

Handheld3016IAQ

PARTICLE COUNTER



OPERATING MANUAL

Lighthouse Worldwide Solutions

**HANDHELD 3016 IAQ Particle Counter
Gen E**

Operating Manual

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LWS Part Number: 248083402-1 Rev 6



EU DECLARATION OF CONFORMITY

Manufacturer's Name Lighthouse Worldwide Solutions, Inc.

Manufacturer's Address: Lighthouse Worldwide Solutions, Inc.
1221 Disk Drive
Medford, OR 97501

Declares that the product:

Product Name: Handheld Airborne Particle Counter
Model Number(s): Handheld 30161AQ

Conforms to the following Product Specifications:

<u>SAFETY</u>	EN61010-1:2001	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use Part I: General Requirements IEC 61010-1:2000
	CAN/CSA C22.2 No. 1010.1-1992	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part I: General Requirements
<u>LASER SAFETY</u>	IEC 60825-1 Am. 2 IEC 60601-2-22 (Laser Notice 50)	Guidance on Laser Products: Conforms to FDA 21 CFR Chapter I Subchapter J
<u>EMC</u>	EN61326	Electrical Equipment for Measurement, Control and Laboratory Use EMC Requirements Part I: General Requirements Includes Amendment A1:1998; IEC 61326:1997 + A1:1998

UL 61010A-1 – UL Standard for Safety Electrical Equipment for Laboratory Use; Part I: General Requirements.
Replaces UL 3101-1

Supplementary information: The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC amended by Directive 93/68/EEC and the EMC Directive 89/336/EEC amended by Directive 93/68/EEC, and carries the CE marking accordingly.

Fremont, CA, May 15, 2007

William L. Shade – V.P. Engineering

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About this Manual

This manual describes the detailed operation and use of the Lighthouse HANDHELD 3016 IAQ Airborne Particle Counter.

Text Conventions

Note: *A note appears in the sidebar to give extra information regarding a feature or suggestion.*

WARNING: *A warning appears in a paragraph like this and warns that doing something incorrectly could result in personal injury, damage to the instrument or loss and/or improper storage of data.*

The following typefaces have the following meanings:

<i>italics</i>	Represents information not to be typed or interpreted literally. For example, <i>file</i> represents a file name. Manual titles are also displayed in italics.
boldface	Introduces or emphasizes a term.
<code>Courier font</code>	Indicates command syntax or text displayed by the diagnostic terminal.
Bold Courier	Indicates commands and information that you type. You can use uppercase or lowercase letters; in this manual, commands are shown in uppercase.
<i>Helvetica Italics</i>	Indicates a comment on a command or text output.

Hexadecimal numbers are shown with the word “hex” or with a small “h” following the digits. For example:

hex 0D
0Dh

Additional Help

For more information about the Lighthouse HANDHELD 3016 IAQ Airborne Particle Counter, contact Lighthouse Worldwide Solutions:

Service and Support
Tel: 800-945-5905 (USA Toll Free)
Tel: 541-770-5905 (Outside of USA)
techsupport@golighthouse.com

1

General Safety

General Safety

Warnings and cautions are used throughout this manual. Familiarize yourself with the meaning of a warning before operating the particle counter. All warnings will appear in the left margin of the page next to the subject or step to which it applies. Pay close attention to each warning message. Take extreme care when performing any procedure preceded by or containing a warning.

There are several classifications of Warnings directed as follows:

- Laser - pertaining to exposure to visible or invisible laser radiation
- Electrostatic - pertaining to electrostatic discharge

Laser Safety Information

This product contains a laser-based sensor that is a Class 1 product (as defined by 21 CFR, Subchapter J of the Health and Safety Act of 1968) when used under normal operation and maintenance. Service procedures on the sensor can result in exposure to invisible radiation. Service should be performed only by factory-authorized personnel.

The particle counter has been evaluated and tested in accordance with EN 610109-1:1993, "Safety Requirements For Electrical Equipment for Measurement, Control, and Laboratory Use" and IEC 825-1:1993, "Safety of Laser Products". See Figure 1-1.

WARNING: *The use of controls, adjustments, or performance of procedures other than those specified within this manual may result in exposure to invisible (infrared) radiation that can quickly cause blindness. As a general precaution, avoid any possible exposure to laser radiation by honoring manufacturer seals and warranty stickers .*



Figure 1-1 Example of Laser Warning Label

For further technical assistance, contact Lighthouse at 800-945-5905 (USA Toll Free) or 541-770-5905 (Outside of USA).

2

Introduction

Overview

This operating guide describes how to use the Lighthouse HANDHELD 3016 IAQ Airborne Particle Counter.

The HANDHELD 3016 IAQ has up to six particle-size channels starting at 0.3 μ m with a flow of 0.1 CFM and a touch screen interface. A microprocessor controls all instrument functions. Count data is displayed as cumulative or differential count in Particle Mode. In Mass Concentration Mode, particles are displayed in micrograms per cubic meter.

The model number signifies the minimum particle size measured by the instrument. The number “3016” indicates a 0.3 μ m minimum channel size at 0.1 CFM with up to 6 channels.

The instrument uses a laser-diode light source and collection optics for particle detection. Particles scatter light from the laser diode. The collection optics collect and focus the light onto a photo diode that converts the bursts of light into electrical pulses. The pulse height is a measure of particle size. Pulses are counted and their amplitude is measured for particle sizing. Results are displayed as particle counts in the specified size channel.

Description

Ergonomically designed and lightweight, the Lighthouse HANDHELD 3016 IAQ particle counter is the newest and most advanced handheld particle counters on the market.

The HANDHELD 3016 IAQ displays cumulative or differential particle count data, Mass Concentration data and Temperature/Relative Humidity data on its easy to read 3.8" (9.25cm) touch screen. A rechargeable battery maximizes the HANDHELD's uptime. Data is easily downloaded using LMS XChange software.

The HANDHELD allows you to:

- Set the Sample Time
- Configure the number of samples taken in a given Location

- Sample many different locations
- Save your data for historical data review
- Print data tables using the data transfer software included with your instrument.

HANDHELD Specifications

Table 2-1 Specifications

Size Range	0.3 - 10.0µm
HANDHELD 3016 Channel Thresholds	0.3, 0.5, 1.0, 2.5, 5.0, 10.0 µm
Flow Rate	0.1 CFM (2.83 LPM)
Counting Efficiency	50% (per ISO 21501-4)
Laser Source	Laser diode
Zero Count Level	<1 count / 5 minutes (per ISO 21501-4)
Calibration	NIST Traceable
Count Modes (Particle Mode)	Concentration, manual/automatic, beep, cumulative/differential,
Count Modes (MASS Mode)	Mass Concentration, PM
Data Storage	Up to 3000 sample records, includes particle & environmental data, plus location and time
Communication Modes	RS232 via RJ-45 to PC or printer
Supporting Software	LMS XChange Data Transfer Software
Environmental Sensors Temperature, Relative Humidity	0-150°F (-17.8 to 65.6°C) ±1.8°F @ 77°F, 0-100% ± 5% @ 33%
Touch Screen Display	3.8" (9.25 cm), 320x240
Printer	External thermal printer (optional)
Key Software Features	Historical data review, password protection
Enclosure	High impact injection molded plastic
Sample Output	Internally filtered to HEPA standards (>99.97% @ 0.3µm)
Vacuum Source	Internal pump, flow controlled

Table 2-1 Specifications

Power	Unit: +12VDC; AC/DC Adapter: 100-240V, 50-60Hz
Battery	Li-Ion, removable and rechargeable
Dimensions	8.75"(L) x 5.0"(W) x 2.5"(H) [22.23 x 12.7 x 6.35 cm]
Weight	2.2 lb (1kg)
Operating Temp/RH	50°F to 104°F (10°C to 40°C) / 20% to 95% non-condensing
Storage Temp/RH	14°F to 122°F (-10°C to 50°C) / Up to 98% non-condensing

The manufacturer recommends that your Lighthouse instrument be calibrated annually by a Certified Lighthouse Service Provider in order to ensure that your unit continues to perform within specification.

3

Unpacking, Inspecting and Installation

Unpacking and Initial Inspection

Your instrument is thoroughly inspected and tested at the factory and is ready for use upon receipt. When received, inspect the shipping carton for damage. If the carton is damaged, notify the shipper immediately.

If the carton appears to be undamaged, carefully inspect the instrument for broken parts, scratches, dents, or other damage before using.

Verify the contents of the package against the Packing List.

If anything is missing from the above list, please contact your sales representative at Lighthouse Worldwide Solutions immediately at 1-(800) 945-5905 or techsupport@golighthouse.com.

WARNING: *Do not
ship the instrument with
the battery installed.*

Keep the carton and all packing material for reshipment of the HANDHELD for its annual calibration.

Accessories

You may order several optional accessories to tailor the unit to your needs.

- **External Battery Charger** with AC and car adapters
- **Spare Li-Ion Battery** (removable and rechargeable)
- **Carrying Case**
- **Isokinetic Sample Probe**
- **6 ft. Tubing** (for extending Isokinetic sampling input)
- **Thermal Printer** with cable (AC or battery operated)
- **Validation Documentation**

- **LMS Express software** (standard), an analysis tool that allows the user to:
 1. Manually download data from the instrument
 2. Save data for historical review
 3. Have advanced reporting with standard reports and much more.
- **LMS Express RT software** (optional), an analysis tool that allows the user to perform the following:
 1. Download data from the instrument
 2. Collect data real time
 3. Save data for historical review
 4. Have advanced reporting with standard reports
...and much more.

Please contact Lighthouse Worldwide Solutions at 800-945-5905 (USA Toll Free) or 541-770-5905 (Outside of USA) for details.

Prepare Instrument for Use

Power Requirements

The power adapter input requirement is 100-240VAC, 50-60Hz, 1.25 Amps. Its output is +12VDC, 3A. A power cord and power adapter are included with your HANDHELD 3016 IAQ.

To protect the instrument from voltage spikes, Lighthouse recommends using protected power. Using an uninterruptible power supply (UPS) when the HANDHELD is kept in a stationary location will help prevent damage to the instrument or loss of data in the event of a power outage.

Install the Battery

The HANDHELD comes with a standard rechargeable battery. An optional external battery charger is available; otherwise, the battery recharges in the unit when the unit is plugged into AC power.

Install the battery as illustrated in the following instructions.

1. Make sure that the power switch is in the OFF position and the instrument's power adapter is not connected.
2. Open the battery compartment by sliding the battery compartment door on the bottom of the unit to the left to unlock it. When the door is unlocked, open the door. The hinge is on the right side of the door. See Figure 3-1.

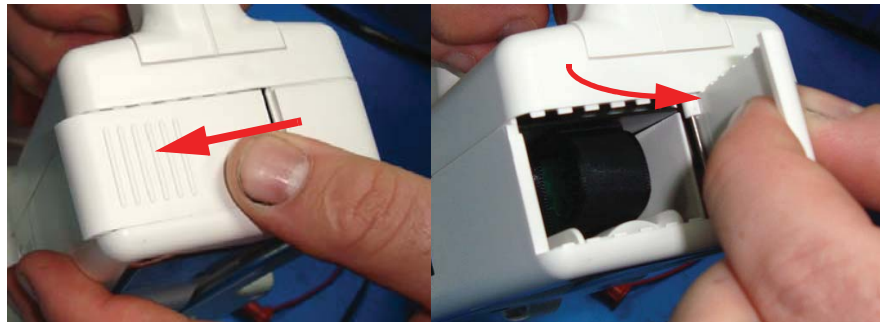


Figure 3-1 Open the battery compartment door

3. Pull the battery release ribbon out of the battery compartment as shown in Figure 3-2.



Figure 3-2 Pull Battery release ribbon out

4. Hold the battery connector side toward the HANDHELD. Place the battery into the compartment, on top of the release ribbon. Push the battery fully into the compartment until it connects and is entirely inside the battery compartment as shown in Figure 3-3.



Figure 3-3 Insert battery into battery compartment

5. Tuck the battery release ribbon over the battery. See Figure 3-4.



Figure 3-4 Tuck battery release ribbon

6. Close the door so that it is flush with the bottom of the HANDHELD. See Figure 3-5.



Figure 3-5 Close the Battery Compartment door

7. Slide the battery compartment door to the right until it clicks and latches as shown in Figure 3-6.



Figure 3-6 Secure the battery compartment door

Connect Power

Connect the power adapter as illustrated in the following steps:

1. Insert the round DC power plug into its receptacle on the left side of the HANDHELD. See Figure 3-7.



Figure 3-7 DC power plug

2. Push the connector in until fully seated as shown in Figure 3-8.



Figure 3-8 Inserting DC power plug.

3. Plug the adapter's AC power cord into the AC power source. The battery will begin and continue to charge until it is fully charged or DC power is removed.

WARNING: *Do not ship the instrument with the battery installed.*

Battery Removal

1. To remove the battery, open the door to the battery compartment by sliding the door to the left to unlatch it as shown in Figure 3-9.

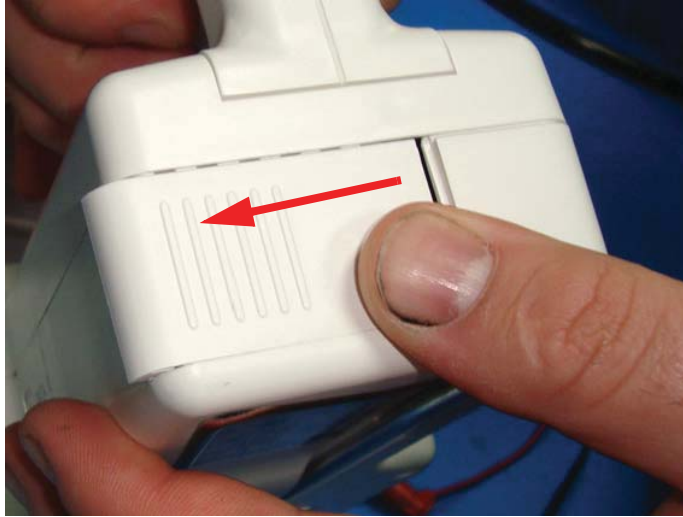


Figure 3-9 Unlatch Battery Compartment door

Note: *Remove the battery if the instrument will be stored for a month or longer. Leaving the battery in during storage will drain the battery to the point where it will not recharge.*

2. Swing the battery compartment door open. See Figure 3-10.

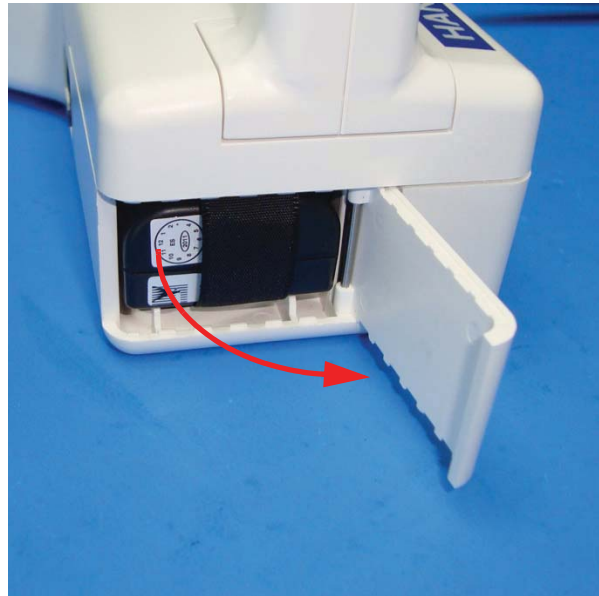


Figure 3-10 Open Battery Compartment door

3. Hold the instrument securely then pull the battery release ribbon outward to disconnect the battery and slide the battery out. Remove the battery. See Figure 3-11.

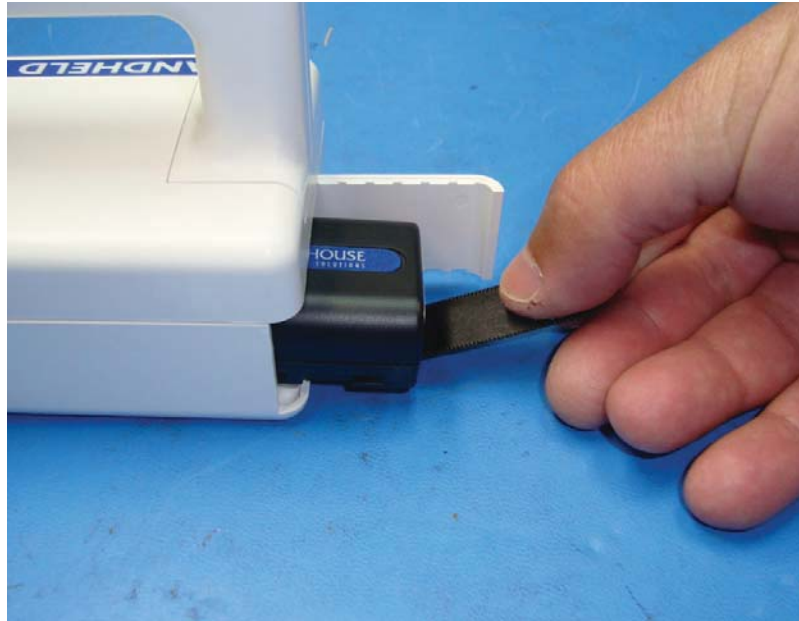


Figure 3-11 Remove Battery

Optional Printer Accessory

An optional external thermal printer can be used with the HANDHELD to print reports directly from the instrument.

Connect the external printer as illustrated in the printer Read Me First, document, #248083378-1, which is included on the Operating Manual CD.



Figure 3-12 HANDHELD Printer

Connecting to an External Computer or Facility Management System

The HANDHELD has the ability to be connected to LMS XChange Data Transfer Software to download its data. LMS XChange software can export data to a *.csv file for historical review.

Note: *The DATA port can be used for the printer or to connect HANDHELD to an external computer. It cannot be used to connect to both at the same time.*

1. To connect to the HANDHELD, insert the RJ-45 end of the HANDHELD data communications cable to the DATA port as shown in Figure 3-13.



Figure 3-13 Connecting RJ-45 data communications cable

2. Connect the other end of the data communication cable to your PC running LMS XChange software.

Please refer to the LMS XChange manual for further information.

4

Operation - Particle Mode

Note: *Operation of the instrument in Mass Concentration Mode is described in the next chapter.*

Using the Instrument

WARNING: *Do not attempt to sample reactive gases (such as hydrogen or oxygen) with this instrument. Reactive gases create an explosion hazard in the instrument.*

Sampling any gas under pressure can damage the instrument and void the warranty.

Sampling any gas that is not the same density as ambient air can result in inaccurate data.

Contact Lighthouse for more information.

This chapter describes how to use the HANDHELD 3016 IAQ Airborne Particle Counter in Particle Mode.

The HANDHELD comes with a charged battery and is ready for use. To start using the instrument, proceed as follows:

1. Insert the battery included with the shipment (see Chapter 2 for instructions.)
2. Position the instrument in the environment to be measured.
3. Remove the protective cap from the inlet tube. To use the provided isokinetic probe, install it by connecting to inlet tube on the top of the instrument. **NOTE: Do not discard the protective cap. It should be placed on the inlet tube any time the instrument is to be moved outside the environment being measured.**
4. The included Temperature/Relative Humidity probe can be attached to the provided receptacle to read environmental data.
5. Set on/off switch found on the left side of the unit to ON.
6. The Start Up screen displays on the LCD.
7. The MAIN screen appears.
8. On the touch screen, press the START button to start the instrument.
9. “STARTING” will display when the pump is initially turned on.

WARNING: *Do NOT allow water, solvents, or other liquids enter the instrument via the inlet tube - the instrument will be damaged and void the warranty.*

Do NOT operate the instrument with the inlet tube capped or plugged - the internal pump will be damaged and void the warranty.

10. When the HANDHELD starts counting, “COUNTING” appears on the display. Particle counts are displayed according to the size of each particle.
11. If the instrument is in AUTO mode with cycles and a hold time, “HOLDING” will display after each cycle and “FINISHED” will display when all the cycles are complete.
12. Press the “STOP” button to stop the instrument before the cycles are complete.

Touch Screen Overview

The HANDHELD incorporates a unique touch screen interface to control and configure the instrument.

Operation Mode

Two modes of operation are available on the HANDHELD 3016 IAQ. The mode is chosen by toggling the PARTICLE/MASS button circled in Figure 4-1. This chapter assumes that button reads PARTICLE. Click the button to change the mode.

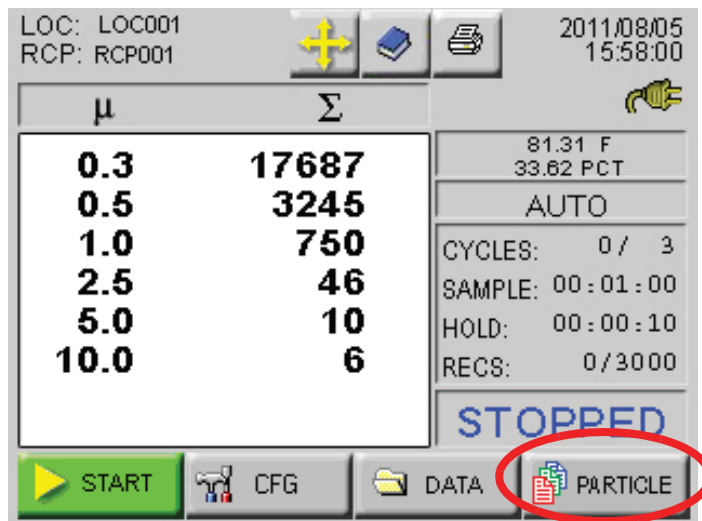
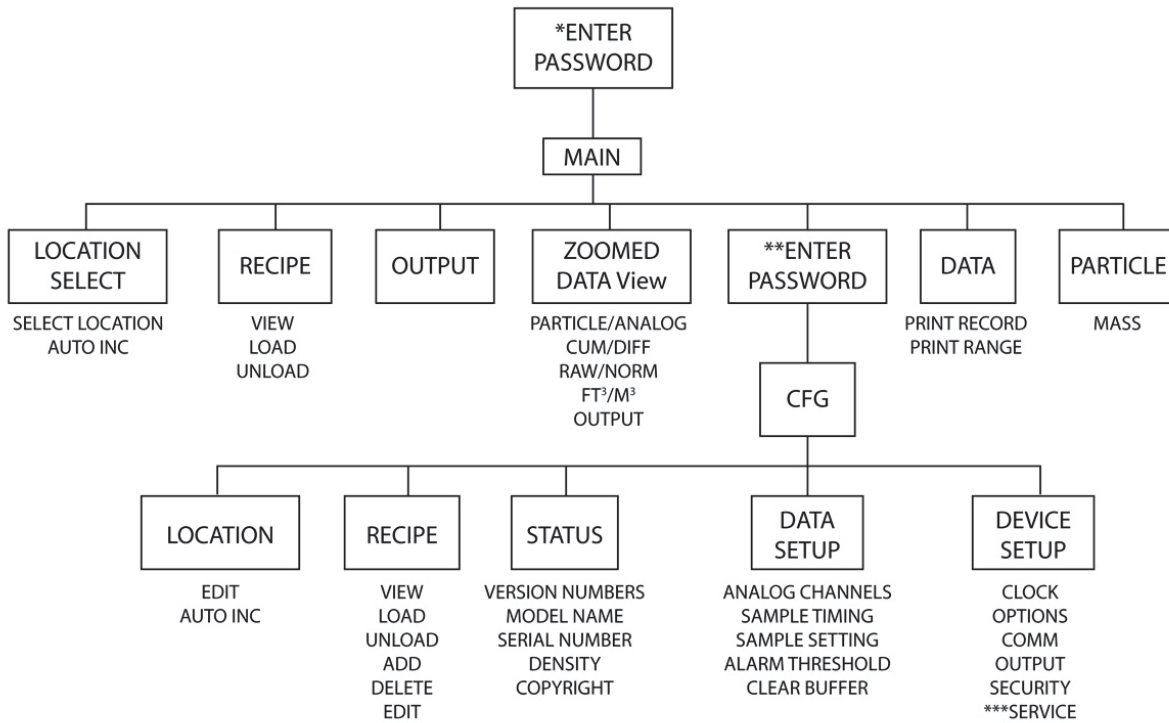


Figure 4-1 Particle / Mass Mode Toggle

Menu Map Particle Mode

This interface allows the user to view and configure the instrument to specific needs and applications. See Figure 4-2.



- * If POWER ON password is enabled.
- ** If CFG password is enabled.
- *** For Authorized Service Provider Only.

Figure 4-2 Menu Map, Particle Mode

MAIN Screen

The MAIN screen gives the user a single snapshot view of the status of the instrument. The instrument can be powered by an external power supply or from a removable battery. When a battery is used, the battery indicator will show the level of the battery charge remaining. See Figure 4-3.

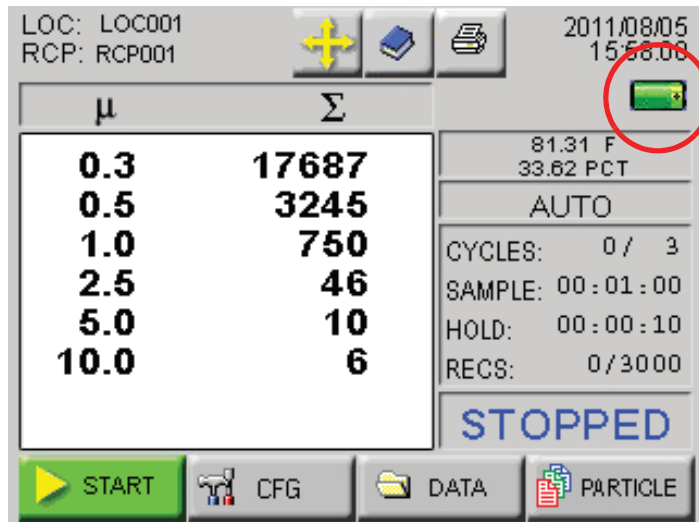


Figure 4-3 MAIN Screen - battery operation

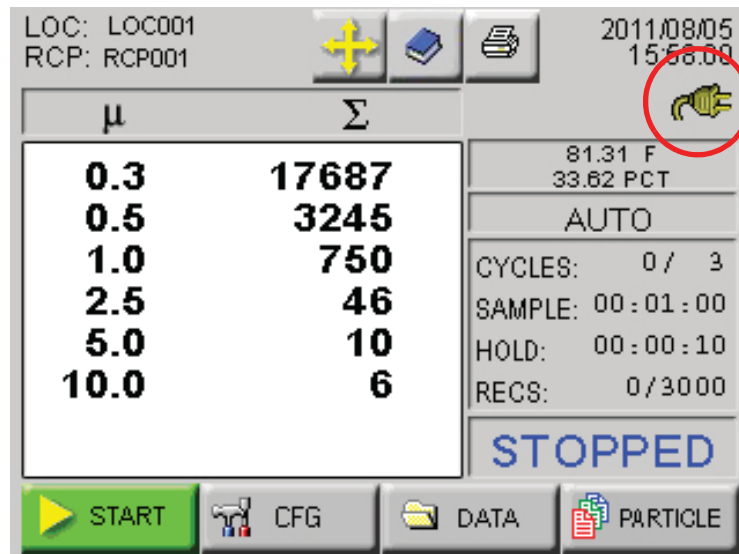


Figure 4-4 MAIN Screen - AC operation

When the AC indicator symbol is displayed, it indicates the instrument is getting its power from an AC source. See Figure 4-4.

