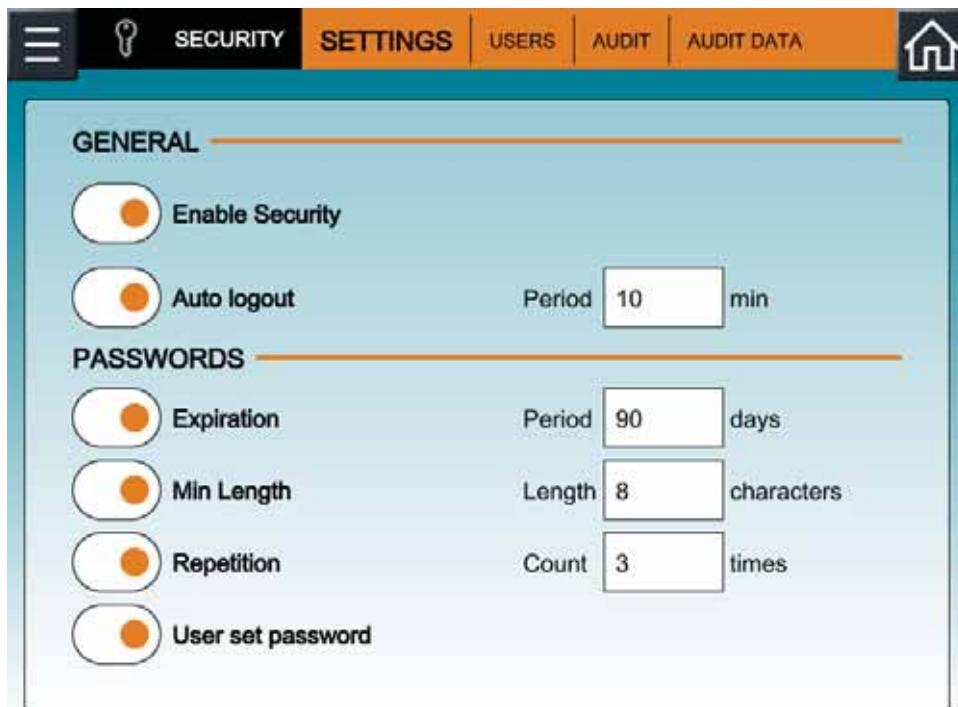


Figure 6-7. SETTINGS tab, SECURITY

The **SETTINGS** tab allows an administrator to enable or disable security, enable or disable the auto-logout feature, and configure password settings.

All settings are described in **Table 6-3** on page 6-11.

Image	Name	Description
<b>GENERAL</b>		
 <b>Enable Security</b>	<b>Enable Security</b>	<p>Enables all security features. Security cannot be enabled if there is no administrator account has been enabled.</p>
 <b>Auto logout</b>	<b>Auto Logout</b>	<p>Enables the Lasair Pro counter to automatically log the user out at the end of a specified time period.</p>
<p>Period <input type="text" value="10"/> min</p>	<b>Auto Logout Period (min)</b>	<p>Sets the minutes before the auto-logout feature is activated.</p>
<b>PASSWORDS</b>		
 <b>Expiration</b>	<b>Expiration</b>	<p>Activates password expiration after a set number of days.</p>
<p>Period <input type="text" value="90"/> days</p>	<b>Period before Expiration (days)</b>	<p>Sets the number of days before passwords expire. Counts down after the password is set.</p>
 <b>Min Length</b>	<b>Min Length</b>	<p>Activates a minimum password length.</p>
<p>Length <input type="text" value="8"/> characters</p>	<b>Minimum Password Length (characters)</b>	<p>Sets the minimum number of password characters.</p>
 <b>Repetition</b>	<b>Repetition</b>	<p>Activates the option to use repeat passwords.</p>
<p>Count <input type="text" value="3"/> times</p>	<b>Different Passwords Before Reuse (number)</b>	<p>Sets the amount of passwords before the same password can be reused again.</p>
 <b>User set password</b>	<b>User set password</b>	<p>When activated, this setting allows the user to set their own password. When deactivated, passwords are created by the administrator.</p>

Table 6-3. SETTINGS tab, SECURITY

## Users Tab



ON/OFF	USER NAME	ACCESS LEVEL	PASSWORD
1	Admin	Administrator	*****
2	NFC_ADMINISTRATOR	Administrator NFC	*****
3	NFC_SUPERVISOR	Supervisor NFC	*****
4	NFC_OPERATOR	Operator NFC	*****
5	Admin2	Administrator	*****
6	Super	Supervisor	*****

**Figure 6-8.** List of users

The primary feature of this tab is a table with all entered users. A lock icon appears next to the logged-in administrator inside the Access Level column. The table has the following columns:

- **ON/OFF:** Allows the administrator to enable or disable specific users of the Lasair Pro.
- **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 LEVEL:** Allows the administrator to edit the user's access level.
- **PASSWORD:** Allows the administrator to modify a user password.

All buttons are described in **Table 6-4** on page 6-13.

Image	Name	Description
	<b>Add</b>	<p>Allows for the entry of a new user. The Administrator user can add up to 100 users to be saved on the Lasair Pro.</p>
	<b>Modify</b>	<p>The user name, password, and access level can be modified after user creation. After selecting a user from the list, press this button to edit.</p>
	<b>Delete</b>	<p>Users can be deleted at any time by an administrator, or by the current user if security is not enabled. Select the user to be deleted and press this button to delete.</p>
	<b>Delete All</b>	<p>Allows for the deletion of a user. To delete a specific user, first press anywhere inside the specific row and press the “delete” button.</p> <p><b>NOTE:</b> When security is enabled, the instrument prevents the removal of the Administrator account currently logged into the instrument.</p>
	<b>Write to NFC Card</b>	<p>Opens the <b>Create NFC User Card</b> window. Only active when an NFC user has been created.</p> <p><b>Note:</b> This feature is not available on Lasair Pro 310 models that do not have NFC and Wifi capability (1014102X2X).</p>
	<b>Print</b>	<p>The print buttons allow the Administrator to print the User Setup Report to either thermal printer or the USB key. The Print to USB button is only activated when a USB key is inserted.</p>
	<b>Print to USB</b>	<p>The report lists usernames with their access level and enable status.</p>

Table 6-4. USERS tab, SECURITY

## Example User Setup Report



**Figure 6-9.** Example User Setup Report

**To generate your User Setup Report:**

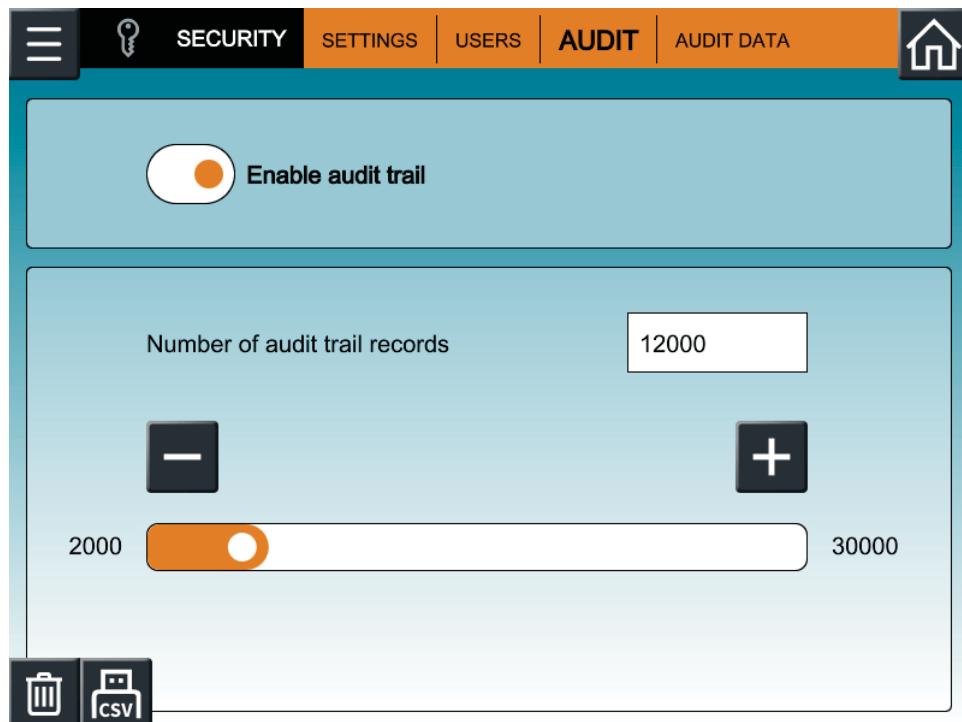
The report will list all current users. If no users are created, the report will generate an empty table.

1. Press  and then  (SECURITY).
2. Go to the **USERS** tab and press .
3. Press  or 

Example:

**NOTE:** Security does not need to be enabled to generate a report.

## Audit Tab



**Figure 6-10.** Audit trail settings

The Lasair Pro will gather all user activity into an audit trail, organizing by type and date/time. To enable the audit trail functionality, toggle the **Enable audit trail** button so that the orange indicator dot is on the right.

The audit trail is recorded and stored using the Lasair Pro counter's internal memory. The number of entries before auto-deletion can be set between 2000 and 30000. When changing the number of audit trail records stored by the instrument, reboot the instrument immediately after the change is made to properly enable the new setting.



Image	Name	Description
	<b>USB Export to CSV File</b>	When a USB key is inserted, pressing this button exports the current Audit Data listing (shown in <b>Figure 6-11</b> ) to a CSV file or XML file on the inserted USB key.

**Table 6-5. AUDIT tab, SECURITY**

Image	Name	Description
	<b>Delete Current Audit Trail</b>	Press this button to clear all current audit trail records from the Lasair Pro.

Table 6-5. AUDIT tab, SECURITY

## Audit Data Tab

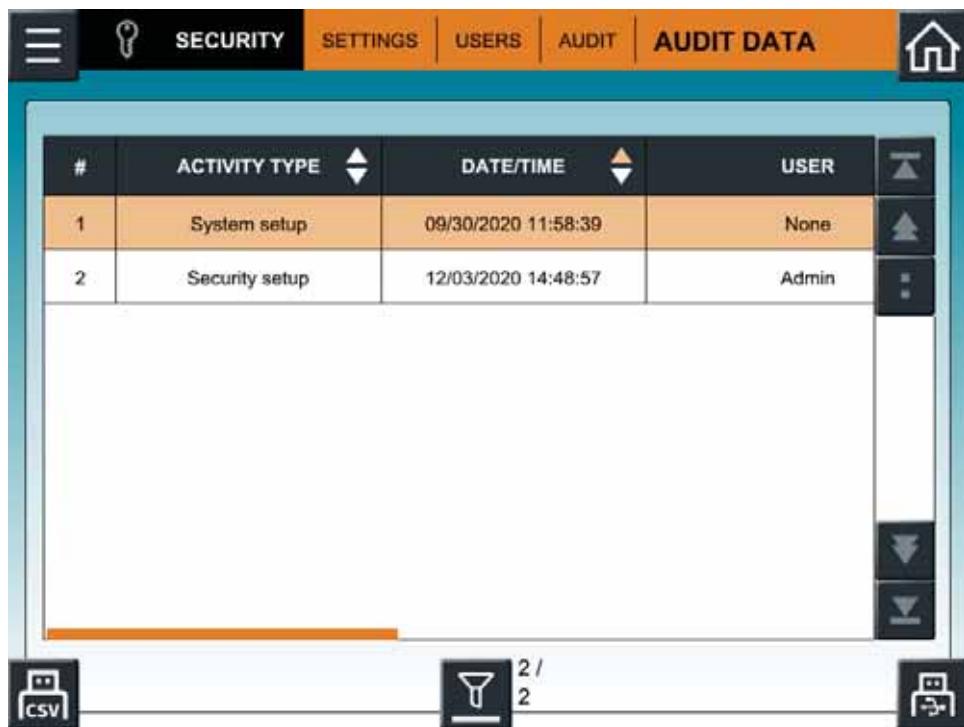


Figure 6-11. Audit Data listing

The Audit Data tab lists the activities of configured users, grouped by the location of activity (Security, Recipe, Sampling, Data, etc). Default sorting is by date/time, with earliest shown first.

Image	Name	Description
	<b>USB Export to CSV File</b>	When a USB key is inserted, pressing this button exports the current Audit Data listing (shown in <b>Figure 6-11</b> ) to a CSV file or XML file on the inserted USB key.
	<b>Filter Options</b>	Press this button to open a window with list filter options for Operator, Date/Time, and Activity Type.
	<b>USB Export</b>	When a USB key is inserted, pressing this button exports the current Audit Trail list to the inserted USB. The file type is PDF.
<b>Table 6-6. AUDIT DATA tab, SECURITY</b>		

## Example Audit Report



21 CFR 11 Compliant 

Audit Trail Report

Instrument ID:	Lasair Pro		
Serial Number:	PrePilot238075		
Calibrated:	11/7/2019		
Batch ID:			
Operator:	Admin		
Model:	LasairPro_310C		

---

1	Main Screen	03/09/2020 12:46:40	Super
UserEnable	0 0 0	Admin	Super
2	Main Screen	03/09/2020 12:46:41	Super
UserEnable	1 0 0	Admin	Super
3	Diagnostics	03/09/2020 12:47:29	Super
ChangeParameters	stat_stat_standard	unit	Previous New
4	Diagnostics	03/09/2020 12:47:30	Super
ChangeParameters	stat_stat_standard	Previous	New
5	Diagnostics	03/09/2020 12:47:30	Super
ChangeParameters	stat_stat_class	Previous	New
6	Alarm Setup	03/09/2020 12:47:31	Super
ChangeParameters	stat_channel_mask	Previous	New
7	Diagnostics	03/09/2020 12:47:31	Super
ChangeParameters	stat_stat_loc_samples	Previous	New
8	Diagnostics	03/09/2020 12:47:32	Super
ChangeParameters	stat_stat_sample_volume	Previous	New
9	Diagnostics	03/09/2020 12:47:35	Super
ChangeParameters	stat_stat_flow	Previous	New
10	Diagnostics	03/09/2020 12:47:36	Super
ChangeParameters	stat_stat_standard	Previous	New
11	Diagnostics	03/09/2020 12:47:36	Super
ChangeParameters	stat_stat_class	Previous	New
12	Alarm Setup	03/09/2020 12:47:37	Super
ChangeParameters	stat_channel_mask	Previous	New

Figure 6-12. Audit Trail Report example

---

**NOTE:** Information contained in the USB export includes instrument identifiers.

---

---

**NOTE:** The CSV and XML exports generated on the **AUDIT** and **AUDIT DATA** tabs are identical.

---



## Chapter 7

# Alarms

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---

Alarm limits can be set for all available particle and environmental channels. One particle alarm may be set for up to four particle size channels—and each particle alarm may be individually enabled or disabled.

Use the following tabs to configure alarm settings:

- **GENERAL Tab** on page 7-2
- **PARTICLES Tab** on page 7-3
- **ENVIRONMENTAL Tab** on page 7-5
- **TREND Tab** on page 7-6
- **REASONS Tab** on page 7-8

## Navigation

Press  and then  (ALARMS). You should now see the **GENERAL** tab.

## GENERAL Tab

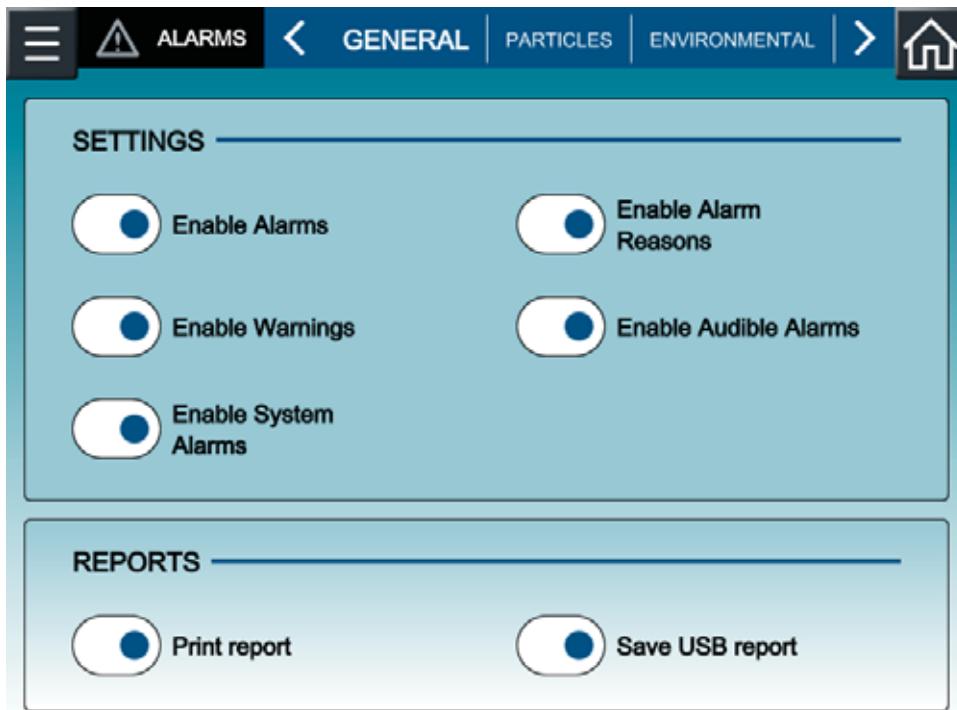


Figure 7-1. GENERAL tab, ALARMS

The **GENERAL** tab allows the user to enable or disable the following options:

- **Enable Alarms:** Enables all alarms (particle, environmental, and trend). When the button is disabled, all alarms and alarm settings are disabled. Alarms are triggered after warning limits are reached.
- **Enable Warnings:** Enables all particle warnings. When the button is disabled, all warnings and warning settings are disabled. Warnings are triggered prior to alarms.
- **Enable System Alarms:** Enables Pump, Laser, Coincidence alarms during sampling.
- **Enable Alarm Reasons:** Enables the alarm reason feature. The user may predefine up to 32 alarm reasons, 32 characters in length, and assign an alarm reason to a sample if the sample contains a particle, environmental or trend alarm.
- **Enable Audible Alarms:** Enables or disables an audible buzzer when alarm occurs.
- **Print report on Alarm:** Enables printing of the sampling report on alarm to the thermal printer.
- **Save USB report:** Enables printing on alarm to an attached USB key.

**NOTE:** These errors are always shown on the status bar on the main screen and flagged in sample data. Enabling System Alarms also provides alarm indication on these items.

## PARTICLES Tab

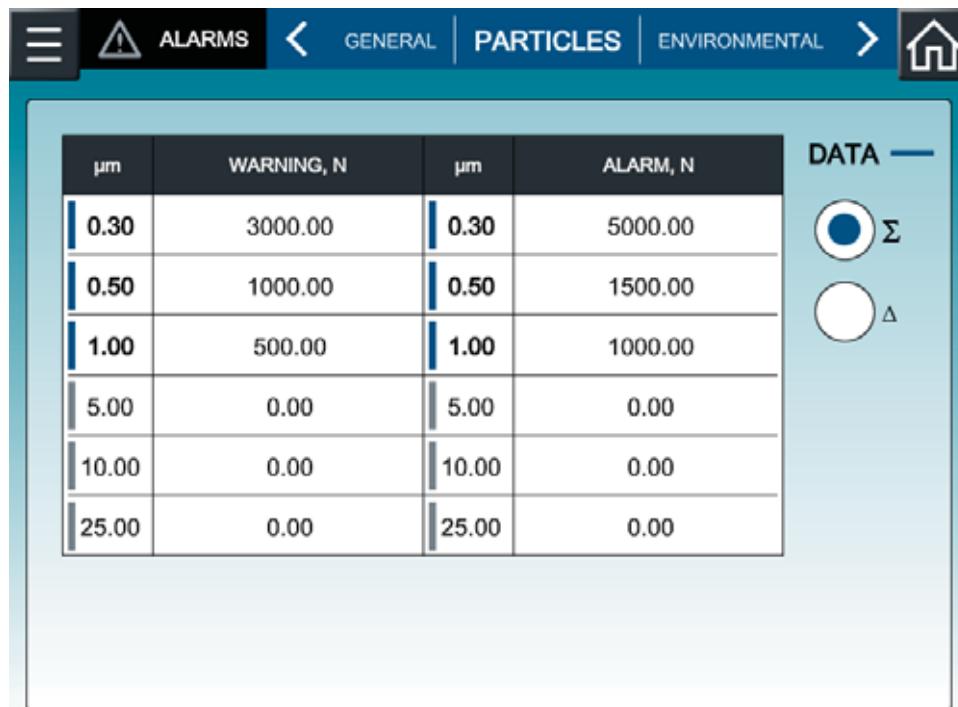


Figure 7-2. PARTICLES tab, ALARMS

Use the **PARTICLES** tab to adjust the following:

- Enable/disable the particle alarm for each channel
- Set the particle warning and alarm limit for each channel. Warnings will trigger prior to alarms.
- Select either cumulative (Σ) or differential (Δ) count for triggering all particle channel alarm

The table on this tab defines alarms for each available particle size channel. The left side lists particle warnings, and the right side lists particle alarms.

### Size Column (µm)

The size column displays the channel's particle size. The header indicates the units of each particle size in micrometers (µm). Units can be changed to nanometers (nm) in the **CHANNELS** tab of the **SYSTEM** screen.

## Triggering Value Column (WARNING, Units)

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.

The unit of measure for the triggering value depends on the configuration of the **SETTINGS** tab of the **SAMPLE** screen. It can be one of the following:

- N
- N/ft<sup>3</sup>
- N/m<sup>3</sup>
- N/ℓ

## DATA

The first and third column are used to enable or disable warnings and alarms. Press inside the cell 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
	<b>Cumulative Count Option</b>	When enabled, particle counts will be triggered when the cumulative count reaches the warning or alarm limit set. Cumulative counts are the number of particle counts of a certain size and larger in one sample.  The cumulative count values set for particle alarms and warnings will trigger even when the <b>HOME</b> screen is configured to display differential counts.
	<b>Differential Count Option</b>	When enabled, particle counts will be triggered when the differential count reaches the warning or alarm limit set. Differential counts are the number of particle counts of a certain size in one sample.  The differential count values set for particle alarms and warnings will trigger even when the <b>HOME</b> screen is configured to display cumulative counts.

**Table 7-1. DATA, PARTICLES tab**

## ENVIRONMENTAL Tab

Environmental (or analog) channel alarms are configured on the **ENVIRONMENTAL** tab of the **IN/OUT** screen (see **Environmental (Analog) Input** on page 4-6). The same analog channels displayed in the **ENVIRONMENTAL** tab of the **ALARMS** screen are also displayed on the **HOME** screen by swiping left.

#	NAME	UNITS	MIN	ON/OFF	MAX	ON/OFF
1	T	F	40.00	ON	120.0	ON
2	RH	%	5.000	ON	66.00	ON
3	Analog 3	mA	0.0	OFF	0.0	OFF
4	Analog 4	mA	0.0	OFF	0.0	OFF

Figure 7-3. ENVIRONMENTAL tab, ALARMS

The **ENVIRONMENTAL** tab displays all analog channel alarms in tabular format. Changes are made on the **ENVIRONMENTAL** tab of the **IN/OUT** screen. Going by column, the user is able to:

- **NAME:** Change the default display name of the analog channel (Analog 1, Analog 2, etc.) to a user-defined name. There is a 16-character limit.
- **UNITS:** Set the units of the analog channel. There is a 10-character limit.
- **MIN:** Set the minimum values for alarm triggering. Values at or below the minimum value will trigger the alarm. Four digit places are required.
- **MAX:** Set the maximum values for alarm triggering. Values at or above the maximum value will also trigger the alarm. Four digit places are required.
- **ON/OFF:** Enable or disable any analog channel alarm.

