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USER GUIDE

ActiveCount microbial air samplers

Lighthouse

Distributed by AKRIBIS



ActiveCount100H

MICROBIAL SAMPLER WITH HEPA FILTERED EXHAUST



Operators Manual

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Manufactured by:

Lighthouse Worldwide Solutions
1221 Disk Drive
Medford, Oregon 97501
www.golighthouse.com

Table of Contents

Introduction 6
- ActiveCount100H Basics 6
- Safety Warnings 6
- Touch Screen Calibration 7
- Quick look at ActiveCount100H 8
- Data logging on USB Flash Drive 9
- Charge battery 9
- Get Ready For Sampling 10

Interpret Results 11
- Microorganism Sampling Principles 11
- Constant and Periodic Sampling Modes 12
- Continuous Sampling Exercise 14
- Periodic Sampling Exercise 15
- Security: Configuration Lock 16
- Status LED: Sampling Status 17
- Sampling Status Screens 18
- Sampling Run Metadata 18

Total Sampling Volume 19
- Select Total Sampling Volume 19
- Active Volume Applies to Sampling Runs 19

Locations and Users 20
- Assigns Active Location to Sampling Runs 20
- Assigns Active User to Sampling Runs 21

Data Logging – Sampling Data 22
- Save sampling data to USB flash drive. 22

Status Indicators 23
- Device Status Indicators 23

Settings 25
- ActiveCount100H Settings 25

Tripod/Monopod 26
- Vertical and Horizontal Sampling 26

Optional Compressed Gas Sampler 27
- Verify Nominal Flow before Gas Sampling 27

Clean and Disinfect 30
- Avoid Cross Contamination 30
- External Enclosure 30
- Sampling Head, Dust Cover and Petri Dish Assembly 31
- Transport 31
- Warnings 31

Calibration 32
- Calibration – Contact Authorized Facility 32

Technical Specifications 33
- Benefits 33
- Features 33
- Package Contents 34
- Conforming Specifications 34
- Additional Help 34

Appendix A: Database Files 35
- Databases in Comma-Delimited Files 35
- Location Database 35
- User Database 35

Sampling Run Databases....36
Appendix B: Feller Conversion Table....38
Sampling Head with 300 Holes x 0.6mm....38
Appendix C: Limited Warranty....39
Limitation of Warranties....39
Warranty of Repairs After Initial Two (2) Year Warranty....39

EU CE DECLARATION OF CONFORMITY

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

Declares the product:

Product Name:	ActiveCount
Model Number(s):	ActiveCount100H

Conforms to the following Product Specifications:

SAFETY	EN61010-1:2010	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use Part 1: General Requirements IEC 61010-1:2010
	CAN/CSA C22.2 No. 1010.1-1992	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use, Part 1: General Requirements
EMC	EN61326-1:2013	Electrical Equipment for Measurement, Control and Laboratory Use EN 61326-1:2013

UL 61010A-1 - UL Standard for Safety Electrical Equipment for Laboratory Use; Part 1: 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. March 16, 2017

Jerry Szpak – VP Engineering

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Introduction

ActiveCount100H Basics

Monitoring air for live microorganisms is essential when manufacturing hygiene-sensitive products in safe and sterile environments, such as:

- Pharmaceutical, hospital, food & beverage
- Cleanrooms, biological safety cabinets, isolators
- IAQ indoor air quality, museums, libraries
- Cosmetics, textiles, agricultural, environment
- Additional aseptic environment monitoring applications

Microorganisms have the potential to contaminate industrial products and harm human health.

ActiveCount100H is a high-performance instrument that uses a well-known method, *impaction,* to aspirate air through a perforated plate and deposit airborne bacteria onto an agar-coated petri dish. The petri dish is then removed, incubated, and tested for live microorganisms.