The MAIN screen displays the following options and information.

- **LOCATION:** Displays the location that is currently being measured. Up to 200 alphanumeric locations can be configured.



- **LOCATION SELECT button:** Allows user to change location before sampling.



- **RECIPE button:** Allows the user to view, load and unload recipes that have been configured and saved in the recipe data base.



- **PRINT LAST RECORD:** Prints the last recorded sample using the current configuration to determine the type of data printed.

The print configuration is set through the PRINT SETUP button in the Configuration screen. For more details about printing, see the the Configuration section later in this chapter.

- **Date/Time:** Displays the current date and time.
- **Battery Indicator:** Indicates that the instrument is being powered by a rechargeable battery. The amount of battery life left is denoted by the fill inside the battery icon. When the battery is low, the words “BATT LOW!” will appear on the screen and the unit will beep continually until it is plugged into its AC power cord for recharging. See Figure 4-5.

Note: *If the instrument is counting when the “X” appears in the battery indicator, the pump will automatically stop to prevent the battery from discharging completely.*



Figure 4-5 Battery Indicator levels from Full to Empty, left to right



- **AC Indicator:** Indicates that the instrument is being powered with its AC power cord. If the battery is installed, the HANDHELD will charge the battery when the instrument is plugged in.



- **Flow Status:** When the instrument is sampling, the Flow Indicator will display sufficient or insufficient flow.

WARNING: *If the Air Flow is insufficient, turn the instrument off and contact Lighthouse Worldwide Solutions tech support at 1-(800) 945-5905 or techsupport@golighthouse.com.*



- **Service Indicator:** Indicates that the instrument may be in need of service. If wrench displays, please contact your authorized Lighthouse Service Provider for assistance or send an e-mail to techsupport@golighthouse.com.

- **μ:** The mu symbol indicates the particle sizes, in micrometers, configured for the instrument.
- **DATA DISPLAY:** This indicates whether the counts are being displayed in Differential (Diff) mode or in Cumulative (Cuml) mode and when the counts are normalized to ft³ or m³.

81.31 F
33.62 PCT

- **Analog Data:** Gives a snapshot view of the enabled analog channels. (Analog channels are enabled by default.)
- **MODE:** Displays the current mode selected; possible modes are AUTO, MANUAL, CONCEN (Concentration) and BEEP.
- **CYCLES:** Indicates the number of times that the count will be taken at a given location in Auto mode. "1/ 3" indicates that the last completed count was the first of three samples to be recorded at this location. The maximum number of cycles is 999. When set to 0, the unit will run in Auto mode continuously until the STOP button is pressed.
- **SAMPLE:** The Sample Time (hh:mm:ss) is the duration of one counting cycle. The Sample Time will count down on the MAIN screen when the instrument is in AUTO or Manual mode so you can see how much time remains in the sample period. In Concentration mode, the Sample Time will count up to 6 seconds per cycle.
- **HOLD:** Displays the hold time in between cycles. The maximum hold time is 99 hours, 59 minutes, 59 seconds.
- **RECS:** This displays the current number of records stored in the instrument and the total number of records that can be stored. The data buffer is a circular buffer. The HANDHELD can store up to 3000 records. An asterisk (*) will appear in front of counts when the buffer wraps.

Note: *If Hold time is greater than 1 minute, the pump will stop during that time. At the end of the hold time, the pump will restart.*

Note: *There is a one second startup during which the pump is accelerating to full power. During this time, the word "STARTING" will display.*

- **START/STOP:** Press START button on the screen to start counting. When sampling, the instrument will display "COUNTING" in the lower right portion of the screen as shown in Figure 4-6.

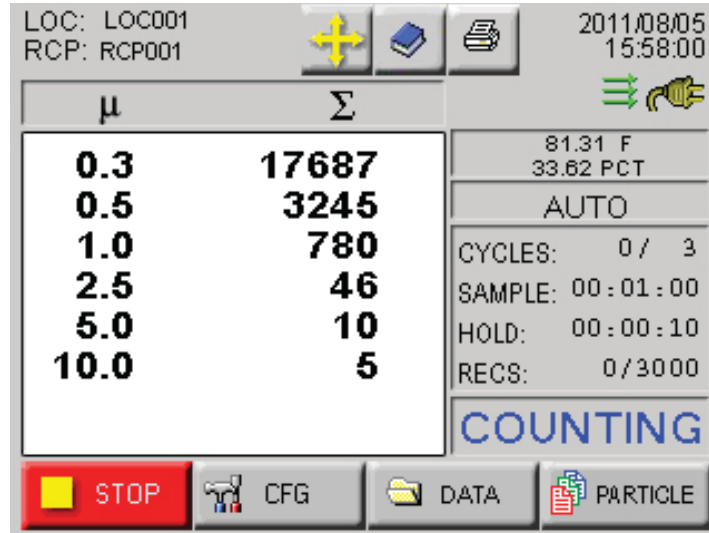


Figure 4-6 Main Screen, Counting mode

Press the STOP button to stop counting; the word "STOPPED" will display.



LOCATION Selection

Changing Locations

The location number for the environment to be measured can be changed by pressing the LOCATION button at the top of the MAIN screen. The following screen will display. See Figure 4-7.

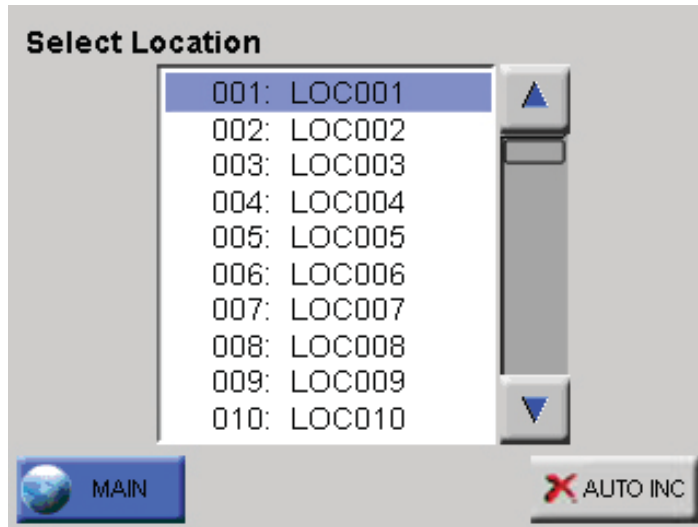
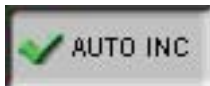


Figure 4-7 Location Select Screen

- The blue highlight indicates which location is currently selected.
- Use the UP and DOWN arrows to select a location. The single arrows will move the cursor up and down by a single line. Locations can also be selected by touching the location name on the screen.
- The AUTO INC button, when activated will allow the user to advance to the next location once the current cycle is completed.
- Press the MAIN button to return to the MAIN screen. Whichever location is currently selected will be the location displayed on the MAIN screen.



Locations in AUTO Mode

When the instrument is in Automatic Mode and the START button is pressed, the instrument will start counting particles automatically according to the SAMPLE time, HOLD time and number of cycles that are configured.

Zoomed Data View

Press anywhere in the Particle Data area to display the Zoomed view as shown in Figure 4-8.

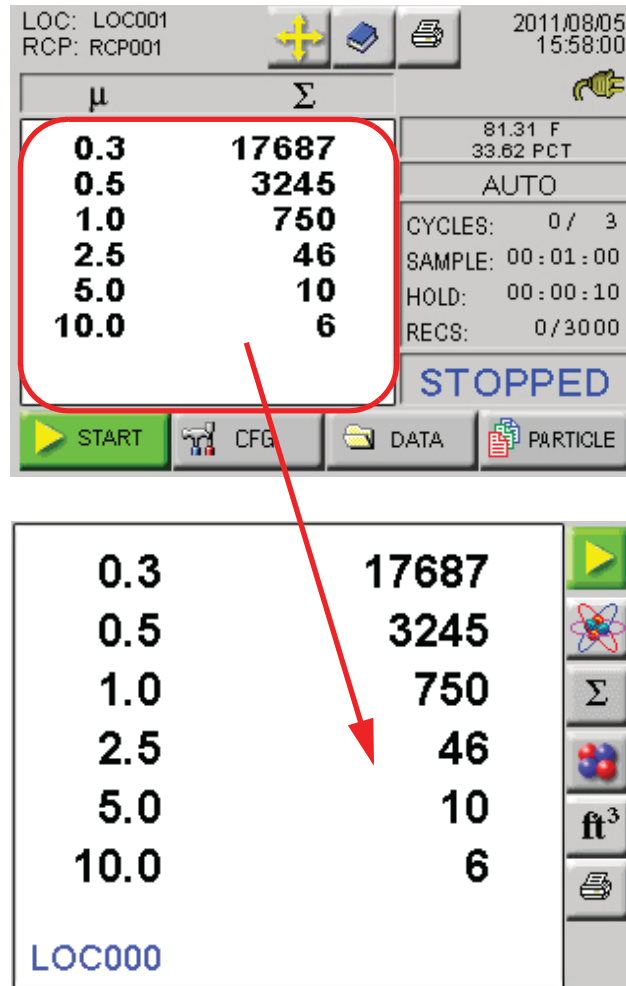


Figure 4-8 Zoomed Data View

In this view, the following functions can be performed using the toggle buttons on the right side bar:

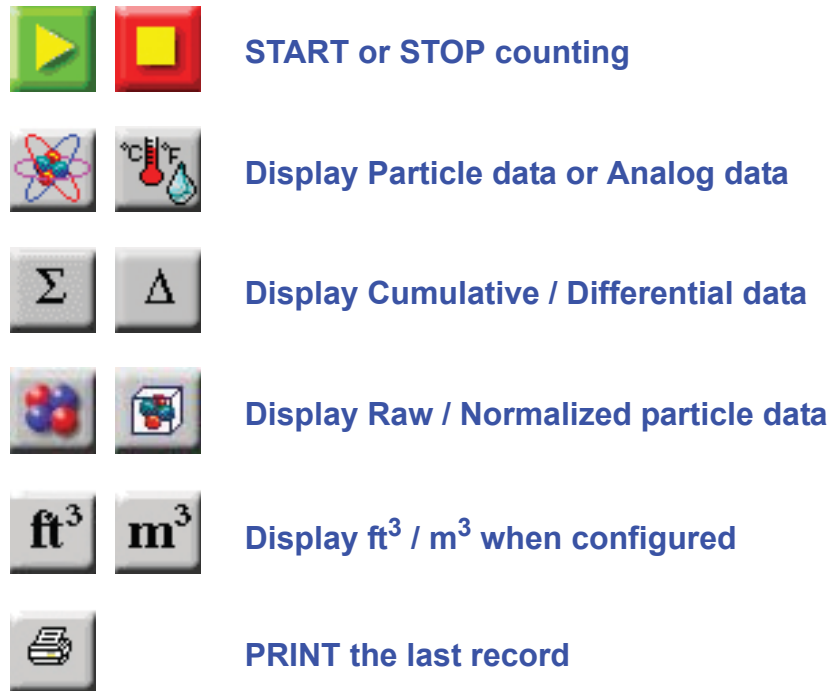


Figure 4-9 Zoomed Data View Buttons

When the instrument is STOPPED or HOLDING, press anywhere in the white data area to return back to the MAIN screen.

CONFIGURATION Screen

Press CONFIG on the MAIN screen to display this screen as shown in Figure .

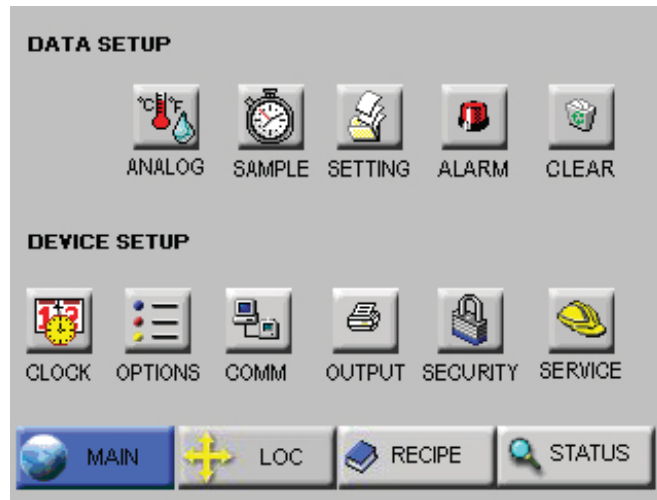


Figure 4-10 Configuration Screen

Data Setup includes buttons to change temperature units for analog channels, set sample record parameters, sample settings, enable/disable alarms and thresholds and clear the data buffer.

Device Setup includes buttons to configure the instrument's date and time, set the LCD contrast, adjust the instrument's beep volume, enable the instrument to AutoStart, set the instrument's communication address, setting print options, enable password restrictions, and/or (with proper authorization) adjust service settings.

DATA SETUP

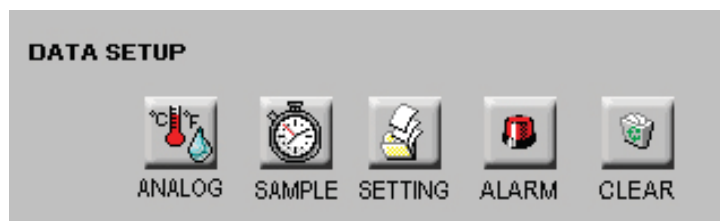


Figure 4-11 Data Setup options



Analog Channels

A Temperature and Relative Humidity probe can be connected to the HANDHELD via a connector on the top of the unit.

Users can select if the HANDHELD displays analog temperature data as Fahrenheit or Celsius by pressing the ANALOG button on the Configuration screen. The Select Temperature Units window displays.

There are two buttons on the Select Temperature Units window. The button displayed shows the units that are currently selected: F for Fahrenheit and C for Celsius.

To change to Celsius, press the C button. To change to Fahrenheit, press the F button. See Figure 4-12 & Figure 4-13.

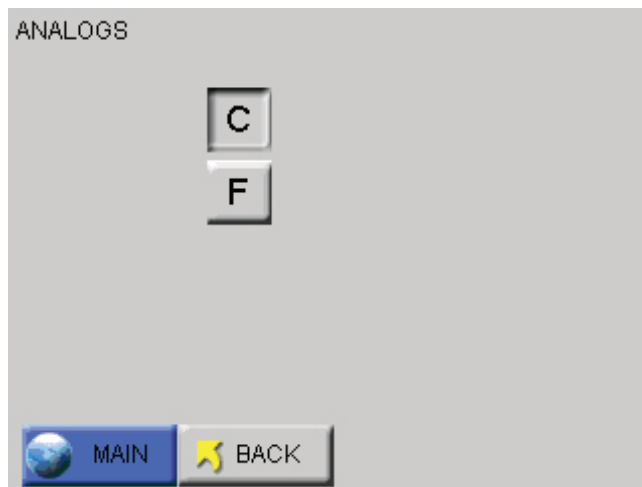


Figure 4-12 Analog Channels - Select Celsius Units

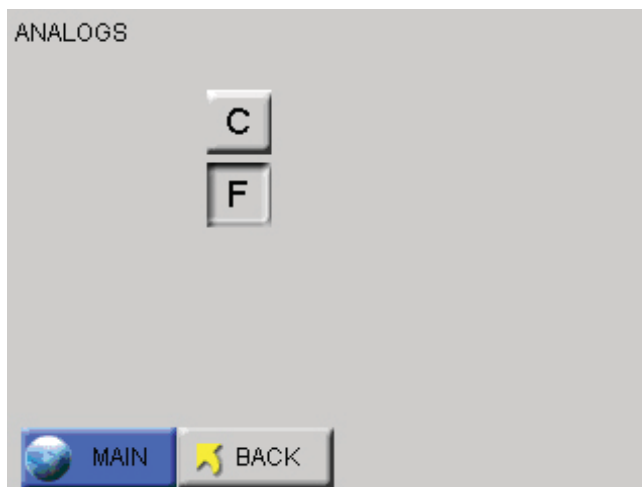


Figure 4-13 Analog Channel - Select Fahrenheit Units

Temperature and relative humidity values appear on the MAIN screen with the units you selected. The values are updated in real time as shown in Figure 4-14.

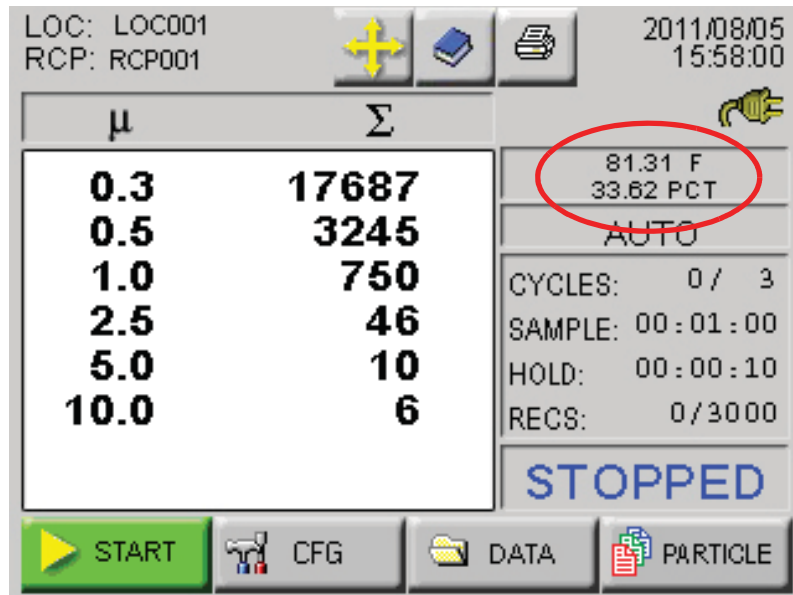


Figure 4-14 Analog data on MAIN screen

When the unit is not counting or when it is holding, you can zoom on the instrument's current Analog data display. Press anywhere in the Particle Data area to bring up the Zoomed Data View, then press the Analog toggle button to display Analog data. See Figure 4-15.

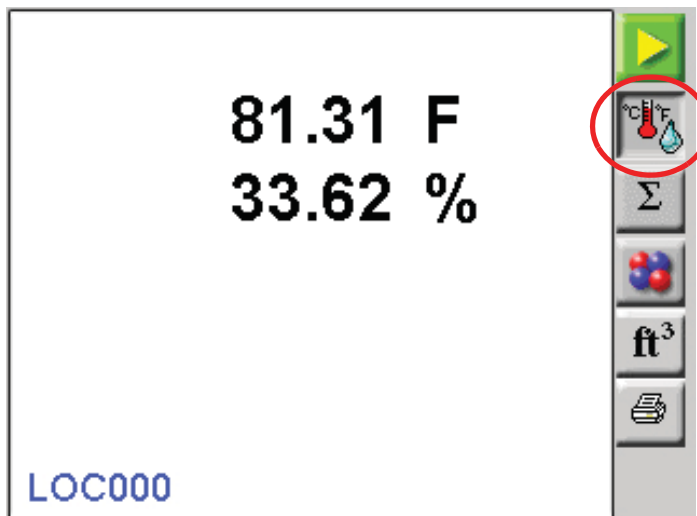


Figure 4-15 Zoomed Data View: Analog data



SAMPLE

From the CONFIG Screen, press SAMPLE to configure the Sample Time and the number of samples to be collected on the Sample screen. See Figure 4-16.

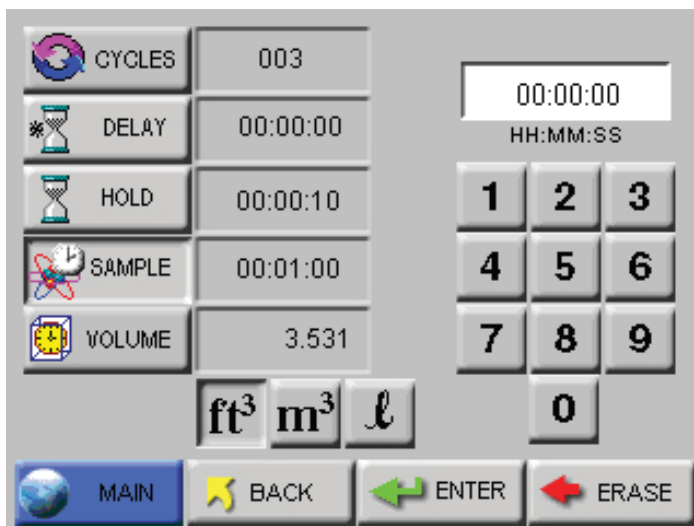


Figure 4-16 Sample Timing Configuration Screen

- **CYCLES:** The number cycles is set to determine how many times the instrument samples the air in a single location. This is used only in AUTO mode. The range is 0 - 999. When Cycles is set to 0, the instrument will continue running samples indefinitely until the STOP button is pressed.

Select the CYCLES button; enter the number of desired cycles using the numeric keypad on the right. Press ERASE to erase a number, if needed. Press ENTER to set the Cycles.

- **DELAY:** The Initial Start Delay (hh:mm:ss) is the time between pressing the START button and the unit actually starting counting.

The Initial Start Delay gives the operator time to exit the area under test so that the measurement is taken under a controlled condition. The maximum delay time is 99 hours, 59 minutes and 59 seconds.

Select the DELAY button; enter the initial delay time in hours, minutes and seconds using the numeric keypad on the right.

After the value is entered, press ENTER.

Note: *The pump starts immediately when START is pressed. In order to operate properly, if a Delay is set, the Delay should not be less than 5 seconds.*

Note: *If the Hold time is set to 00:00:00 in Auto Mode, the instrument will run the samples according to the sample time and the # of cycles, but with no hold time in between cycles.*

The maximum hold time is 99 hours, 59 minutes and 59 seconds. This field will count down to indicate how much time is left for the Hold period.

Select the HOLD button; enter the time in hours, minutes and seconds using the numeric keypad on the right. Press ERASE to erase a number, if needed. Press ENTER to set the Hold Time.

Note: *If the Hold time is greater than one minute, the pump will shut off during the specified hold time.*

- **HOLD:** The Hold Time (hh:mm:ss) is the time between count cycles when the instrument is not counting particles.

Note: *The maximum Sample Time is 23:59:59.*

- **SAMPLE:** The Sample Time (hh:mm:ss) is the duration of one counting cycle. The Sample Time will count down on the MAIN screen when the instrument is in Auto or Manual mode to indicate how much time is remaining in the Sample.

Select the SAMPLE button; enter the time in hours, minutes and seconds using the numeric keypad on the right. Press ERASE to erase a number, if needed. Press ENTER to set the Sample time.

Note: When the particle volume is ft^3 the minimum sample volume is 0.1 ft^3 .

- **SAMPLE VOLUME:** Instead of selecting a specific Sample Time, the instrument can be set to measure a specific Sample Volume in cubic feet (ft^3), cubic meters (m^3) or liters (l). When this is set, the corresponding Sample Time will automatically be set. See Figure 4-17.

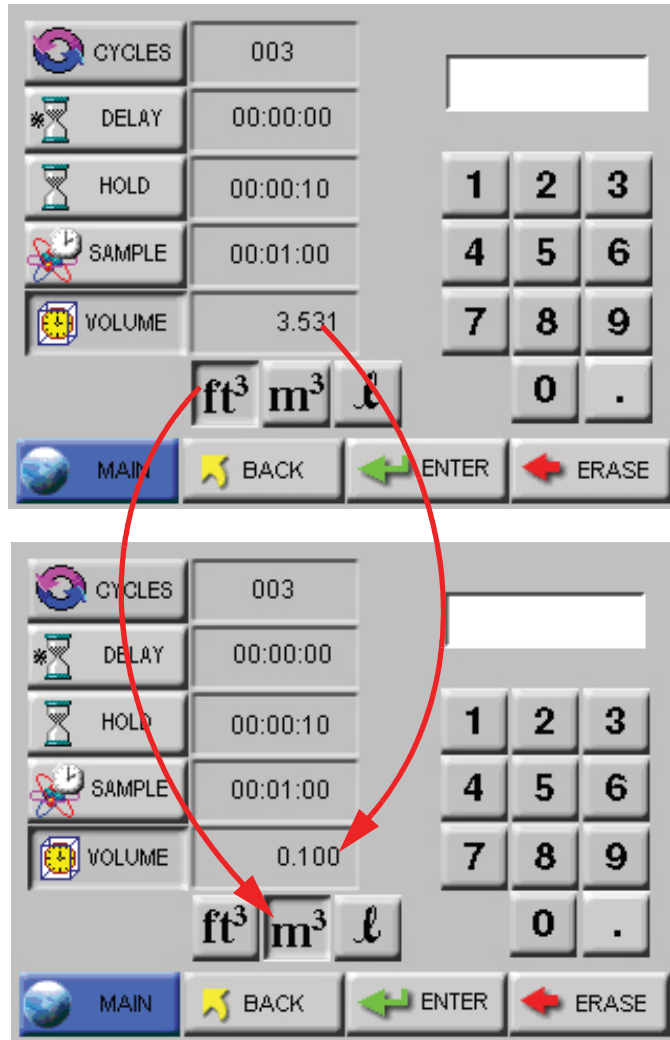


Figure 4-17 Changing Sample Volume unit of measure

Note: If the particle volume is liters or m^3 , sample volume is displayed in liters.
If the particle volume is cubic feet (ft^3), the sample volume is displayed in cubic feet (ft^3).

Press BACK to return to the Configuration screen or press MAIN to return to the MAIN screen.



SETTINGS

The instrument can be configured to count in different modes and formats as shown in Figure 4-18.

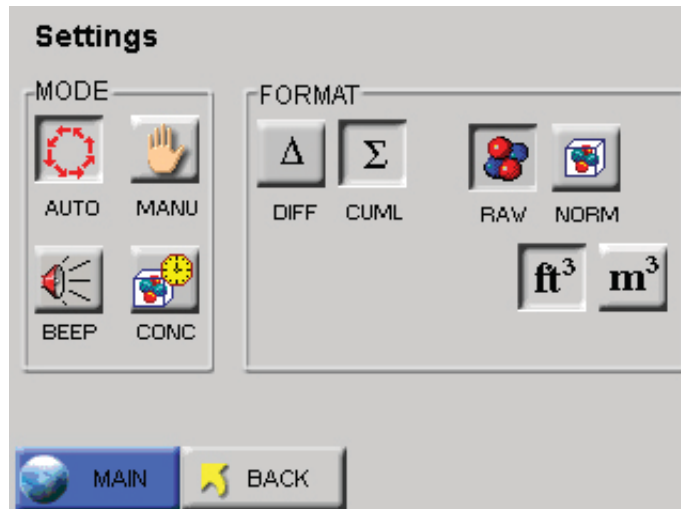


Figure 4-18 Sample settings screen

COUNT MODE

The following modes are available: Auto, Manual, Beep and Concentration.