## Recipes and Environmental Alarms

Recipes may contain environmental alarm settings, but they do not contain environmental sensor scale and offset setting parameters. When a recipe is loaded, the environmental sensor name and units text name are compared between the Lasair Pro instrument settings and the recipe. If they do not match, then environmental alarm settings from the recipe are not loaded.

## TREND Tab

The **TREND** tab allows the user to define trend alarms for a specific channel size. The triggering value of the alarm is displayed on the trend graph (see **GRAPH Tab** on page 10-17). 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 y-axis position of the line will correspond to the alarm limit value. When the trend alarm condition is reached, the particle counter will trigger a sample alarm.

---

**NOTE:** Channels listed on the **TREND** tab are configured in the **TREND** tab of the **DISPLAY** screen. See **TREND Tab** on page 10-4.

---

μm	VALUE $\Sigma(N/m^3)$	N	M
0.5	1000.00	5	30
5.0	100.00	2	2
-	0.00	1	1
-	0.00	1	1

Figure 7-4. TREND tab, ALARMS

The **TREND** tab displays the trend alarms for all configured particle channels in tabular format. Going by column, the user is able to:

- **μm:** Enable or disable any trend alarm.
- **VALUE:** Change the triggering value of the trend alarm. The units displayed here, for example,  $\Sigma(N/ft^3)$ , are set in the **SETTINGS** tab of the **SAMPLE** screen.
- **N:** Set the number of samples (1 to 35) to exceed the set **VALUE** before alarm is triggered. **N** is also known as Triggered Sample Count. This number should be less than or equal to the **M** value.
- **M:** Set the number of samples (1 to 35) to elapse before the alarm is triggered. **M** is also known as the Last Number of Samples. This number should be greater than or equal to the **N** value. See below for examples of alarm triggering (On/Off) based on **N** and **M** numbers when **VALUE** is set to 1000:

Sample #		1	2	3	4	5	6	7
Particle Counts		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

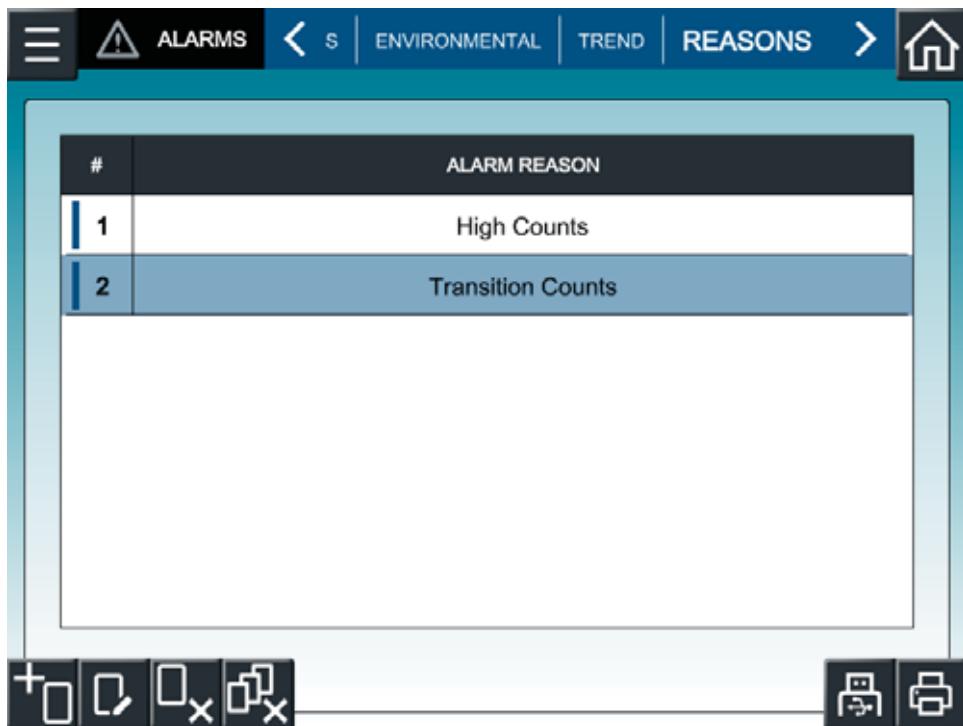


Figure 7-5. REASONS tab, ALARMS

The **REASONS** tab allows the user to define pre-set alarm reasons to select for alarm acknowledgement of particle or environmental alarms. Alarm reasons can be created, deleted, modified, enabled, and disabled. All alarm reasons are automatically enabled after creation. Users may define up to 30 different alarm reasons, and each alarm reason may be up to 32 characters in length.

Image	Name	Description
	<b>Add Reason</b>	Opens the keyboard to define a new alarm reason.
	<b>Edit Reason</b>	When an alarm reason is selected from the list, opens the keyboard to allow the reason to be edited.

Table 7-2. REASONS tab, ALARMS

	<b>Delete Selected Alarm Reason</b>	Deletes the selected alarm reason from the Lasair Pro. A confirmation window appears before the reason is deleted.
	<b>Delete All Alarm Reasons</b>	Deletes all alarm reasons from the list.
	<b>Save to USB</b>	Creates the Alarm Reasons Report on the inserted USB key. The report contains the list of current alarm reasons saved to the Lasair Pro. This button is only activated when a USB key is inserted.
	<b>Print</b>	Prints the current list of alarm reasons to the thermal printer.

Table 7-2. REASONS tab, ALARMS

---

**NOTE:** The Lasair Pro 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 **All channels** mode and **Pharmaceuticals** mode (see **CHANNELS Tab** on page 12-14), 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.

---

## Assigning Alarm Reasons

If a sample contains a particle or analog warning or alarm and the **Enable Alarms Reasons** option is active (see **GENERAL Tab** on page 7-2), the **Alarm Acknowledgement** button appears on the **HOME** screen.

If a warning limit has been reached, the font color for the channel(s) affected will change from black to yellow. If an alarm limit has been reached, the font color for the channel(s) will change from black or yellow (depending on if a warning limit was set) to red. The background of the **HOME** screen will also change from blue to red when either a warning or alarm limit has been reached.



Figure 7-6. Warning/Alarm Acknowledgement button (circled) on the **HOME** screen

In **Figure 7-6**, both an alarm and warning have been triggered for the sample's raw (N) particle counts. The 0.30 µm size channel was set to trigger an alarm at 5,000 counts, and the 0.50 µm size channel was set to trigger a warning at 1,000 counts. All alarms and warnings are acknowledged by pressing the **Alarm Acknowledgement** button (circled in **Figure 7-6**) and confirming the **Alarm Acknowledgement** window.

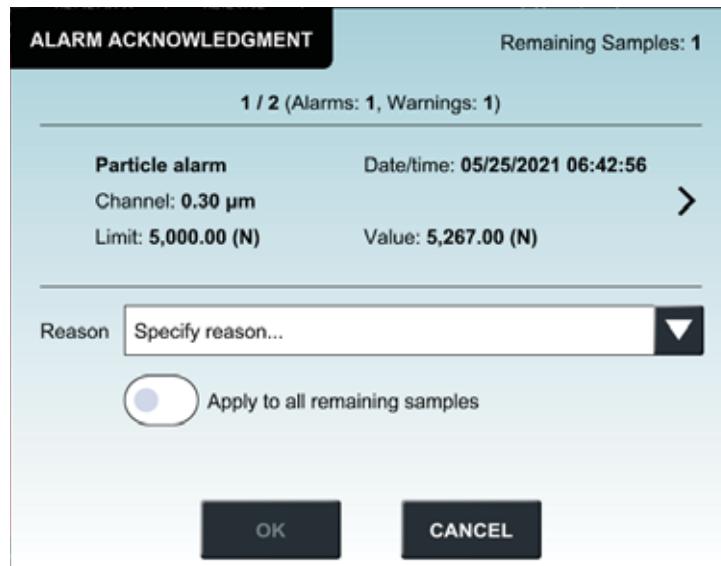


Figure 7-7. Particle Alarm information

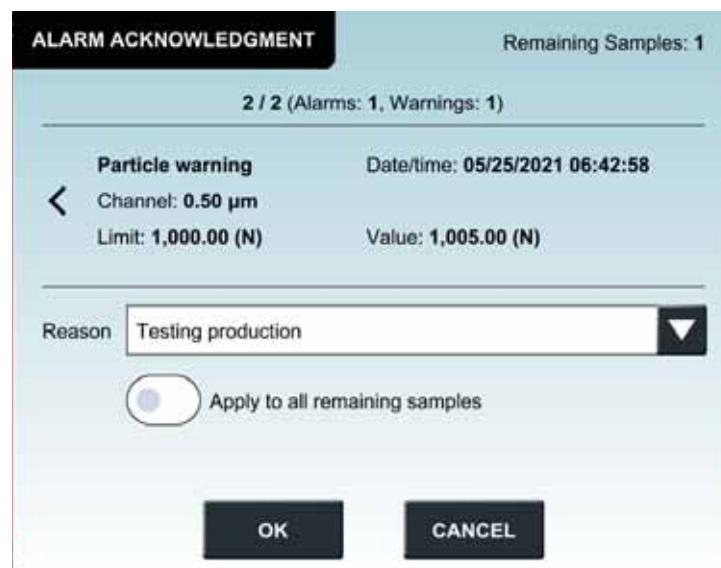


Figure 7-8. Particle Warning information

The **Alarm Acknowledgement** window allows the user to view alarm details and either define an alarm reason to apply to the sampling data, or select an alarm reason defined in the **REASONS Tab** to apply to the sampling data. An alarm reason can be selected for a single alarm or for all remaining alarms in the queue.

**NOTE:** When acknowledging alarms, the option **Apply to all remaining samples** only applies that alarm acknowledgement to samples that have already been taken. It does not apply to any samples in progress, or that have not been started.

---

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

---

The following details are displayed in the **Alarm Acknowledgement** window:

- Number of warnings and alarms in the queue
- Sample date/time
- Warning or alarm type (Particle, Environmental, or Trend)
- Warning or alarm limit (these are user-configured values)
- Warning or alarm channel (the size channel that caused the alarm)
- Data value (the value of the particle count that caused the alarm)

Once the alarm reason has been selected and the user has pressed the **OK** button, the user will be prompted to confirm the selection.

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.”



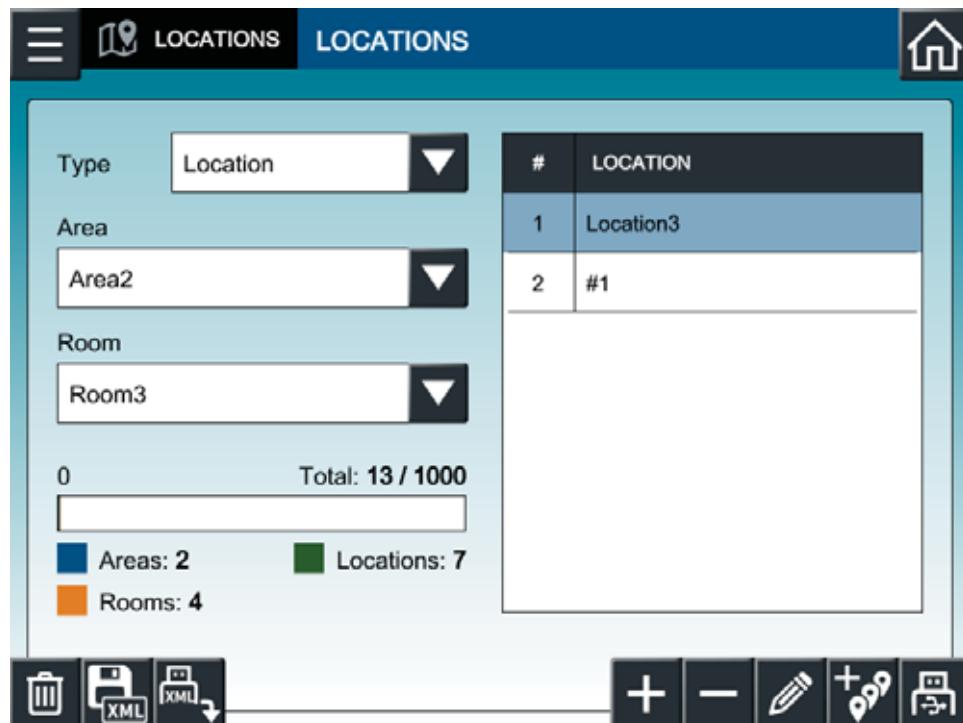
## Chapter 8

# Locations

---

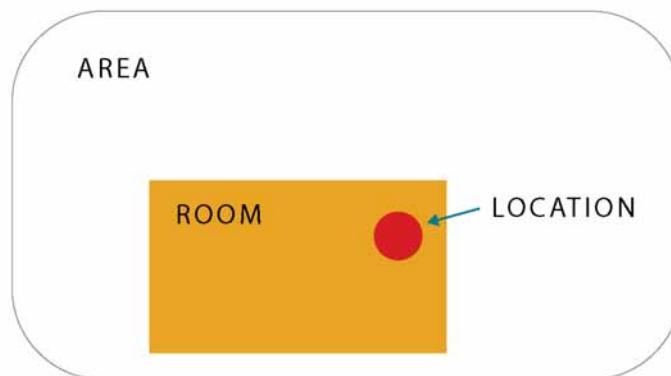
---

If you are moving the instrument to different sampling points, the Lasair Pro particle counter lets you categorize and name these points in **LOCATIONS**.



**Figure 8-1.** Locations configuration for recipes

Areas, rooms, and locations can be added individually or generated automatically with numbering between 1 and 100. You can store up to 1000 locations, rooms, and areas combined.



**Figure 8-2.** Hierarchy of areas, rooms, and locations

You are free to add only the items you need. For example, you may choose to only use locations to refer to your critical sampling points, forgoing the use of rooms and areas.

Areas, rooms, and locations are selectable from the **HOME** screen once created, and sampling data will be labeled with location data whether it is assigned or unassigned.



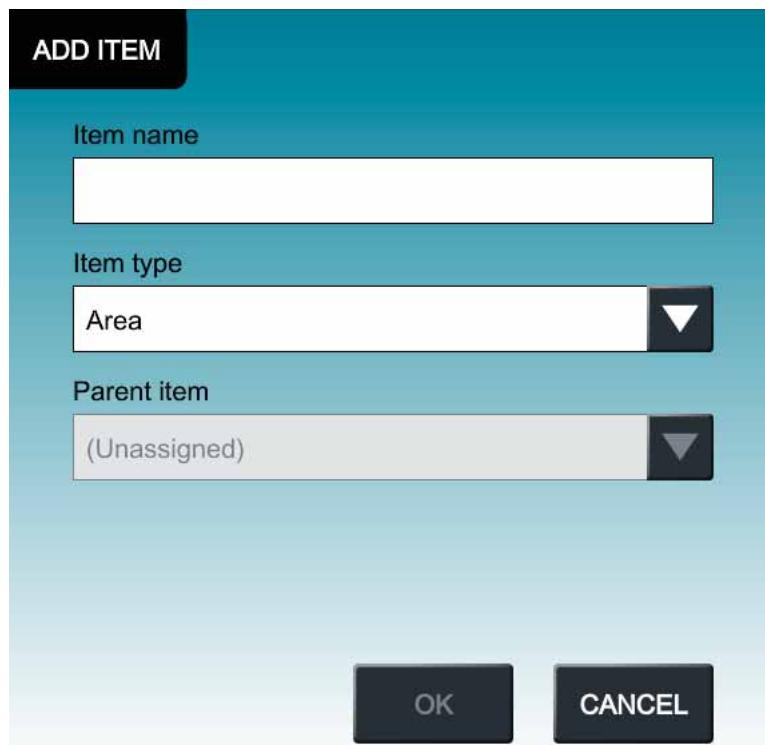
**Figure 8-3.** Sampling data (left), and the **HOME** screen (right)

### ***Adding a New Area, Room, and Location***

If you plan to use the Lasair Pro for multiple sampling points, you can add these locations and organize them ahead of time to ensure sampling data is appropriately labeled.

1. Go to  >  (LOCATIONS).

2. Press .



**Figure 8-4. Add Item window**

3. If using the full hierarchy, it is best to create areas, rooms, and locations in that order. Select **Area** as the Item type and press the **Item name** field to open the keyboard.
4. Press **OK** to confirm the Item name, then **OK** again to add the item.



5. Press  again, and select **Room** as the **Item type**.
6. From the **Parent item** dropdown, select your previously created **Area** to assign the area to the room.
7. Press **OK** to confirm your selection.



8. Press  again, and select **Location** as the **Item type**.
9. From the **Parent item** dropdown, select your previously created **Room** to assign the location to the room.

---

**NOTE:** Note the **Parent item** will include both the room and its associated area.

---

#### ***Adding Multiple Areas, Rooms, and Locations***



1. Go to  (LOCATIONS).
2. In the **Type** dropdown, select the option you intend to multiply. For the quickest assignment, first select the largest Parent item you wish to use: Area > Room > Location.

---

**NOTE:** If you do not intend to assign locations to rooms, or rooms to areas, skip to step 3 and finish with step 5. Choose Location from the Type dropdown.

---



3. Press .

4. In the **Auto Fill** dialog, press inside the fields to configure the entry with the keyboard:
  - a. The **Base name** is the text applied to each entry.
  - b. The **Number** determines how many entries will be generated.
5. Press **OK**.
6. Choose the next largest option from the **Type** dropdown. If you selected Area in step 2, you should now select Room. If you selected Room in step 2, select Location.
7. Depending on your choice in step 6, you will have the option to select from the Area dropdown only, or both the Area and Room dropdown. Choose the entry you intend to assign to your multiple Room or Location entries.

---

**NOTE:** Here, the **(Unassigned)** option indicates you have not created any entries of that type.

---

8. Press .
9. In the **Auto Fill** dialog, press inside the fields to configure the entry with the keyboard, as done in step 4. Press **OK**.
10. If you are using the full hierarchy, perform steps 6 -7 to create assigned Locations.

### **Checking Assignments**

1. You can check assignments by using the Type, Area, and Room dropdown arrows on the **LOCATIONS** screen.
2. From the **Area** and/or **Room** dropdown, select any combination to populate the **Type** listing with the existing assignments.

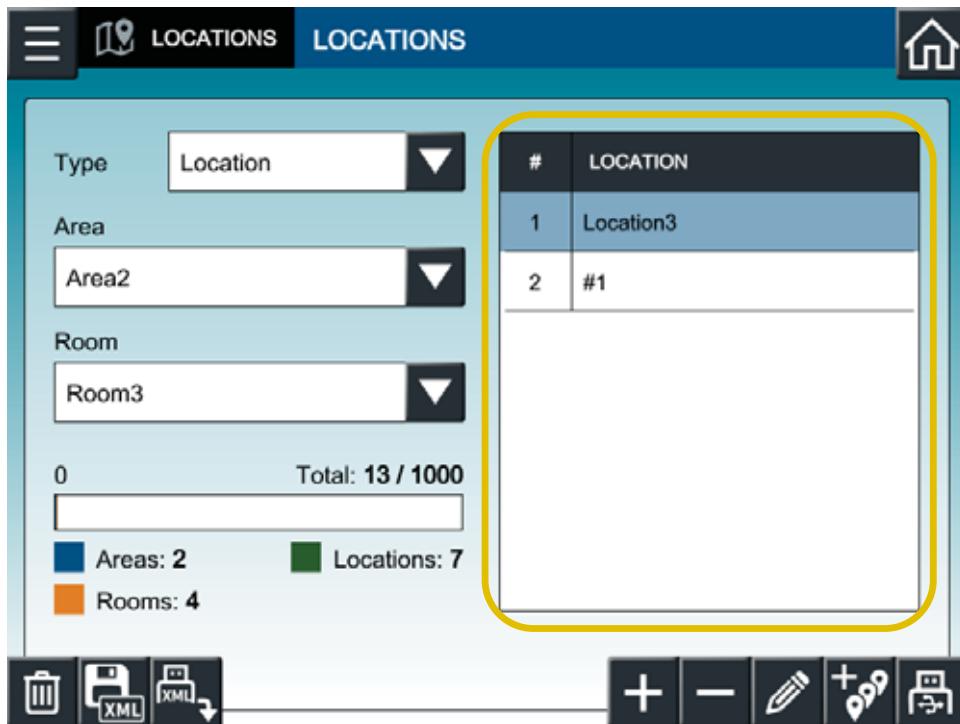


Figure 8-5. Type listing circled

3. You can also print a summary with either the  or  buttons.

---

**NOTE:** Selecting an Area and/or Room with the dropdown arrows automatically populates those fields after using the  button.

---

---

**NOTE:** When using the  button for adding multiple locations and/or rooms within a hierarchy, select the Parent items (Area and/or Room) using the dropdown arrows for automatic assignment.

---

### Assigning a Location to a New Sample

1. On the **HOME** screen, select  .
2. The top button,  , displays the **Area** and **Room** listing. The bottom button,  , displays the **Room** and **Location** listing.



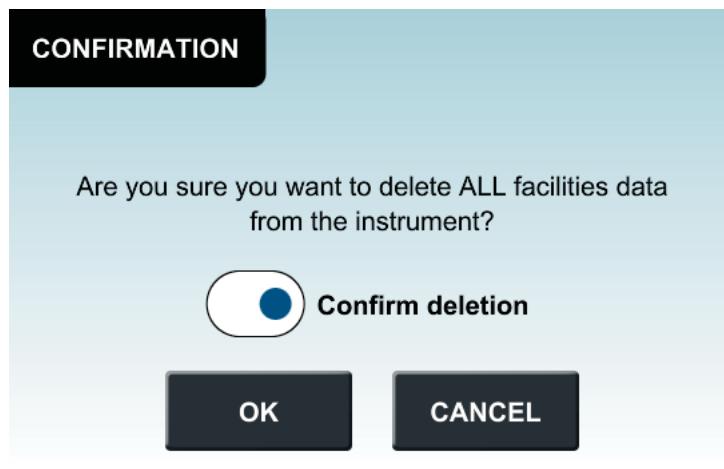
Figure 8-6. **Area** and **Room** assignment list

3. Double tap the **Room** or **Location** selection to complete. The **HOME** screen will now display your choice of **Room** and **Location** to associate with sampling data.

If a recipe (see **Chapter 9** on page 9-1), is assigned to a room or location, selecting that room or location by double tapping, will pop-up a dialog to load and activate the recipe.