Safety Warnings

ActiveCount100H Safety Warnings

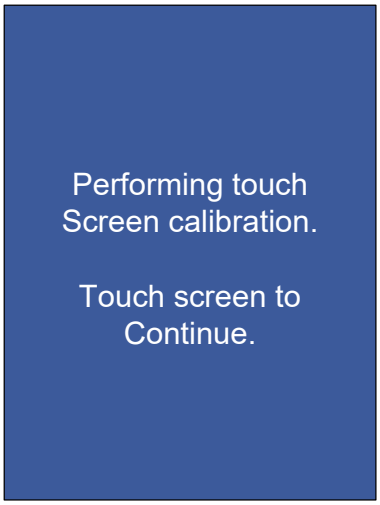
- If the ActiveCount100H is /was used in Biosafety Level 2 (BSL2) or higher, please contact your nearest Lighthouse Worldwide Solutions service center to follow the required decontamination procedures before returning the unit for service or calibration.
    - Service Contact:https://www.golighthouse.com/en/technical-support-request
- Do not sample flammable or corrosive gases.
- ActiveCount100H gas sampler is designed to sample compressed air, CO_2 or NO_2 only.
- To minimize the chance of electric shock, turn off the instrument and disconnect power adapter during sterilization.
- Do not charge ActiveCount100H with a power supply other than one provided by Lighthouse Worldwide Solutions.
- Do not submerge ActiveCount100H in any liquids.
- Do not spray disinfectant solution directly into ActiveCount100H enclosure.
- Do not use gasses to disinfect ActiveCount100H.

Touch Screen Calibration

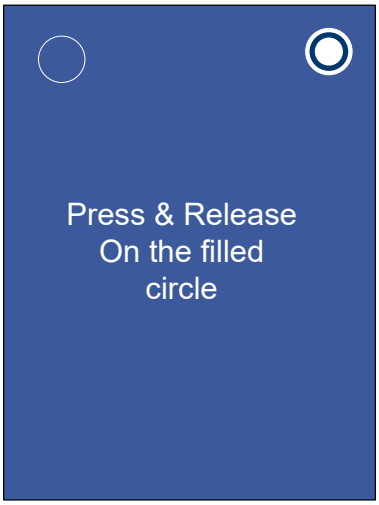
The ActiveCount100H 3.5” color touch screen is calibrated prior to shipping and there should be no need to recalibrate at any time. Alternatively touch screen calibration may be performed at any time by following the steps outlined here.

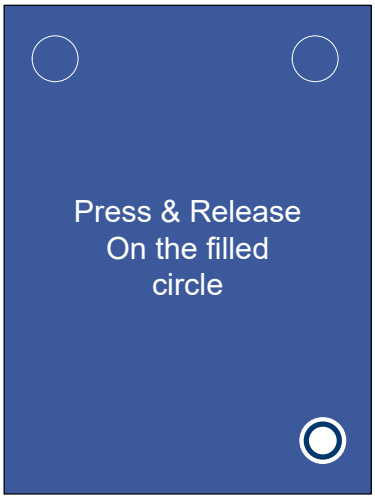
Touch Screen Calibration

1. Power off the ActiveCount100H.
2. While holding your finger on the touch screen; Power on ActiveCount100H and continue to hold your finger on the touch screen until the “Performing touch screen calibration” screen appears.
3. Follow the prompts to calibrate the touch screen by pressing and releasing on the filled circles for all four corners.