- **AUTO** - When the instrument is in Automatic Mode and the START button is pressed, the instrument will start counting particles automatically according to the Sample Time, Hold Time and the number of Cycles that are configured. If Cycles are set to 0, the instrument will continue indefinitely in Auto Mode until the STOP button is pressed.
- **MANU (Manual Mode)** - When the instrument is in Manual Mode, it will start counting when START is pressed and stop at the end of one programmed Sample Time.
- **CONC (Concentration Mode)** - When the instrument is in Concentration mode, it gives a calculated value of the concentration of particles in a volume of air, measured and displayed on the MAIN screen in either counts per cubic foot or per cubic meter.

Note: *The sample time for Auto, Manual, and Beep modes count down and the sample times for Concentration mode count up.*

Counting starts when the START button is pressed and it will continue until the STOP button is pressed. The sample time for Concentration mode is six seconds. As the sample time on the MAIN screen counts from one to six, the particle counts are updated continuously.

Concentration data will be recorded and can be viewed in the Data screen and on the printouts.

Note: *BEEP mode only works with CUMULATIVE data and for Sample Times greater or equal to 6 seconds.*

- **BEEP** - In this mode, the instrument is pre-configured to beep according to the alarm threshold set in Alarm Configuration and the instrument's sample time if the instrument is set to collect cumulative data. Counting starts one second after the START button is pressed and will continue until the STOP button is pressed.

If no channel is set for alarming and BEEP mode is selected, the smallest channel size will be automatically selected and its alarm threshold will be used to trigger the alarm.

Note: *BEEP mode only works with CUMULATIVE data.*

If alarming is enabled on more than one channel size, only the smallest channel size will be used to trigger the alarm in BEEP mode. Larger channel sizes will be ignored.

Note: *If BEEP mode is set to one count, the beeps may not be for every single count.*

The data will be recorded based on the set sample time and hold time and can be viewed in the View Buffer and on the printouts. There will be no indication on the record, however, that the data was saved while the instrument was in BEEP mode.

Geiger Counter Mode

While in BEEP mode the instrument can be set to beep 1 to 4 beeps per second depending on the number of particles the instrument has counted per second.

To set up the instrument for Geiger Counter Mode:

1. Enable BEEP Mode.
2. Set the smallest particle channel to 1.

In Geiger Counter Mode the instrument will beep from 1 beep up to 4 beeps per second if it counts from 1 particle up to 4 particles per second. The maximum beeps per second the instrument can emit are 4 per second even if the instrument counts 100 particles per second.

The value set in the smallest particle channel's alarm is the trigger for a single beep per second. If the smallest particle channel is set to 2, the instrument will beep once every second for every 2 particles the instrument counts per second.

PARTICLE Display

Data on the instrument can be displayed in **Differential** (DIFF) or **Cumulative** (CUML) counts.

For example, the cumulative count for the 1µm channel is the sum of that channel's count + 2.5µm count + the 5µm count.

The differential count for the 1µm channel is the number of particles between 1µm and 2.5µm.

The data displays on the MAIN screen according to whichever is selected (DIFF or CUML).

The data format is either Raw (RAW) or Normalized (NORM). **Raw** data displays the actual number of particles counted. **Normalized** data shows particle concentrations calculated from the raw data based on the settings chosen (ft³ or m³).

$$\text{Volume of Air} = \text{Sample time (minutes)} \times \text{FlowRate (CFM)}$$

$$\text{Normalized Data} = \text{Number of Particles/Volume of Air}$$

Press BACK to return to the Configuration screen or press MAIN to return to the MAIN screen.



ALARM

The user can enable alarming on specific channels as illustrated in Figure 4-19.

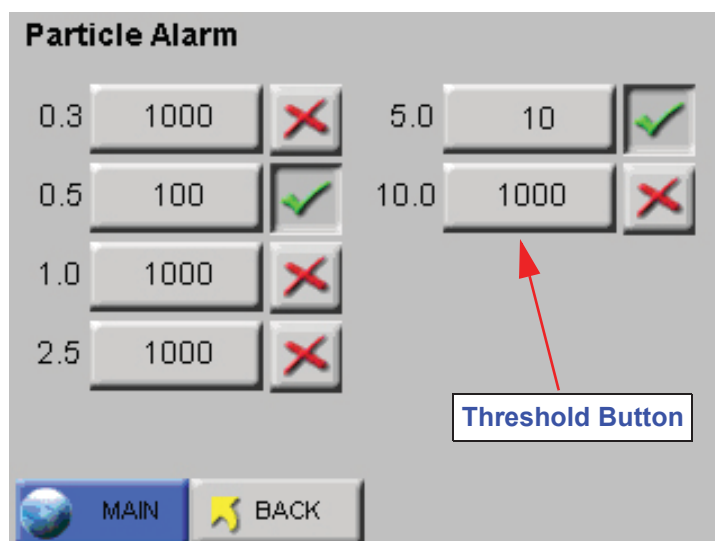


Figure 4-19 Particle Alarm Configuration, 2 channels enabled

Note: *Alarming is only applicable for AUTO and MANUAL mode. It applies only to Raw particle counts even if the instrument is displaying Normalized data.*

If the instrument is set to Differential data, the alarm threshold will apply to the differential counts.

If the instrument is set to display Cumulative data, the alarm threshold will apply to the cumulative counts.

To enable the alarming for any channel, press the “X” next to that channel. When a checkmark is displayed, that channel is enabled for alarming. Press the checkmark to disable the alarming for that channel.

Alarm Threshold

Press the threshold button next to the enabled channel in order to set the alarm threshold for that channel. See Figure 4-20.

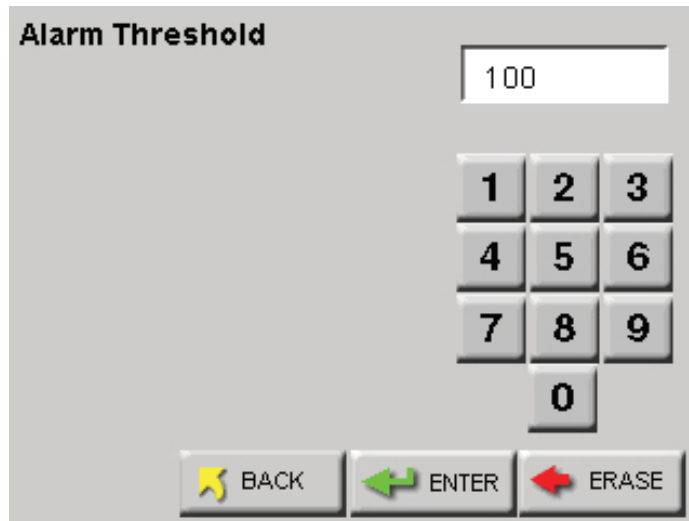


Figure 4-20 Configure Alarm Threshold

Enter the desired alarm threshold for the selected particle channel, in number of particles, then press ENTER. The threshold value will be updated on the Particle Alarm screen as shown in Figure 4-21.

Note: Alarms are triggered per sample record. At the end of the sample time, the alarms reset.

Press BACK to return to the Configuration screen or press MAIN to return to the MAIN screen.

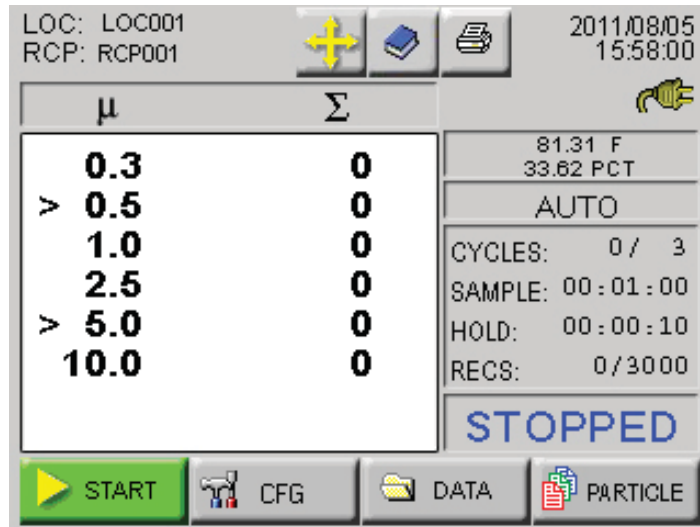


Figure 4-21 MAIN screen with 2 channels enabled for alarming

Note: To receive alarms, the Sample Time must be greater than 1 second.

When a particle channel that is enabled for alarming goes into alarm, the selection cursor (>) and the channel size is highlighted in red. See Figure 4-22.

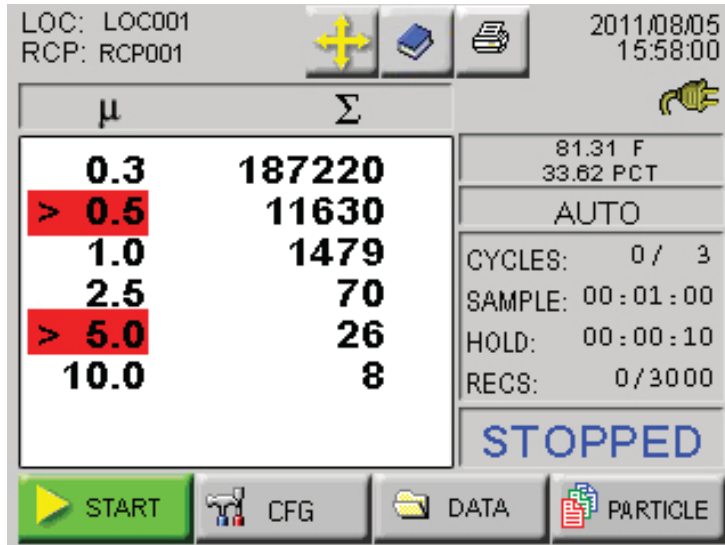


Figure 4-22 Channel in Alarm

Alarm Acknowledge

Note: *If alarms are enabled on two channels, when the user presses the Alarm Acknowledge button after the first channel goes into alarm, the alarm will not sound if the second channel's threshold is reached within the sample period.*

When the instrument beeps in response to the Alarm and Threshold settings, it can be silenced by tapping anywhere on the screen while the unit is sampling.

After acknowledging the alarm, the alarm count will reset when the next sample cycle begins.



Clear Buffer

Press the Clear Buffer button to clear the instrument's data buffer. See Figure 4-23.



Figure 4-23 Clear Buffer message screen

Press OK to clear the data or press Cancel to exit screen without clearing the data.

DEVICE SETUP

Device Setup includes setting the instrument's date and time, adjusting the instrument's LCD contrast or beep volume, aligning the touchscreen, enabling autostart, setting the instrument's communications address, setting print options, enabling password restrictions, viewing the instrument's current status, and/or (with proper authorization) adjust service settings. See Figure 4-24.

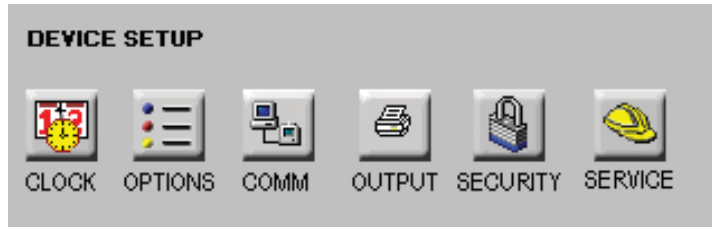


Figure 4-24 Device Setup options



CLOCK

Use the Clock screen to set the instrument's date and time. See Figure 4-25.

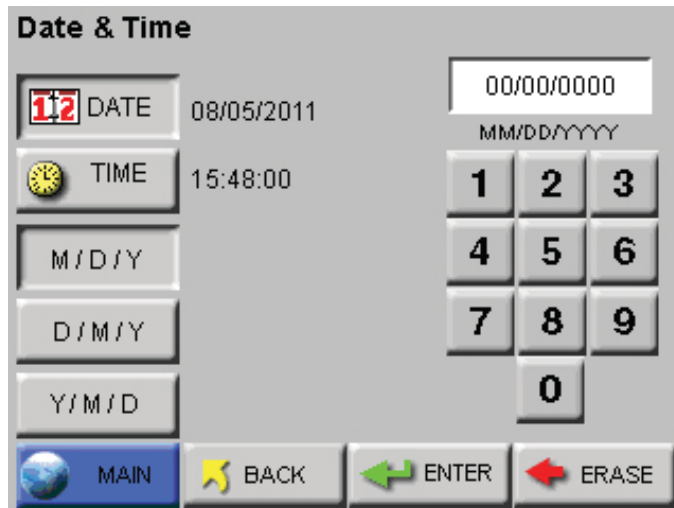


Figure 4-25 Date & Time Configuration Screen

Set the instrument's Date by entering values for the desired month, day and year and then press the ENTER button.

Note: *M/D/Y is the default date format.*

Change the Date's format by pressing the M/D/Y button to display the date with the month first. Alternatively press the D/M/Y button to display the Date with the day first or press the Y/M/D button to display the date with the year first. See Figure 4-26 & Figure 4-27.

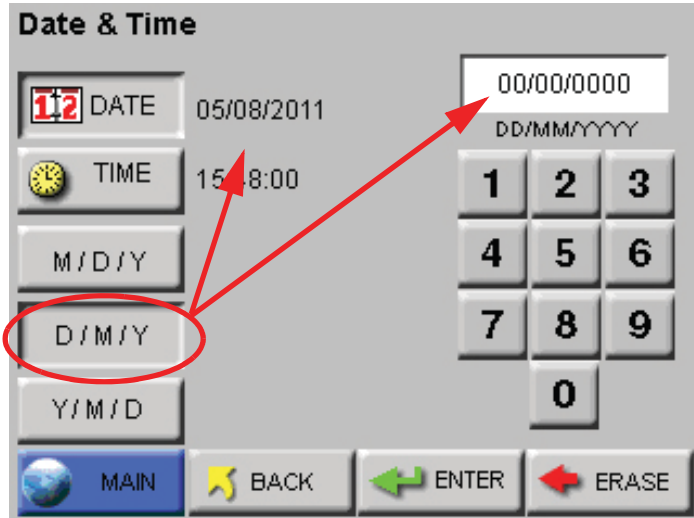


Figure 4-26 Date Option: Day first

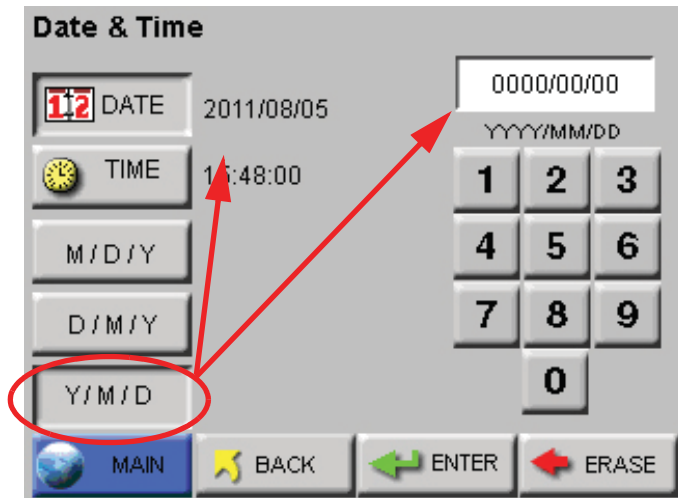


Figure 4-27 Date Option: Year first

Set the instrument's Time by pressing the TIME button as shown in Figure 4-28.

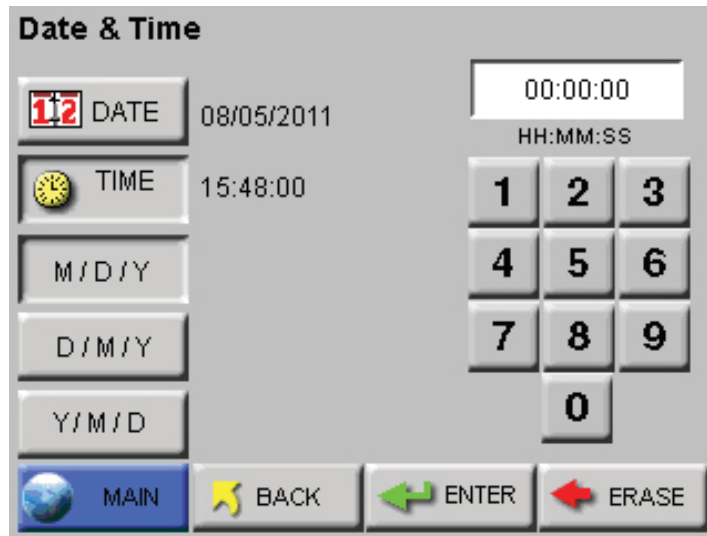


Figure 4-28 Configuring TIME

Enter the desired Time in hours, minutes and seconds then press ENTER to save the new time.

Press BACK to return to the Configuration screen or press MAIN to return to the MAIN screen.



OPTIONS

Several optional configuration settings are found on the OPTIONS screen. See Figure 4-29.

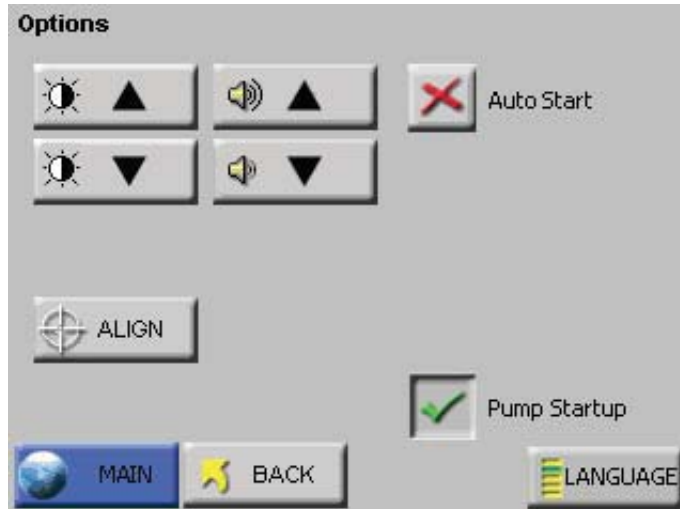


Figure 4-29 Options Configuration screen



CONTRAST ADJUST

The contrast/brightness of the LCD screen can be adjusted by pressing the first set of UP and DOWN arrows.



AUDIBLE BEEP ADJUST

The audio level of the BEEP can be adjusted by pressing the second set of UP and DOWN arrows.

ALIGN TOUCH SCREEN

The ALIGN button allows you to re-align the touch screen so the locations that you touch on the screen correspond to the expected button or function.

- Press the ALIGN button.



WARNING: *Be careful to touch the screen at the specified locations only. If you touch the screen elsewhere during this process, you will align the screen incorrectly.*

- The following screen appears. Touch the circle in the lower left corner as shown in Figure 4-30.

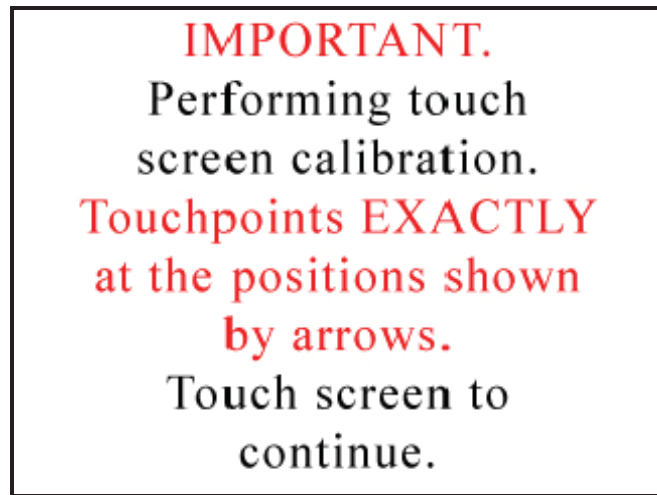


Figure 4-30 Alignment Step 1

Note: *Using a PDA Stylus may give more accuracy to the touch screen interface.*

- Touch the circle in the upper right corner. See Figure 4-31.

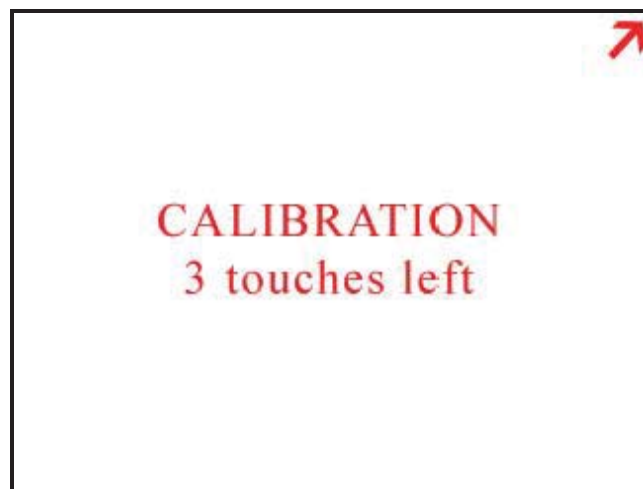


Figure 4-31 Alignment Step 2

- Touch the circle in the lower right corner as shown in .

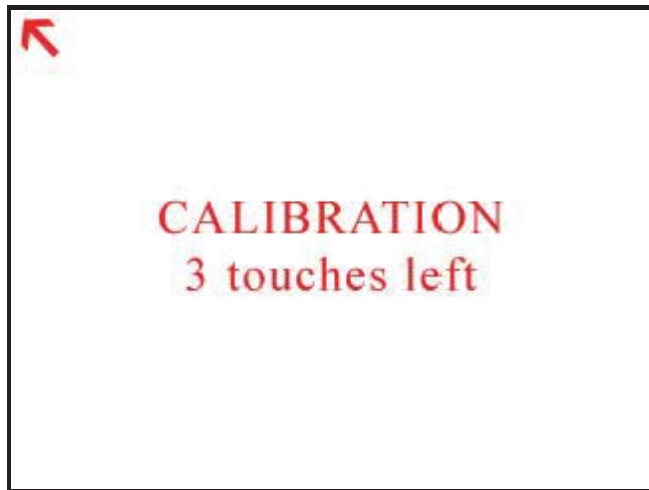


Figure 4-32 Alignment Step3

- Press anywhere inside the rectangle to when you are ready to complete aligning the screen. See Figure 4-33.

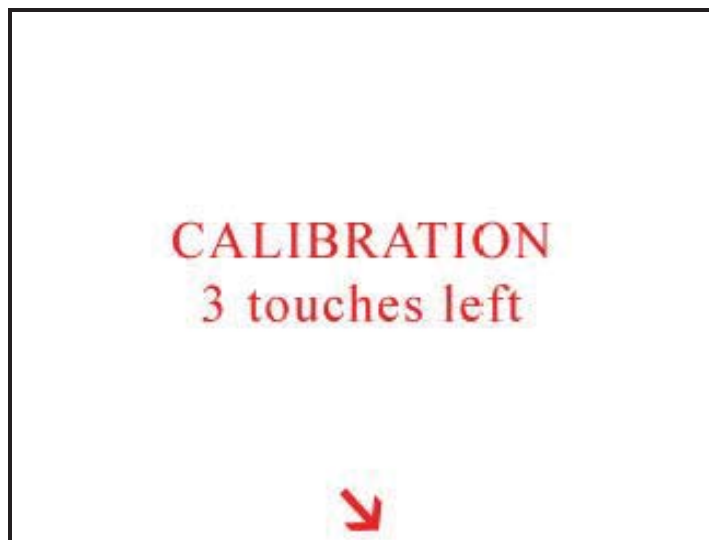


Figure 4-33 Alignment Step 4

- The unit will save the settings and display the MAIN screen. See Figure 4-34.

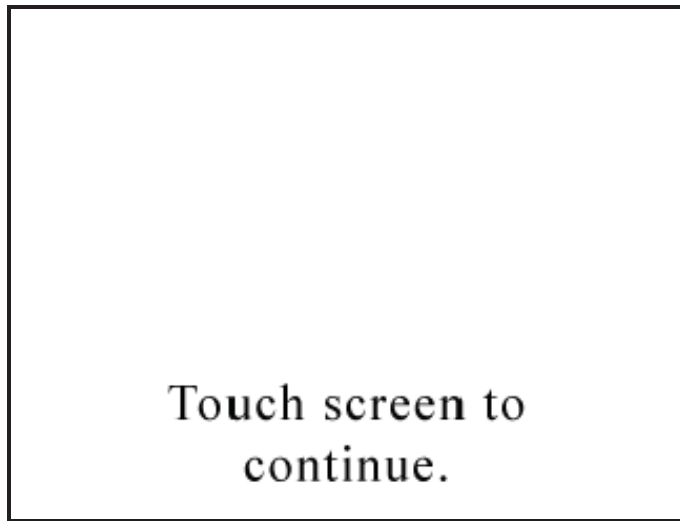


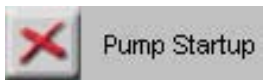
Figure 4-34 Calibration Saved Screen



Autostart Mode

Note: *When Autostart mode is enabled, set the Delay time to at least 5 seconds or enable the 5 Sec Startup in CFG Options.*

If Autostart mode is enabled and the instrument is powered on (or regains power after a power outage), the instrument will immediately begin sampling based its configured mode, delay, start, and hold times.



Pump Startup

This is ON by default and sets a five-second pump ramp up time at the beginning of the first sample, or at the beginning of all samples if the HOLD time is greater than one minute, to stabilize the laser and air flow. This setting should be left in the default mode unless special applications, such as “surface scans”, require it to be disabled.



LANGUAGE

Pressing the LANGUAGE button allows the user to change the operating language displaying the screen shown in Figure 4-35.



Figure 4-35 Operating Language Selection Screen

Press the desired language button then BACK or MAIN. The default is English.



COMM ADDRESS

When the HANDHELD is connected to a data collection system or daisy chained at the end of a chain of RS-485 instruments, the instrument's COMM address is used to identify it.

LMS XChange will search for the instrument by the COMM Address specified on the Communication screen shown below. COMM addresses range from 1 to 63.

For RS-485 communications, each device on a multi-port chain must have a unique address.

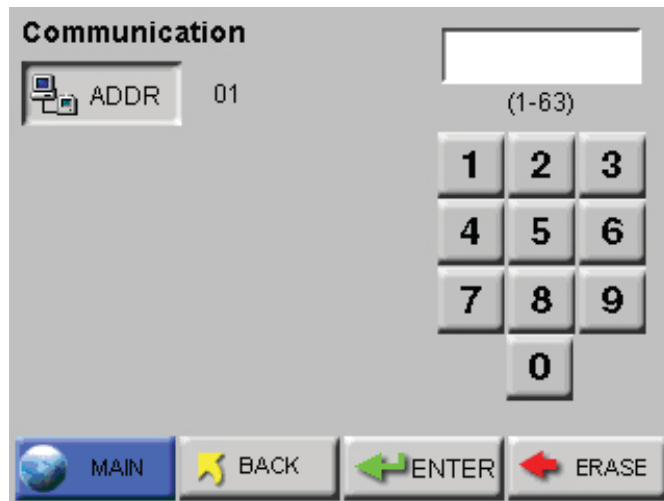


Figure 4-36 COMM Address Configuration screen

Set the COMM Address by using the numeric keypad to select the address; press ERASE to erase a number, if needed. Press ENTER to accept the value. See Figure 4-36.

Press BACK to return to the Configuration screen or press MAIN to return to the MAIN screen.

OUTPUT SETUP

The Print configuration has several options for printing the data that the user sets on the Printer Setup screen shown in Figure 4-37.