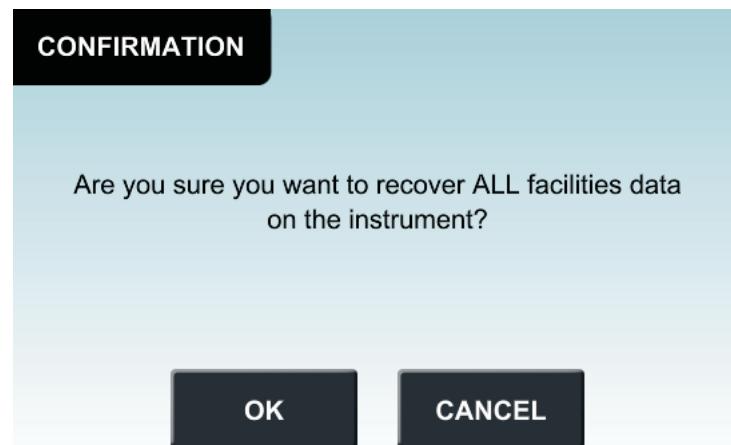
### ***Deletion and Recovery***

1. Go to  >  (LOCATIONS).
2. Press  to delete all location and assignment data. Recipes will become unassigned by default after this action.



**Figure 8-7.** Delete all location facility data

3. After confirming deletion by pressing **OK**, you will have the option to recover data until the Lasair Pro instrument is restarted.
4. To recover location data, press . Press OK in the confirmation window to complete the data recovery.



**Figure 8-8.** Recover all location facility data

## Buttons

The following table lists the buttons of the **LOCATIONS** screen.

Image	Name	Description
	<b>Edit Item</b>	Allows the modification of the selected entry.
	<b>Add Item</b>	Enables the entry of a new area, room, or location.
	<b>Remove Selected</b>	Removes selected area, room or location data. A confirmation window appears.
	<b>Delete All Facilities</b>	Deletes all saved area, room, location, and hierarchy data. A confirmation window appears after pressing.
	<b>Recover Location Data</b>	Only appears after pressing the <b>Delete All Location Data</b> button and confirming. Allows the user to revert the change after confirmation.
	<b>Export Facilities</b>	Saves all area, room, location, and hierarchy data in an XML file. This button is only activated when a USB key is inserted.
	<b>Import Facilities</b>	Loads location settings from a USB. This button is only activated when a USB key is inserted.
	<b>Auto Fill</b>	Automatically numbers new locations from 1 to N, where N is selected by the user and may be up to 100.
	<b>Save to USB</b>	Saves the Location Hierarchy Report to the USB as a PDF file. This button is only activated when a USB key is inserted.

**Table 8-1.** Buttons of the **LOCATIONS** screen

## Example Location Hierarchy Report



PARTICLE  
MEASURING  
SYSTEMS<sup>®</sup>  
a SPECIFICATIONS company

21 CFR 11 Compliant 

### Locations Hierarchy Report

Heading name1  
Heading name2

Generated on: 05/25/2021 08:04:12  
Instrument Model: LasairPro\_350L  
Instrument ID: Lasair Pro  
Serial Number: PrePilot39  
Calibrated: 03/10/2020

Batch ID: D21234  
Operator: Operator\_name  
Number of Areas: 3  
Number of Rooms: 5  
Number of Locations: 5

#	Area	Room	Location
1	Area1	Room1	Location1
2	Area1	Room1	Location2
3	Area1	Room1_2	Location#11
4	Area1	Room1_2	Location#2_2
5	Area1	Room1_3	
6	Area2	Room2	
7	Area2	Room2_1	Location4
8	Area3		

Figure 8-9. Example Location Hierarchy Report

The Location Hierarchy Report displays areas, rooms, locations and their assignments configured in the **LOCATIONS** tab of the **LOCATIONS** screen.

# Chapter 9

## Recipes

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---

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 they can add a quality control measure to ensure consistency between locations and among employees. Up to 100 recipes can be stored on the Lasair Pro.

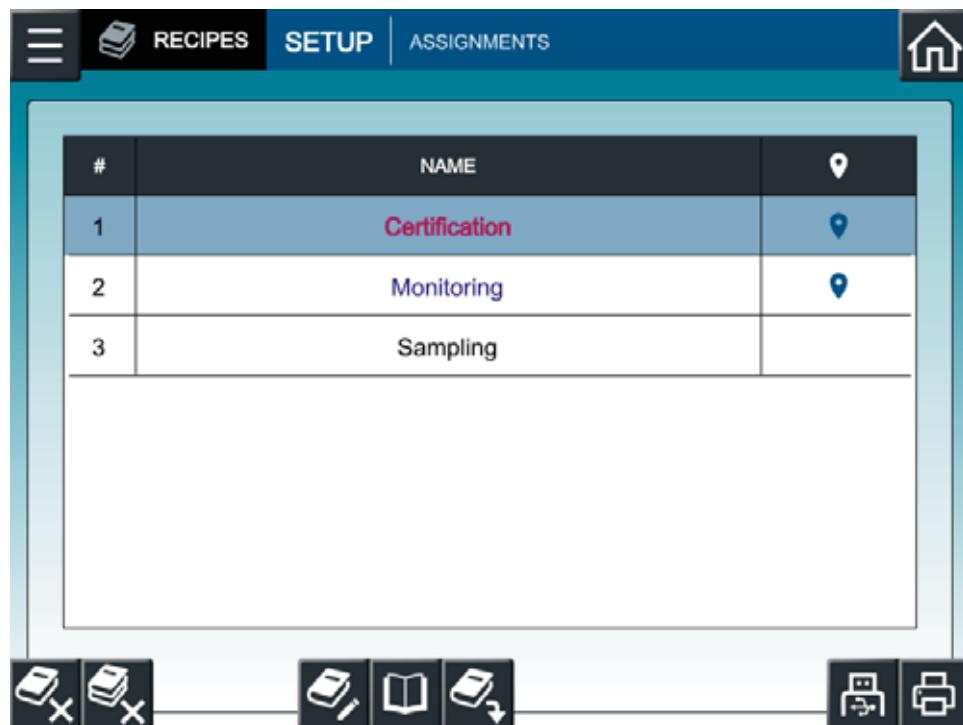


Figure 9-1. SETUP tab, RECIPES

---

**NOTE:** The text color of the recipes refers to its type: **Certification** (Magenta), **Monitoring** (Blue), and **Sampling** (Black). These categories are based on the type of report generated.

---

### ***Creating a New Recipe***

Recipes save the current configurations found in **SAMPLE**, **ALARMS**, **LOCATIONS**, and **STATISTICS**.

1. After configuring sampling settings, navigate to  >  **(SAMPLE)**.

2. Press  to open the keyboard to name the new recipe. Recipe names can include up to 16 characters.
3. You can now find your recipe and load it at any time if settings change from  **(RECIPES)**.

### ***Viewing Recipe Settings***

You can view all configuration parameters associated with a specific recipe from the **SETUP** tab of **RECIPES**.

1. Go to  >  **(RECIPES)**.

2. Select the recipe you would like to view.

3. Press  to open **RECIPE DETAILS**. See **Figure 9-2**.

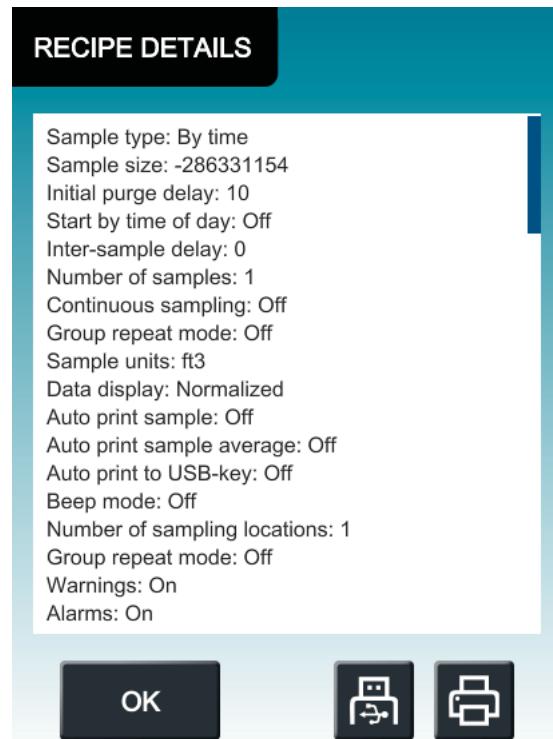


Figure 9-2. RECIPES DETAILS window

4. Press  to save the recipe to a USB. Press  to print the recipe using the thermal printer.
5. Press **OK** when finished.



### Assigning a Location to a Recipe

Recipes may be assigned to rooms and locations to facilitate setting the correct sampling.

1. From  (RECIPES), select the **ASSIGNMENTS** tab.
2. Press  and choose the recipe, area and room from the dropdown menus.
3. Select the Location from the adjacent list. If you want the location to be virtual, select **Add virtual**.

The Location list is generated based on the area and room selection. See **Adding a New Area, Room, and Location** on page 8-3 for more information.

Note that there is some variation in what Recipes can be assigned to what locations.

- **Sampling Recipes** are assigned to individual locations.
- **Monitoring and Statistics Recipes** are assigned to a room with one or more locations (or virtual locations) within them.

4. Select **OK** when finished.

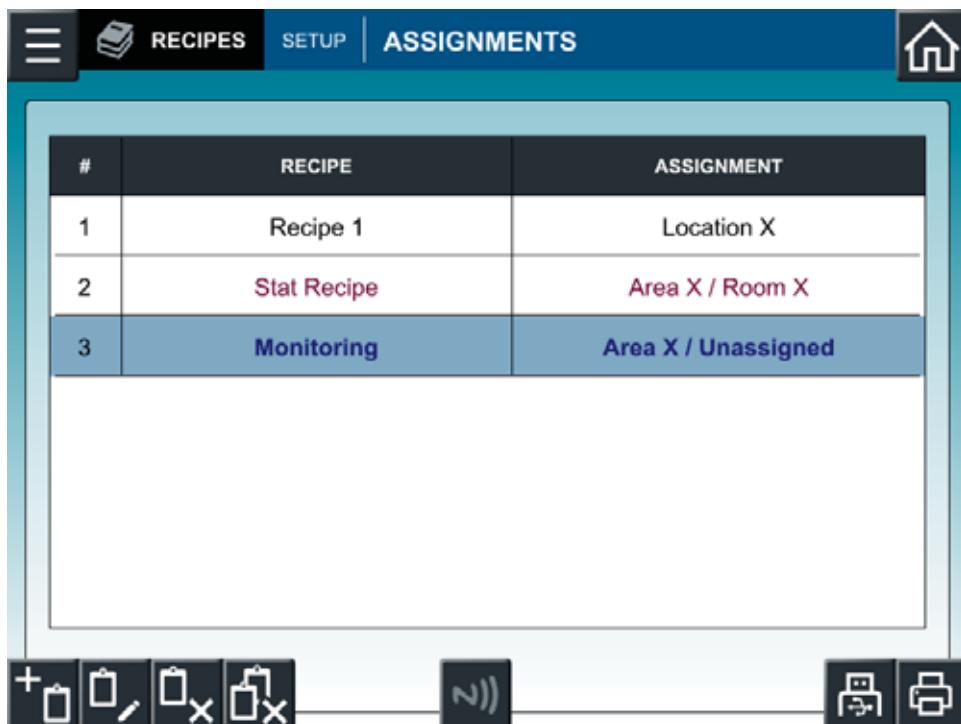


Figure 9-3. ASSIGNMENTS tab, RECIPES

- After returning to the **SETUP** tab, you will see  beside the recipe with an assigned location.

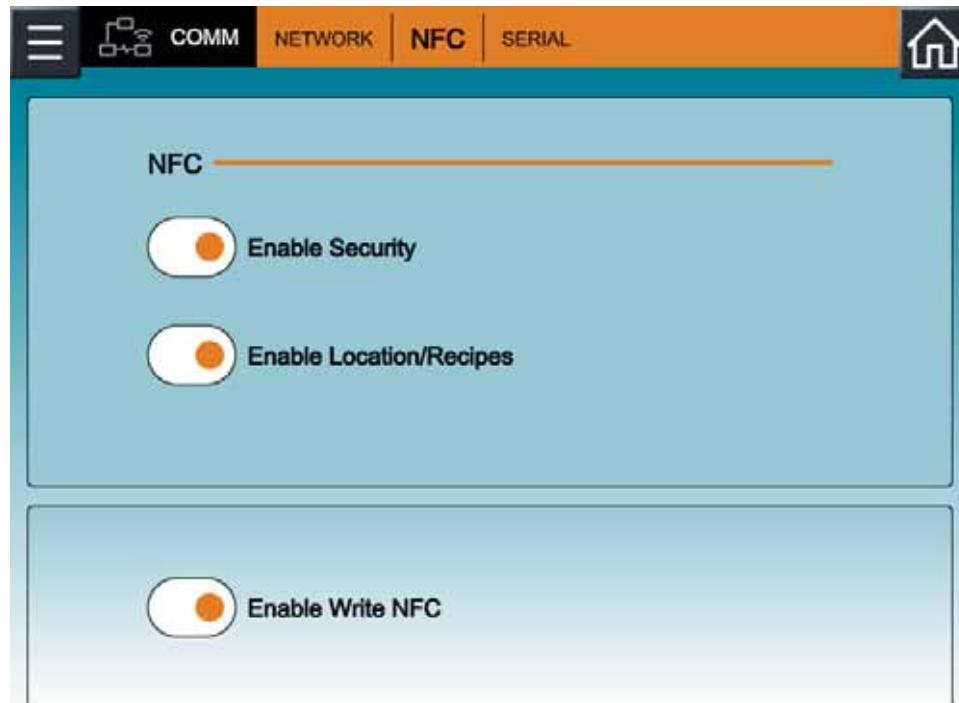
Locations and rooms may have more than one recipe associated with them. In this case, when the location (or room) is selected, the operator will have the option of choosing one of the assigned recipes to load and run.

Selecting a location that has a sampling recipe attached on the main screen drop down menu (i.e. double clicking on the room) will allow selecting and loading the recipe.

### ***Creating NFC Recipes***

Recipes can be stored to an NFC card so the user can easily switch between recipes configured for different areas, rooms, and locations. A maximum of 50 locations can be used with one NFC recipe card.

- Press  , then  (COMM).
- Go to the **NFC** tab and press the **Enable Location/Recipes** and **Enable Write NFC** indicators. A gray dot indicates the setting has not been enabled.



**Figure 9-4. NFC tab, COMM**

3. After configuring sampling settings found in **SAMPLE, ALARMS, LOCATIONS**, and

**STATISTICS**,



4. Press to open the keyboard to name the new recipe.
5. Press and then **(RECIPES)**.
6. On the **ASSIGNMENTS** tab, you should see a list of your created recipes and their area, room, and location assignments. If you have not assigned the recipe to an area, room, and location, do so now. See **Assigning a Location to a Recipe** on page 9-4 for more information.
7. Press to open the **Create NFC Recipe Card** window.
8. Press inside the **NFC recipe name** field and enter the recipe name of the NFC recipe recently created.
9. Press **Write**.
10. Press your NFC card to the NFC card reader located on the right side of the Lasair Pro counter.



**Figure 9-5.** Internal NFC card reader location

11. Wait as the recipe is written to the NFC card. Continue to hold the card in place.
12. Once complete, the message **NFC RECIPE card is successfully written** will appear in green. The NFC user can now use this specific card to sync the recipe configuration with the Lasair Pro counter without using the keyboard.

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**NOTE:** If user information has already been written to the NFC card, the older data will be automatically overwritten. Only one recipe can be written to an NFC card.

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## SETUP Tab Buttons

Use the **SETUP** tab to add, modify, and delete recipes from the Lasair Pro counter.

Image	Name	Description
	<b>Delete Recipe</b>	Erases the selected recipe from the Lasair Pro counter's internal memory.
	<b>Delete All Recipes</b>	Erases all recipes from the Lasair Pro counter. A warning/confirmation prompt is displayed before the recipes are erased.
	<b>Modify Recipe Name</b>	Select the recipe from the list and press this button to edit recipe name.
	<b>View Recipe</b>	Press to view all recipe parameters.
	<b>Load</b>	Loads selected recipe into current settings. You may still make adjustments to settings after a specific recipe is loaded.
	<b>Save to USB</b>	<p>Saves the highlighted recipe to the attached USB key. There are three types of recipe reports: Certification, Monitoring, and Sampling. The button is enabled only when the USB is attached.</p> <ul style="list-style-type: none"> <li><b>Certification:</b> This report lists the current settings found on the <b>STANDARDS</b> and <b>SETUP</b> tabs of the <b>STATISTICS</b> screen.</li> <li><b>Monitoring:</b> Generates when <b>Number of sampling locations</b> is greater than 1 (Monitoring Mode is selectable).</li> <li><b>Sampling:</b> This report lists the current settings found on the <b>STANDARDS</b> and <b>SETUP</b> tabs of the <b>SAMPLE</b> screen.</li> </ul> <p>Both Monitoring and Sampling recipe reports list the current settings found on the <b>SETTINGS</b> and <b>ADVANCED</b> tab of the <b>SAMPLE</b> screen, in addition to <b>GENERAL</b>, <b>PARTICLES</b>, <b>ENVIRONMENTAL</b>, and <b>TREND</b> tabs of the <b>ALARMS</b> screen.</p>
	<b>Print</b>	Prints the selected recipe to the Lasair Pro thermal printer

**Table 9-1.** Buttons of the **SETUP** tab, **RECIPES**

Image	Name	Description
 A dark blue square icon containing a white house outline.	<b>Return to Home</b>	Press to return to the <b>HOME</b> screen.

**Table 9-1.** Buttons of the **SETUP** tab, **RECIPES**

## ASSIGNMENTS Tab Buttons

Use the **ASSIGNMENTS** tab to associate a recipe to an area, room, location, or all three.

Image	Name	Description
	<b>Add Assignment</b>	Opens a configuration window to assign a specific recipe to any combination of area, room, and location. Virtual locations can also be assigned.
	<b>Modify Assignment</b>	Modifies the selected assignment.
	<b>Save to NFC</b>	Writes assignment to the NFC card.
	<b>Delete Assignment</b>	Deletes the association between the selected location and recipe.
	<b>Delete All Assignments</b>	Erases the assignment between all locations and recipes.

**Table 9-2.** Buttons of the **ASSIGNMENTS** tab, **RECIPES**

## Recipe Importing and Exporting

Lasair Pro recipes can be imported and exported to other Lasair Pro counters. See **Clone Export and Import** on page 12-8. Be aware of the following:

- Moving a recipe between instruments with different flowrates may result in unexpected sample times or sample volumes. The Lasair Pro can sample by time or by volume, and this information is recorded in a sample recipe.
  - For example, if a one minute sample recipe is exported from a 310 model and imported to a 5100, then the sample volume on the 5100 will be 100 liters rather than  $1 \text{ ft}^3$ , in order to keep the time the same.
- Moving a recipe between instruments with different channel sizes may result in missing alarms.
- For example, a recipe created on a 310 model with an alarm of 1000 counts @  $0.3 \mu\text{m}$  will be unable to export that alarm setting properly to a 5100, where there is no  $0.3 \mu\text{m}$  channel.
- 
- 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.
- Recipes may contain environmental alarm settings, but they do not contain environmental sensor scale and offset setting parameters. When a recipe is imported, the environmental sensor name and units text name are compared between the Lasair Pro instrument settings and the recipe. If they do not match, then environmental alarm settings from the recipe are not imported.

## Recipe Details

You can view the details of saved recipes on the **SETUP** tab of the **RECIPES** screen by

pressing . A typical recipe includes the following details:

- Sample type (volume or time)
- Sample size (volume or time)
- Initial purge delay (in seconds)
- Start by time of day (On/Off)

- Inter-sample delay (in seconds)
- Number of samples
- Continuous sampling (On/Off)
- Group repeat mode (On/Off)
- Sample units (ft<sup>3</sup>, m<sup>3</sup>, or l)
- Data display (Raw or Normalized)
- Auto print sample (On/Off)
- Auto print sample average (for two or more samples)
- Auto print to USB-key (On/Off)
- Beep mode (On/Off)
- Number of sampling locations
- Warnings (On/Off)
- Alarms (On/Off)
- Alarm buzzer (On/Off)
- **For Each Particle Size:**
  - Particle alarm type (Cumulative/Differential)
  - Particle channel
  - Alarm setting
  - Alarm (On/Off)
  - Warning setting
  - Warning (On/Off)
- **For Each Analog Channel:**
  - Environmental channel
  - Min alarm setting
  - Max alarm setting
  - Min alarm (On/Off)
  - Max alarm (On/Off)

## Statistics Recipe Details

Statistics recipes are found in the same list as normal recipes. Statistics recipes are saved on the **SETUP** tab of the **STATISTICS** screen. See **SETUP Tab** on page 11-9. The following is the list of all parameters saved for a statistics recipe:

- Channels configuration (List of channels included in statistics plan)
- Instrument type (Lasair Pro model)
- Start type (Standard or )
- Statistics standard (ISO-14644-1 2015, EU GMP, China GMP, FS-209E, or AVERAGE)
- Class (not applicable for AVERAGE mode)
- Purge delay (seconds)
- Inter-sample delay (seconds)
- Auto-Track mode (On/Off)
- Confirm sample mode (On/Off)
- Units (ft<sup>3</sup>/m<sup>3</sup>)
- Particle channel
- Flow (Uni-directional/Multi-directional)
- Room state (Static or Dynamic)
- Room area
- Room area units
- 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.



# Chapter 10

## Display, Data and Reports

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The tabs of the **DISPLAY** screen allow the user to adjust screen and sound parameters, configure channel settings, set graphical displays, and insert report data. Tabs under the **DATA** screen allow the user to view previous sampling data in a variety of formats.

You can view sample data in a number of ways on the **HOME** and **DATA** screens, in addition to reports. Tables and graphs change based on your selections made to the parameters described in this chapter:

Tabs of the **DISPLAY** screen:

- **DISPLAY Tab** on page 10-2
- **TREND Tab** on page 10-4
- **HISTOGRAM Tab** on page 10-7
- **REPORTS Tab** on page 10-9

Tabs of the **DATA** screen:

- **TABLE Tab** on page 10-16
- **GRAPH Tab** on page 10-17

## DISPLAY Tab

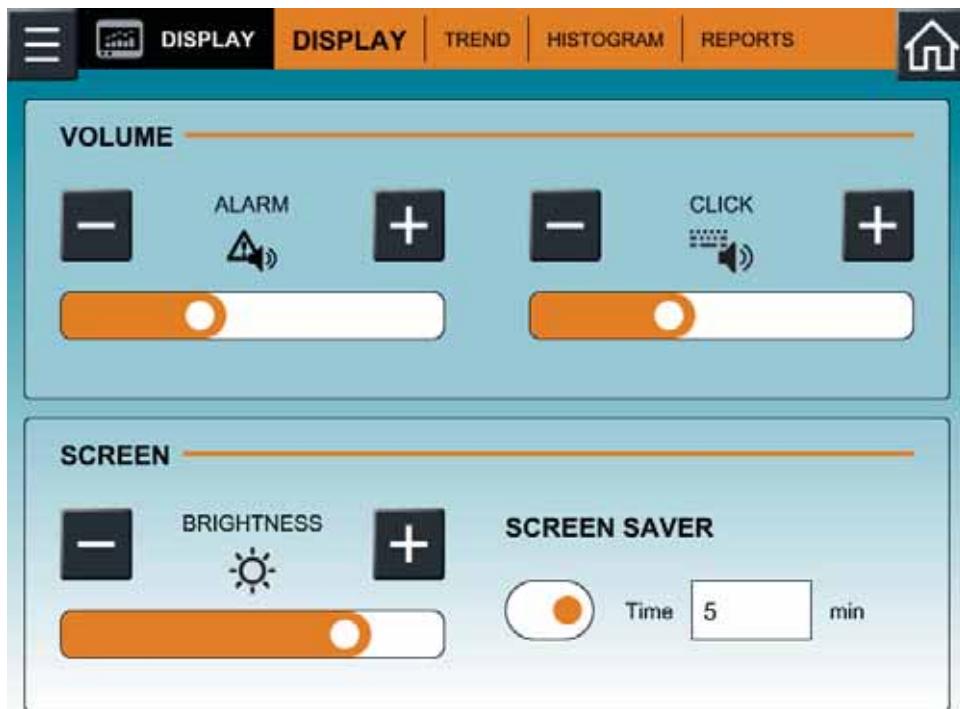


Figure 10-1. DISPLAY tab, DISPLAY

Use the Options tab to adjust the display brightness, screen saver, alarm signal volume, and click button volume. **Table 10-1** describes all settings on this tab.