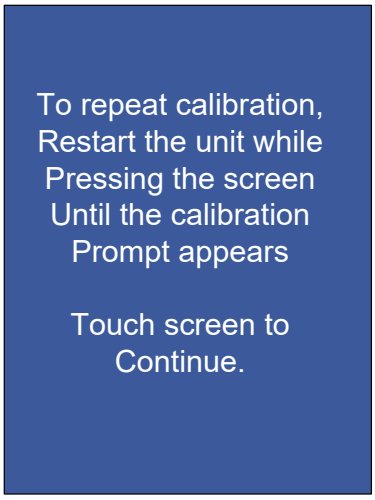












Quick look at ActiveCount100H

- User-friendly and easy to use
- Large 3.5” (8.9 cm) color touchscreen
- Airflow 100 liters per min ± four liters
- 8 programmable sample volumes
- 50 programmable users
- 400 programmable locations
- Programmable delay start
- Continuous and periodic sampling modes
- Sampling head dust cover
- Autoclave-able sampling head and dust cover
- Stainless steel sampling head
- Uses standard ISO 24998 90mm petri dishes
- Status LED
- Allen wrench for petri dish holder (non-cassette version only)
- Lithium ion rechargeable battery
- Battery life 8 hours continuous sampling or 10 hours normal sampling use. Normal sampling use is defined as sampling 10 minutes, pausing 5 minutes and repeating.
- Battery charge time 4 hours
- Store sample data on USB flash drive
- Supports 3/8” tripod screws
- Tripod adapter for 1/4” tripod screws
- Calibration reminder
- Calibration certificate
- Carrying case
- Optional compressed gas sampler
- Optional remote sample adapter

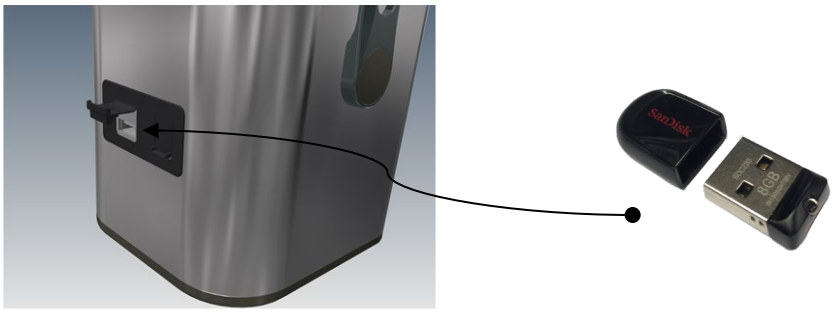


ActiveCount100H
Main screen

Data logging on USB Flash Drive

Data logging

Insert the included USB flash drive to store sampling data.

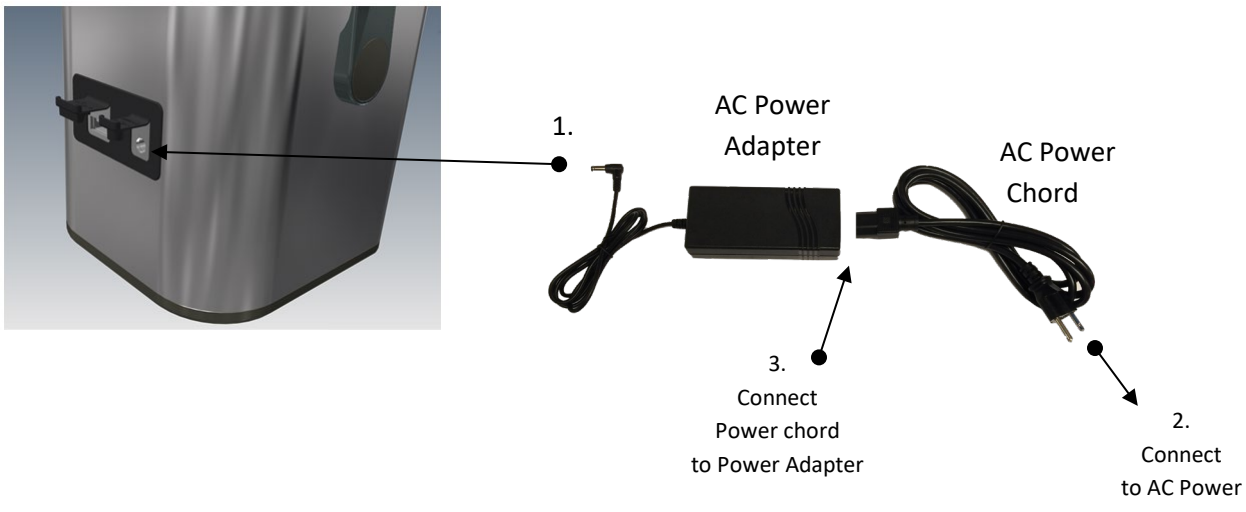


Charge battery

Follow the instructions below to charge the ActiveCount100H battery. To achieve a fully charged battery, please allow four hours.