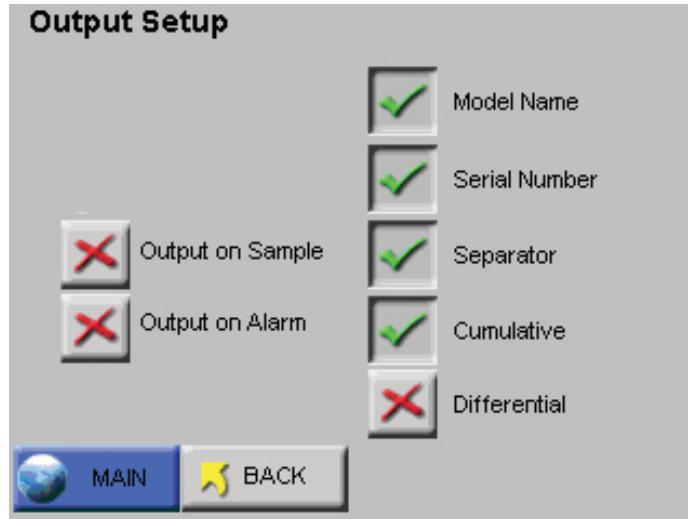


Figure 4-37 Printer Setup Screen

- **Output on Sample / Output on Alarm** - When **Output on Sample** is enabled, a single record will print at the end of every sample.

When **Output on Alarm** is enabled, a single record printout will print at the end of any sample that experiences an alarm condition.

- **Model Name** - When enabled, the Model name of the instrument will print in the header of all printouts.
- **Serial Number** - When enabled, the Serial Number of the instrument will print in the header of all printouts.
- **Separator** - When enabled, a line separator will print after the Model Name and Serial Number in the header of all printouts.
- **Differential / Cumulative Toggle** - This toggle option specifies how the data will appear on the printouts.

Note: *You can select both Differential and Cumulative printing at the same time. For normalized values with more than 8 digits, only the whole number will be printed.*

Press BACK to return to the Configuration screen or press MAIN to return to the MAIN screen.



SECURITY

To restrict access to the instrument and/or configuring the instrument, the HANDHELD has two different password levels. See Figure 4-38.

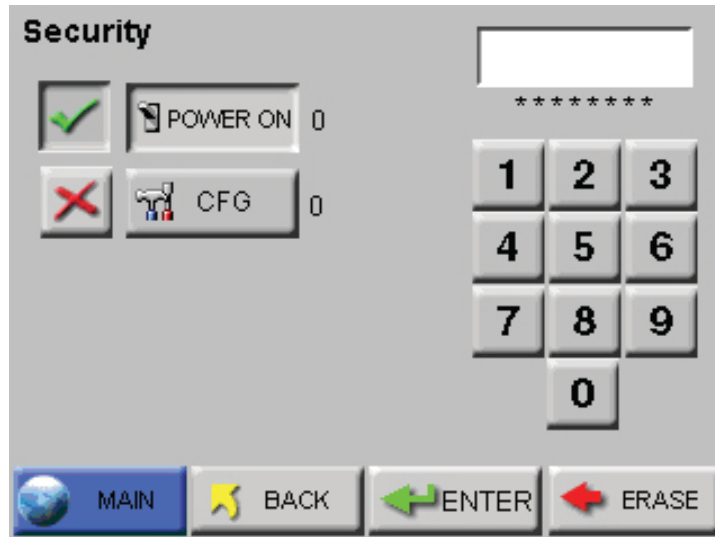


Figure 4-38 Security Password Configuration Screen

To restrict who can operate the instrument, enable the POWER ON password. When the POWER ON password is enabled, the user will be required to enter the correct password each time the instrument is turned on.

To restrict who can configure the instrument, enable the Configuration (CFG) password. When the Configuration password is enabled, the user will be required to enter the correct password to access the Configuration screen.

- To set the password for the POWER ON, select the POWER ON button, then type in a password using the numeric keypad. Press the ERASE button to delete the last character, if needed.
- Press ENTER to save.
- To set the Configuration (CFG) password, select the CFG button, then type in a password using the numeric keypad.
- Press the ERASE button to delete the last character, if needed.
- Press ENTER to save the changes.
- Press the “X” button to enable either or both passwords. The “X” changes to a check mark, indicating the password is enabled.

Press BACK to return to the Configuration screen or press MAIN to return to the MAIN screen.

POWER ON PASSWORD

WARNING: *Be sure to record the unit's passwords in a safe place. If the password is lost or forgotten, contact Lighthouse technical support for assistance. The unit may have to be returned to the factory to reset the password.*

To require that a password must be entered before the instrument can be used, enable the POWER ON password. See Figure 4-39.

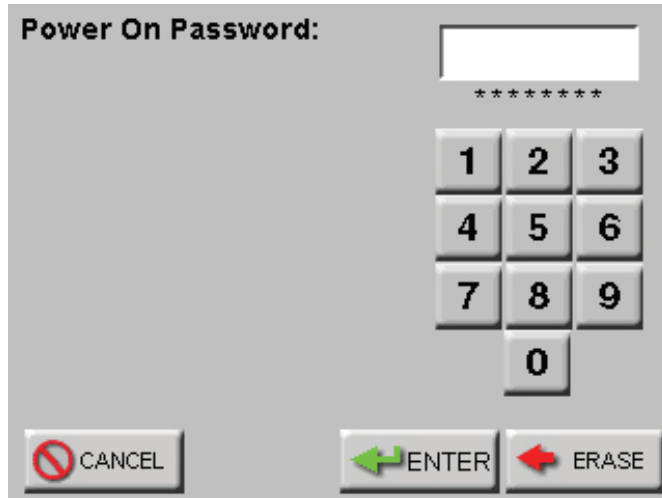


Figure 4-39 POWER ON Password Access Screen

When the POWER ON password is enabled, you will see a password access screen just after you turn the unit on. The instrument will remain locked until the correct password is entered.

CONFIGURATION PASSWORD

The Configuration password prevents unauthorized access to the Configuration screen. See Figure 4-40.

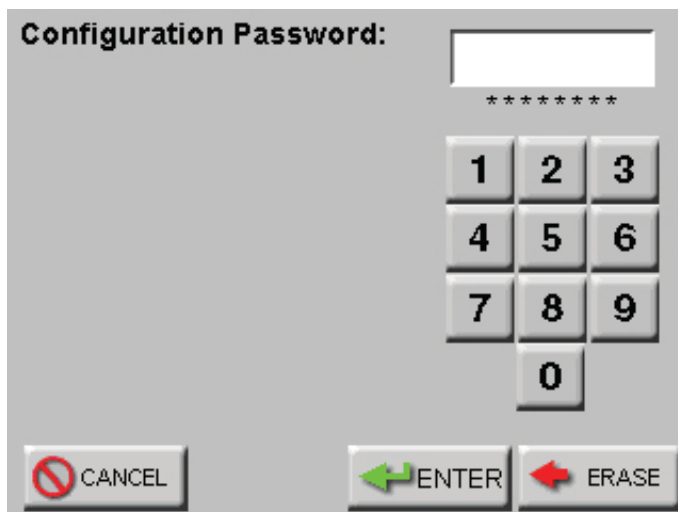


Figure 4-40 CONFIGURATION Password Access Screen

SERVICE



This section of the Configuration screen is reserved for Lighthouse Authorized Service Providers only. The correct service password must be entered to access this area.

STATUS



Touching the STATUS button displays the instrument programmed version of the various firmware modules. This information is useful when contacting Lighthouse Technical Support personnel. See Figure 4-41.

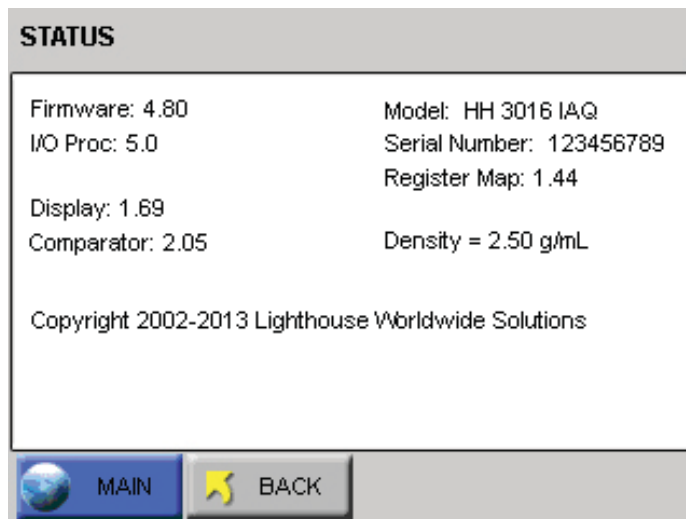


Figure 4-41 HANDHELD 3016 STATUS Screen

RECIPE

Selecting the RECIPE button displays the Recipe setup screen. See Figure 4-42.

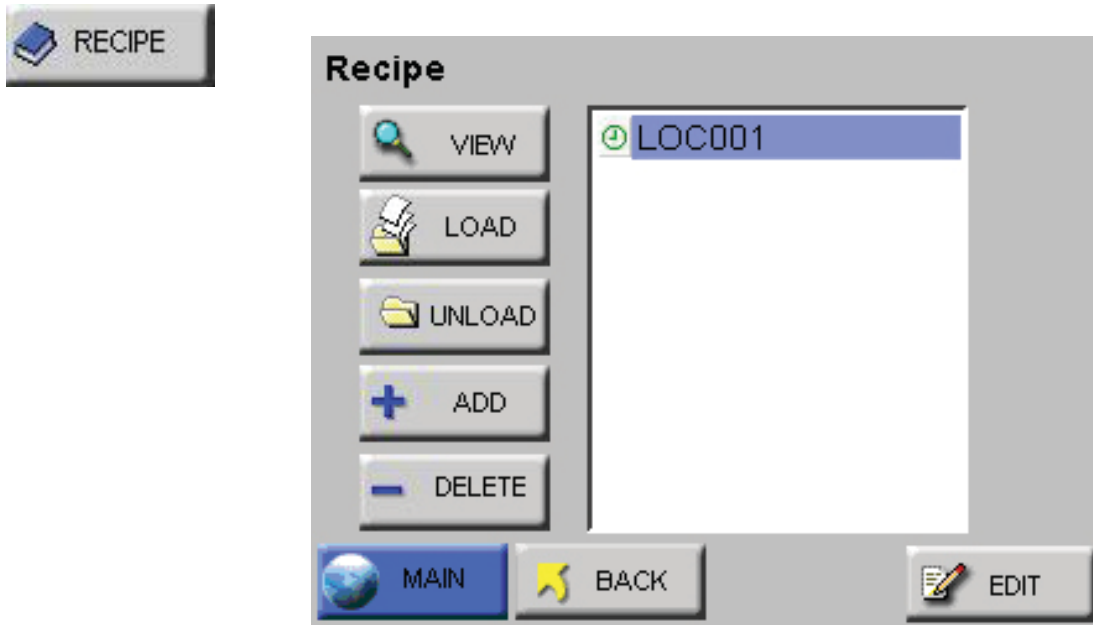


Figure 4-42 Recipe Setup Screen

The Recipe feature allows the user to save instrument settings for sampling and reports in a database that can store up to 50 recipes.



Selecting the ADD button displays the RECIPE text screen. See Figure 4-43. The recipe can be named using up to 12 characters.

Note: *If the location selected is already assigned to another recipe or if there are no available free locations, the user will not be able to add a new recipe. The "Add" button will not be displayed.*

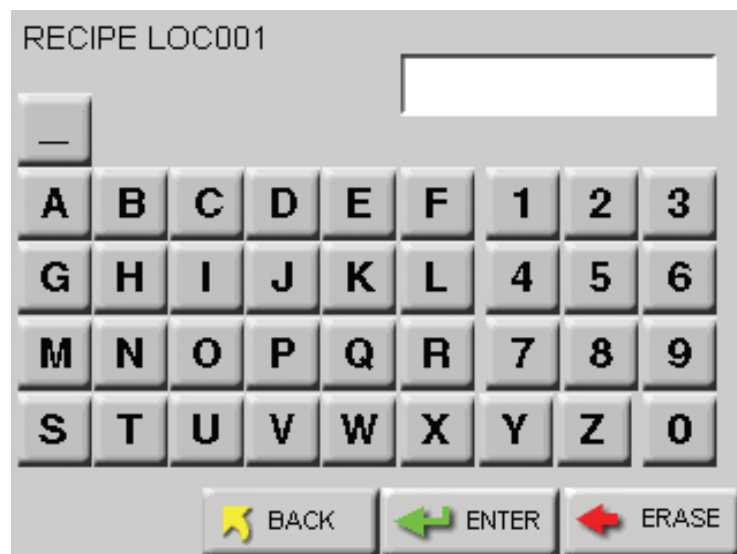


Figure 4-43 Recipe Name Screen

Pressing the ENTER button will add the recipe to the database and display the recipe CFG screen as shown in Figure 4-44. Each option allows the user to configure the instrument to the current recipe.

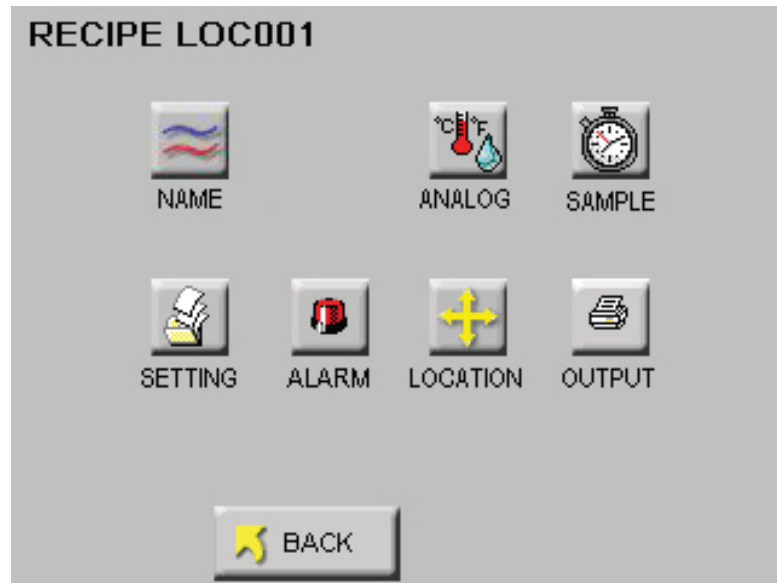


Figure 4-44 Recipe Configuration

Press the BACK button to save the settings and return to the RECIPE screen.



The VIEW button displays the current settings for the highlighted recipe. See Figure 4-45.

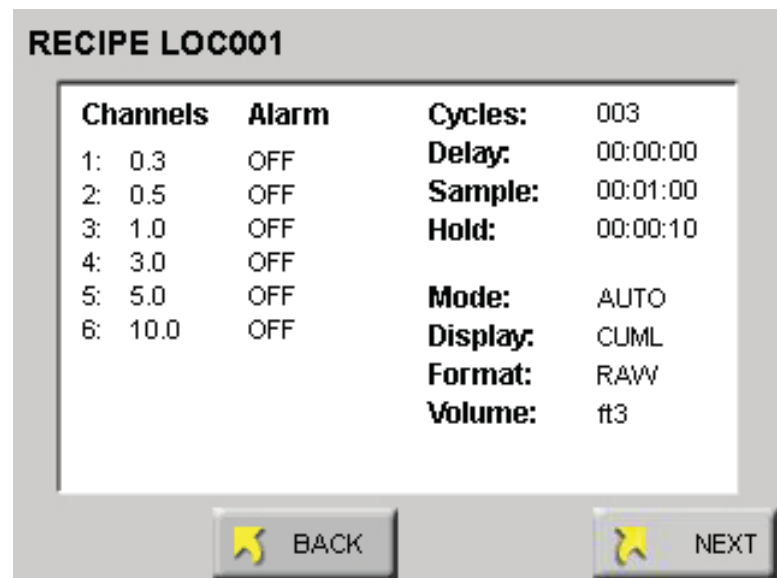


Figure 4-45 Recipe - Channel Settings

Press the NEXT button to view the analog and output settings. See Figure 4-46.

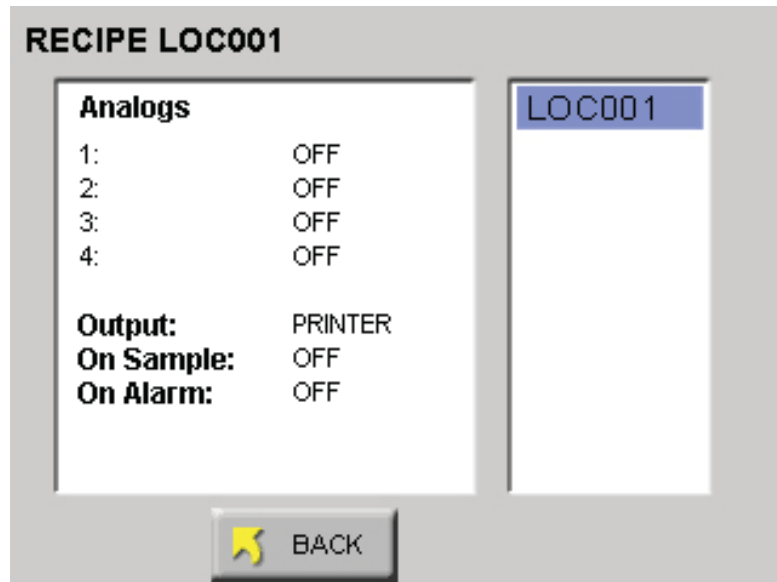
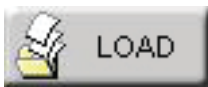


Figure 4-46 Recipe - Analog & Output Settings



Pressing the EDIT button on the main RECIPE screen will allow the user to change settings on the highlighted recipe.



The LOAD and UNLOAD buttons add or remove the highlighted recipe as the instrument's current operating configuration.



The DELETE button will delete recipes from the database.

LOCATION

The HANDHELD allows up to 200 different locations and associated alphanumeric labels.



Press the LOC button on the Configuration screen to display the Select Location screen as shown in Figure 4-47.

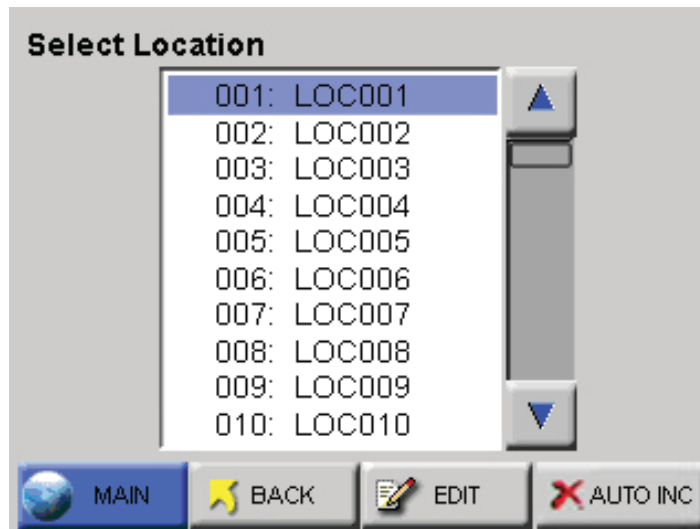


Figure 4-47 LOCATION Setup Screen

On the Select Location screen, the Location name can be selected using the UP and DOWN arrows or by touching the location name on the screen.

The following options can be enabled to configure locations for the HANDHELD.

- When enabled, the Auto Increment option will automatically select the next location after completing the programmed number of cycles. The default position is “off” when the unit is powered up.
- The unit can be configured for a maximum of 200 Locations. Each location name can be configured with a maximum of 8 characters per name.
- Recipes associated with a specific location are denoted by an asterisk (*) to the right of the location name.

- When selecting a location with a recipe, the user is provided with the option of loading the recipe as shown in Figure 4-48. If the user chooses not to load the recipe, the location can still be used with the current settings.

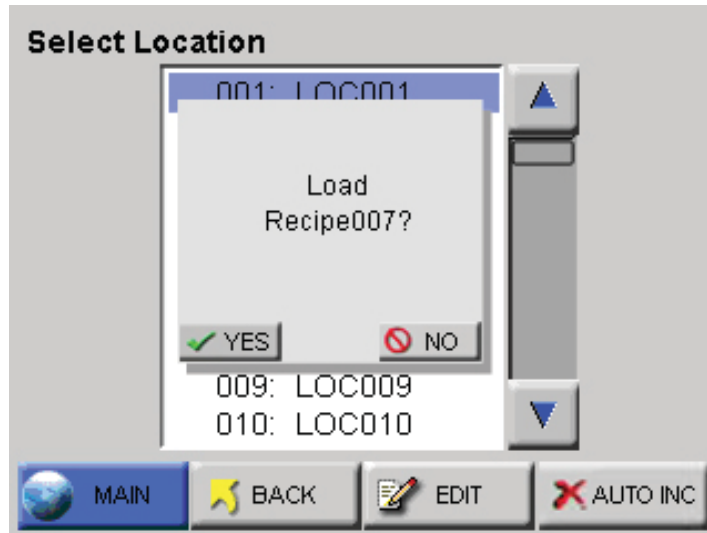


Figure 4-48 Location - Load Recipe

- If a recipe is loaded and a location is selected that is not associated with a recipe, the user is given the option to unload the current recipe. If the user chooses to keep the loaded recipe, the location will adopt the current recipe settings.



To create a name for a location, press the EDIT button to display the Edit screen.

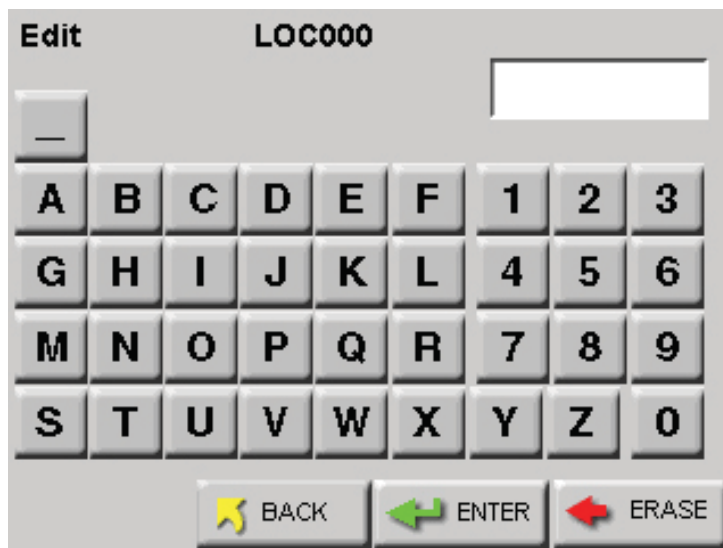
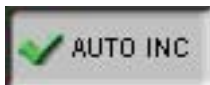


Figure 4-49 LOCATION Edit Screen

- Type in the name of the location using the alphanumeric and underscore keys.
- Press the ERASE button to erase the last character typed, if needed.
- Press ENTER.
- Use the Arrow keys to go to the next location to be edited and press the EDIT button. Continue in the same way to edit as many Locations as desired.

Press the BACK button to return to the Configuration screen or the MAIN button to return to the MAIN screen.



Activating the AUTO INC button allows the user to select the next location once the number of cycles is completed.

- The user is prompted to move to the next location after the programmed number of cycle. See Figure 4-50.

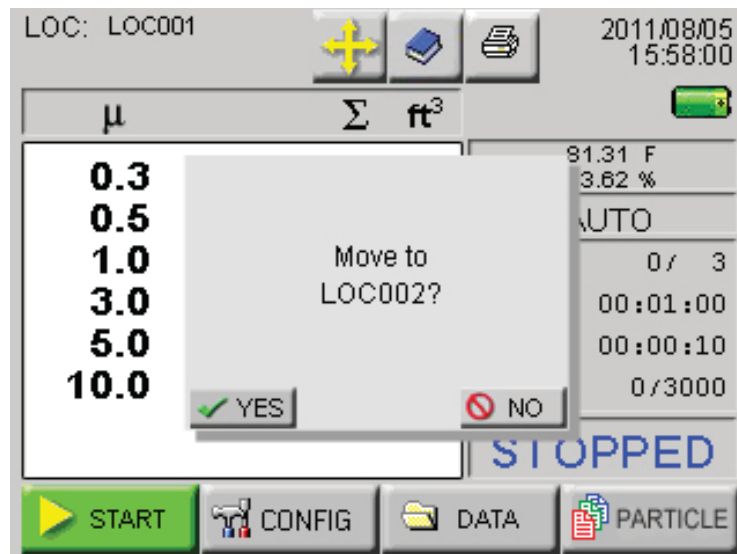


Figure 4-50 Auto Increment Prompt

The Auto Increment mode will select the next corresponding location and continue to sample using the current configuration. If the current location is using a recipe, the user will be prompted to unload the recipe before moving to the next location.

DATA VIEW

Data that is stored on the instrument is viewed in the Data Screen. When the buffer has filled to its limit of 3000 records, the newest records will overwrite the first records stored. The word “Records” on the MAIN screen will have an asterisk (*) next to it to indicate that the buffer has wrapped. When you go to the Data screen after the data has wrapped, the first record viewed will be the most current record, which will not necessarily be record #1.

If the Particle Volume is set to ft^3 , then the concentration data will display and print in ft^3 . If the Particle Volume is set to m^3 or Liters (L), then the concentration data will display and print in m^3 .

Press the DATA button on the MAIN screen to display the Data screen.

Note: *Mass Concentration data may be shown, even if the instrument was in Particle mode when the sample was taken. On the MAIN Screen, press the PARTICLE button, which changes to MASS. Then return to this screen to see the Mass Concentration data.*

Depending on how the HANDHELD is configured, the data will display in either raw data mode, or be normalized to ft^3 or m^3 . See Figure 4-51 & Figure 4-52.

Size	Diff	Cuml
0.3	26519	31575
0.5	4017	5056
1.0	993	1039
3.0	27	46
5.0	15	19
10.0	4	4

Loc: LOC000	Instr: GOOD
Smpl: 00:01:00	Flow: OK
Date: 08/08/2011	Alarm: NONE
Time: 12:43:23	Laser: OK

Figure 4-51 Data Screen - RAW Data

Scroll through the data using the UP and DOWN arrow buttons.

- The single arrow moves one record at a time.

Rec # 209		208/3000
Size	Diff/ft ³	Cuml/ft ³
0.3	26519.0	31575.0
0.5	4017.0	5056.0
1.0	993.0	1039.0
2.5	27.0	46.0
5.0	15.0	19.0
10.0	4.0	4.0

Loc: LOC000	Instr: GOOD
Smpl: 00:01:00	Flow: OK
Date: 08/08/2011	Alarm: NONE
Time: 12:43:23	Laser: OK

MAIN RANGE RECORD

Figure 4-52 Data Screen - Normalized data in ft³

Rec # 209		208/3000
Size	Diff/m ³	Cuml/m ³
0.3	936509.4	1115060.4
0.5	141859.0	178550.9
1.0	35067.5	36691.9
2.5	953.5	41624.5
5.0	529.7	671.0
10.0	141.3	141.3

Loc: LOC000	Instr: GOOD
Smpl: 00:01:00	Flow: OK
Date: 08/08/2011	Alarm: NONE
Time: 12:43:23	Laser: OK

MAIN RANGE RECORD

Figure 4-53 Data Screen - Normalized data in m³

The Data screen displays the following information for each data record as shown in Figure 4-53.