Image	Name	Description
	<b>Brightness</b>	<p>Use the minus and plus buttons to decrease and increase the brightness of the LCD display.</p> <p><b>NOTE:</b> This setting affects battery life.</p>
<b>Table 10-1. DISPLAY tab, DISPLAY</b>		

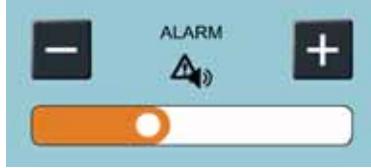
Image	Name	Description
	<b>Screen Saver</b>	<p>Enables the screen saver feature. Press the Time (min) field to access the keyboard for entering the number of minutes (1 - 60) of inactivity required before the screen saver is activated.</p> <ul style="list-style-type: none"> <li>The screen saver option saves the device power by turning off the backlight, while the device continues working.</li> <li>Touch any area of the screen to reactivate.</li> </ul>
	<b>Volume: Alarm</b>	<p>Use the minus and plus buttons to decrease and increase the volume of the alarm signal. For Lasair Pro units with the optional Alarm Siren, the volume bar is from 0 - 3 levels.</p>
	<b>Volume: Click</b>	<p>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, an orange bar (0 - 3) indicates the amount of volume.</p>

Table 10-1. DISPLAY tab, DISPLAY

## TREND Tab



Figure 10-2. TREND tab, DISPLAY

The options of the **TREND** tab of the **DISPLAY** screen pertain to the fourth display option (      ) on the **MAIN** screen. See **Table 10-2** for a description of each option.

Image	Name	Description
<b>CHANNELS</b>		
Channel 1 0.50	<b>Channel 1</b> <b>Channel 2</b> <b>Channel 3</b> <b>Channel 4</b>	Sets the size of each channel to be displayed on the trend graph. Your choice of channel size will be displayed in the <b>TREND</b> tab of the <b>ALARM</b> screen.
<b>Table 10-2. TREND tab, DISPLAY</b>		

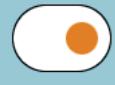
Image	Name	Description
<b>SETTING</b>		
Minutes <input type="text" value="30"/>	Minutes	The interval (total time span) to display on the trend graph's x-axis.
 <b>Moving averages</b>	<b>Moving averages</b>	Displays the moving average value as a dashed line on the graph for two samples. The moving average value is the mean value for the <b>Size</b> number of previous samples.
Size <input type="text" value="5"/>	Size	<p>Defines how many previous samples are used for calculating the moving average (2-10). The default value is 5.</p> <ul style="list-style-type: none"> <li>The value for this field should be less than the number of samples for the x-axis.</li> <li>This field is only activated when the <b>Moving averages</b> option is enabled.</li> </ul>
 <b>Alarm levels</b>	<b>Alarm levels</b>	Displays the configured alarm levels as horizontal lines across the trend graph. Alarm levels are set on the <b>PARTICLES</b> tab of the <b>ALARMS</b> screen. See <b>Chapter 7</b> .
<b>SCALE</b>		
 <b>Linear</b>	<b>Linear</b>	<p>This option sets the y-axis scale as linear.</p> <ul style="list-style-type: none"> <li>0 is the minimum value</li> </ul>
 <b>Log</b>	<b>Log</b>	<p>This option sets the y-axis scale as logarithmic where:</p> <ul style="list-style-type: none"> <li>1 is the minimum value</li> <li>0 to 1 the scale is linear</li> <li>1 to the maximum y-axis value is logarithmic</li> </ul>
<b>Table 10-2. TREND tab, DISPLAY</b>		

Image	Name	Description
 <b>Auto scale</b>	<b>Auto scale</b>	This option allows all sampling data to be displayed on the graph. The maximum value for the y-axis scale adjusts automatically.
 <b>Min</b> 0	<b>Min</b>	The minimum value to display for the y-axis. This field is only active when the Auto Scale option is Off.
 <b>Max</b> 100000	<b>Max</b>	The maximum value to display for the y-axis. This field is only active when the Auto Scale option is Off.

**Table 10-2. TREND tab, DISPLAY**

## Example Trend Graph



**Figure 10-3.** Example trend graph, **MAIN** screen

**NOTE:** Each datapoint represents one sample.

## HISTOGRAM Tab



Figure 10-4. HISTOGRAM tab, DISPLAY

On the **Histogram** tab, you can configure settings for the graphical and report data display. See **Table 10-3** on page 10-7 for a description of each setting on this screen.

Image	Name	Description
<b>DATA TYPE</b>		
 <b>Cumulative</b>	<b>Cumulative Data</b>	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.

Table 10-3. HISTOGRAM tab, DISPLAY

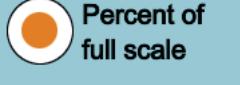
Image	Name	Description
 Differential	<b>Differential Data</b>	Sets differential as the type of data to be used for the histogram graph.  Differential Count refers to a number of particles of certain size that are found in one sample.
<b>DISPLAY MODE</b>		
 Percent of full scale	<b>Percent full scale</b>	Sets the histogram to show the percentages for all enabled channels. <ul style="list-style-type: none"> <li>The minimum setting is 0 and the maximum setting is 100.</li> </ul>
 Linear	<b>Linear</b>	Represents linear scale for the y-axis. The minimum value is 0.
 Log	<b>Log</b>	Represents the logarithmic scale for the y-axis. The minimum value is 1.
<b>SCALE</b>		
 Auto scale	<b>Enable Auto Scale</b>	Enables graphical displays to auto scale with data.
 Max	<b>Max</b>	Represents the maximum y-axis value for Percent of full scale, Linear and Log(arithmic) scale. <ul style="list-style-type: none"> <li>When <b>Percent of full scale</b> is selected, this field displays the maximum value (5 - 100) for this display mode.</li> <li>When the Linear or Log scale mode is selected, the field displays a default value (100000 for either option).</li> </ul>

Table 10-3. HISTOGRAM tab, DISPLAY

## REPORTS Tab

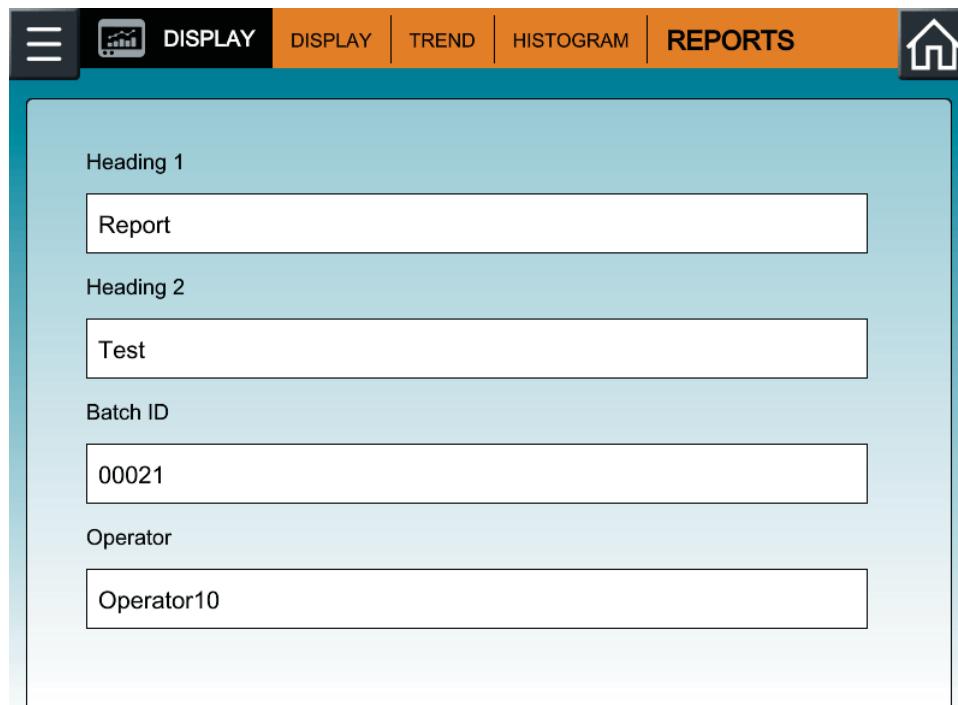


Figure 10-5. REPORTS tab, DISPLAY

Reports can be personalized to include additional text used in the report layout for PDF files. The **REPORTS** tab allows the user to add the following text to sampling reports:

- **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 of the operator to display on the reports (maximum 32 alphanumeric characters). The **Operator** field is automatically disabled and shows the current logged-in user when the instrument security is active.

## Reports Overview

You can output sampling results to the following:

- Built-in thermal printer
- USB key
- PMS software such as FacilityPro and Pharmaceutical Net Pro

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

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After completing a sample, you can press one of the following buttons on the **HOME** screen to transfer the results:

	<b>Save to USB</b>	Saves the report as a PDF to the USB key.
	<b>Print</b>	Prints the report to the thermal printer.

## Final Sample Report Example

	 <b>PARTICLE MEASURING SYSTEMS<sup>®</sup></b> SpeciCS	21 CFR Part 11 Compliant 			
<b>Final Sample Report</b>					
<b>1</b>	Heading 1				
<b>2</b>	Heading 2				
<b>4</b>	Generated on:	01/01/2021			
<b>5</b>	Instrument Model:	Lasair Pro_310C			
<b>5</b>	Instrument ID:	Lasair Pro			
<b>5</b>	Serial Number:	82217			
<b>6</b>	Calibrated:	01/01/2021			
<b>7</b>	Batch ID:	00021			
<b>8</b>	Operator:	John Doe			
<b>9</b>	Area:	Fill Point			
<b>10</b>	Room:	1416A			
<b>11</b>	Location:	#001			
<b>12</b>	Recipe:	Recipe Name			
<b>13</b>	Started:	04/01/2021 13:57:07			
<b>14</b>	Finished:	04/01/2021 13:57:17			
<b>15</b>	Sample:	81			
<b>16</b>	Sample Status:	VALID			
<b>17</b>	Particle Data				
<b>18</b>	µm	Δ (N)			
<b>19</b>	0.3	6,679			
<b>19</b>	0.5	1,371			
<b>19</b>	1.0	675			
<b>19</b>	5.0	20			
<b>19</b>	10.0	6			
<b>19</b>	25.0	0			
<b>20</b>	Volume: 0.0047 m <sup>3</sup>	Flow: 0.03 m <sup>3</sup> /min			
<b>21</b>	Duration: 00:00:10				
<b>22</b>	Environmental Data				
<b>23</b>		Avg	Min	Max	
<b>24</b>	Analog 1	mA	8.2	8.1	8.4
<b>24</b>	Analog 2	mA	15.8	15.8	15.9
<b>24</b>	Analog 3	mA	NaN	NaN	NaN
<b>24</b>	Analog 4	mA	NaN	NaN	NaN
<b>25</b>	Alarms:				
<b>26</b>	Alarm Reason:				

Line No.	Displayed Text	Description
1	<b>Final Sample Report</b>	Title of Report. Possible values: <ul style="list-style-type: none"> <li>• <b>Final:</b> Report printed after the sampling completed.</li> <li>• <b>Partial:</b> Report printed during the sampling process.</li> </ul>
2	<b>Heading 1</b>	Heading 1 text specified in the <b>REPORTS</b> tab of the <b>DISPLAY</b> screen. Not shown if the field is blank.
3	<b>Heading 2</b>	Heading 2 text specified in the <b>REPORTS</b> tab of the <b>DISPLAY</b> screen. Not shown if the field is left blank.
4	<b>Generated on</b>	Date on which the final sample report was generated.
5	<b>Instrument Model, Instrument ID, and Serial Number</b>	These lines pertain to instrument-specific parameters:  Instrument Model: The model of the Lasair Pro, also found on the label above the touchscreen.  Instrument ID: Name/ID of the Lasair Pro particle counter that produced the data. The ID of the instrument may be edited on the <b>SETUP</b> tab of the <b>SYSTEM</b> screen, impacting all reports.  Serial Number: Serial number of the Lasair Pro particle counter that produced the data.
6	<b>Calibrated</b>	Date on which the Lasair Pro particle counter was last calibrated (format selectable on the <b>DATE/TIME</b> tab of the <b>SYSTEM</b> screen).
7	<b>Batch ID</b>	Batch ID text specified in the <b>REPORTS</b> tab of the <b>DISPLAY</b> screen. Not shown if Batch ID field is blank.
8	<b>Operator</b>	Operator text specified in the <b>REPORTS</b> tab of the <b>DISPLAY</b> screen or the current logged user if security is enabled.  See <b>Chapter 6</b> for security configuration.
9	<b>Area</b>	Area where the sampling was performed. Labeled as “Unassigned” if no areas are defined.  See <b>Chapter 8</b> for area configuration.

**Table 10-4.** Final Sample Report legend

Line No.	Displayed Text	Description
10	<b>Room</b>	Room where the sampling was performed. Labeled as “Unassigned” if no rooms are defined. See <b>Chapter 8</b> for area configuration.
11	<b>Location</b>	Location where the sampling was performed. Labeled as “Unassigned” if no locations are defined. See <b>Chapter 8</b> for location configuration.
12	<b>Recipe</b>	Name of the recipe used, if any. See <b>Chapter 9</b> for recipe configuration.
13	<b>Started:</b> 04/01/2021 13:57:07	Date stamp (format selectable on the <b>DATE/TIME</b> tab of the <b>SYSTEM</b> screen) followed by a time stamp (hour : minute : second) when the sample was started.
14	<b>Finished:</b> 04/01/2021 13:57:17	Date stamp (format selectable on the <b>DATE/TIME</b> tab of the <b>SYSTEM</b> screen) followed by a time stamp (hour : minute : second) when the sample ended.  <b>NOTE:</b> The sample number is not shown when the sample is printed after an Alarm Acknowledge Reason is selected.
15	<b>Sample</b>	The sequential sample number out of the total samples taken with the instrument. Also corresponds to the row number on the <b>TABLE</b> tab of the <b>DATA</b> screen.
16	<b>Sample Status</b>	Validity of the sample. Possible values: <ul style="list-style-type: none"> <li>• <b>VALID:</b> Particle counter did not detect any condition that would invalidate the sample.</li> <li>• <b>INVALID:</b> Particle counter detected a condition that invalidates the sample. Can also occur if sampling is manually ended.</li> </ul>
17	<b>Particle Data</b>	Header for particle data report that follows.

**Table 10-4.** Final Sample Report legend

Line No.	Displayed Text	Description
18	$\mu\text{m}$ $\Delta\text{N}$ $\Sigma\text{N}$	Column headers: <ul style="list-style-type: none"><li>• <math>\mu\text{m}</math>: Particle size in microns or nanometers</li><li>• <math>\Delta</math>: Number of particles detected of that size. When followed by N, indicates raw counts. When followed by <math>\text{N}/\text{m}^3</math>, <math>\text{N}/\text{ft}^3</math>, or <math>\text{N}/\text{l}</math>, indicates normalized data.</li><li>• <math>\Sigma</math>: Sum of all particles of particle size and larger counted. When followed by N, indicates raw counts. When followed by <math>\text{N}/\text{m}^3</math>, <math>\text{N}/\text{ft}^3</math>, or <math>\text{N}/\text{l}</math>, indicates normalized data.</li></ul>
19	0.3 6,679 8,751	Channel and channel data. For column definitions, see Line 15 above.
20	<b>Volume</b> <b>Flow</b>	Volume: Total volume of medium (e.g., air) sampled. Flow: Flowrate of the medium during sampling. For thermal printouts of sampling reports, this information is below Environmental Data.
21	<b>Duration</b>	Total sampling time. For thermal printouts of sampling reports, this information is below Environmental Data.
22	<b>Environmental Data</b>	Header for analog data that follows. This information displays only if one or more analog sensors are configured and enabled. See <b>Analog</b> on page 4-6 for analog channel configuration.
23	<b>Avg Min Max</b>	Column headers for average, minimum, and maximum values for each analog channel.
24	<b>Analog 1 mA 8.2 8.1 8.4</b>	Average, minimum, and maximum values for the analog channel. If a channel is enabled, but a sensor is not attached, the value is NaN.

Table 10-4. Final Sample Report legend

Line No.	Displayed Text	Description
	<b>Alarms:</b>	<p>Lists the alarms that occurred during sampling.</p> <p>Flow Error: This alarm prints when the particle counter senses that the flowrate is outside the boundary of 1 CFM, 50 LPM, or 100 LPM <math>\pm 5\%</math>.</p> <p>Laser Error: This alarm prints when the particle counter senses that the laser power is out of the specified range.</p> <p>Coincidence Error: This line prints when 10% coincidence error is exceeded during a sample.</p> <p>Other alarms: Particle Alarm, Particle Warning, Trend Alarm, Environmental Alarm</p>
25	<b>Alarm Reason</b>	<p>This line prints on alarm if Alarm Reasons are enabled.</p> <p>See <b>Chapter 7</b> for alarm configuration.</p>
26	<b>Alarm Reason text</b>	This line prints the user-defined alarm reason if Alarm Reasons are enabled.

**Table 10-4.** Final Sample Report legend

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

## DATA Screen

Results of individual samples and trending of multiple samples can be viewed with the tabs of the **DATA** screen.

### TABLE Tab

The screenshot shows the DATA screen with the TABLE tab selected. The table displays the following data:

#	DATE/TIME	LOCATION
9	01/22/2021 13:15:09	Area X/Room X/Location X
10	01/22/2021 13:16:09	Area X/Room X/Location X
11	01/22/2021 13:17:09	Area X/Room X/Location X
12	01/22/2021 13:18:09	Area X/Room X/Location X

Below the table are several icons: a trash can, a filter, a sort icon, a CSV export icon, and two print icons.

Figure 10-6. Table display of sampling data

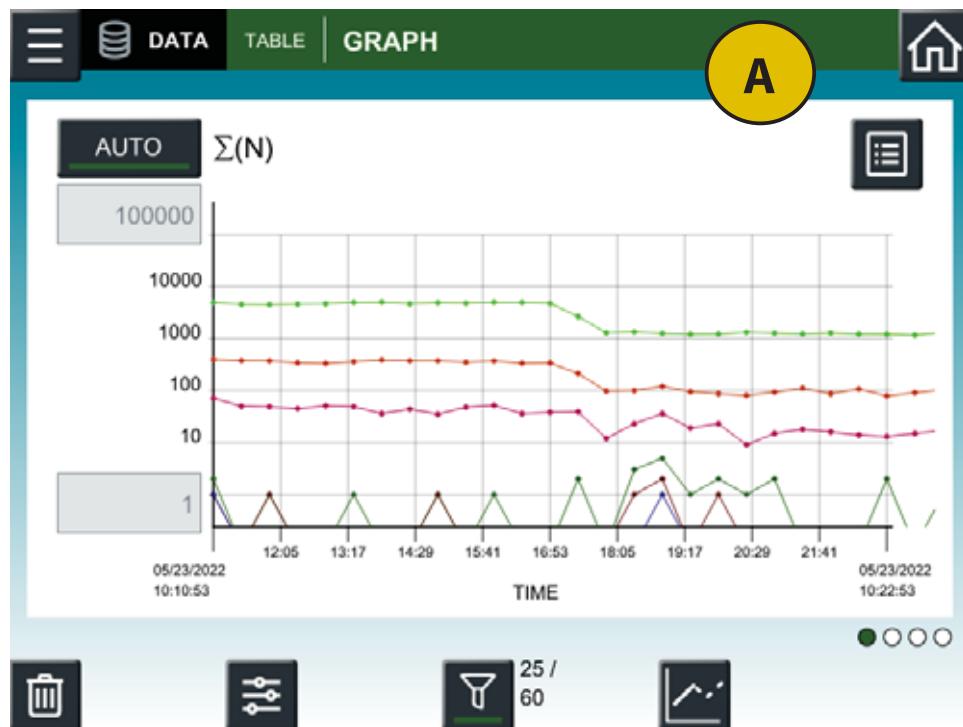
The **TABLE** tab of the **DATA** screen displays all sampling and environmental sensor data stored internally on the Lasair Pro counter in a list format. The list is automatically updated each time a new sample is completed. All stored data displays unless filters have been set.

Use the scroll bars on the right side and bottom of the data table to go up, down, left and right. Column order can be adjusted by pressing the arrows in the column headers.

All of the following columns can be re-ordered:

- DATE/TIME
- LOCATION
- OPERATOR
- SAMPLE TIME
- VOLUME

## GRAPH Tab



**Figure 10-7. GRAPH tab, swipe left/right to for additional formats**

The **GRAPH** tab is for viewing four possible graphical displays:

- **A. Historical Trend** (  ): Particle counts over time for all configured channel sizes. Multi-colored lines represent individual channels. Used for trending data over multiple samples. Time format is DD/MM:MM.
- **B. Box Plot** (  ): Multi-colored box and whisker plot displays particle counts for all configured channel sizes.
- **C. Historical Histogram** (  ): Bar graph displays particle counts for all configured channel sizes. Raw data: Displays the sum of particle channel data. Normalized data: Displays the average of the samples.
- **D. Frequency Polygon** (  ): Displays line graph of particle counts from eight samples for all configured channel sizes. Multi-colored lines represent individual samples.



Figure 10-8. Additional formats on the **GRAPH** tab, **DATA**

**NOTE:** The **TABLE** and **GRAPH** tabs support data filtering. Press  to filter the display to show specific ranges of data.

**Buttons**

Image	Name	Description
 AUTO	Auto Scaling	Automatically adjusts scaling to show all data values.
 Legend	Legend	<p>Press and hold to display information for each channel's graph. There are two legends, one for each channel. Each legend has the following information:</p> <ul style="list-style-type: none"> <li>• <b>Solid box:</b> Line color and style for actual line count</li> <li>• <b>x (next to solid box):</b> Most recent value</li> <li>• <b>Dashed box:</b> Line color and style for moving average value</li> <li>• <b>x (next to dashed box):</b> Moving average value</li> <li>• <b>Line:</b> Alarm value that appears as a horizontal line across the graph</li> <li>• <b>N <math>\mu</math>m:</b> Particle size channel associated with above information</li> </ul>
 Delete All Historical Data	Delete All Historical Data	Deletes all sampling data from the Lasair Pro. A confirmation appears before deletion.
 Restore Historical Data	Restore Historical Data	Restores previously deleted historical (sampling) data.