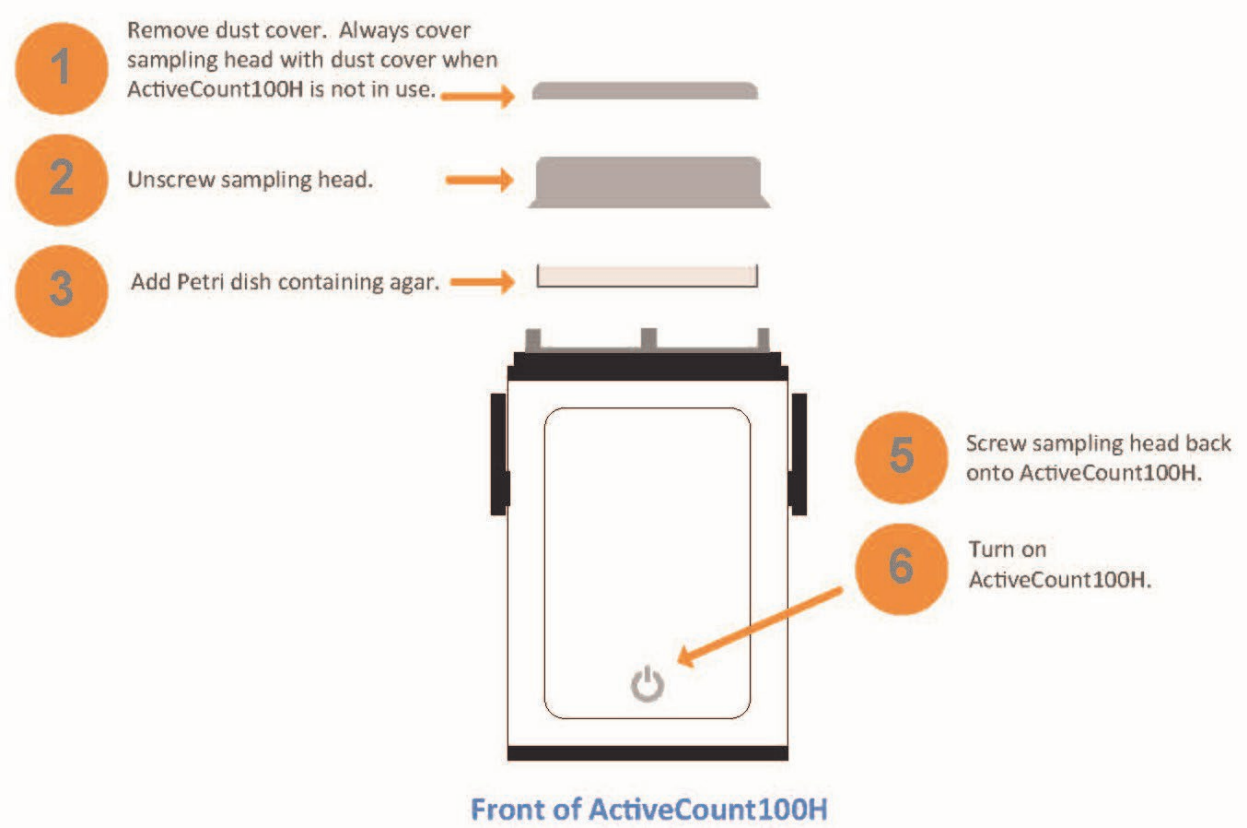
Connection to Power

1. Connect AC Power Adapter to ActiveCount100H.
2. Connect Power Chord male end to AC Power.
3. Connect Power Chord female end to Power Adapter.
4. Charge Battery to 100%.



Get Ready For Sampling

Follow these steps to prepare Activecount100H for microorganism sampling. When ActiveCount100H is not in use, always cover sampling head with dust cover.



Interpret Results

Microorganism Sampling Principles

Microorganisms can be found in droplets suspended in air for long periods, and can contaminate hygiene-sensitive environments. These droplets fall and settle on surfaces, potentially causing infections in medical facilities and contamination in manufacturing facilities.