Note: *When the buffer has wrapped, the record that is first displayed in the Data screen is the first record in the data buffer. This may not be Rec#1.*

If you press the single down arrow button once, the instrument will display the last record in the data buffer.

- **Rec#** - Identifies which record is currently viewed.
- ***Recs** - Displays how many records are currently stored in the HANDHELD's buffer. When there is an asterisk (*) next to the word "Recs", this means that the 3000 record data buffer has wrapped. The basic concept is First In, First Out (FIFO).
- **Size** - Lists the channel sizes configured on the instrument.
- **Diff#, Diff/ft³, Diff/m³** - Indicates that each channel size's data is displayed in differential mode. If a channel was disabled, then there is a blank space in its column; # indicates raw counts; ft³ and m³ indicate normalized counts.
- **Cuml#, Cuml/ft³, Cuml/m³** - Indicates that each channel size's data is displayed in cumulative mode. If a channel was disabled, there will be a blank space in this column. # indicates raw counts while ft³ and m³ indicate normalized counts.
- **Loc** - Indicates the location at which the data record was recorded. The Location name listed is the alphanumeric label that was saved.
- **Smpl** - Indicates the Sample Time (HH:MM:SS) at which the data record was sampled.
- **Date** - Indicates the instrument date on which the data was recorded. The date will display in the format selected in the configuration (MM/DD/YYYY, DD/MM/YYYY or YYYY/MM/DD).
- **Time** - Indicates the instrument time at which the data was recorded (HH:MM:SS).
- **Instr** - Indicates the state of the instrument at the time the data was recorded. Instrument states include GOOD or SRVC.

If SRVC appears, printouts will say "Service Required" and the sensor may need cleaning. Please contact Lighthouse Technical Support at 1-(800) 945-5905 or techsupport@golighthouse.com.

- **Flow** - Indicates the flow state of the instrument at the time the data record was recorded. Flow is recorded as OK or ALRM. If the flow was in alarm, it will print as Flow: Alert on the printouts.
- **Alarm** - Indicates (NONE or YES) if the data record exceeded any of the alarm thresholds of any of the channels that were enabled for alarms. If the data record exceeded alarm thresholds, printouts show "Alarm: Yes".

- **Laser** - Indicates the status of the laser at the time the data record was recorded; possible laser states include OK or SRVC. If the laser needs to be serviced, it will print as Laser: Service.

If laser state is SRVC, please contact Lighthouse Technical Support at 1-(800) 945-5905 or techsupport@golighthouse.com.

ANALOG DATA

If the Temperature/Relative Humidity probe is attached during data recording, the analog data will be listed in the Data screen.

Note: *Mass Concentration data may be printed, even if the instrument was in Particle mode when the sample was taken. On the MAIN Screen, press the PARTICLE button, which changes to MASS. Then return to this command to print the Mass Concentration data.*

PRINT RECORD

When you push the PRINT RECORD button, whatever record is currently displayed in the Data screen will print as a single sample record. The record will print according to the settings in the Print Configuration. See Figure 4-54.

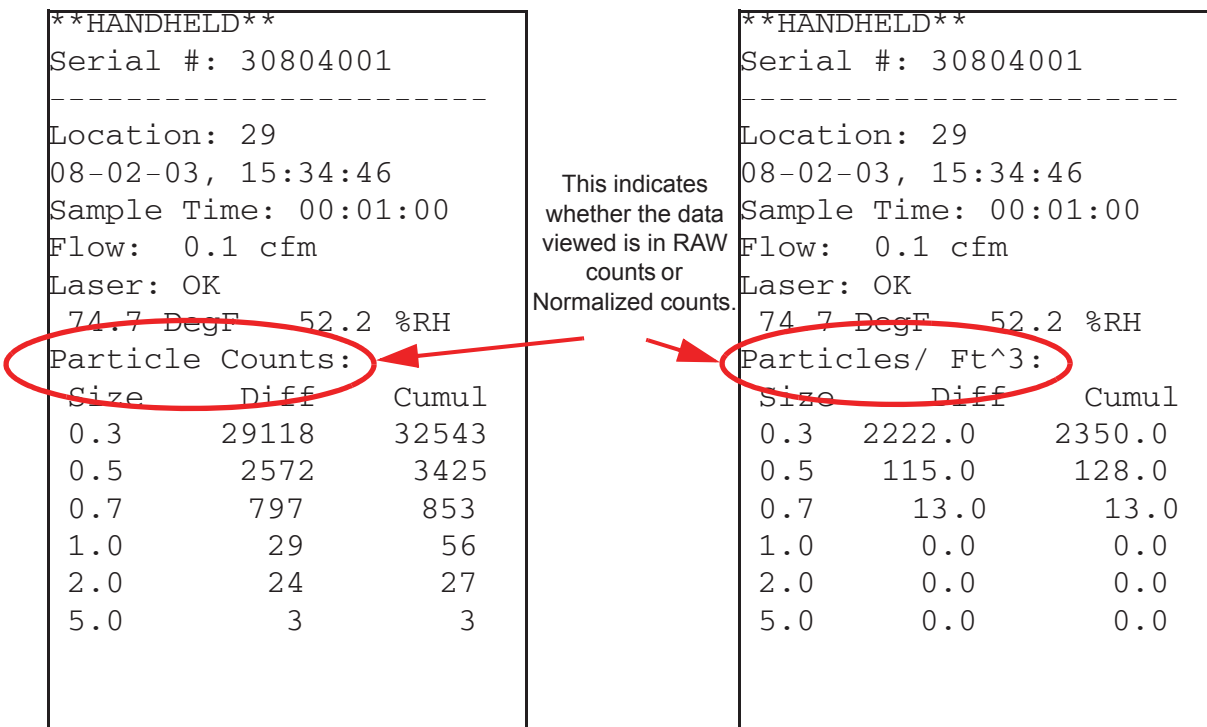


Figure 4-54 Examples of Output from Auto Printout of Sample

PRINT RANGE (BUFFER REPORT)

The instrument stores up to 3000 records in its data buffer. The Buffer Report prints all or a range of the records in the buffer in the format specified by the selections in the Configuration.

At the end of the Buffer Report, the following summary information is printed.

- Data displayed in Cumulative or Differential mode
- Raw (“Particle Counts”) or Normalized (“Particles/ft³” or “Particles/m³”)
- # of samples in the report
- For each channel size:
 - Maximum Value
 - Minimum Value
 - Average
 - Standard Deviation

The UCL calculation will be printed for each channel size if the number of locations in the range is 2 through 9. The calculation will only print if the Format settings (Setting screen) are set to CUMUL and NORM. Any other format settings or locations less than 2 and greater than 9 will print N/A for each channel.

View the same data in different formats just by changing the Particle Display options on the Sample Setting screen.

The Data Summary can be viewed as:

- Raw Counts, Differential Data
- Raw Counts, Cumulative Data
- Normalized Counts, Differential Data, Particles/ft³
- Normalized Counts, Differential Data, Particles/m³
- Normalized Counts, Cumulative Data, Particles/ft³
- Normalized Counts, Cumulative Data, Particles/m³

Printing Buffer Report

- To print a range of data from the buffer, scroll to the first data record to be included in the range.
- Press the RANGE button. The following screen will display. See Figure 4-55.

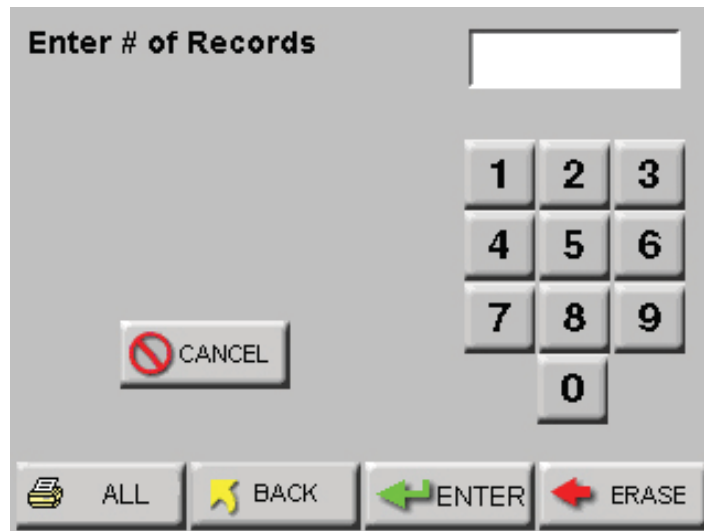


Figure 4-55 Print Range Screen

- Enter the number of records to print and press the ENTER button.
- Press ALL to print all records in the buffer.
- Press CANCEL to cancel printing.
- Press BACK to return to the View Buffer screen without printing the report.

Note: *Printing ALL records may take some time if the buffer is full.*

```

***** SUMMARY *****
**HANDHELD 3016IAQ
Serial #: 130602001
-----
Location:      LOC002
06-20-2013,  15:34:30
Sample Time:   00:01:00
Flow:         0.1 cfm
Laser:        OK
TEMP:         66.77 F
RH:           35.71 %
Particles/ ft^3:
Size          Cumul
0.3           4260.0
0.5           810.0
1.0           580.0
3.0           360.0
5.0           350.0
10.0          310.0

Location:      LOC003
^ ^ ^ ^ ^ ^ ^ ^
v v v v v v v v
Particles/ ft^3:
Summary (Cuml):
-----
# of samples =2
Size          Max
0.3           4260.0
0.5           810.0
1.0           580.0
3.0           360.0
5.0           350.0
10.0          150.0

Size          Min
0.3           3860.0
0.5           750.0
1.0           360.0
3.0           240.0
5.0           180.0
10.0          150.0

^ ^ ^ ^ ^ ^ ^ ^
v v v v v v v v
Size          95% UCL
0.3           5322.0
0.5           969.3
1.0           1164.1
3.0           678.6
5.0           801.4
10.0          734.8
    
```

Figure 4-56 Sample Buffer Report







Power Shutdown Levels

Note: *It is not recommended to allow the battery to discharge completely.*

When the HANDHELD is powered from its rechargeable battery, a Power Shutdown feature protects the battery from discharging completely. A complete discharge could damage the battery.

The battery levels are as follows:

Table 4-1 Levels of Battery Life

Battery Icon	Description
	FULL
	75%
	50%
	25%
	Empty; at this level, the instrument will begin to beep and will display “BATT LOW!” on the main screen. It is recommended to connect the AC cord and plug it into an outlet at this level.
	Pump Shutdown; if the instrument is currently on and sampling the pump will turn off and the instrument will shut down.

After the pump shutdown level and before the battery reaches its critical low point, the instrument will shut down all power. To prevent loss of power, attach the AC cord and plug into an outlet as soon as the BATT LOW! message appears on the screen.

5

Operation - Mass Concentration Mode

Introduction

This chapter describes how to use the HANDHELD 3016 IAQ Particle Counter in Mass Concentration mode.

Much of the material in this chapter repeats that found in Chapter 3. The redundancy allows the user to operate the instrument in either Particle or Mass Concentration mode without having to flip back and forth between chapters.

The primary differences found in Mass Concentration mode, vs. Particle mode, are:

1. Data must be normalized to cubic meter to match the IAQ standard.
2. Data, whether seen on the Main screen or in View Buffer, are displayed in micrograms per cubic meters.
3. Some screens differ from those in Particle mode.

Using the Instrument

The HANDHELD comes with a charged battery and is ready for use. To start using the instrument, proceed as follows:

WARNING: *Do not attempt to sample reactive gases (such as hydrogen or oxygen) with this instrument. Reactive gases create an explosion hazard in the instrument.*

Sampling any gas under pressure can damage the instrument and void the warranty.

Sampling any gas that is not the same density as ambient air can result in inaccurate data.

Contact Lighthouse for more information.

WARNING: *Do NOT allow water, solvents, or other liquids enter the instrument via the inlet tube - the instrument will be damaged and void the warranty.*

Do NOT operate the instrument with the inlet tube capped or plugged - the internal pump will be damaged and void the warranty.

Note: *The pump motor requires a minimum 5 seconds to ramp up to full flow. Refer to "Pump Startup" on page 5-26.*

1. Insert the battery included with the shipment (see Chapter 2 for instructions.)
2. Position the instrument in the environment to be measured.
3. Remove the protective cap from the inlet tube. To use the provided isokinetic probe, install it by connecting to inlet tube on the top of the instrument. **NOTE: Do not discard the protective cap. It should be placed on the inlet tube any time the instrument is to be moved outside the environment being measured.**
4. The included Temperature/Relative Humidity probe can be attached to the provided receptacle to read environmental data.
5. Set on/off switch found on the left side of the unit to ON.
6. The Start Up screen displays on the LCD.
7. The MAIN screen appears.
8. On the touch screen, press the START button to start the instrument.
9. "STARTING" will display when the pump is initially turned on.
10. When the HANDHELD starts counting, "COUNTING" appears on the display. Data is displayed according to the size of each particle.
11. If the instrument is in AUTO mode with cycles and a hold time, "HOLDING" will display after each cycle and "FINISHED" will display when all the cycles are complete.
12. Press the "STOP" button to stop the instrument before the cycles are complete.

Touch Screen Overview

The HANDHELD incorporates a unique touch screen interface to control and configure the instrument.

Operation Mode

Two modes of operation are available on the HANDHELD 3016 IAQ. The mode is chosen by toggling the PARTICLE/MASS button circled in Figure 5-1. This chapter assumes that MASS mode has been selected. Click the button to change the mode to Particle if desired.

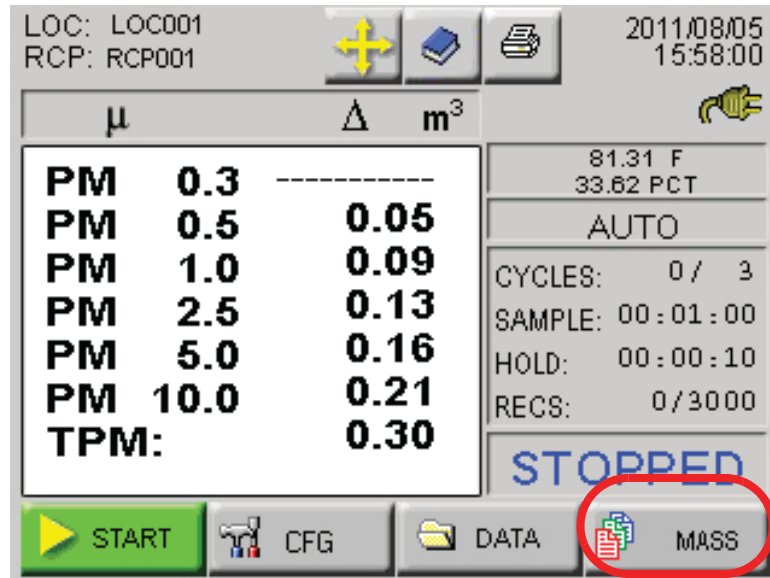
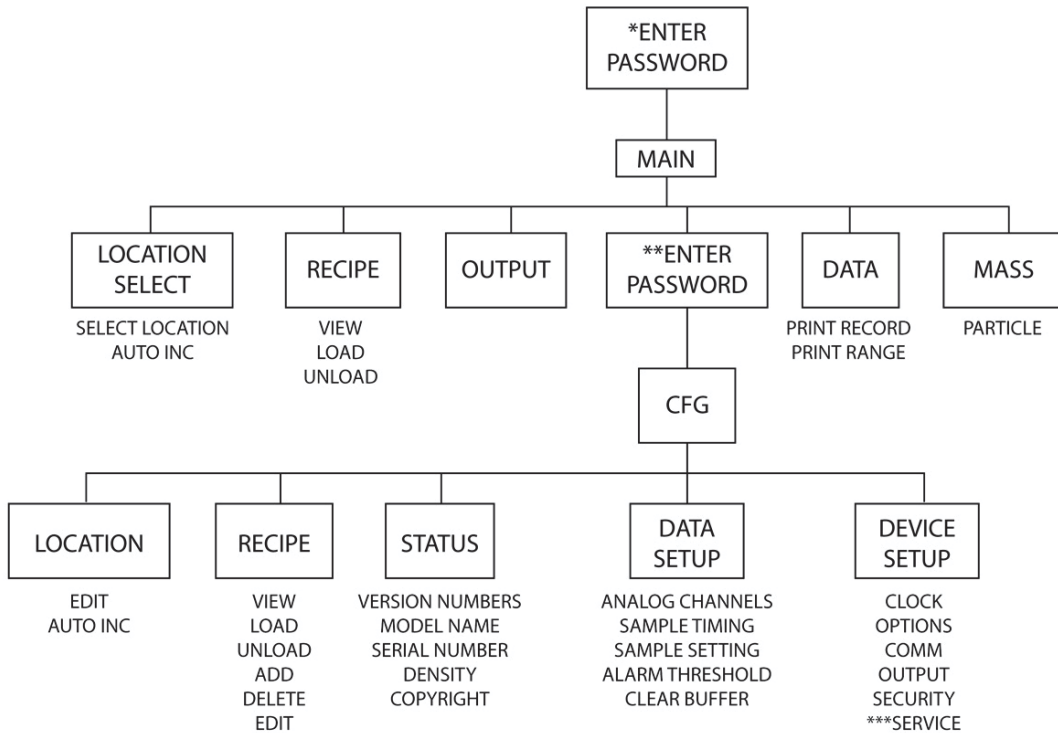


Figure 5-1 Particle / Mass Mode Toggle

Menu Map Mass Concentration Mode

This interface allows the user to view and configure the instrument to specific needs and applications. See Figure 5-2.



- * If POWER ON password is enabled.
- ** If CFG password is enabled.
- *** For Authorized Service Provider Only.

Figure 5-2 Menu Map, Mass Concentration Mode

MAIN Screen

The MAIN screen gives the user a single snapshot view of the status of the instrument.

The instrument can be powered by an external power supply or from a removable battery. When a battery is used, the battery indicator will show the level of the battery charge remaining. See Figure 5-3.

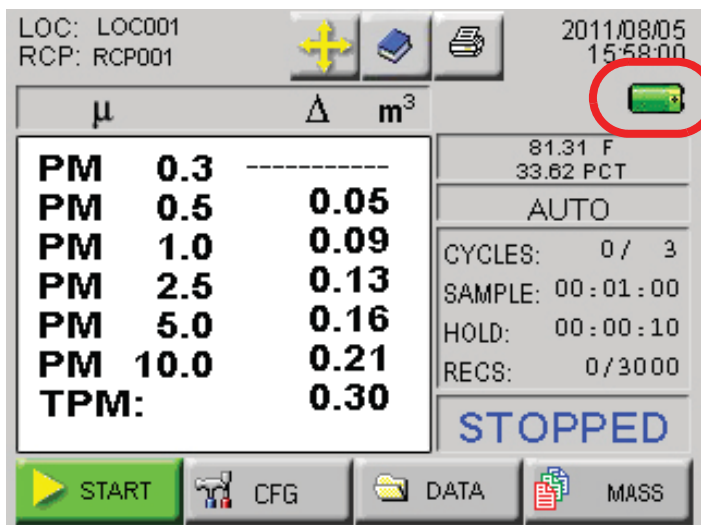


Figure 5-3 MAIN Screen - battery operation

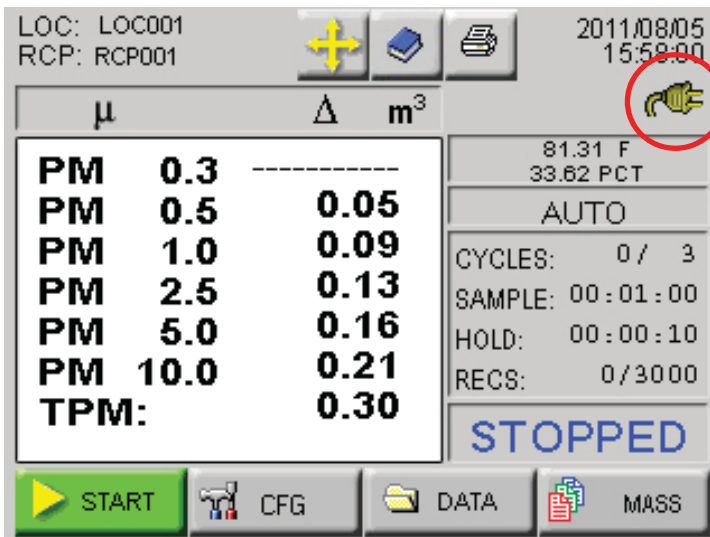


Figure 5-4 MAIN Screen - AC operation

When the AC indicator symbol is displayed, it indicates the instrument is getting its power from an AC source. See Figure 5-4.

The MAIN screen displays the following options and information.

- **LOCATION:** Displays the location that is currently being measured. Up to 200 alphanumeric locations can be configured.



- **LOCATION SELECT button:** Allows user to change location before sampling.



- **RECIPE button:** Allows the user to view, load and unload recipes that have been configured and saved in the recipe data base.



- **PRINT LAST RECORD:** Prints the last recorded sample using the current configuration to determine the type of data printed.

The print configuration is set through the PRINT SETUP button in the Configuration screen. For more details about printing, see the Configuration section later in this chapter.

- **Date/Time:** Displays the current date and time.
- **Battery Indicator:** Indicates that the instrument is being powered by a rechargeable battery. The amount of battery life left is denoted by the fill inside the battery icon. When the battery is low, the words “BATT LOW!” will appear on the screen and the unit will beep continually until it is plugged into its AC power cord for recharging. See Figure 5-5.

Note: *If the instrument is counting when the “X” appears in the battery indicator, the pump will automatically stop to prevent the battery from discharging completely.*



Figure 5-5 Battery Indicator levels from Full to Empty, left to right



- **AC Indicator:** Indicates that the instrument is being powered with its AC power cord. If the battery is installed, the HANDHELD will charge the battery when the instrument is plugged in.



- **Flow Status:** When the instrument is sampling, the Flow Indicator will display sufficient or insufficient flow.

WARNING: *If the Air Flow is insufficient, turn the instrument off and contact Lighthouse Worldwide Solutions tech support at 1-(800) 945-5905 or techsupport@golighthouse.com.*



- **Service Indicator:** Indicates that the instrument may be in need of service. If wrench displays, please contact your authorized Lighthouse Service Provider for assistance or send an e-mail to techsupport@golighthouse.com.
- **μ:** The mu symbol indicates the particle sizes, in micrometers, configured for the instrument.
- **DATA DISPLAY:** indicates whether the counts are being displayed in PM or UGR and when the counts are normalized to ft³ or m³.

81.31 F
33.62 PCT

- **Analog Data:** Gives a snapshot view of the enabled analog channels. (Analog channels are enabled by default.)
- **MODE:** Displays the current mode selected; possible modes are AUTO and MANUAL.
- **CYCLES:** Indicates the number of times that the count will be taken at a given location in Auto mode. "1/ 3" indicates that the last completed count was the first of three samples to be recorded at this location. The maximum number of cycles is 999. When set to 0, the unit will run in Auto mode continuously until the STOP button is pressed.
- **SAMPLE:** The Sample Time (hh:mm:ss) is the duration of one counting cycle. The Sample Time will count down on the MAIN screen when the instrument is in AUTO or Manual mode so you can see how much time remains in the sample period. In Concentration mode, the Sample Time will count up to 6 seconds per cycle.
- **HOLD:** Displays the hold time in between cycles. The maximum hold time is 99 hours, 59 minutes, 59 seconds.
- **RECS:** This displays the current number of records stored in the instrument and the total number of records that can be stored. The data buffer is a circular buffer. The HANDHELD can store up to 3000 records. An asterisk (*) will appear in front of counts when the buffer wraps.

Note: *If Hold time is greater than 1 minute, the pump will stop during that time. At the end of the hold time, the pump will restart.*

Note: *There is a one second startup during which the pump is accelerating to full power. During this time, the word "STARTING" will display.*

- **START/STOP:** Press START button on the screen to start counting. When sampling, the instrument will display "COUNTING" in the lower right portion of the screen as shown in Figure 5-6.

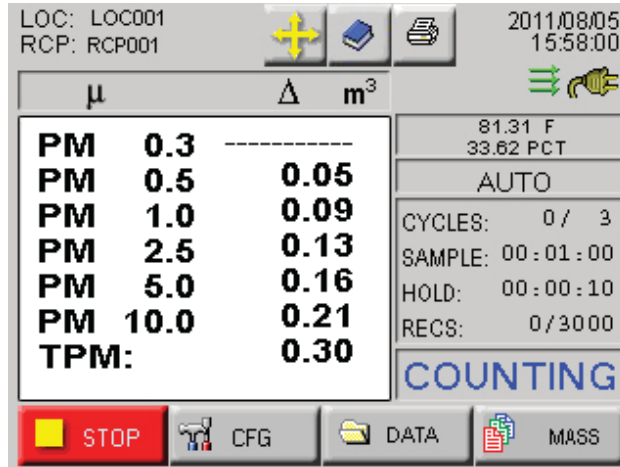


Figure 5-6 Main Screen, Counting mode

Press the STOP button to stop counting; the word "STOPPED" will display.



MASS / PARTICLE Button

Pressing the MASS / PARTICLE button changes the operating mode of the counter between Mass Concentration (shown) and PARTICLE. In Mass Concentration mode, particle counts are displayed as an approximation of micrograms per cubic meter. By default, the instrument assumes all particles have a density of 2.5 grams per milliliter, which is the density of Carbon. The user can change the density value in LMS XChange.



LOCATION Selection

Changing Locations

The location number for the environment to be measured can be changed by pressing the LOCATION button at the top of the MAIN screen. The following screen will display.

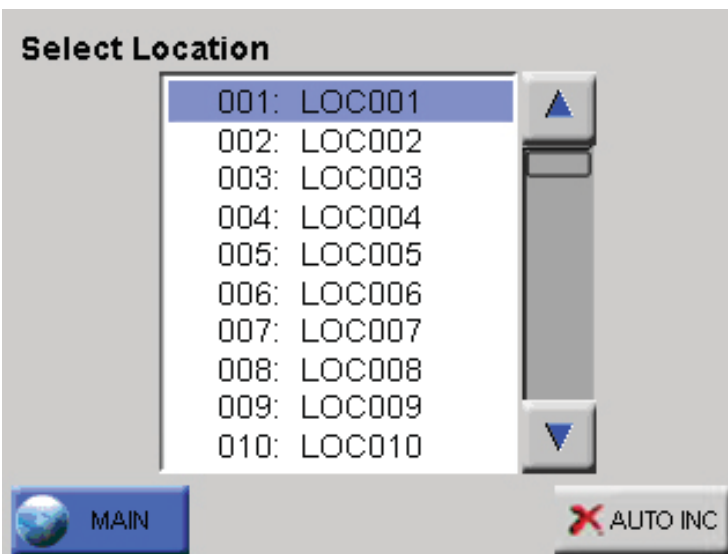
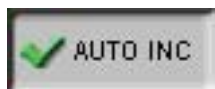


Figure 5-7 Location Select Screen

- The blue highlight indicates which location is currently selected.
- Use the UP and DOWN arrows to select a location. The single arrows will move the cursor up and down by a single line. Locations can also be selected by touching the location name on the screen.
- Recipes associated with a specific location may also be loaded when that location is selected.
- The AUTO INC button, when activated will allow the user to advance to the next location once the current cycle is completed.
- Press the MAIN button to return to the MAIN screen. Whichever location is currently selected will be the location displayed on the MAIN screen.