Table 10-5. TABLE and GRAPH buttons

Image	Name	Description
	<b>Options</b>	<p>Opens general display options, which include the following:</p> <ul style="list-style-type: none"> <li>• Cumulative or differential counts</li> <li>• Raw or normalized counts</li> <li>• Units of volume</li> <li>• Linear, log, or % of full scaling</li> <li>• Size channel view/Hide</li> <li>• Enable moving averages</li> <li>• Enable alarm limits</li> </ul>
	<b>Filter Options</b>	<p>Opens filter options, which include the following:</p> <ul style="list-style-type: none"> <li>• Operator</li> <li>• Date/time</li> <li>• Start/end row</li> <li>• Area</li> <li>• Room</li> <li>• Location</li> </ul>
	<b>Display</b>	<p>Enables graphical display with AUTO size fit.</p>
	<b>Save as CSV File</b>	<p>Saves a series of sample data as a CSV or XML file to the USB key.</p>
	<b>Save to USB</b>	<p>Saves tables to a PDF file on the inserted USB key. Reports include the following (see <b>Figure 10-9</b> on page 10-19)</p>
	<b>Print</b>	<p>Prints a series of sample data in a report to the thermal printer.</p>

**Table 10-5. TABLE and GRAPH buttons**

## Options

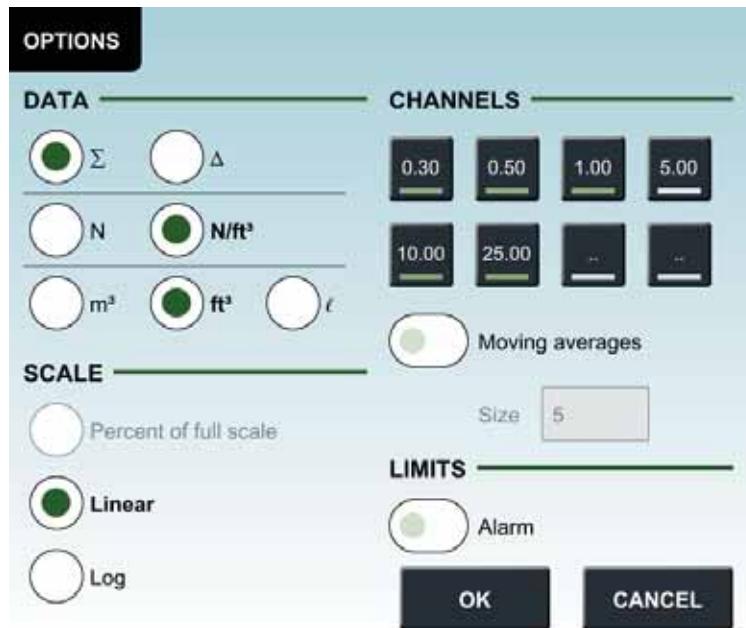


Figure 10-9. Options dialog

### Data

Allows the user to configure the units of their sampling data.

- **Cumulative( $\Sigma$ ):** Sets the data display to cumulative counts only.
- **Differential( $\Delta$ ):** Sets the data display to differential counts only.
- **Raw(N):** Sets the data display as raw particle counts
- **N/volume:** Sets the data display as normalized. Volume units are set below this option.
- **Volume units:** Defined as either  $m^3$ ,  $ft^3$ , or  $l$ .

### Scale

- **Percent of full scale:** Displays the size channel's value as a percentage of the current maximum value. This option is disabled for the Historical Trend graph.
- **Linear:** Displays the size channel's value as a comparison to the linear maximum y-axis value. The value is located above each bar.
- **Log:** Displays the size channel's value as a comparison to the logarithmic maximum y-axis value. The value is located above each bar.

### ***Channels***

Allows the user to:

- Configure which configured size channels will be included in the display. Channels can be configured in the **CHANNELS** tab of the **SYSTEM** screen.
- Enable **Moving averages**, which is the sampling average displayed beside the graph. The **Size** field is the set number of samples (2-10) used to calculate the average.

### ***Limits***

Allows the user to adjust the display of configured particle alarm levels. These levels are configured in the **PARTICLES** tab of the **ALARMS** screen.

# Chapter 11

## Statistics

---

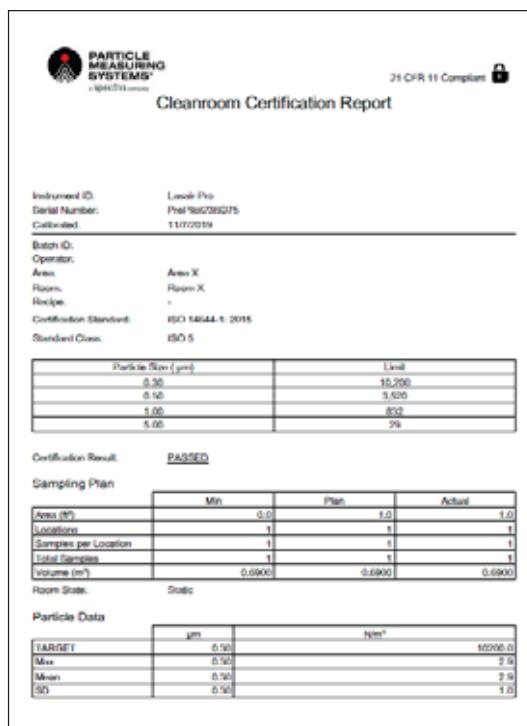


---

### Overview

The Lasair Pro particle counter can be configured for certification statistics when in Statistics Mode. A choice of certification standards includes ISO 14644-1:2015, FS-209E, EU GMP, China GMP, and AVERAGE.

Selecting the certification standard and class automatically sets the particle count limits for the sampling location. After configuring parameters such as the size of the room to be certified and its state (dynamic or static), enabling Statistics Mode opens a prompt window for the user to select their locations to sample. The user is automatically taken to the **HOME** screen to start the sampling process, where upon successful completion, a report can be generated.



**Cleanroom Certification Report**

**Instrument ID:** Lasair Pro  
**Serial Number:** Pnf980200075  
**Calibrated:** 11/17/2019

**Batch ID:**  
**Operator:**  
**Area:** Area X  
**Room:** Room X  
**Recipe:** -  
**Certification Standard:** ISO 14644-1: 2015  
**Standard Class:** ISO 5

Particle Size (μm)	Limit
0.30	10,200
0.50	3,000
1.00	832
5.00	99

**Certification Result:** PASSED

**Sampling Plan**

	Min	Plan	Actual
Area (ft <sup>2</sup> )	0.0	1.0	1.0
Locations	1	1	1
Samples per Location	1	1	1
Total Samples	1	1	1
Volume (m <sup>3</sup> )	0.6900	0.6900	0.6900

**Room State:** Static

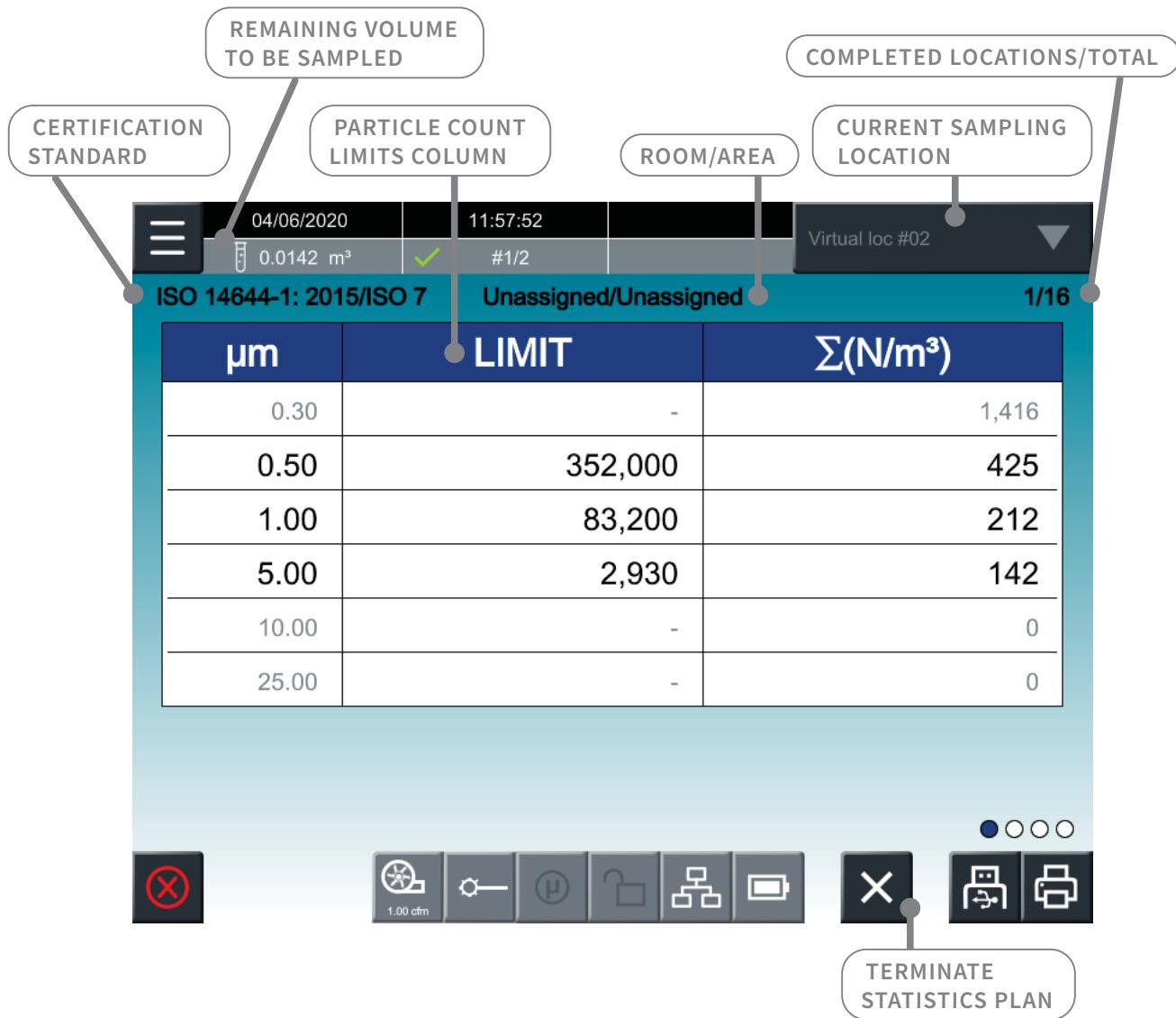
**Particle Data**

	μm	Nm <sup>3</sup>
Target	0.10	62000.0
Max	0.10	2.9
Mean	0.10	2.9
SD	0.10	1.0

**Figure 11-1.** Example Cleanroom Certification Report

## HOME Screen

In Statistics Mode, the **HOME** screen and its data displays are adjusted to include the standard, limits, and locations configured on the **STATISTICS** screen. Refer to **Figure 3-2** on page 3-5 for the details not described in **Figure 11-2**.



**Figure 11-2. HOME screen, Statistics Mode**

## Data Displays

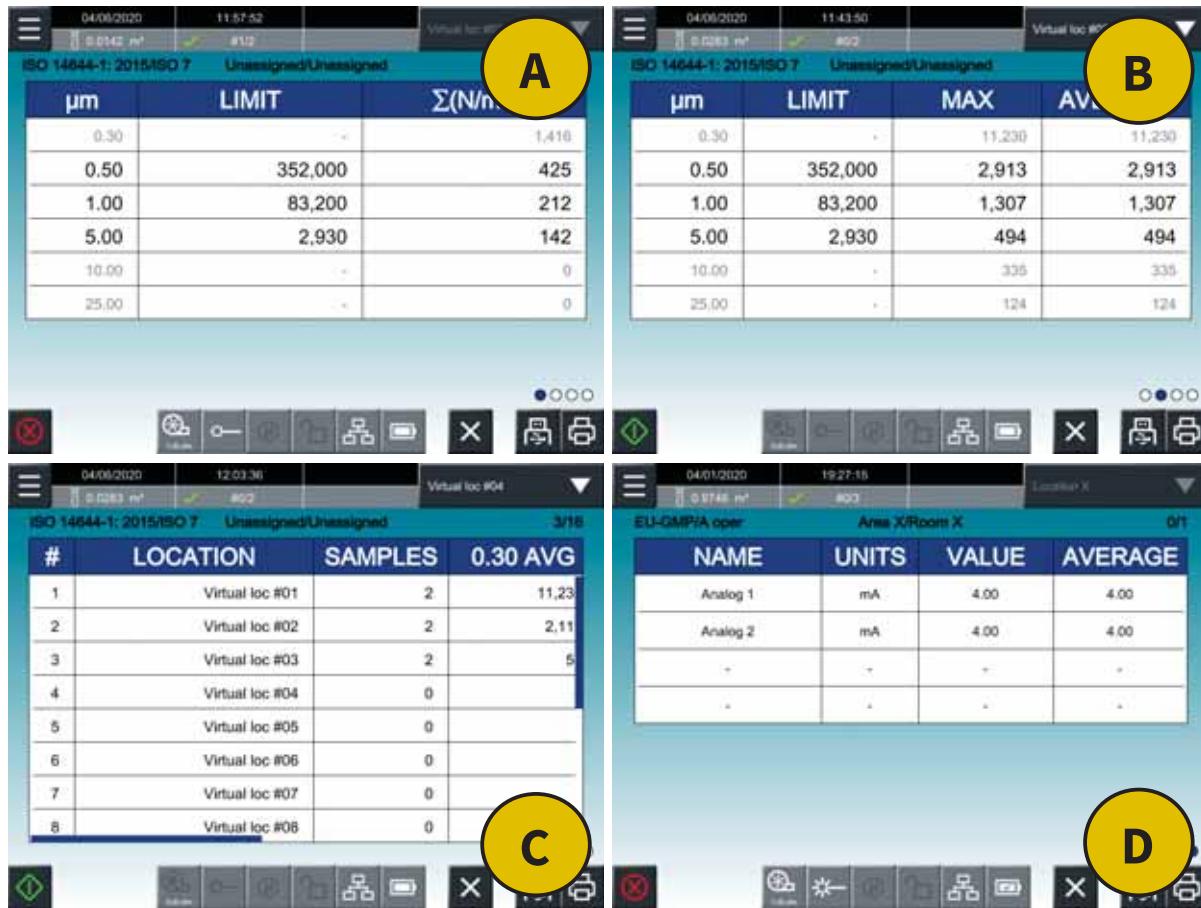


Figure 11-3. Swipe left to switch between displays

In Statistics Mode, the following data displays are available on the **HOME** screen:

- **A. Cumulative particle count display:** For each channel size, the table displays the particle count limit to meet the standard, and the cumulative particle count for the current volume sampled at the location.
- **B. Maximum and Average counts display:** For each channel size, the table displays the maximum and average cumulative particle count recorded for all locations.
- **C. Completed sampling data by location:** Displays all completed sampling data for each location and each particle size, including those not enabled for the statistics plan. Scrollbars on the right side and bottom of the table allow the entire table to be shown.

- **D. Environmental (analog) input channel display:** Displays environmental sensor readings while Statistics Mode is running. See **Environmental (Analog) Input** on page 4-6 for more information.

---

**NOTE:** All particle count data is normalized, meaning it has been divided by the sample volume.

---

**NOTE:** When the Statistics Mode is enabled, TCP/IP communications are disabled.

---

**NOTE:** When Statistics Mode is enabled, global alarms are automatically disabled. You must exit Statistics Mode to change alarm parameters.

---

## Average Mode

**Average** mode calculates simple statistics on data from one or more locations.



**Figure 11-4.** HOME screen displays for Average mode

**Figure 11-4** shows the following adjustments to the **HOME** screen:

- **A. Average and cumulative normalized counts:** Average values refer to the mean particle count data for all samples across all locations, directly comparable to cumulative normalized counts (counts of a certain particle size and larger over the configured sample volume) for all locations.
- **B. Average, maximum, and 95% UCL statistics:** Average values refer to the mean particle count data for all samples across all locations, directly comparable to the maximum particle size count of all samples, and the 95% Upper Confidence Limit, a more conservative value indicating how many particles or less of a certain size are found within the tested locations with 95% certainty.

**NOTE:** 95% UCL will only be calculated for the FS209E standard with sample numbers configured as  $\geq 2$  and  $\leq 9$ . The “Average” shall be used otherwise.

- **C. Average particle counts by size and location:** Organizes data into tabular format by location and the average count for each particle size. Swipe right and left to view the table in its entirety.

## Results

You can print or save a classification report similar in scope to the other standard options

by pressing either  or  on the bottom-left of display **B** or **C** of the **HOME** screen (see **Figure 11-4**). An example is provided in **Figure 11-5**.

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**Cleanroom Certification Report**

---

Instrument ID: Lasair Pro  
Serial Number: PrePlot23B075  
Calibrated: 11/7/2019

---

Batch ID:   
Operator:   
Area: Area X  
Room: Room X  
Recipe: -  
Certification Standard: Average  
Standard Class: 1

Particle Size ( $\mu\text{m}$ )	Limit
0.30	-
0.50	-
1.00	-
5.00	-
10.00	-
25.00	-

Certification Result: **PASSED**

Sampling Plan

	Min	Plan	Actual
Area ( $\text{m}^2$ )	0.0	50.0	50.0
Locations	1	15	15
Samples per Location	1	3	3
Total Samples	1	45	45
Volume ( $\text{m}^3$ )	0.0005	0.0005	0.0005

Particle Data

	$\mu\text{m}$	$\text{N/m}^3$
Mean	0.30	2037999.9
Max	0.30	28875998.0
SD	0.30	1.0
95% UCL	0.30	-

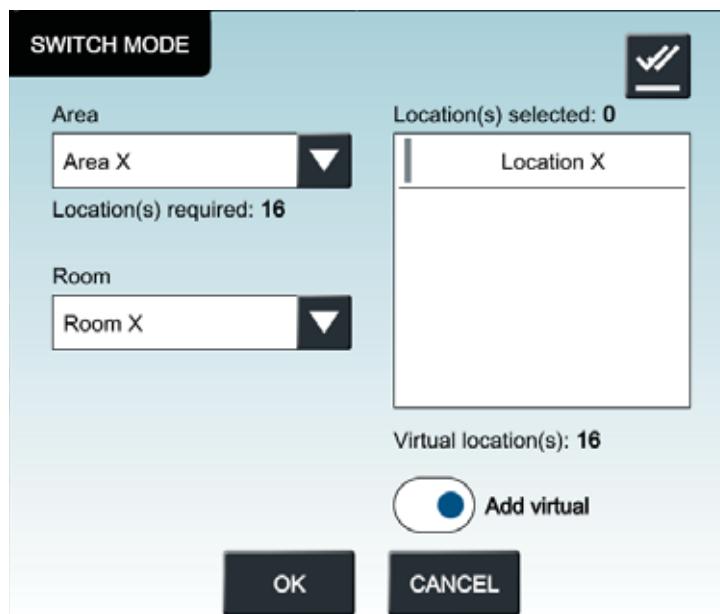
**Figure 11-5.** Average mode report, first page

Data unique to this report include the following:

- Average particle count of a certain size for all samples (Mean), maximum particle count of all samples for a certain particle size (Max), how different each sample differs from the mean of all samples or standard deviation (SD), and 95% upper confidence limit (95% UCL) for each particle size.
- Average cumulative normalized counts for each particle size at each location. Units are either Avg( $N/m^3$ ) or Avg( $N/ft^3$ ).

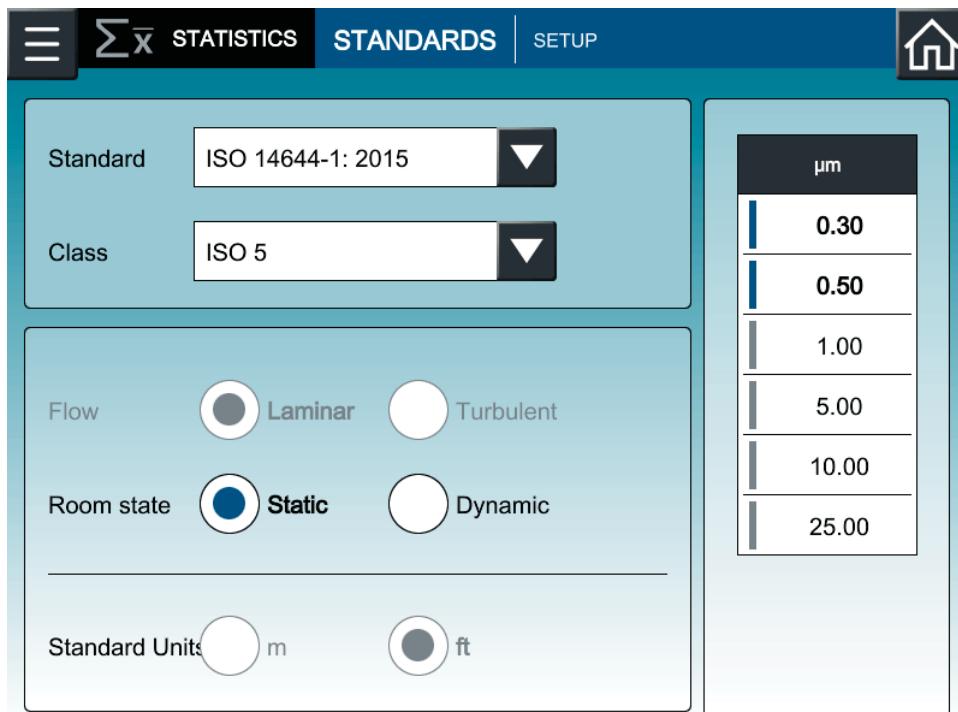
## Switch Mode

After enabling Statistics Mode, the user is prompted for a selection of locations. Previously created areas, rooms, and locations can be selected here, in addition to virtual locations. Virtual locations are not stored for later use in the Lasair Pro, but are generated specifically for one-time use after Statistics Mode is enabled. They are labeled as “Virtual loc #01” and so on in sampling data and reports.



**Figure 11-6.** Virtual locations in Statistics Mode

## STANDARDS Tab



**Figure 11-7. STANDARDS tab, STATISTICS**

The following configurations can be made on the **STANDARDS** tab:

- **Standard:** Set the cleanliness standard to determine the particle count limits for an area.
- **Class:** Set the cleanliness level of the area to be certified.
- **Flow:** Set the room's airflow conditions to laminar or turbulent. Only available when using the FS-209E standard.
- **Room state:** Set the **Class** options to pertain to **Static** (At rest) or **Dynamic** (In operation) conditions.
- **Standard Units:** Set the units to meters (m) or feet (ft).
- **µm:** Enable or disable particle size channels.