MPN (most probable number) is a well established method to estimate the number of viable microorganisms in a monitored area. To derive MPN, ActiveCount100H uses the principle that statistically assumes an increasing number of organisms enter the same hole in the sampling head as the number of organisms per sample rises.

After sampling, incubate the petri dish to determine the number of Colony Forming Units (CFU). Then, refer to the Feller Conversation Table in Appendix B to find the Most Probable Number (MPN) of microorganisms.

As an example, if an incubated agar sample contains 5 CFUs, the Feller Conversion Table shows the MPN is 5.

Sampling Modes

Constant and Periodic Sampling Modes

ActiveCount100H supports three sampling modes:

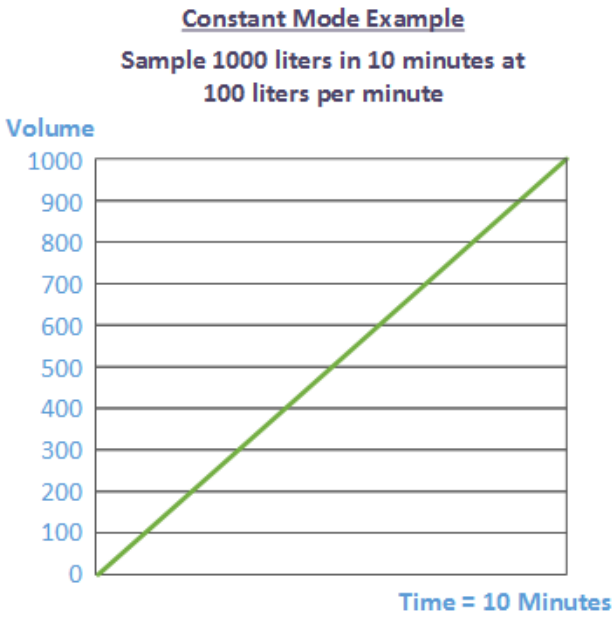
- Constant – samples continuously for a user-specified volume of air.
- Periodic – samples periodically for a user-specified time and volume.
- Gas – samples compressed gas with the optional compressed gas adapter.

Sampling Mode	Description
Constant	ActiveCount100H continuously samples until it reaches the desired sample volume at 100 liters per minute.



For the example below, select 1,000 liters of air as the desired volume. ActiveCount100H performs the following calculation to determine the sampling period is 10 minutes.

```
1,000 liters ÷ 100 liters/minute = 10 minutes
```



Sampling Mode	Description

Periodic

ActiveCount100H samples *periodically* for a user-specified number of cycles and for a user-specified period until it reaches the user-specified volume at 100 liters per minute.