Locations in AUTO Mode

- When the instrument is in Automatic Mode and the START button is pressed, the instrument will start counting particles automatically according to the SAMPLE time, HOLD time and number of cycles that are configured.

CONFIGURATION Screen

Press CFG on the MAIN screen to display this screen. See Figure 5-8.

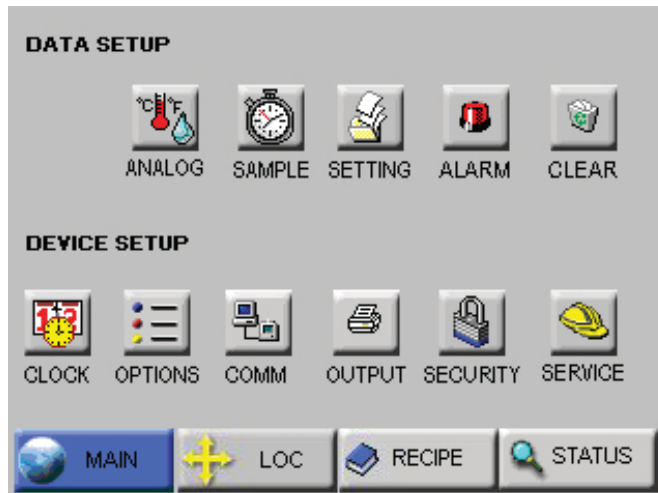


Figure 5-8 Configuration Screen

Data Setup includes buttons to enable/disable analog channels, set sample record parameters, sample settings, thresholds, enable/disable alarms, and clear the data buffer.

Device Setup includes buttons to configure the instrument's date and time, set the LCD contrast, adjust the instrument's beep volume, enable the instrument to AutoStart, set the instrument's communication address, setting print options, enable password restrictions, and/or (with proper authorization) adjust service settings.

DATA SETUP

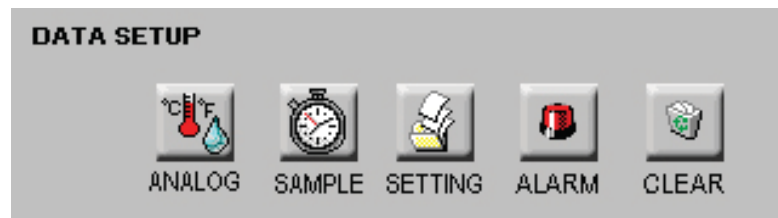


Figure 5-9 Data Setup options



Analog Channels

A Temperature and Relative Humidity probe can be connected to the HANDHELD via a connector on the top of the unit.

Users can select if the HANDHELD displays analog temperature data as Fahrenheit or Celsius by pressing the ANALOG button on the Configuration screen. The Select Temperature Units window displays.

There are two buttons on the Select Temperature Units window. The button displayed shows the units that are currently selected: F for Fahrenheit and C for Celsius.

To change to Celsius, press the C button. To change to Fahrenheit, press the F button. See Figure 5-10 & Figure 5-11.

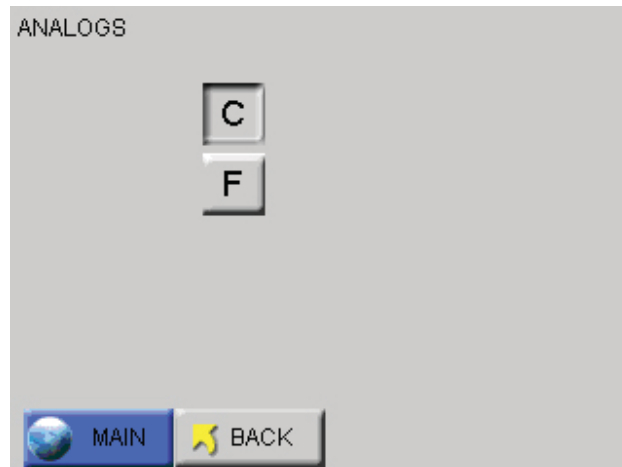


Figure 5-10 Analog Channels - Select Celsius Units

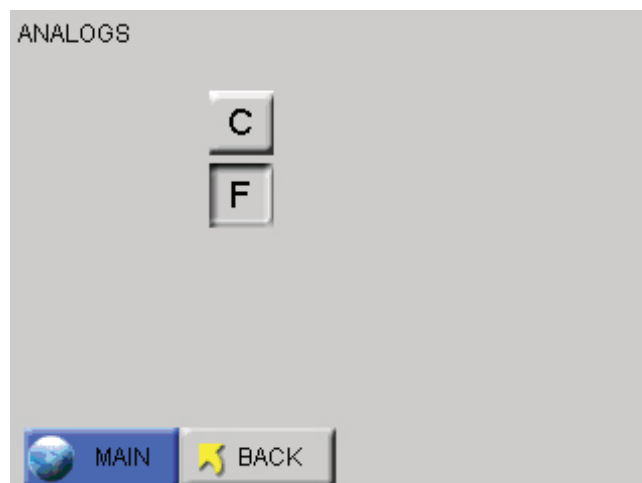


Figure 5-11 Analog Channel - Select Fahrenheit Units

Temperature and relative humidity values appear on the MAIN screen with the units you selected. The values are updated in real time as shown in Figure 5-12.

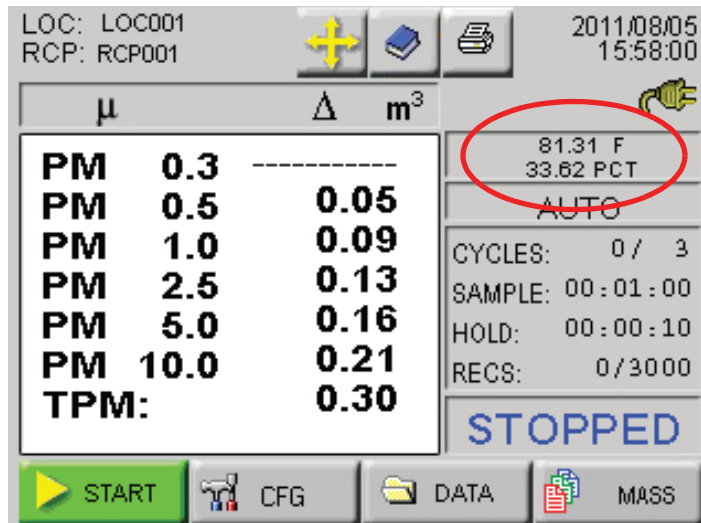


Figure 5-12 Analog data on MAIN screen



SAMPLE

From the CONFIG Screen, press SAMPLE to configure the Sample Time and the number of samples to be collected on the Sample screen. See Figure 5-13.

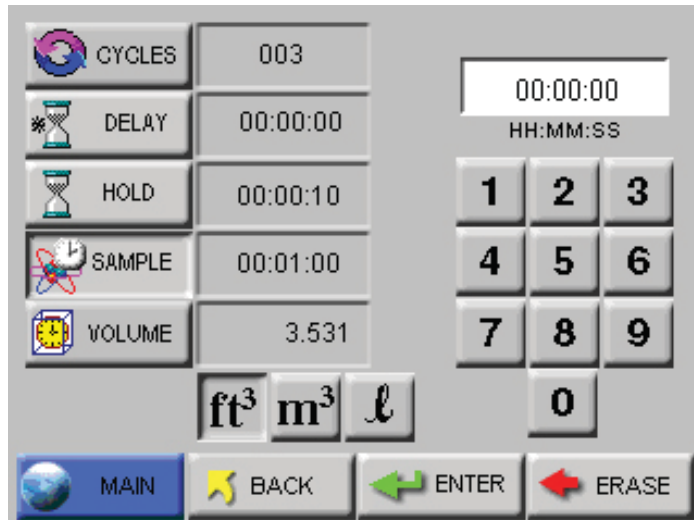


Figure 5-13 Sample Timing Configuration Screen

- CYCLES:** The number cycles is set to determine how many times the instrument samples the air in a single location. This is used only in AUTO mode. The range is 0 - 999. When Cycles is set to 0, the instrument will continue running samples indefinitely until the STOP button is pressed.

Select the CYCLES button; enter the number of desired cycles using the numeric keypad on the right. Press ERASE to erase a number, if needed. Press ENTER to set the Cycles.

- DELAY:** The Initial Start Delay (hh:mm:ss) is the time between pressing the START button and the unit actually starting counting.

The Initial Start Delay gives the operator time to exit the area under test so that the measurement is taken under a controlled condition. The maximum delay time is 99 hours, 59 minutes and 59 seconds.

Select the DELAY button; enter the initial delay time in hours, minutes and seconds using the numeric keypad on the right.

After the value is entered, press ENTER.

Note: *The pump starts immediately when START is pressed. In order to operate properly, if a Delay is set, the Delay should not be less than 5 seconds.*

Note: *If the Hold time is set to 00:00:00 in Auto Mode, the instrument will run the samples according to the sample time and the # of cycles, but with no hold time in between cycles.*

The maximum hold time is 99 hours, 59 minutes and 59 seconds. This field will count down to indicate how much time is left for the Hold period.

Select the HOLD button; enter the time in hours, minutes and seconds using the numeric keypad on the right. Press ERASE to erase a number, if needed. Press ENTER to set the Hold Time.

Note: *If the Hold time is greater than one minute, the pump will shut off during the specified hold time.*

- **HOLD:** The Hold Time (hh:mm:ss) is the time between count cycles when the instrument is not counting particles.

Note: *The maximum Sample Time is 23:59:59.*

- **SAMPLE:** The Sample Time (hh:mm:ss) is the duration of one counting cycle. The Sample Time will count down on the MAIN screen when the instrument is in Auto or Manual mode to indicate how much time is remaining in the Sample.

Select the SAMPLE button; enter the time in hours, minutes and seconds using the numeric keypad on the right. Press ERASE to erase a number, if needed. Press ENTER to set the Sample time.

Note: *In Mass Concentration mode, the IAQ standard is micrograms per cubic meter.*

- **SAMPLE VOLUME:** Instead of selecting a specific Sample Time, the instrument can be set to measure a specific Sample Volume in cubic feet (ft³), cubic meters (m³) or liters (l). When this is set, the corresponding Sample Time will automatically be set as shown in Figure 5-14.

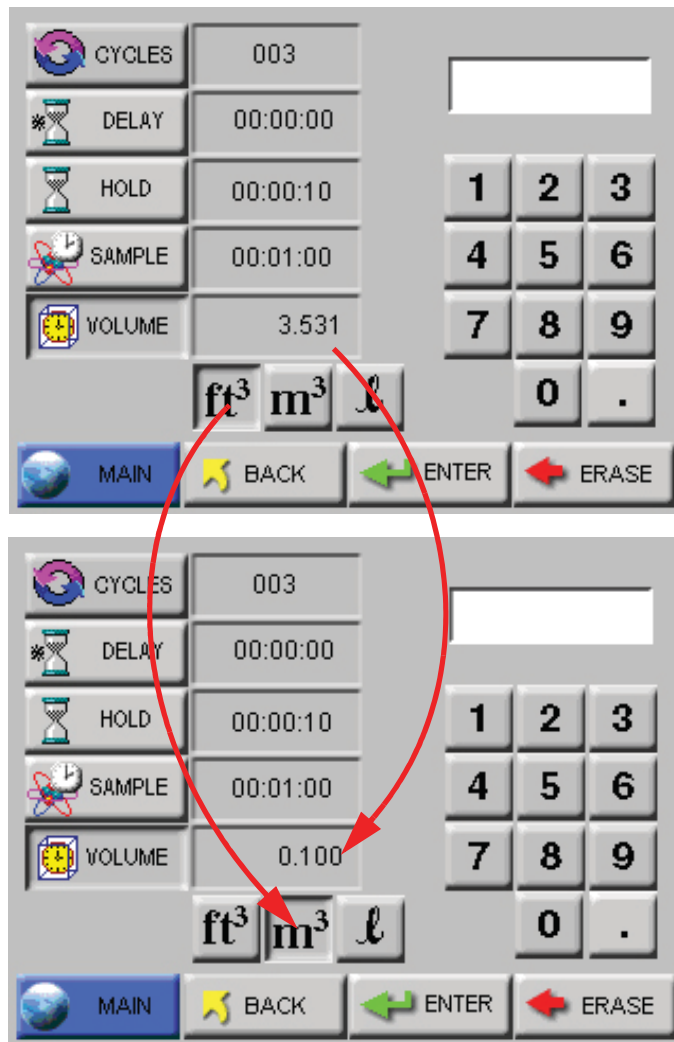


Figure 5-14 Changing Sample Volume unit of measure

Press BACK to return to the Configuration screen or press MAIN to return to the MAIN screen.

Note: *If the particle volume is liters or m³, sample volume is displayed in liters.
If the particle volume is cubic feet (ft³), the sample volume is displayed in cubic feet (ft³).*



SETTINGS

The instrument can be configured to count in different modes and formats. See Figure 5-15.

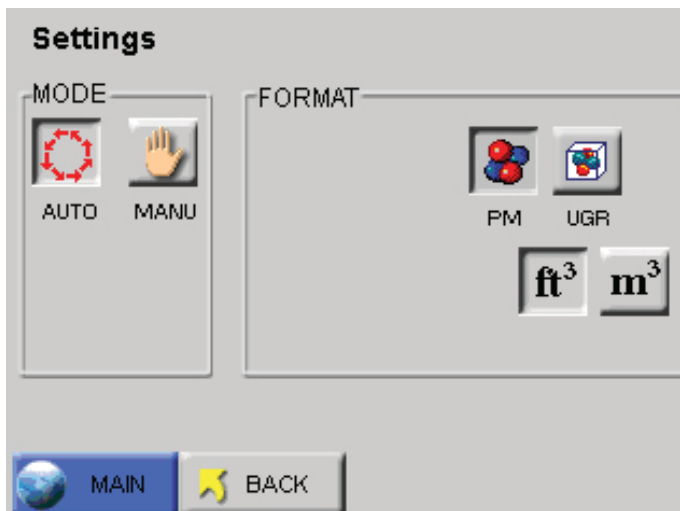


Figure 5-15 Sample settings screen

COUNT MODE

The following modes are available: Auto and Manual.

- **AUTO** - When the instrument is in Automatic Mode and the START button is pressed, the instrument will start counting particles automatically according to the Sample Time, Hold Time and the number of Cycles that are configured. If Cycles are set to 0, the instrument will continue indefinitely in Auto Mode until the STOP button is pressed.
- **MANU (Manual Mode)** - When the instrument is in Manual Mode, it will start counting when START is pressed and stop at the end of one programmed Sample Time.

PARTICLE Display.

The data format is either PM or Mass Concentrations (UGR). PM indicates Particulate Matter, expressed in micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). PM is calculated by summing the mass concentration levels for all channels smaller than the indicated channel. For example, the PM 1.0 = (Mass Concentration of 0.3) + (Mass Concentration of 0.5). PM 10.0 = the sum of the Mass Concentration levels of the 0.3 + 0.5 + 1.0 + 2.5 + 5.0 μm channels. Note that the Mass Concentration of the 10.0 μm channel is not included. It is, however, included in the TPM value, the Total Particulate Matter contained in all channels.

UGR lists the Mass Concentrations for each individual particle size, expressed in micrograms per cubic meter (ugr/m3).

Press BACK to return to the Configuration screen or press MAIN to return to the MAIN screen.



ALARM

The user can enable alarming on specific channels as illustrated in Figure 5-16.

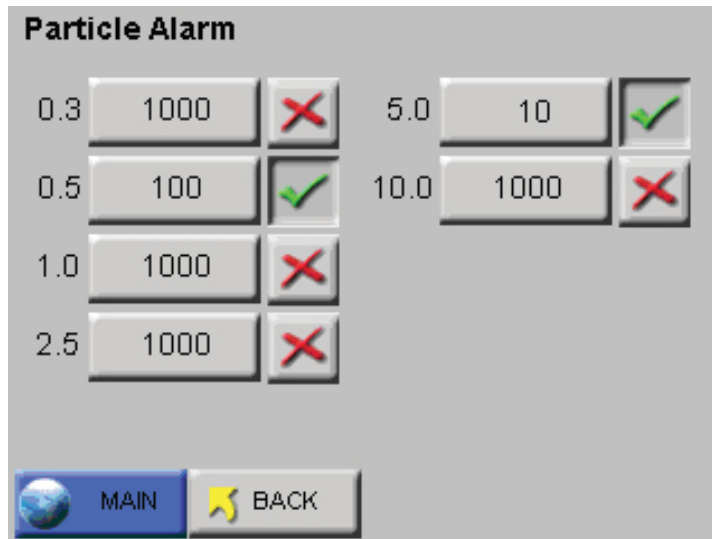


Figure 5-16 Particle Alarm Configuration, 2 channels enabled

Note: *Alarming is only applicable for AUTO and MANUAL mode. It applies only to Raw particle counts even if the instrument is displaying Normalized data.*

To enable the alarming for any channel, press the “X” next to that channel. When a checkmark is displayed, that channel is enabled for alarming. Press the checkmark to disable the alarming for that channel.

Alarm Threshold

Alarm thresholds are always compared to real-time particle counts, even when the instrument is in Mass Concentration mode. The instrument cannot be set to alarm on a specific level of micrograms per cubic meter.

Press the threshold button next to the enabled channel in order to set the alarm threshold for that channel. See Figure 5-17.

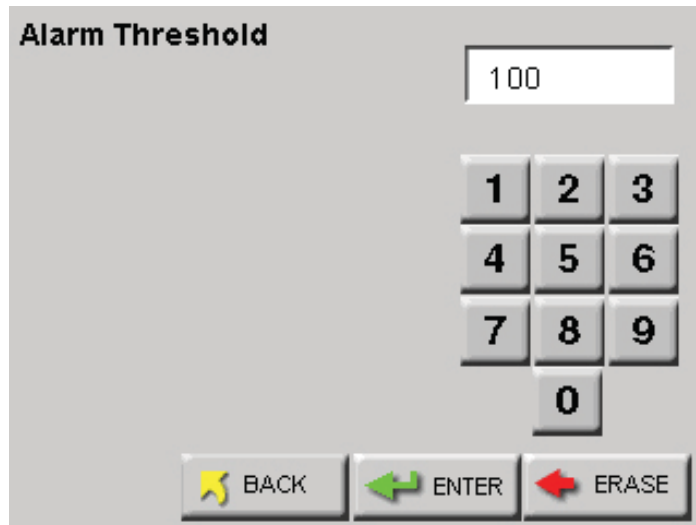


Figure 5-17 Configure Alarm Threshold

Enter the desired alarm threshold for the selected particle channel, in number of particles, then press ENTER. The threshold value will be updated on the Particle Alarm screen as shown in Figure 5-18.

Note: Alarms are triggered per sample record. At the end of the sample time, the alarms reset.

Press BACK to return to the Configuration screen or press MAIN to return to the MAIN screen.

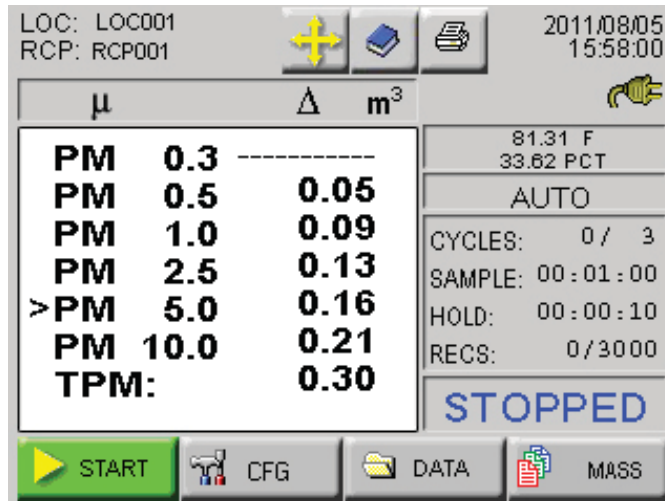


Figure 5-18 MAIN screen, 0.5µm channel enabled for alarming

Note: *To receive alarms, the Sample Time must be greater than 1 second.*

When a particle channel that is enabled for alarming goes into alarm, the selection cursor (>) and the channel size are highlighted in red. See Figure 5-19.

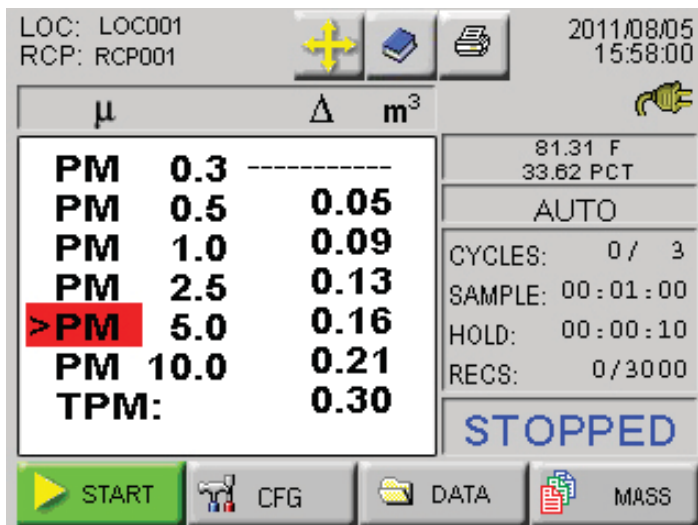


Figure 5-19 Channel in Alarm

Alarm Acknowledge

Note: *If alarms are enabled on two channels, when the user presses the Alarm Acknowledge button after the first channel goes into alarm, the alarm will not sound if the second channel's threshold is reached within the sample sample period.*

When the instrument beeps in response to the Alarm and Threshold settings, it can be silenced by tapping anywhere on the screen while the unit is sampling.

After acknowledging the alarm, the alarm count will reset when the next sample cycle begins.



Clear Buffer

Press the Clear Buffer button to clear the instrument's data buffer. See Figure 5-20.



Figure 5-20 Clear Buffer message screen

Press OK to clear the data or press Cancel to exit screen without clearing the data.

DEVICE SETUP

Device Setup includes setting the instrument's date and time, adjusting the instrument's LCD contrast or beep volume, aligning the touchscreen, enabling autostart, setting the instrument's communications address, setting print options, enabling password restrictions, viewing the instrument's current status, and/or (with proper authorization) adjust service settings. See Figure 5-21.

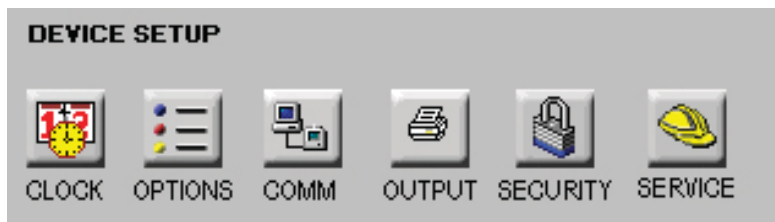


Figure 5-21 Device Setup options



CLOCK

Use the Clock screen to set the instrument's date and time as shown in Figure 5-22.

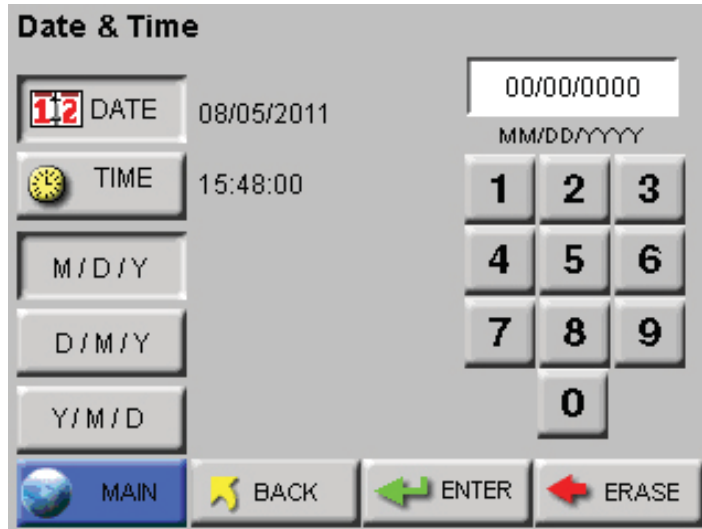


Figure 5-22 Date & Time Configuration Screen

Set the instrument's Date by entering values for the desired month, day and year and then press the ENTER button.

Note: *M/D/Y is the default date format.*

Change the Date's format by pressing the M/D/Y button to display the date with the month first. Alternatively press the D/M/Y button to display the Date with the day first or press the Y/M/D button to display the date with the year first. See Figure 5-23.

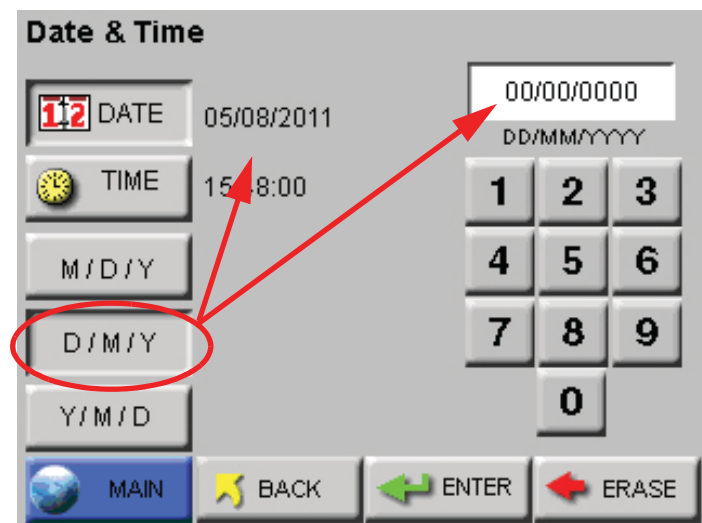


Figure 5-23 Date Option: Day first

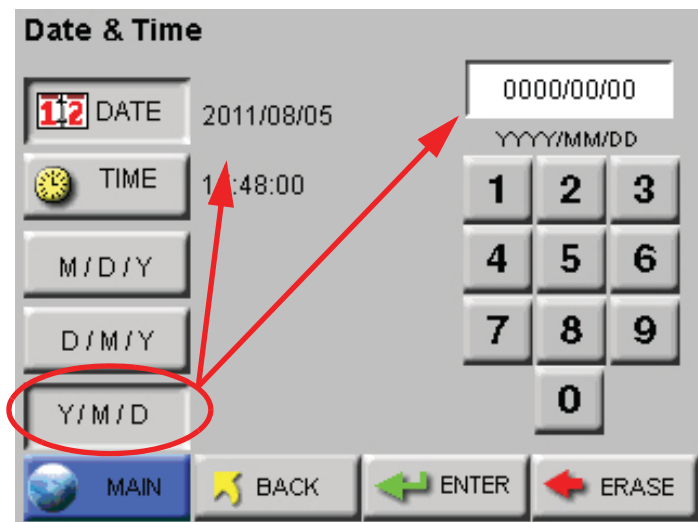


Figure 5-24 Date Option: Year first

Set the instrument's Time by pressing the TIME button as shown in Figure 5-25.