## SETUP Tab

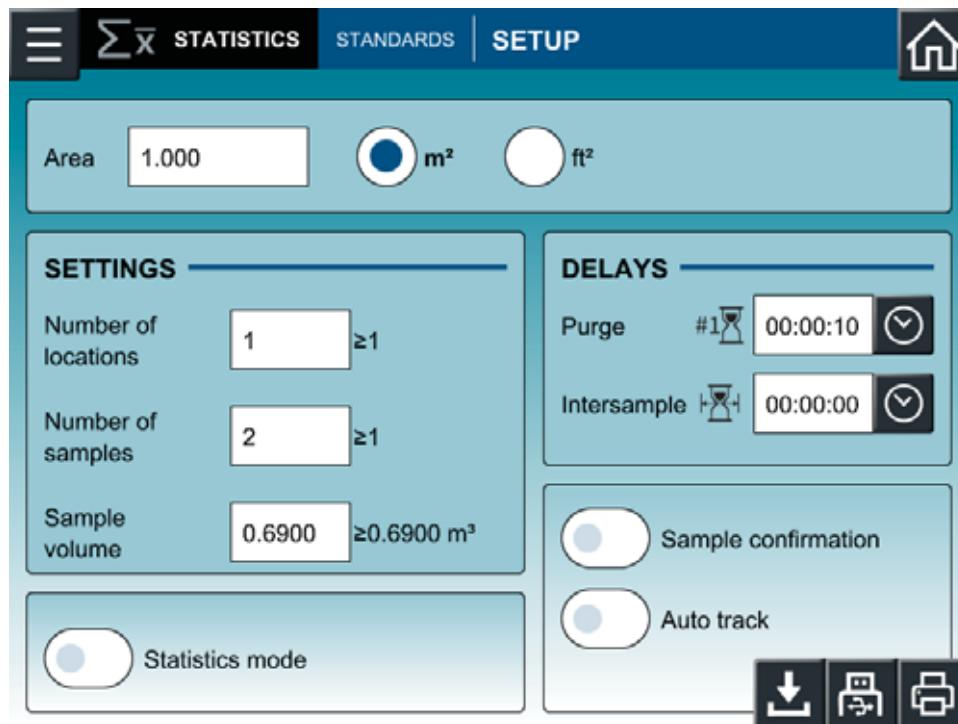


Figure 11-8. SETUP tab, STATISTICS

## Configuration Settings

The following table describes the settings the users can configure before enabling Statistics Mode. Once Statistics Mode is enabled, settings cannot be changed until the Statistics plan has been terminated.

Image	Name	Description
Area 1.00	Area	Sets the area of the room to be certified in $\text{m}^2$ or $\text{ft}^2$ . You cannot change this parameter once Statistics Mode is enabled.
$\text{m}^2$	$\text{m}^2$	Sets the <b>Area</b> units in squared meters. Units cannot be changed once Statistics Mode is enabled.

Table 11-1. SETUP tab, STATISTICS

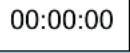
Image	Name	Description
 ft <sup>2</sup>	ft <sup>2</sup>	Sets the <b>Area</b> units in squared feet. Units cannot be changed once Statistics Mode is enabled.
<b>SETTINGS</b>		
Number of locations  $\geq 1$	<b>Number of Locations</b>	Sets the minimum number of the locations to be sampled. The number is automatically calculated to comply with the selected standard based on the <b>Area</b> setting. The number can be increased but not decreased.
Number of samples  $\geq 1$	<b>Number of Samples</b>	Sets the number of samples to be taken at each location.
Sample volume  $\geq 0.028 \text{ ft}^3$	<b>Sample Volume</b>	Sets the minimum sample volume collected at each location.
<b>DELAYS</b>		
Purge  #1   	<b>Purge</b>	Initial delay before the start of sampling.
Intersample    	<b>Intersample</b>	Delay between samples if <b>Number of samples</b> is greater than one.

Table 11-1. SETUP tab, STATISTICS

Image	Name	Description
<b>ENABLE / DISABLE OPTIONS</b>		
	<b>Enable Statistics Mode</b>	<p>Enables Statistics Mode. When enabled, the user is prompted to select the area, room, and location for certification. After pressing <b>OK</b>, the <b>HOME</b> screen automatically appears with statistics sampling criteria loaded.</p> <p>Terminating the Statistics plan from the <b>HOME</b> screen automatically disables Statistics Mode.</p>
	<b>Enable Sample Confirmation</b>	<p>Enables a prompt for either accepting or rejecting the previously completed sample. Rejecting the sample will prevent the use of associated data in statistical calculations.</p>
	<b>Auto Track</b>	<p>Enables the incremental selection of sampling locations on the <b>HOME</b> screen without user prompt.</p>
<b>BUTTONS</b>		
	<b>Save Statistics Recipe</b>	<p>Saves the current Statistics Mode configuration as a recipe.</p>
	<b>Save to USB</b>	<p>Saves the Certification Setup Report to the inserted USB key.</p>
	<b>Print to Thermal Printer</b>	<p>Prints the Certification Setup Report to the thermal printer.</p>

Table 11-1. SETUP tab, STATISTICS

## Example Certification Setup Report



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### Certification Setup Report

Instrument ID:	Lasair Pro
Serial Number:	PrePilot23BD75
Calibrated:	11/7/2019
Batch ID:	
Operator:	Admin
Recipe:	
<b>Certification Standard</b>	
Standard:	ISO 14644-1: 2015
Class:	ISO 2
Flow:	Laminar
Room State:	Static
Standard Units:	m
Particle Sizes:	0.50 $\mu$ m
<b>Sampling Plan</b>	
Area:	5000.000 m <sup>2</sup>
Number of Locations:	26
Number of Samples:	2
Total Samples:	52
Sample Volume:	2.0000 m <sup>3</sup>
<b>Delays</b>	
Purge:	00:00:10
Intersample:	00:00:00
<b>Options</b>	
Auto Track:	No
Sample Confirmation:	No

**Figure 11-9.** Certification Setup Report example

The Certification Setup Report displays the current parameters of the **STANDARDS** and **SETUP** tabs of the **STATISTICS** screen.

## Walkthrough

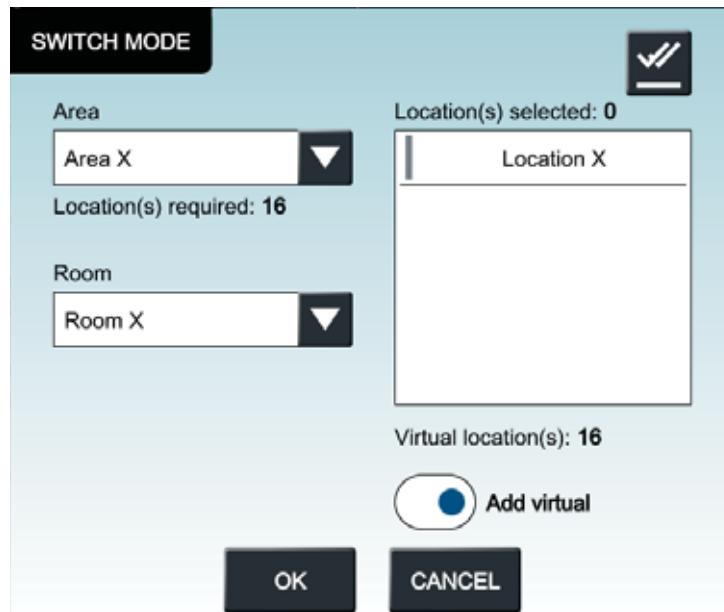
This section describes the general step-by-step process of conducting a statistics plan. The following is an example only.

1. Press  and then  (STATISTICS).
2. Configure the **STANDARDS** and **SETUP** tabs. In this example, we will be using the ISO 14644-1:2015 standard for ISO Class 7. The **Area** of the room to be sampled is 1000 m<sup>3</sup>.
3. After settings are configured, press the **Statistics mode** slider button to enable Statistics Mode. Note that once this button is pressed, all parameters in the **STANDARDS** tab cannot be changed. On the **SETUP** tab, the **Area** and units cannot be changed.
4. In the **Switch Mode** window, select the locations to be included in the statistics plan. You can leave the area, room, and location unassigned, but the **Number of Locations** selection made on the **SETUP** tab must match the number of location selections in this window.

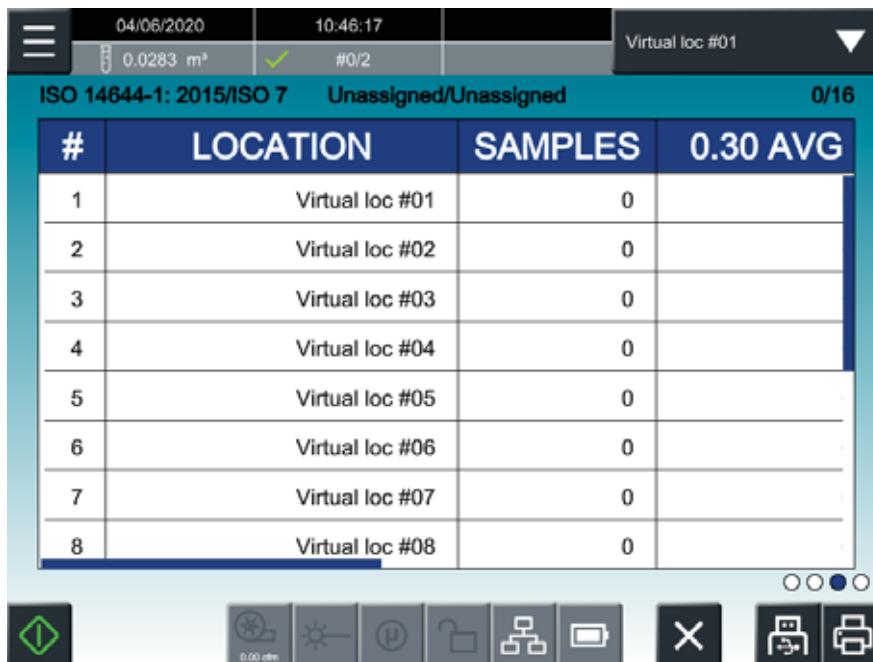
---

**NOTE:** Independent of user-defined locations, there is the option to use virtual locations that are automatically generated for use with the statistics plan. The number generated is dependent on the **Number of Locations** field on the **SETUP** tab. Selecting user-defined locations subtracts from this number.

---



**Figure 11-10.** **Switch Mode** window, virtual locations added

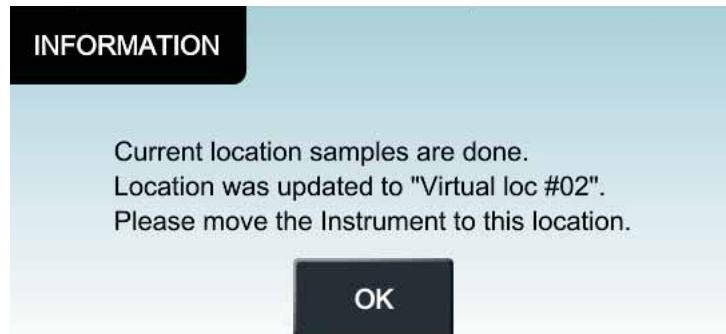


**Figure 11-11.** Automatic list of virtual locations, **HOME** screen

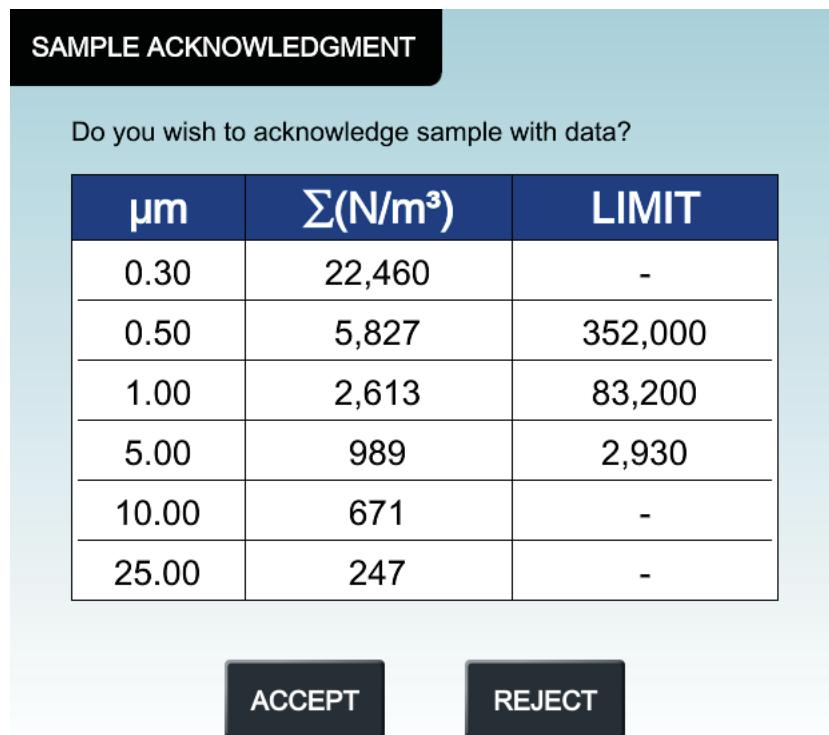
5. Press **OK** when done. You will be automatically taken to the **HOME** screen.
6. When ready, press the

7. After the sample has completed, you will see either of the following messages. If you did not enable Sample Confirmation, you will see **Figure 11-12**. If you enabled Sample Confirmation, you will see **Figure 11-13**.

**NOTE:** If you choose to reject the sample data, it will not be used in the final report. You will be prompted to start the next sample in the series.

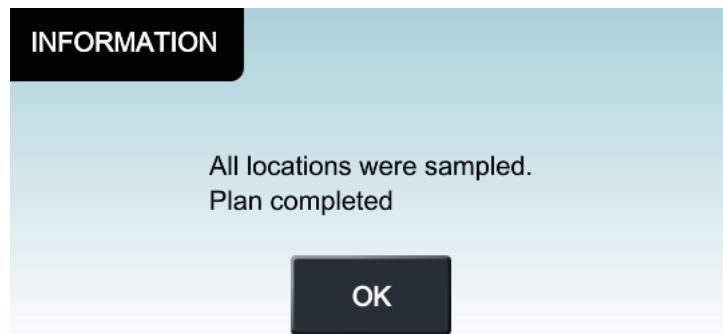


**Figure 11-12.** Statistics sample complete



**Figure 11-13.** Sample Confirmation/Acknowledgement window

8. After sampling is complete, you will receive the following message.



**Figure 11-14.** Statistics plan complete message

9. To save and view the report data, you have the following options:

- Swipe left across the touchscreen to view all the data displays.
- Press  to save all data as a PDF file on the inserted USB key.
- Press  to print all data to the thermal printer.
- Go to  (DATA) to view individual sampling data. Double tap on a row in the TABLE tab for more details.

## Statistics Report Example

The following is an example of the Lasair Pro particle counter's Statistics Report generated when a room is certified to the ISO 14644-1 standard. The lines have been numbered to match the accompanying table containing their descriptions.

	 <b>PARTICLE MEASURING SYSTEMS<sup>®</sup></b> <small>specifications</small>				
<b>1</b>	<b>21 CFR Part 11 Compliant</b> 				
<b>2</b>	<b>Cleanroom Certification Report</b>				
<b>3</b>	<b>Heading 1</b>				
<b>4</b>	<b>Heading 2</b>				
<b>5</b>	Instrument ID:	Lasair Pro			
<b>6</b>	Serial Number:	82217			
<b>7</b>	Calibrated:	01/01/2020			
<b>8</b>	Batch ID:	00021			
<b>9</b>	Operator:	John Doe			
<b>10</b>	Area:	Fill Point			
<b>11</b>	Room:	1416A			
<b>12</b>	Location:	X			
<b>13</b>	Recipe:	Recipe Name			
<b>14</b>	Started:	04/01/2020 09:00:00			
<b>15</b>	Finished:	04/01/2020 09:30:35			
<b>16</b>	<b>Certification Standard:</b>	<b>ISO 14644-1: 2015</b>			
<b>17</b>	<b>Standard Class:</b>	<b>ISO 5</b>			
<b>18</b>	Particle Size (µm)	Limit			
<b>18</b>	0.3	10,200			
<b>18</b>	0.5	3,520			
<b>18</b>	1.0	832			
<b>18</b>	5.0	29			
<b>19</b>	<b>Certification Result</b> <b>PASSED</b>				
<b>20</b>	<b>Sampling Plan</b>				
<b>21</b>		Min	Plan	Actual	
<b>22</b>	Area (ft <sup>2</sup> )	0.0	1.0	1.0	
<b>23</b>	Locations	1	1	1	
<b>24</b>	Samples per Location	1	1	1	
<b>25</b>	Total Samples	1	1	1	
<b>26</b>	Volume (m <sup>3</sup> )	0.6900	0.6900	0.6900	
<b>27</b>	<b>Room State:</b>	Static			

28	Particle Data		
29		µm	N/m <sup>3</sup>
30	TARGET	0.30	10200.0
31	Max	0.30	2.9
32	Mean	0.30	2.9
33	SD	0.30	1.0
	TARGET	0.50	3520.0
	Max	0.50	1.4
	Mean	0.50	1.4
	SD	0.50	1.0
	TARGET	1.00	832.0
	Max	1.00	1.4
	Mean	1.00	1.4
	SD	1.00	1.0
	TARGET	5.00	29.0
	Max	5.00	0.0
	Mean	5.00	0.0
	SD	5.00	1.0
34	Location Averages		
35	Location	#	µm
36	Location X	1	0.30
36	Location X	1	0.50
36	Location X	1	1.00
36	Location X	1	5.00
36	Location X	1	10.00
36	Location X	1	25.00
37	Deleted Samples:	0	

Figure 11-15. Example statistics sampling report

Line No.	Displayed Text	Description
1	<b>Cleanroom Certification Report</b>	Title of report.
2	<b>Heading One</b>	Heading 1 text specified in the <b>REPORTS</b> tab of the <b>DISPLAY</b> screen. Not shown if Heading One field is blank.
<b>Table 11-2. Statistics Printout</b> legend		

Line No.	Displayed Text	Description
3	<b>Heading Two</b>	Heading 2 text specified in the <b>REPORTS</b> tab of the <b>DISPLAY</b> screen. Not shown if Heading One field is blank.
4	<b>Instrument ID</b>	Name/ID of the particle counter that produced the data.
5	<b>Serial Number</b>	Serial number of the particle counter that produced the data.
6	<b>Calibrated</b>	Date on which the particle counter was last calibrated.
7	<b>Batch ID</b>	Batch ID text specified in the <b>REPORTS</b> tab of the <b>DISPLAY</b> screen. Not shown if Heading One field is blank.
8	<b>Operator</b>	Operator text specified in the <b>REPORTS</b> tab of the <b>DISPLAY</b> screen. Not shown if Heading One field is blank.
9	<b>Area</b>	Area where the sampling was performed. See <b>Chapter 8</b> for area configuration.
10	<b>Room</b>	Room where the sampling was performed. See <b>Chapter 8</b> for area configuration.
11	<b>Location</b>	Location where the sampling was performed. See <b>Chapter 8</b> for location configuration.
12	<b>Recipe</b>	Name of the recipe used, if any. See <b>Chapter 9</b> for recipe configuration.
13	<b>Started:</b> 04/01/2020 09:00:00	Date stamp (day / month / year) followed by a time stamp (hour : minute : second) when the statistics sample was started.
14	<b>Finished:</b> 04/01/2020 09:30:35	Date stamp (day / month / year) followed by a time stamp (hour : minute : second) when the sample ended.
15	<b>Certification Standard</b>	<p>The certification standard chosen.</p> <p>Possible values:</p> <ul style="list-style-type: none"> <li>• ISO 14644-1</li> <li>• EU GMP Annex 1</li> <li>• China GMP</li> <li>• FS-209E</li> <li>• Average</li> </ul>

Table 11-2. Statistics Printout legend

Line No.	Displayed Text	Description
16	<b>Standard Class</b>	The classification the room is being tested against. The Standard Class determines the particle limits to meet classification.
17	<b>Particle Size &amp; Limits</b>	Refers to the column headers for particle sizes of interest and their limits to meet classification.
18	<b>0.3 10200</b>	Lists particle sizes and their classification limits.
19	<b>Certification Results</b>	Results of certification. Possible values: <ul style="list-style-type: none"> <li>• <b>PASSED:</b> Sampling met certification standards.</li> <li>• <b>FAILED:</b> Sampling did not meet certification standards.</li> <li>• <b>INCOMPLETE:</b> Sampling was not completed.</li> </ul>
20	<b>Sampling Plan</b>	Header for sampling plan that follows.
21	<b>Min Plan Actual</b>	Number of samples to be taken. <ul style="list-style-type: none"> <li>• <b>Min:</b> Minimum number of samples to be taken</li> <li>• <b>Plan:</b> Number of samples planned to be taken</li> <li>• <b>Actual:</b> Actual number of samples taken.</li> </ul>
22	<b>Area</b>	The area of cleanroom being certified.
23	<b>Locations</b>	The number of locations to be sampled. For column definitions, see line 21 above.
24	<b>Samples per Locations</b>	Number of samples taken at each location. For column definitions, see line 21 above.
25	<b>Total Samples</b>	Total number of samples taken.
26	<b>Volume</b>	Minimum volume to be sampled.
27	<b>Room State</b>	Refers to the option chosen in the <b>STANDARDS</b> tab of the <b>STATISTICS</b> screen before enabling Statistics Mode.
28	<b>Particle Data</b>	Header for the particle data that follows.
29	<b>µm (N/m<sup>3</sup>)</b>	Column headers: <ul style="list-style-type: none"> <li>• <b>µm:</b> Particle size in microns.</li> <li>• <b>N/m<sup>3</sup>:</b> Normalized particle counts per cubic meter.</li> </ul>

Table 11-2. Statistics Printout legend

Line No.	Displayed Text	Description
30	<b>TARGET</b>	The particle size of interest. For column definitions, see line 29 above.
31	<b>Max</b>	The maximum value of the samples averaged.
32	<b>Mean</b>	Mean of all locations. For column definitions, see line 29 above.
33	<b>SD</b>	Standard Deviation of all location means. For column definitions, see line 29 above.
34	<b>Location Averages</b>	Header for the location data that follows.
35	<b>Location #</b> <b>µm</b> <b>Avg(N/m<sup>3</sup>)</b>	Column headers for data that follows. <ul style="list-style-type: none"> <li>• Location – Location of sample</li> <li>• # – Number of samples taken at location.</li> <li>• µm – Particle size sampled.</li> <li>• Avg(N/m<sup>3</sup>) – Average number of particles detected and normalized per cubic meter.</li> </ul>
36	<b>Location X 1</b> <b>0.3    3</b>	Summary of sample at each location for the particle size chosen. For column definitions, see line 35 above.
37	<b>Deleted Samples</b>	Number of samples removed from statistical summary.

Table 11-2. Statistics Printout legend

## Cleanliness Standards

The standards tables in this section are reproductions of those found in their respective documents, and are supported by the Lasair Pro 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  $\mu\text{m}$  or greater particle size.

### ISO 14644-1:2015 Standard

The particle limits shown in **Table 11-3** are cumulative counts, meaning they include all particles of a certain size and larger. For example, for particle sizes in the range of 0.5  $\mu\text{m}$  to 5.0  $\mu\text{m}$ , there can be no more than 3,520 particles counted to meet ISO 5 certification standards. Note that 0.1 and 0.2  $\mu\text{m}$  particle sizes are not counted with the Lasair Pro.

Class	0.1 $\mu\text{m}$	0.2 $\mu\text{m}$	0.3 $\mu\text{m}$	0.5 $\mu\text{m}$	1.0 $\mu\text{m}$	5.0 $\mu\text{m}$
<b>ISO 1</b>	10					
<b>ISO 1.5</b>	32					
<b>ISO 2</b>	100	24	10			
<b>ISO 2.5</b>	316	75	32			
<b>ISO 3</b>	1,000	237	102	35		
<b>ISO 3.5</b>	3,160	748	322	111		
<b>ISO 4</b>	10,000	2,370	1,020	352	83	
<b>ISO 4.5</b>	31,600	7,480	3,220	1,110	263	
<b>ISO 5</b>	100,000	23,700	10,200	3,520	832	29*
<b>ISO 5.5</b>	316,000	74,800	32,200	11,100	2,630	
<b>ISO 6</b>	1,000,000	237,000	102,000	35,200	8,320	293
<b>ISO 6.5</b>	3,160,000	748,000	322,000	111,000	26,300	924
<b>ISO 7</b>				352,000	83,200	2,930
<b>ISO 7.5</b>				1,110,000	263,000	9,240
<b>ISO 8</b>				3,520,000	832,000	29,300
<b>ISO 8.5</b>				11,100,000	2,630,000	92,400
<b>ISO 9</b>				35,200,000	8,320,000	293,000
<i>*ISO 5 at 5 <math>\mu\text{m}</math> requires a smaller particle size to be used.</i>						
<b>Table 11-3.</b> ISO 14644-1:2015 Standard Class Details						

## EU GMP Annex 1 Standard and China GMP

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<sup>3</sup> for each location of all samples taken.

**Table 11-4** shows EU GMP Annex 1 and corresponding ISO classes. **Table 11-5** are the cumulative particle concentration limits for the EU GMP Annex 1 standard. The China GMP uses the same limits.

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

**Table 11-4.** EU GMP Grade and ISO classes

Maximum Particles per M <sup>3</sup>				
	At Rest (Static)		In Operation (Dynamic)	
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 11-5.** Maximum Particles for

## FS-209E Standard

ISO 14644-1 is used in place of the FS-209E standard globally, but the Lasair Pro particle counter still implements the classes specified in **Table 11-6**. Note that 0.1 and 0.2  $\mu\text{m}$  particle sizes are not counted with the Lasair Pro.

Maximum Particles Per Unit Volume											
Class		0.1 $\mu\text{m}$		0.2 $\mu\text{m}$		0.3 $\mu\text{m}$		0.5 $\mu\text{m}$		5.0 $\mu\text{m}$	
SI	English	$\text{m}^3$	$\text{ft}^3$								
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 11-6.** Maximum Particles Per Unit Volume



## Chapter 12

# System Configuration

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Use **SYSTEM** to set general system options such as the instrument ID, calibration warning, language, date format, channel size, and sampling medium. You can also view the status of the instrument, including firmware version, the last calibration date, laser and pump information, and battery life.

To view the status and configure system settings, go to > (SYSTEM).

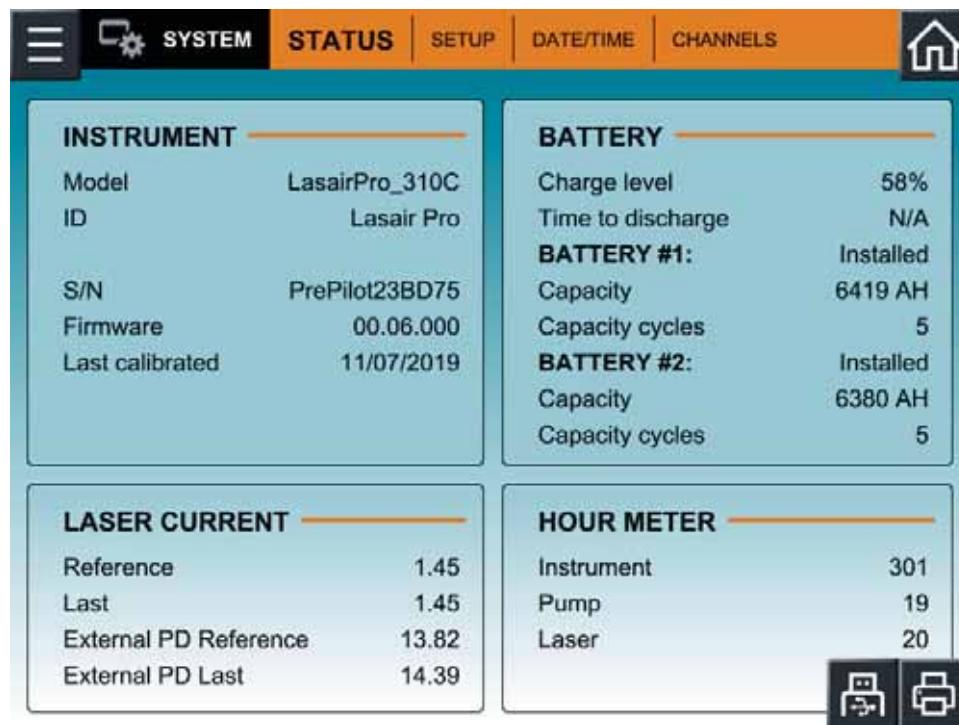


Figure 12-1. STATUS tab, SYSTEM

Press  or  to generate the Instrument Status Report, which summarizes the information of the **STATUS** tab of the **SYSTEM** screen.

## SETUP Tab



Figure 12-2. SETUP tab, SYSTEM

### Instrument ID

Press inside the field to open the keyboard to personalize the particle counter identification. The character limit is 16. This text appears on sampling and audit reports.

### Calibration Warning

Enable the calibration warning to display when a calibration is due every six months or twelve months. Also enables a warning message when calibration is past due. If a calibration is due, the warning message will appear every time the Lasair Pro is turned on.

## Gas

Allows the user to set the gas medium, which is associated with an unchangeable specific density in kg/m<sup>3</sup>. Choices of gas include:

- Air (1.205 kg/m<sup>3</sup>)
- CO<sub>2</sub> (1.842 kg/m<sup>3</sup>)
- Argon (1.661 kg/m<sup>3</sup>)
- Nitrogen (1.165 kg/m<sup>3</sup>)

## Language

The Lasair Pro interface supports several international languages:

- English
- French (Français)
- Italian (Italiano)
- German (Deutsch)
- Portuguese (Português)
- Russian (Русский)
- Chinese CHT (繁體中文)
- Chinese CHS (简体中文)
- Japanese (日本語)

This language setting affects field names, prompts, and user messages. Data remains in English. Choose the desired language from the dropdown menu to adjust the display language.

## Keyboard Inputs

Press the desired keyboard languages to activate (orange)  or deactivate (gray)  them for use. The user can switch between keyboards while typing (see **Figure 12-3**).

## CSV Exporting for Non-Standard Characters

If the CSV file contains accented, Asian or any other non-standard characters, it may not be read by programs such as Microsoft Excel with the proper encoding. To ensure your CSV files are encoded properly:

1. Open a blank workbook in Excel.
2. On the **Data** tab, select **Get Data** → **From File** → **From Text/CSV**.
3. Choose the CSV file to import. A pop-up window will open.
4. Set the **File Origin** to **Unicode (UTF-8)**.



**Figure 12-3.** Change to another language keyboard

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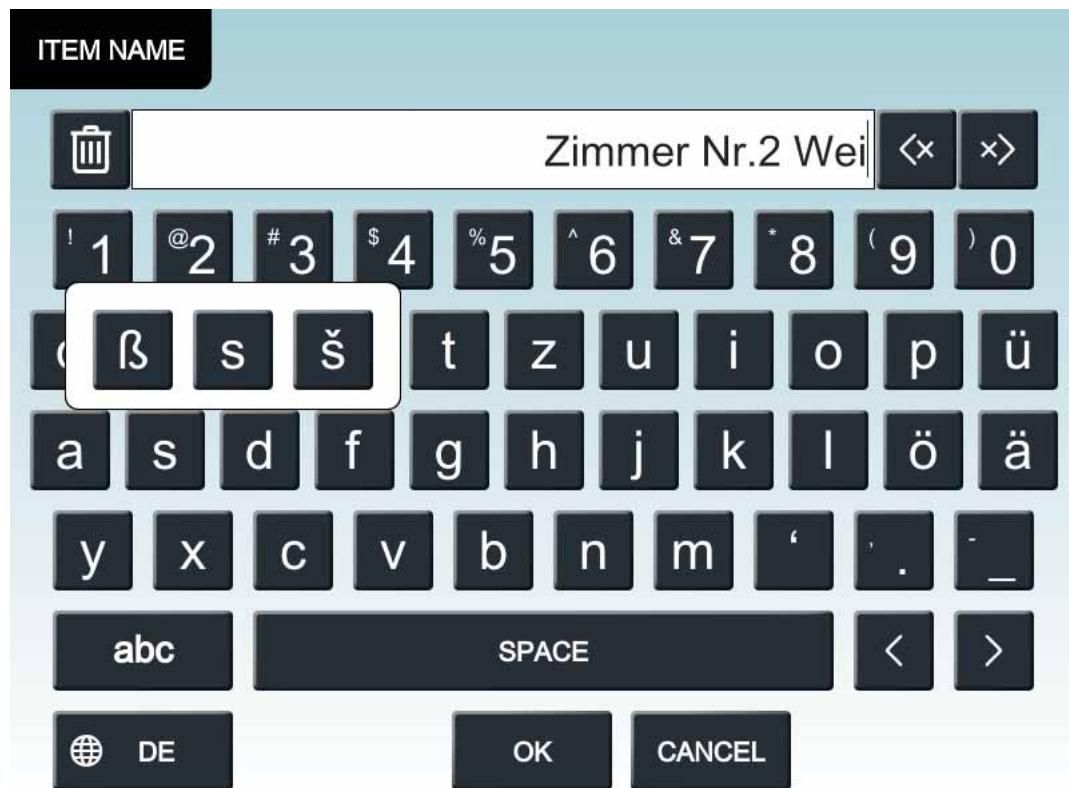
**NOTE:** Some symbols are shown in the top-left of the numeric character buttons. Press and hold until the field is populated with the symbol.

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**NOTE:** Some keyboard letters only display when the user holds down their finger against a displayed letter for 2 - 3 seconds. See **Figure 12-4**.

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**Figure 12-4.** Press and hold the 's' letter on the DE keyboard for more options

Other examples of additional letters not shown in the keyboards main display include the following:

	Press and hold...	...to generate this list of characters.
FR	'a'	à, á, â, ã, ä, å, æ, ã, a
	'e'	è, é, ê, ë, ê, é, ë
	'y'	ÿ
	'u'	ù, ú, ê, û, ü
	'i'	ì, í, î, ï, ï
	'o'	ò, ó, ô, õ, ö, ø, œ, o
	'c'	ç, č, č
	'n'	ń, ñ

	Press and hold...	...to generate this list of characters.
<b>IT</b>	‘e’	è, é, ê, ë, ē, ê, é
	‘u’	ù, ú, û, û, ü
	‘i’	ì, í, î, ï, ï
	‘o’	ò, ó, ô, õ, ö, ø, œ, o
	‘a’	à, á, â, ã, ä, å, æ, á, a
	‘s’	ß, ś, š
	‘c’	ç, č, č
<b>ES</b>	‘e’	è, é, ê, ë, ê, é, é
	‘u’	ù, ú, û, û, ü
	‘i’	ì, í, î, ï, ï
	‘o’	ò, ó, ô, õ, ö, ø, œ, o
	‘a’	à, á, â, ã, ä, å, æ, á, a
	‘s’	ś
	‘d’	đ
	‘c’	ç, č, č
	‘n’	ń
<b>DE</b>	‘e’	è, é, ê, ë, ê, é
	‘u’	ù, ú, û, û
	‘i’	ì, í, î, ï, ï
	‘o’	ò, ó, ô, õ, ö, ø, ö, œ
	‘a’	à, á, â, ã, ä, å, æ, á
	‘s’	ß, ś, š
	‘y’	ÿ
	‘c’	ç, č, č
	‘n’	ń, ñ
<b>PT</b>	‘e’	è, é, ê, ë, ê, é, é
	‘u’	ù, ú, û, û, ü
	‘i’	ì, í, î, ï, ï
	‘o’	ò, ó, ô, õ, ö, ø, ö, œ, o
	‘a’	à, á, â, ã, ä, å, æ, a
	‘c’	ç, č, č
	‘n’	ń

🌐	Press and hold...	...to generate this list of characters.
PL	'e'	è, é, ê, ë, ē, é, ë
	'o'	ò, ó, ô, õ, ö, ø, ò, œ
	'a'	à, á, â, ã, ä, å, æ, á, ã
	's'	ß, ś, š
	'l'	ł
	'z'	ż, ż, ź
	'c'	ç, č, č
	'n'	ń, ñ
RU	'e'	ë
	'b'	þ
KR	'ㅂ'	ㅃ
	'ㄷ'	ㄸ
	'ㄱ'	ㄲ
	'ㅅ'	ㅆ
	'ㅎ'	ㅎ
	'ㅛ'	ㅛ

**NOTE:** The **CHT**, **CHS** and **JP** options use Input Method Editors (IMEs) to generate text for selection beneath the input field.

**NOTE:** If using the **JP** keyboard, the  icon beside the IME text area may be used to switch between hiragana, katakana, and roman characters.

## Clone Export and Import

The Lasair Pro system and data can be cloned and copied to another Lasair Pro instrument. Settings in the clone file include:

- All **SYSTEM** screen parameters
- All **SAMPLE** screen parameters
- All **STATISTICS** screen parameters
- All **SECURITY** screen parameters (including all user data)
- All **COMM** screen parameters
- IP addresses (selectable with Comm Settings)
- Area, Room, Locations and assignments
- Recipes
- All **IN/OUT** screen parameters
- All **DISPLAY** screen parameters
- All **DATA** screen parameters
- Clone file encryption

1. Press  **(SYSTEM)**.
2. Go to the **SETUP** tab.



Figure 12-5. **Clone Export** and **Import** buttons, **SETUP** tab, **SYSTEM**

3. Press either of the following buttons:

	<b>Clone Export</b>	Exports a file to the attached USB with selected parameters. You may choose to encrypt the file.
	<b>Clone Import</b>	Imports previously exported files using the <b>Clone Export</b> button.

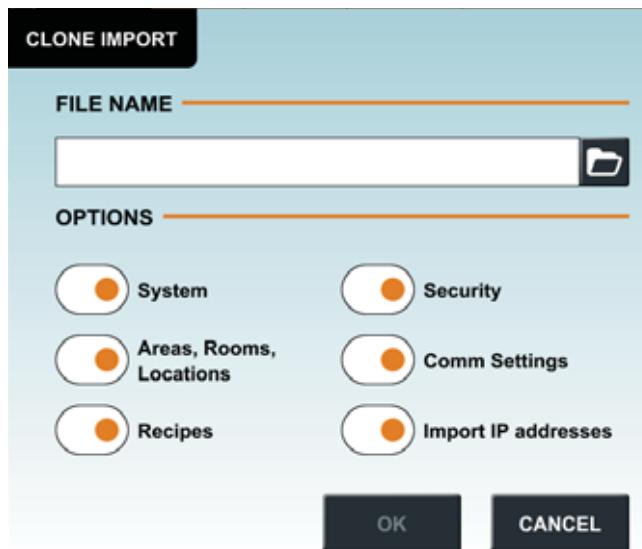
a. Choosing **Clone Export** opens the following window.



Figure 12-6. Clone Export window

- i. Press inside the **File Name** field to open the keyboard, or press to select a file to overwrite. 
- ii. Select the options to be included in the export file and press **OK**. Note that if you choose "Security", Lasair Pro security will automatically become disabled. An administrator will need to re-enable security after import.

b. Choosing **Clone Import** opens the following window.



**Figure 12-7. Clone Import** window

- i. Press inside the **File Name** field to open the keyboard to type the name of the import file, or press  to select a file to import.
- ii. Select the options to be imported and press **OK**.
- iii. The Lasair Pro will logout any users and restart with the imported options.

## Buttons

Image	Name	Description
	<b>Restore Factory Settings</b>	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 12-1. SETUP tab, SYSTEM**

Image	Name	Description
	<b>Clone Export Window</b>	Clones the following settings into a file that can be transferred to another Lasair Pro counter via USB key.
	<b>Clone Import Window</b>	Allows instrument to read and load a clone file from the USB key. After pressing <b>OK</b> , the Lasair Pro will logout any users and restart with the imported file options.

Table 12-1. SETUP tab, SYSTEM

## DATE/TIME Tab



Figure 12-8. DATE/TIME tab, SYSTEM

The **DATE/TIME** tab allows the user to set the formats of both date and time, used on the **HOME** screen, sampling data, and reporting. **Table 12-2** lists the options available for the user to configure.

### Buttons

Image	Name	Description
	<b>Date</b>	Press the calendar icon to define the current date.
	<b>Date Format</b>	Press the down arrow to set the date format. Options are: <ul style="list-style-type: none"> <li>• dd/mm/yyyy</li> <li>• mm/dd/yyyy</li> <li>• yyyy/mm/dd</li> </ul>

Table 12-2. DATE/TIME tab, SYSTEM

Image	Name	Description
	<b>Time</b>	Press the clock icon to set the current time for your time zone. The time displays in a format of HH:MM:SS for hours, minutes, and seconds.
	<b>Use NTP</b>	Enables or disables Network Time Protocol (NTP). Use if you are synchronizing the time display of multiple Lasair Pro counters and other NTP-linked devices.
<input data-bbox="530 720 780 783" type="text" value="0.0.0.0"/> Primary NTP Server	<b>Primary NTP Server</b>	Press to set the IP address of the NTP server.
<input data-bbox="530 853 780 916" type="text" value="0.0.0.0"/> Backup NTP Server	<b>Backup NTP Server</b>	Press to set the IP address of the backup NTP server.
<input data-bbox="530 986 780 1049" type="text" value="240"/> Update interval	<b>Update Interval</b>	Press to set the time interval in minutes that the date and time will update.
<input data-bbox="530 1233 780 1296" type="text" value="UTC-06:00"/> Time zone	<b>Time Zone</b>	Press the globe to set the time zone for your location. If the instrument is attached to Facility Net or FacilityPro, the time zone and date/time are automatically updated. The time zone must be manually changed for daylight savings.

Table 12-2. DATE/TIME tab, SYSTEM

## CHANNELS Tab

The **CHANNELS** tab allows the user to switch between **All channels mode** and **Pharmaceuticals mode**.

- **All channels mode:** Enables all eight particle size channels for use with sampling.
- **Pharmaceuticals mode:** Enables only the 0.5 and 5.0 particle size channels.

Channel sizes can only be set in **All channels** mode. The size range is 0.30 to 25.00 with a resolution of 0.01 for sizes less than 0.50, 0.05 for sizes between 0.50 and 1.00, 0.5 for sizes between 1.00 and 3.00, and 1 for sizes between 3.00 and 25.00. Channel size units can be changed between micrometers ( $\mu\text{m}$ ) and nanometers (nm).

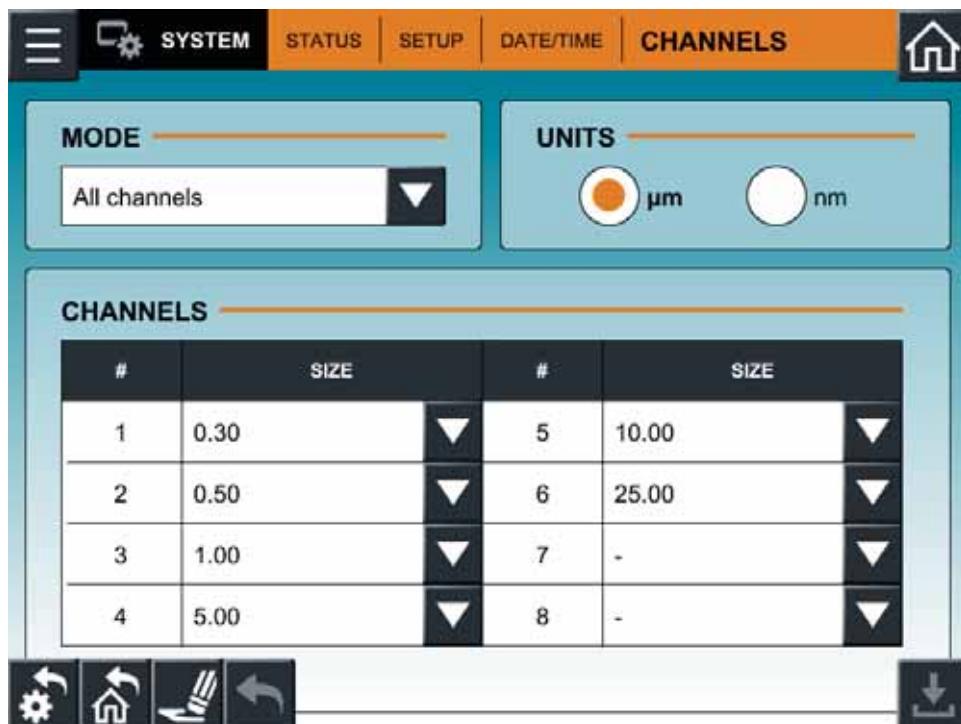


Figure 12-9. CHANNELS tab, SYSTEM

**NOTE:** All sampling data is deleted when the mode is switched. If you wish to save your sampling data, ensure it is manually exported via USB before changing modes, and then re-imported after the mode change is made. In addition, be aware that all alarm settings will be incorrect, and channel sizes for statistics recipes will be incorrect.

**NOTE:** Changing between **Pharmaceuticals** mode and **All channels** mode is

confirmed by pressing



. This will cause the Lasair Pro to reboot and

reconfigure itself. All existing data is deleted.

## Buttons

Image	Name	Description
	<b>Dropdown Available</b>	Press to open the dropdown menu for either the <b>Mode</b> or channel size.
	<b>Micrometer Units</b>	Select for all channel size units to be in $\mu\text{m}$ .
	<b>Nanometer Units</b>	Select for all channel size units to be in nm.
	<b>Restore Factory Default</b>	When pressed, all channel changes made from factory defaults will be undone.
	<b>Return to Previous Saved Settings</b>	When pressed, all channel changes made since starting the Lasair Pro will be undone.
	<b>Delete All Channel Settings</b>	Deletes size settings for each channel.
	<b>Undo Most Recent Change</b>	Reverts display to the last channel size setting. Can be pressed to undo the <b>Delete All Channel Settings</b> option.
	<b>Save</b>	Saves current channel configuration.

**Table 12-3. CHANNELS tab, SYSTEM**

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# Chapter 13

## Maintenance and Diagnostics

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

- **Cleaning and Disinfecting the Enclosure** on page 13-1
- **Replacing the Printer Paper Roll** on page 13-3
- **Calibration Reminder** on page 13-5
- **Other Maintenance** on page 13-5
- **Diagnostics** on page 13-6

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**NOTE:** There are no user-serviceable parts inside the Lasair Pro.

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### Cleaning and Disinfecting the Enclosure

The Lasair Pro particle counter's 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 prevent ingress of fluids.

#### CAUTION

Although the Lasair Pro particle counter is resistant to liquids, it is NOT liquid tight. **Avoid** the application of large amounts of liquids and never submerge the instrument. **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%)
- Hydrogen peroxide, aqueous
- Phenolic detergents
- Paracetic acid
- Peroxide/quaternary ammonium solutions

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

## Cleaning the Enclosure Case

### WARNING

Always wear eye protection when working with cleaning chemicals.