Figure 5-25 Configuring TIME

Enter the desired Time in hours, minutes and seconds then press ENTER to save the new time.

Press BACK to return to the Configuration screen or press MAIN to return to the MAIN screen.



OPTIONS

Several optional configuration settings are found on the OPTIONS screen. See Figure 5-26.

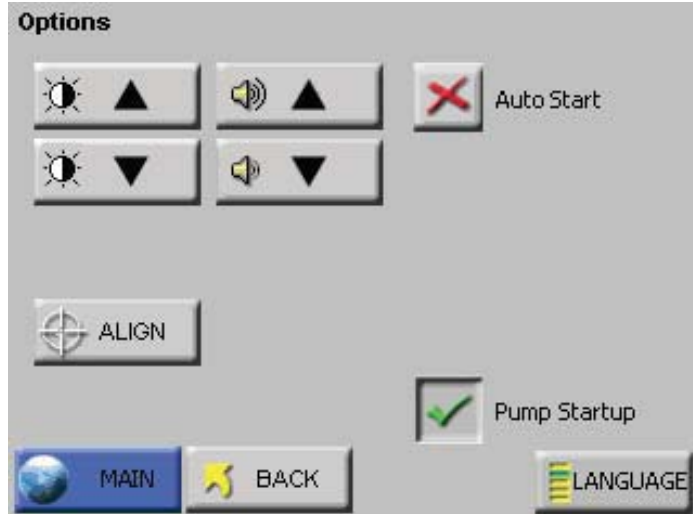


Figure 5-26 Options Configuration screen



CONTRAST ADJUST

The contrast/brightness of the LCD screen can be adjusted by pressing the first set of UP and DOWN arrows.



AUDIBLE BEEP ADJUST

The audio level of the BEEP can be adjusted by pressing the second set of UP and DOWN arrows.

ALIGN TOUCH SCREEN

The ALIGN button allows you to re-align the touch screen so the locations that you touch on the screen correspond to the expected button or function.

- Press the ALIGN button.



WARNING: *Be careful to touch the screen at the specified locations only. If you touch the screen elsewhere during this process, you will align the screen incorrectly.*

- The following screen appears. Touch the circle in the lower left corner as shown in Figure 5-27.

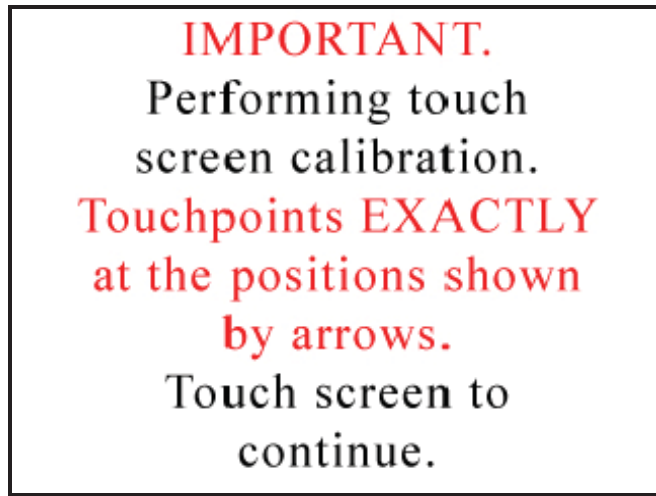


Figure 5-27 Alignment step 1

Note: *Using a PDA Stylus may give more accuracy to the touch screen interface.*

- Touch the circle in the upper right corner. See Figure 5-28.

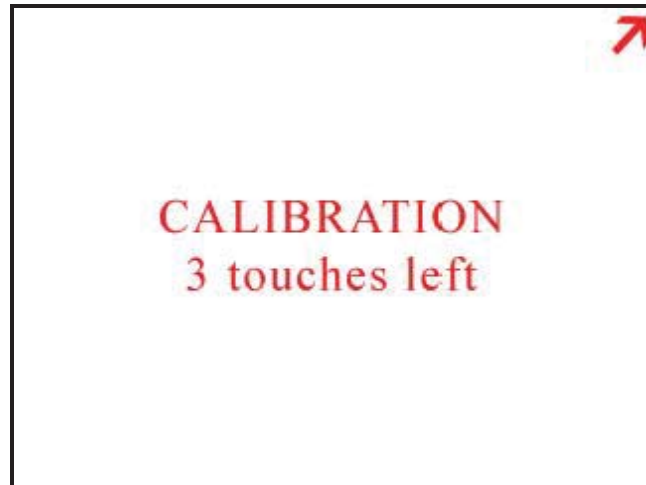


Figure 5-28 Alignment step 2

- Touch the circle in the lower right corner. See Figure 5-29.

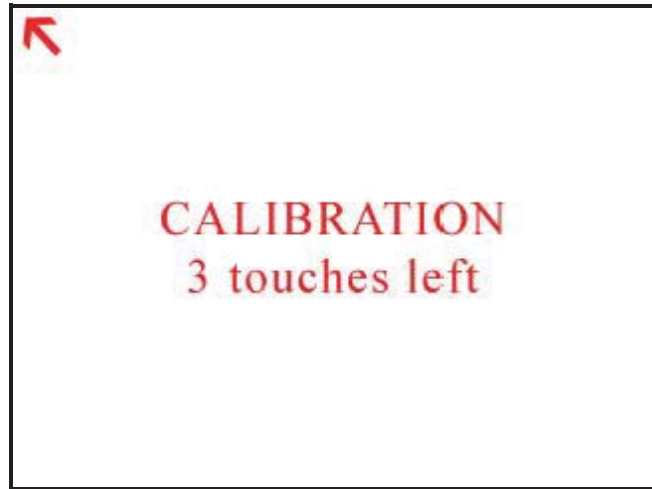


Figure 5-29 Alignment Step 3

- Press anywhere inside the rectangle to when you are ready to complete aligning the screen. See Figure 5-30.

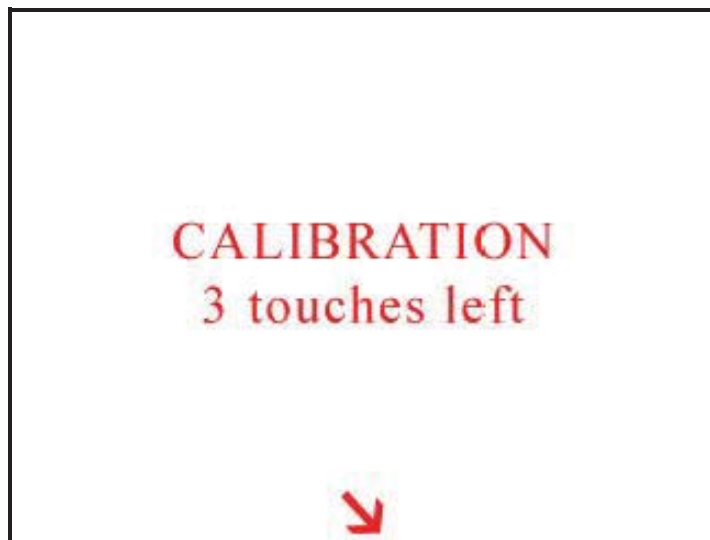


Figure 5-30 Verify Alignment of Touch Screen

- The unit will save the settings and display the MAIN screen as shown in Figure 5-31.

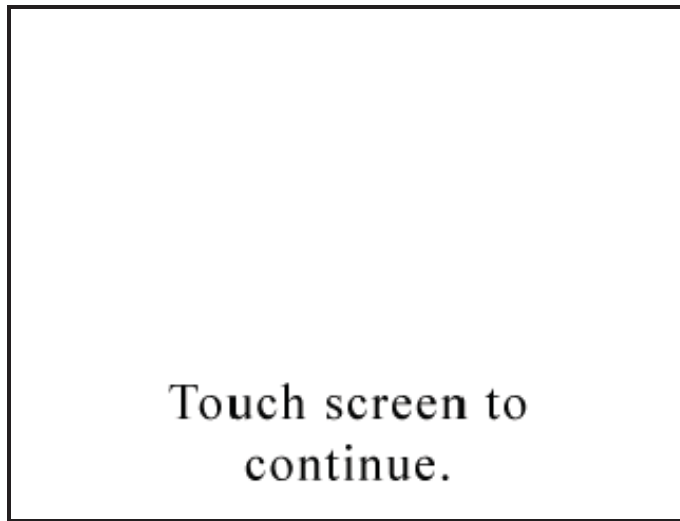


Figure 5-31 Calibration Saved Screen



Autostart Mode

Note: *When Autostart mode is enabled, set the Delay time to at least 5 seconds or enable the 5 Sec Startup in CFG Options.*

If Autostart mode is enabled and the instrument is powered on (or regains power after a power outage), the instrument will immediately begin sampling based its configured mode, delay, start, and hold times.



Pump Startup

This is ON by default and sets a five-second pump ramp up time at the beginning of the first sample, or at the beginning of all samples if the HOLD time is greater than one minute, to stabilize the laser and air flow. This setting should be left in the default mode unless special applications, such as “surface scans”, require it to be disabled.



LANGUAGE

Pressing the LANGUAGE button allows the user to change the operating language displaying the screen shown in Figure 5-32.



Figure 5-32 Operating Language Selection Screen

Press the desired language button then BACK or MAIN. The default is English.



COMM ADDRESS

When the HANDHELD is connected to a data collection system or daisy chained at the end of a chain of RS-485 instruments, the instrument's COMM address is used to identify it.

LMS XChange will search for the instrument by the COMM Address specified on the Communication screen shown below. COMM addresses range from 1 to 63.

For RS-485 communications, each device on a multi-port chain must have a unique address.

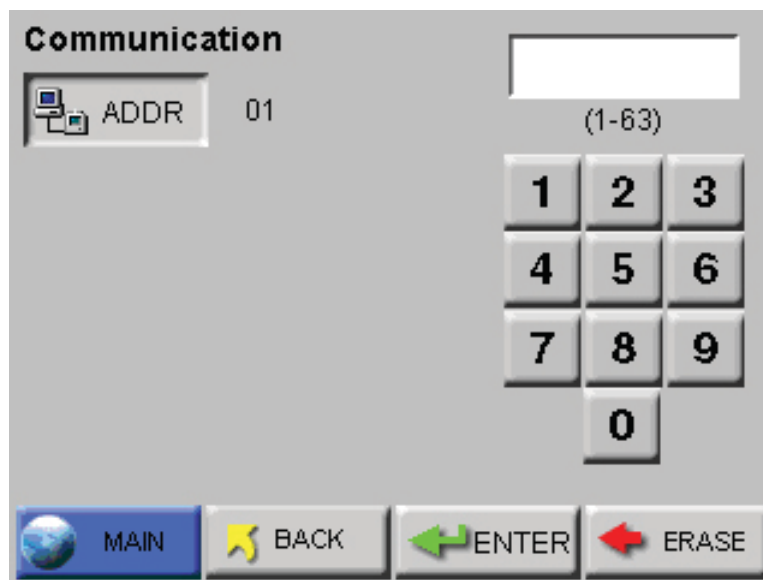


Figure 5-33 COMM Address Configuration screen

Set the COMM Address by using the numeric keypad to select the address; press ERASE to erase a number, if needed. Press ENTER to accept the value. See Figure 5-33.

Press BACK to return to the Configuration screen or press MAIN to return to the MAIN screen.

OUTPUT SETUP

The Print configuration has several options for printing the data that the user sets on the Printer Setup screen shown in Figure 5-34.

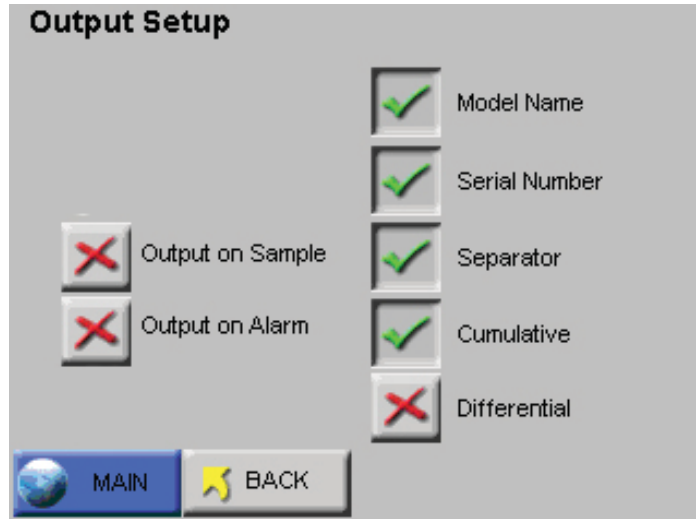


Figure 5-34 Printer Setup Screen

- **Output on Sample / Output on Alarm** - When **Output on Sample** is enabled, a single record will print at the end of every sample.

When **Output on Alarm** is enabled, a single record printout will print at the end of any sample that experiences an alarm condition.

- **Model Name** - When enabled, the Model name of the instrument will print in the header of all printouts.
- **Serial Number** - When enabled, the Serial Number of the instrument will print in the header of all printouts.
- **Separator** - When enabled, a line separator will print after the Model Name and Serial Number in the header of all printouts.

Note: *You can select both Differential and Cumulative printing at the same time. For normalized values with more than 8 digits, only the whole number will be printed.*

Press BACK to return to the Configuration screen or press MAIN to return to the MAIN screen.



SECURITY

To restrict access to the instrument and/or configuring the instrument, the HANDHELD has two different password levels. See Figure 5-35.

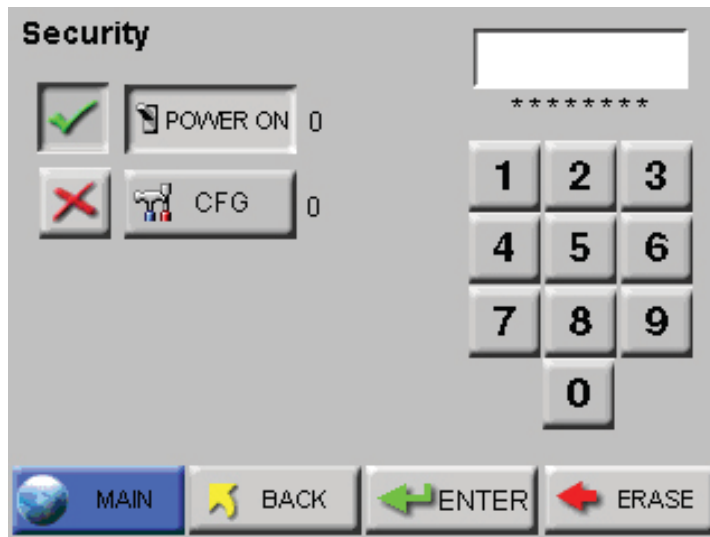


Figure 5-35 Security Password Configuration Screen

To restrict who can operate the instrument, enable the POWER ON password. When the POWER ON password is enabled, the user will be required to enter the correct password each time the instrument is turned on.

To restrict who can configure the instrument, enable the Configuration (CFG) password. When the Configuration password is enabled, the user will be required to enter the correct password to access the Configuration screen.

- To set the password for the POWER ON, select the POWER ON button, then type in a password using the numeric keypad. Press the ERASE button to delete the last character, if needed.
- Press ENTER to save.
- To set the Configuration (CFG) password, select the CFG button, then type in a password using the numeric keypad.
- Press the ERASE button to delete the last character, if needed.
- Press ENTER to save the changes.
- Press the “X” button to enable either or both passwords. The “X” changes to a check mark, indicating the password is enabled.

Press BACK to return to the Configuration screen or press MAIN to return to the MAIN screen.

POWER ON PASSWORD

WARNING: *Be sure to record the unit's passwords in a safe place. If the password is lost or forgotten, contact Lighthouse technical support for assistance. The unit may have to be returned to the factory to reset the password.*

To require that a password must be entered before the instrument can be used, enable the POWER ON password. See Figure 5-36.

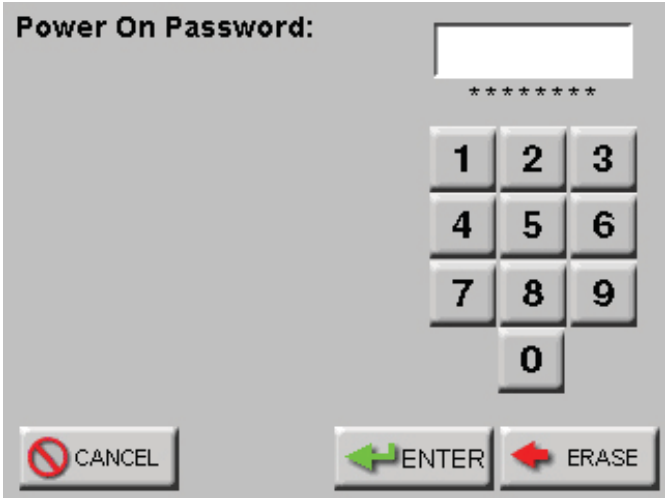


Figure 5-36 POWER ON Password Access Screen

When the POWER ON password is enabled, you will see a password access screen just after you turn the unit on. The instrument will remain locked until the correct password is entered.

CONFIGURATION PASSWORD

The Configuration password prevents unauthorized access to the Configuration screen. See Figure 5-37.

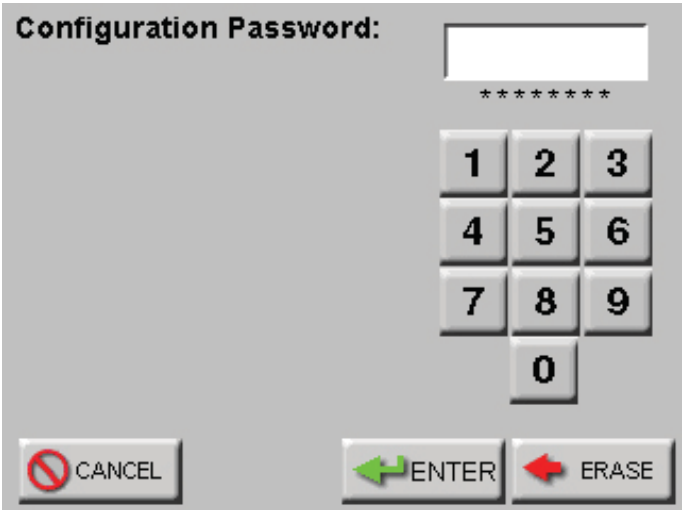


Figure 5-37 CONFIGURATION Password Access Screen

SERVICE



This section of the Configuration screen is reserved for Lighthouse Authorized Service Providers only. The correct service password must be entered to access this area.

STATUS



Touching the STATUS button displays the instrument programmed version of the various firmware modules. This information is useful when contacting Lighthouse Technical Support personnel. See Figure 5-38.

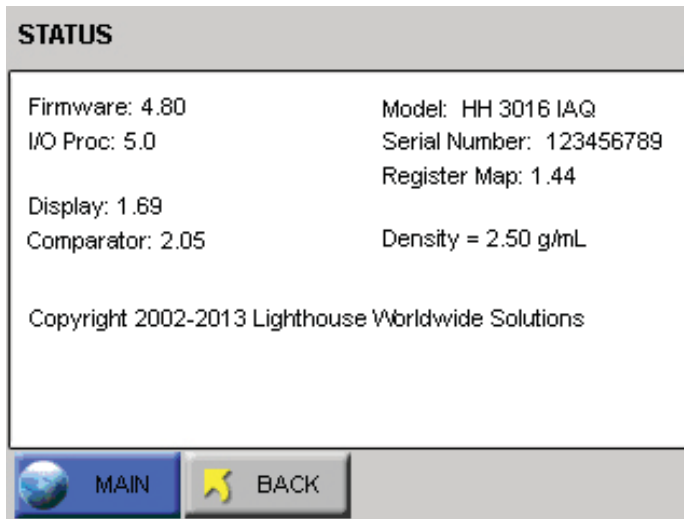


Figure 5-38 HANDHELD 3016 STATUS Screen

RECIPE

Selecting the RECIPE button displays the Recipe setup screen. See Figure 5-39.

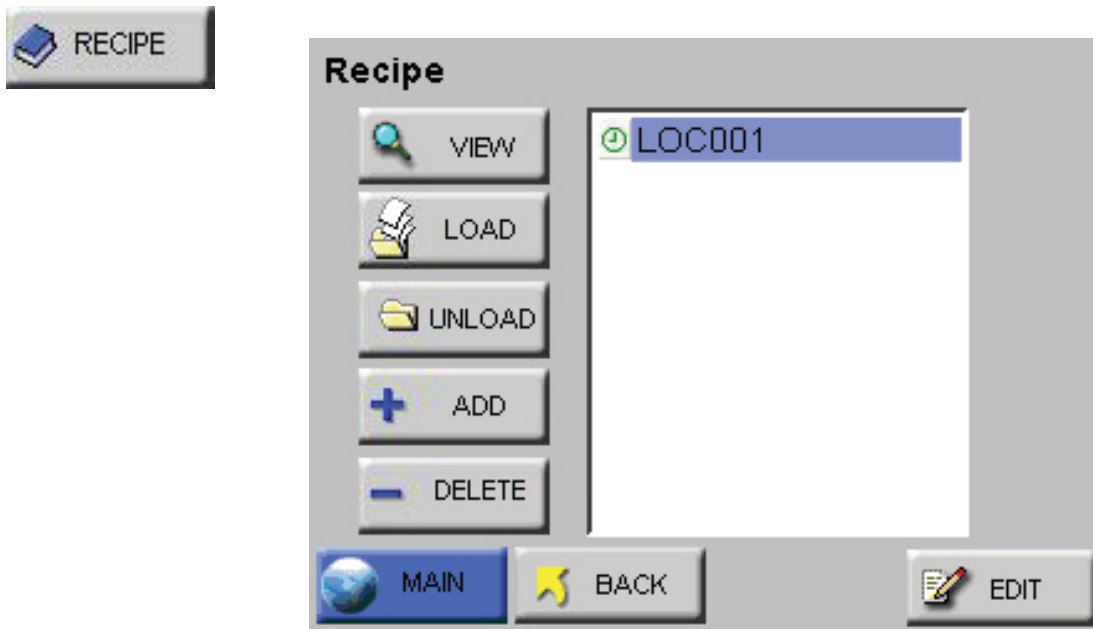


Figure 5-39 Recipe Setup Screen

The Recipe feature allows the user to save instrument settings for sampling and reports in a database that can store up to 50 recipes.



Selecting the ADD button displays the RECIPE text screen. See Figure 5-40. The recipe can be named using up to 12 characters.

Note: *If the location selected is already assigned to another recipe or if there are no available free locations, the user will not be able to add a new recipe. The "Add" button will not be displayed.*

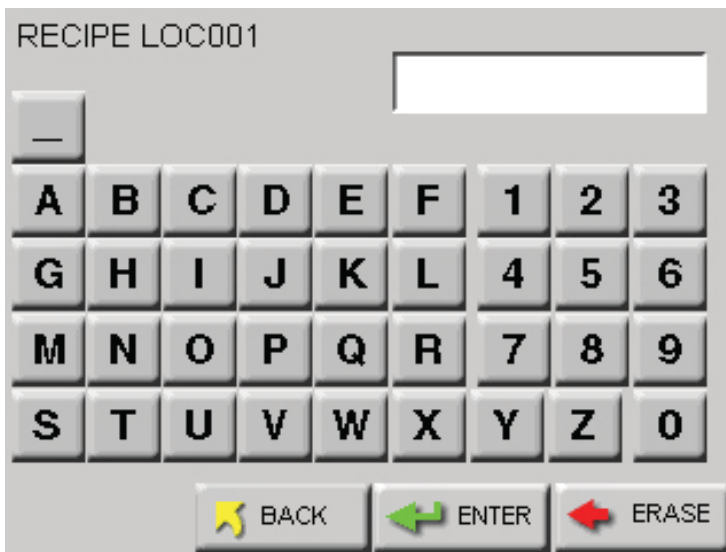


Figure 5-40 Recipe Name Screen

Pressing the ENTER button will add the recipe to the database and display the recipe CFG screen as shown in Figure 5-41. Each option allows the user to configure the instrument to the current recipe.

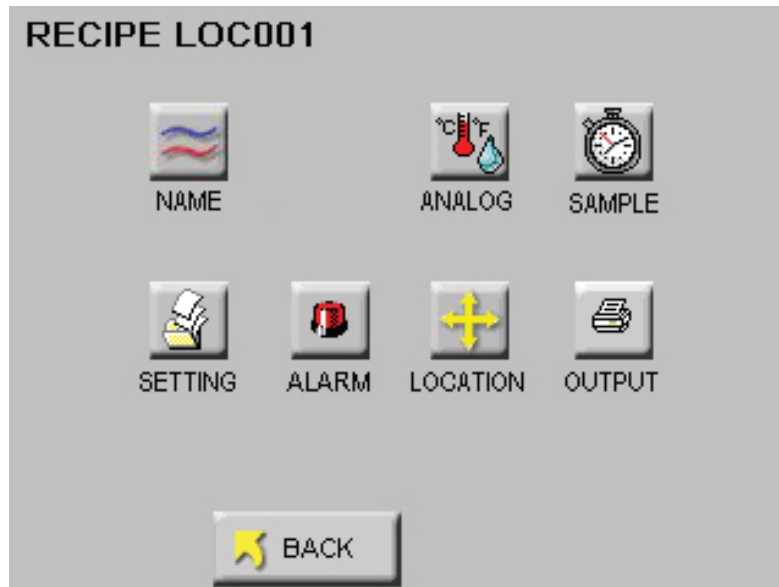


Figure 5-41 Recipe Configuration

Press the BACK button to save the settings and return to the RECIPE screen.



The VIEW button displays the current settings for the highlighted recipe. See Figure 5-42.

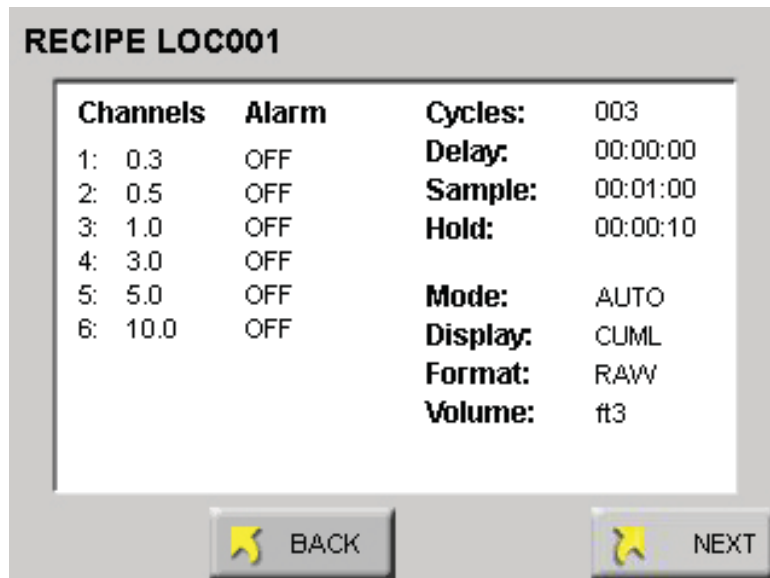


Figure 5-42 Recipe - Channel Settings

Press the NEXT button to view the analog and output settings. See Figure 5-43.