### WARNING

Disconnect the power cord from its power source.

### WARNING

Ensure the Lasair Pro ISP is covered before spray down of the room. Any liquid in the ISP will damage the particle counter's optics.

Follow this procedure when cleaning the Lasair Pro's polycarbonate case and tempered glass screen:

1. Turn the particle counter off, unplug the power cord from the power source and particle counter, and remove the battery or batteries.
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 and screen.
5. Follow this cleaning solution wipe, with a wipe or cloth damped with water.

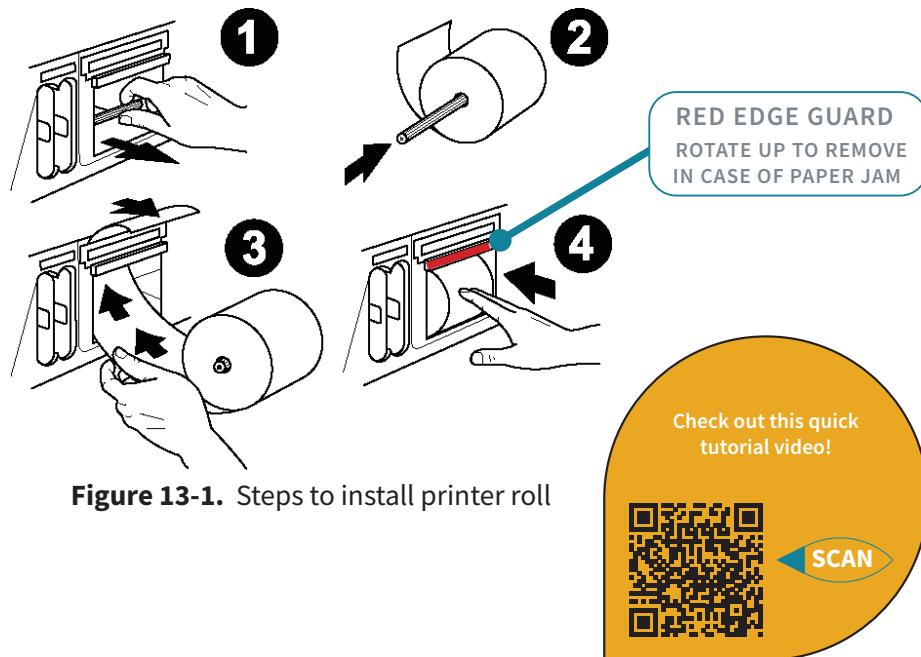
## Replacing the Printer Paper Roll

Pull the right case cover out with the finger notch. You must purchase paper directly from Particle Measuring Systems, or ensure the paper has a width of 61 to 62.5 mm. Paper outside specifications will print improperly.

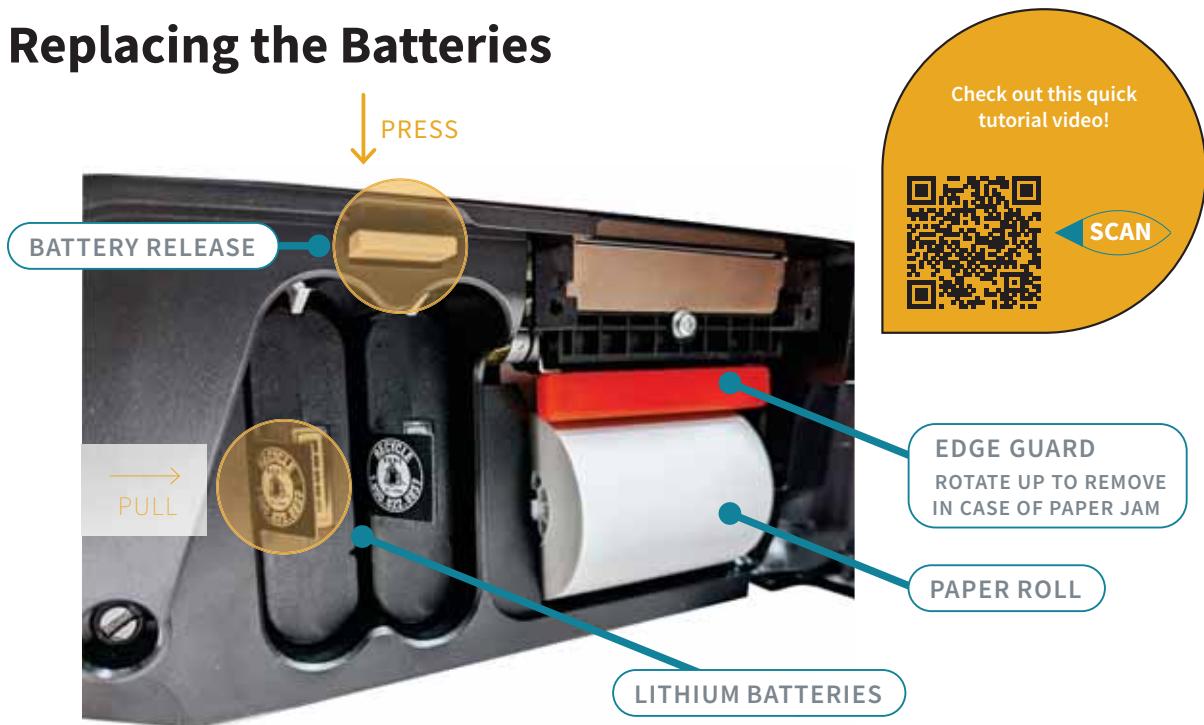
1. Turn the Lasair Pro ON and remove the printer roll holder. Remove the previous printer roll plastic center from the printer roll holder.
2. Insert the printer roll holder into the printer roll's plastic center.
3. Thread the paper into the top of the interior cavity as shown until the automatic feed is engaged. The cutter will automatically snip a small portion of the roll.

**NOTE:** The printer paper must be threaded into the automatic feed as shown in **Figure 13-1**. Paper is coated for printing on one side only. Ensure the edge is oriented straight and square with the automatic feed.

4. Roll the paper so that it fits snug inside the interior cavity. Close the case and restart the Lasair Pro.



## Replacing the Batteries



1. Open the battery and printer chamber door on the side of the Instrument.
2. Press down on the gray battery release tab. You will hear a click when the release unlocks.
3. If replacing a battery, pull on the lithium battery tab protruding from the battery to gently remove it from the bay.
4. Insert the battery with the battery tab protruding from the left side of its individual bay. Install up to two batteries.
5. Lock the battery release by pressing up on the gray tab. You will hear a click when the release locks.
6. Close the battery and printer chamber door.

## Battery Disposal

At end-of-life, batteries should be recycled or discarded safely. 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 warning can be set for either a 6-month notification or a 12-month notification. It can also be disabled with no notification provided. See the **SETUP** tab of the **SYSTEM** screen on your Lasair Pro for configuration.

Schedule the calibration online at:

<https://www.pmeasuring.com/service-and-support/service-repair-and-calibration/>



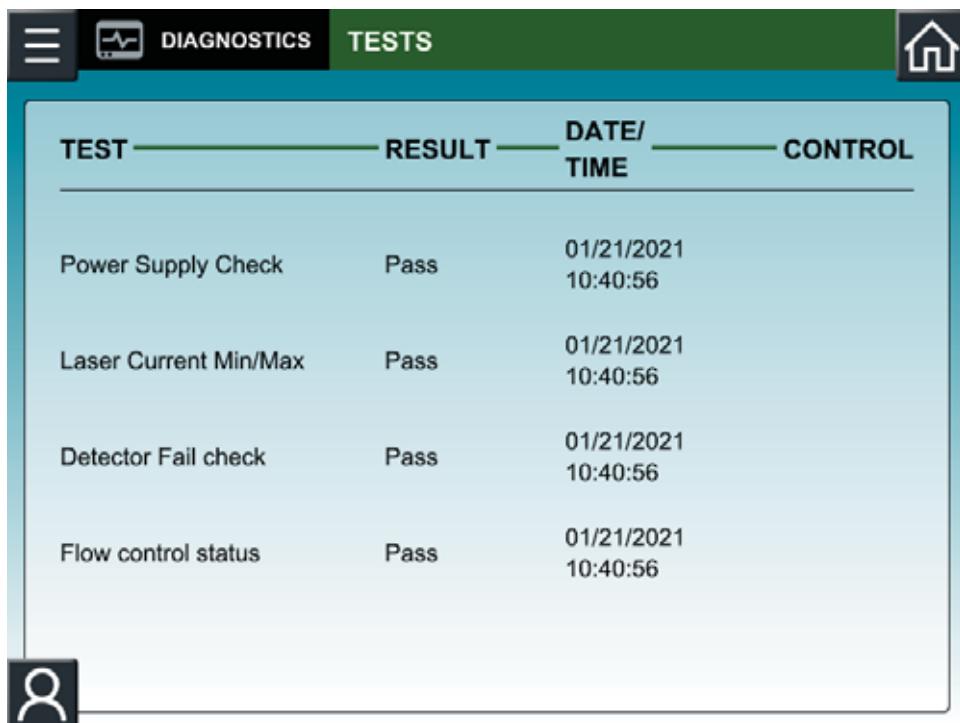
## Service Repair and Calibration

## 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.

## Diagnostics

The Lasair Pro performs automatic diagnostic tests daily. You can view the results of this test by navigating to the **TESTS** tab of the **DIAGNOSTICS** screen. Use the button in the bottom left to view PMS contact information.



TEST	RESULT	DATE/ TIME	CONTROL
Power Supply Check	Pass	01/21/2021 10:40:56	
Laser Current Min/Max	Pass	01/21/2021 10:40:56	
Detector Fail check	Pass	01/21/2021 10:40:56	
Flow control status	Pass	01/21/2021 10:40:56	

Figure 13-2. TESTS tab, DIAGNOSTICS

The Lasair Pro performs the following tests:

- Detector Fail Check
- Flow Control Status
- Laser Current Min/Max
- Power Supply Check

Press the  button to view Particle Measuring Systems contact information.



## Appendix A International Precautions

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### **WARNING**

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

### **AVERTISSEMENT**

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

### **WARNUNG**

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

### **ATTENZIONE**

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

### **ADVERTENCIA**

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

## Hazard Symbols

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

Symbol	Nature of Hazard
 	Attention, consult this document for warnings.
	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:

Symbol	Natur du risque
 	Attention, veuillez consulter ce document pour tout avertissements.
	Danger Electricite
	Avertissement – Rayonnement laser ! Éviter toute exposition au faisceau.

## Warnschilder

Die, an dem Gerät angebrachten Warnschilder haben folgende Bedeutungen:

Symbol	Gefahrenart
 	Achtung, ziehen Sie dieses Dokument hinzu bei Warnhinweisen.
	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 questo documento per le avvertenze.
	Tensione Pericolosa
	Avvertenza – Radiazione laser! Evitare l'esposizione ai raggi.

## Simblos de peligro

Los simblos de peligro que aparecen en el equipo significan:

Símbolo	Naturaleza del Peligro
 	Atención, consulte este documento para ver las advertencias.
	Peligro alto voltaje.
	Advertencia – ¡Radiación láser! Evite exponerse al rayo.

## Appendix B

# Comma Separated Value (CSV) Format

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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. The total number of fields present in the CSV file depends on the number of particle channels active on the instrument.

Ref #	Value Heading	Description
1	<b>Sample Date</b>	Format matches date format as set on the System Setup screen. The format is either YYYY/MM/DD or DD/MM/YYYY or MM/DD/YYYY
2	<b>Sample Time</b>	Formatted HH:MM:SS (end of sample)
3	<b>Sensor Name</b>	User entered name. Up to 16 characters. Name is delimited by quotation ("") marks.
4	<b>Sensor Type</b>	Hard-coded value. Example: "LasairPro_5100"
5	<b>S/N</b>	Sensor serial number. This value programmed during initial calibration.
6	<b>Statistics or Monitoring</b>	This field is used to indicate whether the sample is part of a statistics room certification, a monitoring plan, or just a sample. The field will display either <b>Statistics or Monitoring</b> to indicate the type of sample.
7	<b>Location Changed</b>	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 ( . ).

**Table B-1.** CSV fields and descriptions

Ref #	Value Heading	Description
8	<b>Location</b>	User location name. The location name is given in the format AREA/ROOM/LOCATION. The full name is delimited by quotation ("") marks. The room, area and location have a maximum of 16 Unicode characters each. In the UTF8 output, the names may take up to 48 characters each, plus the / delimiters. The total string length may therefore be approximately 150 characters.
9	<b>Manifold</b>	The manifold position. The value will be zero (0) if no manifold exists. With a manifold, lowest number will be one (1).
10	<b>Laser OK</b>	1 = OK, 0 = bad (language independent)
11	<b>Flow OK</b>	1 = OK, 0 = bad (language independent)
12	<b>&lt;10% Coinc.</b>	1 = OK, 0 = bad (i.e. coincidence limit flag set due to too many particles)
13	<b>Sample Valid</b>	<p>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).</p> <p>A sample that is manually stopped before the sample time/volume has been completed is considered as and marked as invalid.</p> <p>1 = OK, 0 = bad</p>
14	<b>Sample Interval</b>	Time display. Format is HH:MM:SS.
15	<b>Sample Volume Units</b>	This field indicates the format of the sample volume units. It will show one of (m <sup>3</sup> , ft <sup>3</sup> or ℥).
<b>Table B-1.</b> CSV fields and descriptions		

Ref #	Value Heading	Description
16	<b>Particle Count Units</b>	<p>This field indicates particle count data type. There are three parameters that affect the data format as follows:</p> <ol style="list-style-type: none"> <li>1. Whether the counts data is cumulative( <math>\Sigma</math> ) or differential ( <math>\Delta</math> )</li> <li>2. Whether the counts data is raw ( N ) or normalized ( N/unit volume )</li> <li>3. If normalized, the volume units are shown ( <math>\text{m}^3</math>, <math>\text{ft}^3</math>, <math>\ell</math> )</li> </ol> <p>Examples:</p> <p><math>\Delta N/\text{m}^3</math> — Differential, normalized particle data, per cubic meter</p> <p><math>\Sigma N</math> — Cumulative, raw particle data</p> <p><math>\Delta N</math> — Differential, raw particle data</p> <p><math>\Sigma N/\text{ft}^3</math> — Cumulative, normalized particle data, per cubic feet</p>
17	<b>Sample Volume</b>	Floating point value. In “Volume Units” given above.
18	<b>Number of Channels</b>	Varies from 8 to 2 depending on channel configuration of instrument. Factory default is 6 channels. If Pharmaceutical mode is enabled the instrument has 0.5 and 5.0 channels only.
19	<b>Size 1</b>	Particle size for channel 1.
20	<b>Counts 1</b>	The particle counts for channel 1. Count data may be configured to be raw or normalized and may be either cumulative or differential. See Particle Counts Units (Ref # 16) for details.
21	<b>Size 2</b>	See Size 1.
22	<b>Counts 2</b>	See Counts 1.
23	<b>Size 3</b>	Size 1. Only used if 3 channels are active.
24	<b>Counts 3</b>	See Counts 1. Only used if 3 channels are active.
25	<b>Size 4</b>	See Size 1. Only used if 4 channels are active.
26	<b>Counts 4</b>	See Counts 1. Only used if 4 channels are active.
27	<b>Size 5</b>	See Size 1. Only used if 5 channels are active.
28	<b>Counts 5</b>	See Counts 1. Only used if 5 channels are active.
29	<b>Size 6</b>	See Size 1. Only used if 6 channels are active.

**Table B-1.** CSV fields and descriptions

Ref #	Value Heading	Description
<b>30</b>	<b>Counts 6</b>	See Counts 1. Only used if 6 channels are active.
<b>31</b>	<b>Size 7</b>	See Size 1. Only used if 7 channels are active.
<b>32</b>	<b>Counts 7</b>	See Counts 1. Only used if 7 channels are active.
<b>33</b>	<b>Size 8</b>	See Size 1. Only used if 8 channels are active.
<b>34</b>	<b>Counts 8</b>	See Counts 1. Only used if 8 channels are active.
<b>35</b>	<b>Number Analogs</b>	Fixed at 4 for the Lasair Pro.
<b>36</b>	<b>Name 1</b>	User defined name (16 char max) for the analog channel.
<b>37</b>	<b>Units 1</b>	User name (10 char max) for sensor units.
<b>38</b>	<b>Average 1</b>	Average value for channel.
<b>39</b>	<b>Min. 1</b>	Minimum value for channel.
<b>40</b>	<b>Max. 1</b>	Maximum value for channel.
<b>41</b>	<b>Name 2</b>	Same as Name 1
<b>42</b>	<b>Units 2</b>	Same as Units 1
<b>43</b>	<b>Average 2</b>	Same as Average 1
<b>44</b>	<b>Min. 2</b>	Same as Min. 1
<b>45</b>	<b>Max. 2</b>	Same as Max. 1
<b>46</b>	<b>Name 3</b>	Same as Name 1
<b>47</b>	<b>Units 3</b>	Same as Units 1
<b>48</b>	<b>Average 3</b>	Same as Average 1
<b>49</b>	<b>Min. 3</b>	Same as Min. 1
<b>50</b>	<b>Max. 3</b>	Same as Max. 1
<b>51</b>	<b>Name 4</b>	Same as Name 1
<b>52</b>	<b>Units 4</b>	Same as Units 1
<b>53</b>	<b>Average 4</b>	Same as Average 1
<b>54</b>	<b>Min. 4</b>	Same as Min. 1
<b>55</b>	<b>Max. 4</b>	Same as Max. 1
<b>56</b>	<b>Alarm Reason</b>	Text detailing the alarm reason. This field is a null string if the sample has no alarm and/or alarm reasons are not enabled. The string is delimited by quotation ("") marks. See Chapter for information on Alarm Reasons.

**Table B-1.** CSV fields and descriptions

# Appendix C

## Troubleshooting Ethernet

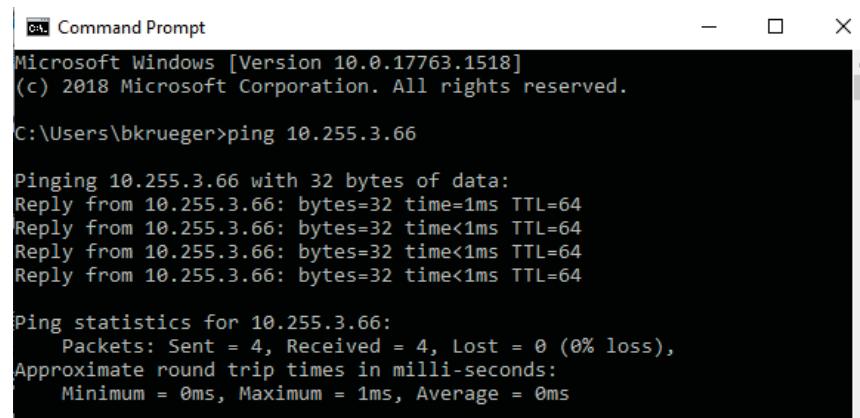
---

---

### 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 steady light to indicate a connection. If not, there is hardware connection problem.
  - a. Is the cable bad?
    - i. Try a different cable.
    - ii. If there is a direct laptop to instrument connection, a cross-over cable may be required. Cross-over cables are specially marked as such.  
PMS cross-over cable: P/N 1000011477
  - b. Is the other end of the cable alive?  
Ensure a known good device works when connected instead.
2. Verify the device can talk using ping.
  - a. Open a command prompt 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, there is an addressing problem.



```
Command Prompt
Microsoft Windows [Version 10.0.17763.1518]
(c) 2018 Microsoft Corporation. All rights reserved.

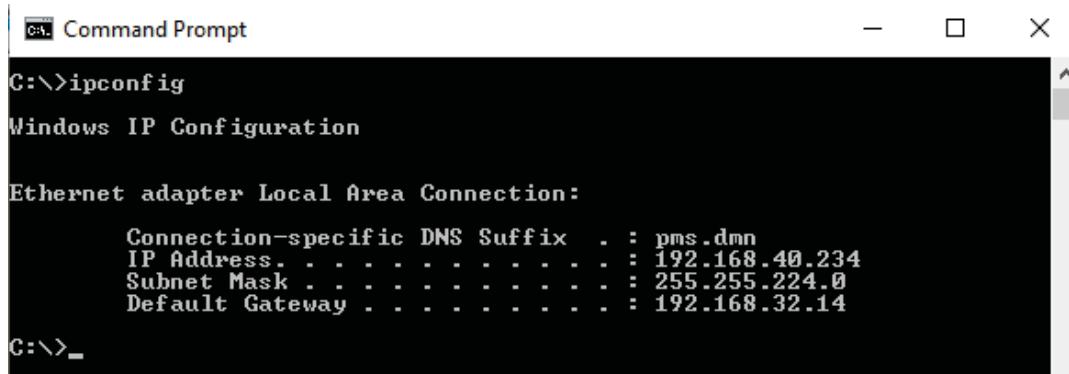
C:\Users\bkrueger>ping 10.255.3.66

Pinging 10.255.3.66 with 32 bytes of data:
Reply from 10.255.3.66: bytes=32 time=1ms TTL=64
Reply from 10.255.3.66: bytes=32 time<1ms TTL=64
Reply from 10.255.3.66: bytes=32 time<1ms TTL=64
Reply from 10.255.3.66: bytes=32 time<1ms TTL=64

Ping statistics for 10.255.3.66:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

**Figure C-1.** Example for ping test

- b.** Make sure the PC and the device are on the same network.
- c.** Check the PC's address by opening a command prompt and typing ipconfig.
  - i.** Ensure the Mask is the same on both the PC and the device.
  - ii.** Ensure the network portion of the address is the same on both the PC and the device.



```
C:\>ipconfig
Windows IP Configuration

Ethernet adapter Local Area Connection:

  Connection-specific DNS Suffix  . : pms.dmn
  IP Address . . . . . : 192.168.40.234
  Subnet Mask . . . . . : 255.255.224.0
  Default Gateway . . . . . : 192.168.32.14

C:\>_
```

**Figure C-2.** 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.



## Appendix D

### 有毒或有害的物质和元素

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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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# Appendix E

## Configuring the Lasair Pro Wi-Fi

### Overview

This document explains the Lasair Pro Wi-Fi hardware usage. The Wi-Fi hardware consists of a separate microprocessor controlled electronics module inside the Lasair Pro instrument.

## Procedure

This procedure explains the basic process of using the Lasair Pro Wi-Fi module. The Wi-Fi module is pre-configured by Particle Measuring Systems to operate such that parameters are set via the Lasair Pro front panel display.

1. Power up the Lasair Pro instrument and wait until loading the code has completed, about 30 seconds.



2. Select the icon of the three horizontal lines in the upper left corner.



3. Select the COMM icon in the middle right of the screen.

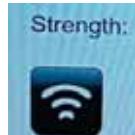


4. Select the word WIRELESS at the top of the screen.

5. Select the Enable WiFi toggle at the top of the screen under Settings. The orange dot will appear when the WiFi is enabled.



6. Select the WiFi icon below Strength.



7. A list of available networks will appear. Select your network and enter the password as prompted and the instrument will then be connected to the network of choice.





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