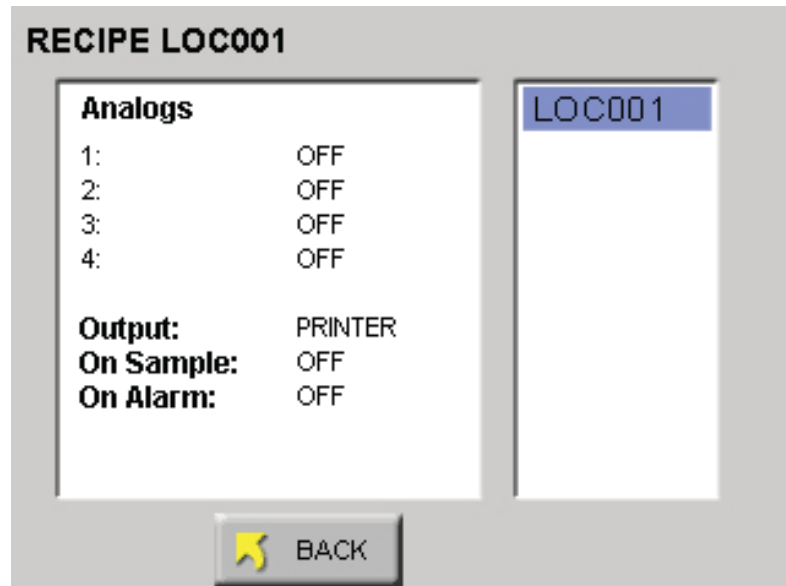
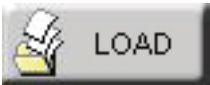


Figure 5-43 Recipe - Analog & Output Settings



Pressing the EDIT button on the main RECIPE screen will allow the user to change settings on the highlighted recipe.



The LOAD and UNLOAD buttons add or remove the highlighted recipe as the instrument's current operating configuration.



The DELETE button will delete recipes from the database.

LOCATION

The HANDHELD allows up to 200 different locations and associated alphanumeric labels.



Press the LOC button on the Configuration screen to display the Select Location screen as shown in Figure 5-44.

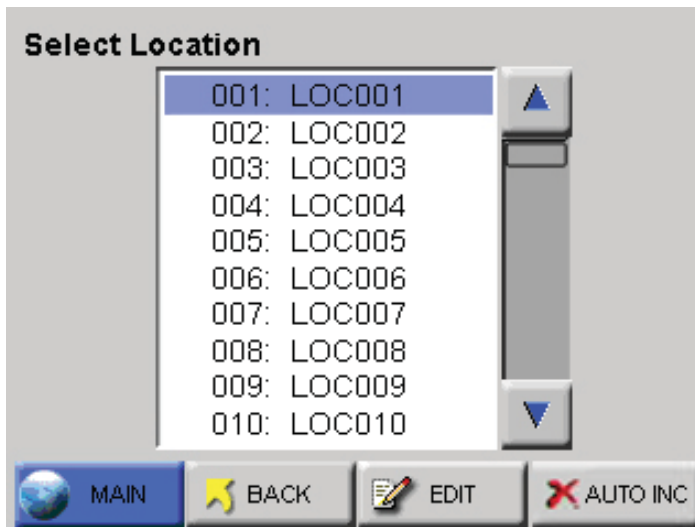


Figure 5-44 LOCATION Setup Screen

On the Select Location screen, the Location name can be selected using the UP and DOWN arrows or by touching the location name on the screen.

The following options can be enabled to configure locations for the HANDHELD.

- When enabled, the Auto Increment option will automatically select the next location after completing the programmed number of cycles. The default position is “off” when the unit is powered up.
- The unit can be configured for a maximum of 200 Locations. Each location name can be configured with a maximum of 8 characters per name.
- Recipes associated with a specific location are denoted by an asterisk (*) to the right of the location name.

- When selecting a location with a recipe, the user is provided with the option of loading the recipe as shown in Figure 5-45. If the user chooses not to load the recipe, the location can still be used with the current settings.

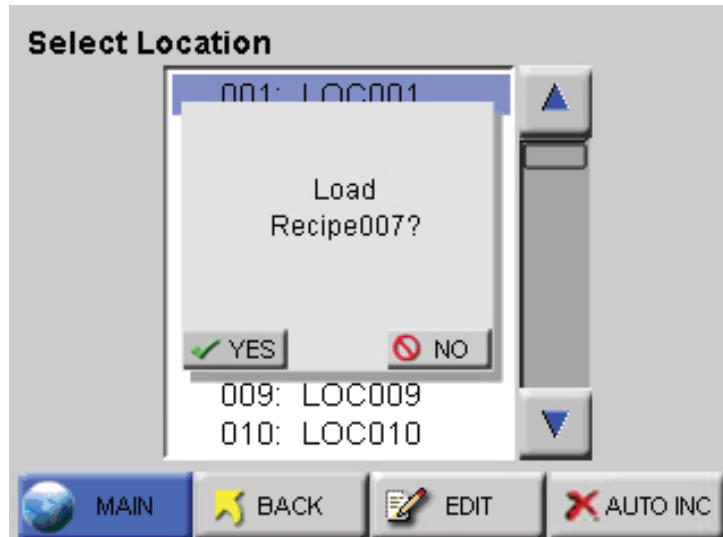


Figure 5-45 Location - Load Recipe

- If a recipe is loaded and a location is selected that is not associated with a recipe, the user is given the option to unload the current recipe. If the user chooses to keep the loaded recipe, the location will adopt the current recipe settings.



To create a name for a location, press the EDIT button to display the Edit screen.

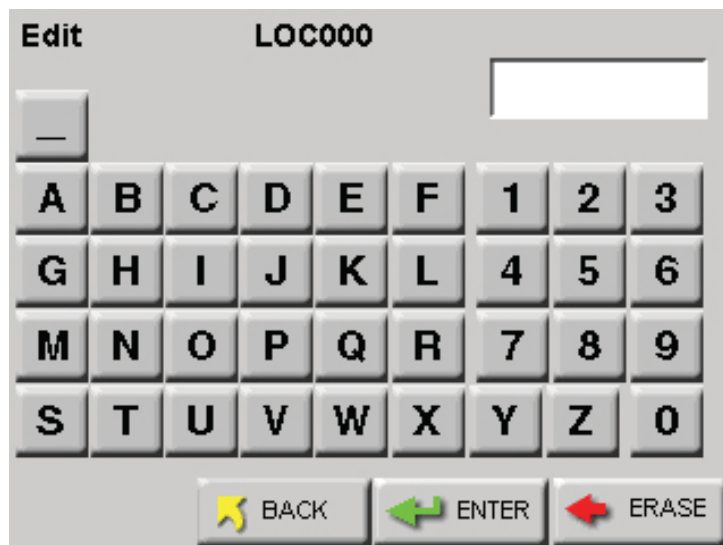
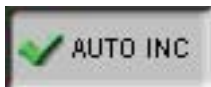


Figure 5-46 LOCATION Edit Screen

- Type in the name of the location using the alphanumeric and underscore keys.
- Press the ERASE button to erase the last character typed, if needed.
- Press ENTER.
- Use the Arrow keys to go to the next location to be edited and press the EDIT button. Continue in the same way to edit as many Locations as desired.

Press the BACK button to return to the Configuration screen or the MAIN button to return to the MAIN screen.



Activating the AUTO INC button allows the user to select the next location once the number of cycles is completed.

- The user is prompted to move to the next location after the programmed number of cycle. See Figure 5-47.

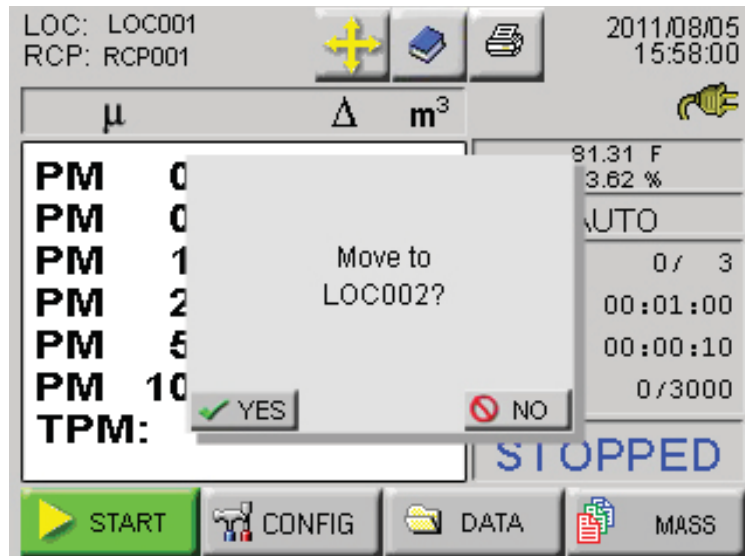


Figure 5-47 Auto Increment Prompt

The Auto Increment mode will select the next corresponding location and continue to sample using the current configuration. If the current location is using a recipe, the user will be prompted to unload the recipe before moving to the next location.

DATA VIEW

Data that is stored on the instrument is viewed in the Data Screen. When the buffer has filled to its limit of 3000 records, the newest records will overwrite the first records stored. The word “Records” on the MAIN screen will have an asterisk (*) next to it to indicate that the buffer has wrapped. When you go to the Data screen after the data has wrapped, the first record viewed will be the most current record, which will not necessarily be record #1.

Note: *PARTICLE data may be printed, even if the data was taken in MASS mode. On the MAIN Screen, press the MASS button, which changes it to PARTICLE. Return to the Data Screen to see the particle counts.*

Press the DATA button on the MAIN screen to display the Data screen.

Scroll through the data using the UP and DOWN arrow buttons.

- The single arrow moves one record at a time.

Size	PM	ugr/m ³
0.3	----	2.12
0.5	2.12	4.29
1.0	6.41	6.93
2.5	13.34	32.18
5.0	45.51	51.48
10.0	97.00	38.33
TPM	0.13	2.50 g/mL

Loc:	LOC000	Instr:	GOOD	75.1	F
Smpl:	00:01:00	Flow:	OK	42.3	%
Date:	08/08/2011	Alarm:	NONE		
Time:	12:43:23	Laser:	OK		

Figure 5-48 Data Screen - Mass Concentration data in ugr/m³

The Data screen displays the following information for each data record. See Figure 5-48. The data in PM column is cumulative. The data in the UGR column is differential. TPM is the total UGR/cubic meter.

Note: *When the buffer has wrapped, the record that is first displayed in the Data screen is the first record in the data buffer. This may not be Rec#1.*

If you press the single down arrow button once, the instrument will display the last record in the data buffer.

- **Rec#** - Identifies which record is currently viewed.
- ***Recs** - Displays how many records are currently stored in the HANDHELD's buffer. When there is an asterisk (*) next to the word "Recs", this means that the 3000 record data buffer has wrapped. The basic concept is First In, First Out (FIFO).
- **Size** - Lists the channel sizes configured on the instrument.
- **PM** - Indicates Particulate Matter, expressed in micrograms per cubic meter (ugr/m³). PM is calculated by summing the mass concentration levels for all channels smaller than the indicated channel. For example, the PM 1.0 = (Mass Concentration of 0.3) + (Mass Concentration of 0.5). PM 10.0 = the sum of the Mass Concentration levels of the 0.3 + 0.5 + 1.0 + 2.5 + 5.0µm channels. Note that the Mass Concentration of the 10.0µm channel is not included. It is, however, included in the TPM value, see TPM below.

Figure 5-48 can be used to aid understanding of PM. Note that the 1.0 value, 6.41, is the sum of the values in the ugr/m³ entries for the 0.3 and 0.5µm channels (2.12 + 4.29 = 6.41).

- **TPM** - Total Particulate Matter, expressed in micrograms per cubic meter, is the sum of mass concentration levels of all channels.
- **ugr/m³** - Lists the Mass Concentrations for each individual channel, expressed in micrograms per cubic meter (ugr/m³).
- **Density** - The mathematical formula used to compute Mass Concentration (simplifies to Mass = Density * Volume) assumes a density value of Carbon, which is 2.5 grams per milliliter. The Density factor may be changed, if desired, using the LMS XChange program.
- **Loc** - Indicates the location at which the data record was recorded. The Location name listed is the alphanumeric label that was saved.
- **Smpl** - Indicates the Sample Time (HH:MM:SS) at which the data record was sampled.
- **Date** - Indicates the instrument date on which the data was recorded. The date will display in the format selected in the configuration (MM/DD/YYYY, DD/MM/YYYY or YYYY/MM/DD).
- **Time** - Indicates the instrument time at which the data was recorded (HH:MM:SS).

- **Instr** - Indicates the state of the instrument at the time the data was recorded. Instrument states include GOOD or SRVC.

If SRVC appears, printouts will say “Service Required” and the sensor may need cleaning. Please contact Lighthouse Technical Support at 1-(800) 945-5905 or techsupport@golighthouse.com.

- **Flow** - Indicates the flow state of the instrument at the time the data record was recorded. Flow is recorded as OK or ALRM. If the flow was in alarm, it will print as Flow: Alert on the printouts.
- **Alarm** - Indicates (NONE or YES) if the data record exceeded any of the alarm thresholds of any of the channels that were enabled for alarms. If the data record exceeded alarm thresholds, printouts show “Alarm: Yes”.
- **Laser** - Indicates the status of the laser at the time the data record was recorded; possible laser states include OK or SRVC. If the laser needs to be serviced, it will print as Laser: Service.

If laser state is SRVC, please contact Lighthouse Technical Support at 1-(800) 945-5905 or techsupport@golighthouse.com.

Analog Data

If the Temperature/Relative Humidity probe is attached during data recording, the analog data will be listed in the Data screen.

PRINT RECORD

Note: *PARTICLE data may be printed, even if the data was taken in MASS mode. On the MAIN Screen, press the MASS button, which changes it to PARTICLE. Return to this point to print the particle counts.*

When you push the PRINT RECORD button, whatever record is currently displayed in the Data screen will print as a single sample record. The record will print according to the settings in the Print Configuration.

The form in which the data is printed (PM or ugr/m³) is dependent the Particle Display setting in CFG:Settings. The left side of Figure 5-49 is a PM printout, the right side is a ugr/m³ printout.

```
**HH 3016 IAQ**  
Serial #: 070244001  
-----  
Location: LOC001  
03/01/2007, 15:51:57  
Sample Time: 00:00:10  
Laser: OK  
TEMP: 74.7 F  
RH: 52.2 %  
PM Values:  
Size      PM  
0.5      3.90  
1.0      5.74  
2.5      6.84  
5.0      9.77  
10.0     14.45  
TPM:     25.54
```

```
**HH 3016 IAQ**  
Serial #: 070244001  
-----  
Location: LOC001  
03-01-07, 15:51:57  
Sample Time: 00:00:10  
Laser: OK  
TEMP: 74.7 F  
RH: 52.2 %  
UGRs/ m^3:  
Size      UGR  
0.3      3.90  
0.5      1.84  
1.0      1.10  
2.5      2.93  
5.0      4.68  
10.0     11.09
```

Figure 5-49 Examples of Output from Auto Printout of Sample

PRINT RANGE (BUFFER REPORT)

Note: *PARTICLE data may be printed, even if the data was taken in MASS mode. On the MAIN Screen, press the MASS button, which changes it to PARTICLE. Return to this point to print the particle counts.*

The instrument stores up to 3000 records in its data buffer. The Buffer Report prints all or a range of the records in the buffer in the format specified by the selections in the Configuration.

At the end of the Buffer Report, the following summary information is printed.

- Data is displayed in PM or UGR mode
- # of samples in the report
- For each channel size:
 - Maximum Value
 - Minimum Value
 - Average
 - Standard Deviation

The UCL calculation will be printed for each channel size if the number of locations in the range is 2 through 9. The calculation will only print if the Format settings (Setting screen) are set to CUMUL and NORM. Any other format settings or locations less than 2 and greater than 9 will print N/A for each channel.

View the same data in different formats just by changing the Particle Display options on the Sample Setting screen.

The Data Summary can be viewed as:

- PM
- UGR/m³

Printing Buffer Report

- To print a range of data from the buffer, scroll to the first data record to be included in the range.
- Press the RANGE button. The following screen will display as shown in Figure 5-50.

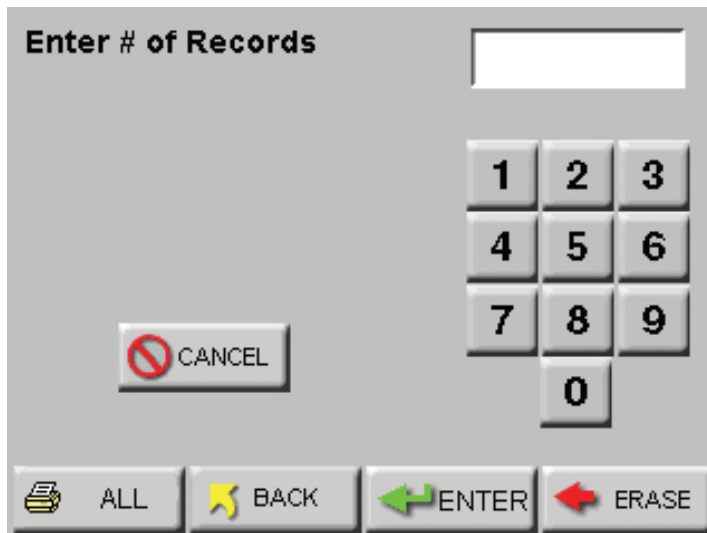


Figure 5-50 Print Range Screen

Note: *Printing ALL records may take some time if the buffer is full.*

- Enter the number of records to print and press the ENTER button.
- Press ALL to print all records in the buffer.
- Press CANCEL to cancel printing.
- Press BACK to return to the View Buffer screen without printing the report.

When more than one record is printed, a second section of the Summary is also generated. This section contains the maximum, minimum, average and standard deviation for all values in the printed records. An example of the Summary appears in Figure 5-51 on the next page.

```

-----
**HANDHELD 3016IAQ
Serial #: 130602001
-----
Location:      LOC002
06-20-2013,  15:34:30
Sample Time:   00:01:00
Flow:         0.1 cfm
Laser:        OK
TEMP:         66.77 F
RH:           35.71 %
Particles/ ft^3:
Size          Cumul
0.3           4260.0
0.5           810.0
1.0           580.0
3.0           360.0
5.0           350.0
10.0          310.0

Location:      LOC003
^ ^ ^ ^ ^ ^ ^ ^ ^ ^
- ^ v ^ v ^ v ^ v ^ v ^ v ^
Particles/ ft^3:
Summary (Cuml):
-----
# of samples =2
Size          Max
0.3           4260.0
0.5           810.0
1.0           580.0
3.0           360.0
5.0           350.0
10.0          150.0

Size          Min
0.3           3860.0
0.5           750.0
1.0           360.0
3.0           240.0
5.0           180.0
10.0          150.0

- ^ v ^ v ^ v ^ v ^ v ^ v ^
Size          95% UCL
0.3           5322.0
0.5           969.3
1.0           1164.1
3.0           678.6
5.0           801.4
10.0          734.8

```

Figure 5-51 Sample Buffer Report







Power Shutdown Levels

When the HANDHELD is powered from its rechargeable battery, a Power Shutdown feature protects the battery from discharging completely. A complete discharge could damage the battery.

Note: *It is not recommended to allow the battery to discharge completely.*

The battery levels are as follows:

Table 5-1 Levels of Battery Life

Battery Icon	Description
	FULL
	75%
	50%
	25%
	Empty; at this level, the instrument will begin to beep and will display “BATT LOW!” on the main screen. It is recommended to connect the AC cord and plug it into an outlet at this level.
	Pump Shutdown; if the instrument is currently on and sampling the pump will turn off and the instrument will shut down.

After the pump shutdown level and before the battery reaches its critical low point, the instrument will shut down all power. To prevent loss of power, attach the AC cord and plug into an outlet as soon as the BATT LOW! message appears on the screen.

6

Maintenance Procedures

This Chapter provides the user with the procedures to perform in maintaining the HANDHELD instrument.

Safety

Before performing any of the maintenance tasks described in this chapter, read Chapter 1 of this manual and become familiar with the warnings and caution labels.

Calibration

To maintain optimum performance of this instrument, it should be recalibrated annually by a Lighthouse Authorized Service Provider.

Cleaning

This procedure may be superceded by customer requirements; however, not under any circumstances apply Acetone to the HANDHELD instrument.

1. To keep the interior of the instrument clean, remove the isokinetic probe from the air inlet and install the protective plastic cap supplied with the instrument.
2. Moisten a lint-free cloth with isopropyl alcohol. The cloth should be moist, not wet.
3. Wipe down the exterior surfaces of the instrument.

Purge Test

1. Connect the Purge filter to the sample inlet. The purge filter should be a 0.1 micron, 0.1 CFM filter.
2. Apply power to the instrument.
3. Configure the unit via the touchscreen interface to sample for 30 minutes.

4. Allow the instrument to sample through a 30 minute period. This time allows the unit to warm up and purge any residual particles that might be inside it.
5. Configure the unit via the touchscreen interface to sample for 5 minutes and set a 10 second hold.
6. Set Cycles to 10 so the instrument will take 10 five-minute samples.
7. If an average of more than one count per five minute sample is reported, reset the instrument to sample for 30 minutes again to purge it, then repeat the Purge Test again.
8. After the instrument has met the requirement of the Purge test, return the instrument to its normal location and operating status.
9. If the instrument still fails the Purge Test, contact Lighthouse Tech Support for assistance.

A *Limited Warranty*

Limitation Of Warranties:

- A. Lighthouse Worldwide Solutions (LWS) warrants that all equipment shall be free from defects in material and workmanship under normal use for a period of two years from date of shipment to Buyer except that LWS does not warrant that operation of the software will be completely uninterrupted or error free or that all program errors will be corrected. Buyer shall be responsible for determining that the equipment is suitable for Buyer's use and that such use complies with any applicable local, state, or federal law. Provided that Buyer notifies LWS in writing of any claimed defect in the equipment immediately upon discovery and any such equipment is returned to the original shipping point, transportation charges prepaid, within two years from date of shipment to Buyer and upon examination LWS determines to its satisfaction that such equipment is defective in material or workmanship, i.e. contains a defect arising out of the manufacture of the equipment and not a defect caused by other circumstances, including, but not limited to accident, misuse, unforeseeable use, neglect, alteration, improper installation, improper adjustment, improper repair, or improper testing, LWS shall, at its option, repair or replace the equipment, shipment to Buyer prepaid. LWS shall have reasonable time to make such repairs or to replace such equipment. Any repair or replacement of equipment shall not extend the period of warranty. If the Instrument is modified or in any way altered without the explicit written consent of LWS then the warranty is null and void. This warranty is limited to a period of two years, except as noted below, without regard to whether any claimed defects were discoverable or latent on the date of shipment. The length of warranty for pumps in hand held particle counters is one (1) year. Batteries and accessories with all products are warranted for one (1) year. Fuses and purge filters carry no warranty. If a third party battery is used in the product, the product warranty is null and void. If the battery is charged by a third party battery charger the battery warranty is null and void.
- B. If Buyer shall fail to pay when due any portion of the purchase price or any other payment required from Buyer to LWS under this contract or otherwise, all warranties and remedies granted under this Section may, at LWS's option, be terminated.
- C. THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER REPRESENTATIONS, WARRANTIES AND COVENANTS, EXPRESS OR IMPLIED WITH RESPECT TO THE EQUIPMENT AND ANY DEFECTS THEREIN OF ANY NATURE WHATSOEVER, INCLUDING AND WITHOUT LIMITATION WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. LWS SHALL NOT BE LIABLE FOR, AND BUYER ASSUMES ALL RISK OF, ANY ADVICE OR FAILURE TO PROVIDE ADVICE BY LWS TO BUYER REGARDING THE EQUIPMENT OR BUYERS USE OF THE SAME. UNDER NO CIRCUMSTANCES SHALL LWS BE LIABLE TO BUYER UNDER ANY TORT, NEGLIGENCE, STRICT LIABILITY,

OR PRODUCT LIABILITY CLAIM AND BUYER AGREES TO WAIVE SUCH CLAIMS. LWS'S SOLE AND EXCLUSIVE LIABILITY AND BUYERS SOLE AND EXCLUSIVE REMEDY, FOR ANY NONCONFORMITY OR DEFECT IN THE PRODUCTS OR ANYTHING DONE IN CONNECTION WITH THIS CONTRACT, IN TORT, (INCLUDING NEGLIGENCE), CONTRACT, OR OTHERWISE, SHALL BE AS SET FORTH IN THE SUBSECTION A HEREOF AS LIMITED BY SUBSECTION B HEREOF. THIS EXCLUSIVE REMEDY SHALL NOT HAVE FAILED OF ITS ESSENTIAL PURPOSE (AS THAT TERM IS USED IN THE UNIFORM COMMERCIAL CODE) PROVIDED THAT THE SELLER REMAINS WILLING TO REPAIR OR REPLACE DEFECTIVE EQUIPMENT (AS DEFINED IN SUBSECTION A) WITH A COMMERCIALY REASONABLE TIME AFTER RECEIVING SUCH EQUIPMENT. BUYER SPECIFICALLY ACKNOWLEDGES THAT SELLER'S PRICE FOR THE EQUIPMENT IS BASED UPON THE LIMITATIONS OF LWS'S LIABILITY AS SET FORTH IN THIS CONTRACT.

Warranty Of Repairs After Initial Two (2) Year Warranty:

- A. Upon expiration of the initial two-year warranty, all parts and repairs completed by an authorized Lighthouse repair technician are subject to a six (6) month warranty.
- B. Other than the above, LWS makes no warranty of any kind, expressed or implied, except that the products manufactured and sold by LWS shall be free from defects in materials and workmanship and shall conform to LWS's specifications; Buyer assumes all risk and liability resulting from use of the products whether used singly or in combination with other products. If instrument is modified or in any way altered without the explicit written consent of LWS, then the warranty is null and void.
- C. WARRANTY REPAIRS SHALL BE COMPLETED AT THE FACTORY, BY AN AUTHORIZED SERVICE LOCATION, BY AN AUTHORIZED SERVICE TECHNICIAN, OR ON SITE AT BUYER'S FACILITY BY A LIGHTHOUSE AUTHORIZED EMPLOYEE. BUYER PAYS FREIGHT TO FACTORY; SELLER WILL PAY STANDARD RETURN FREIGHT DURING THE WARRANTY PERIOD. BUYER MAY SELECT A FASTER METHOD OF SHIPMENT AT ITS OWN EXPENSE.

B

Default Settings

HANDHELD Default Settings

MENU ITEM	VALUE
LOC	001
MODE	AUTO
DATA DISPLAY	CUML
DATA FORMAT	RAW
PARTICLE VOL	FT^3
ENVIRON UNIT	US
PASSWORD	0
SAMPLE TIME	00:01:00
HOLD TIME	00:00:10
# OF CYCLES	10
COMM ADDR	001
AUDIBLE ALERT	OFF
THRESHOLD	1000
STORAGE SETUP	ALL CH ON
DATE FORMAT	M/D/Y
PRINT SAMPLE	OFF
PRINT ALARM	OFF

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