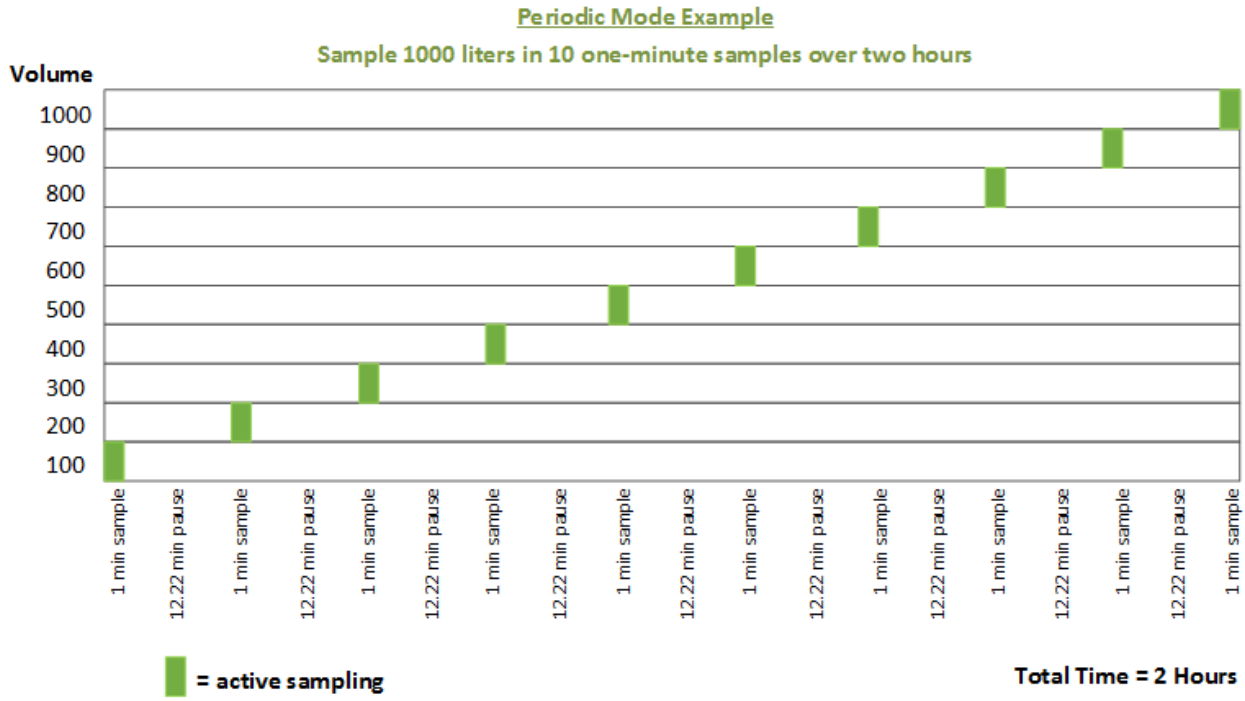


Periodic mode is useful when monitoring a process over longer periods, e.g., manufacturing a batch or lot of food, cosmetics or drugs.

In the example below, select ten cycles over two hours and 1,000 liters of air. ActiveCount100 determines ten one-minute sampling cycles are needed over two hours.

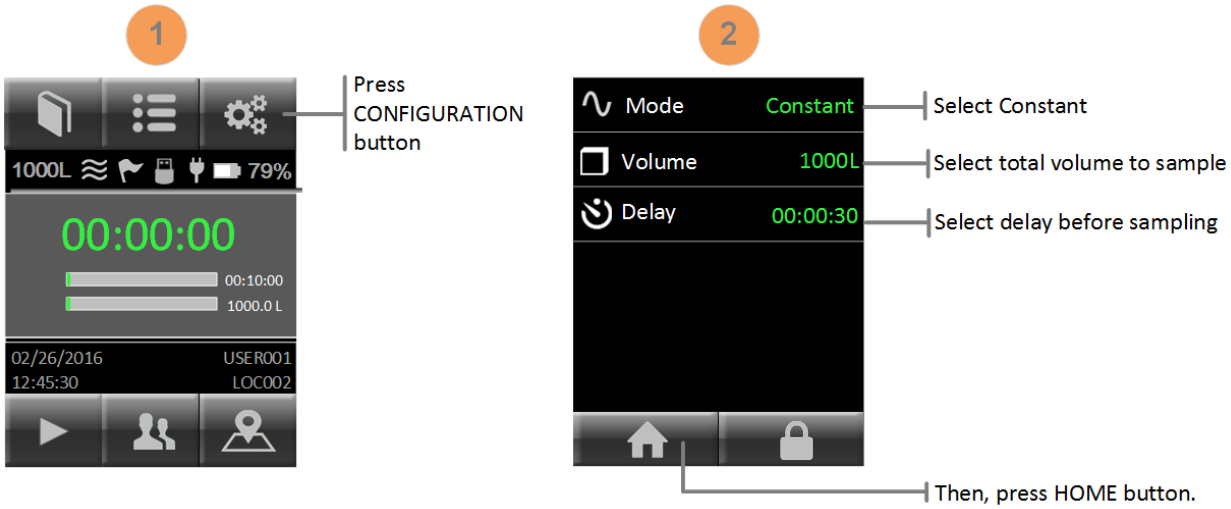
1,000 liters ÷ 100 liters/minute = 10 minutes

Pause between cycles. ActiveCount100H calculates the number of minutes to pause between ten one-minute samples over two hours, or 12.22 minutes.

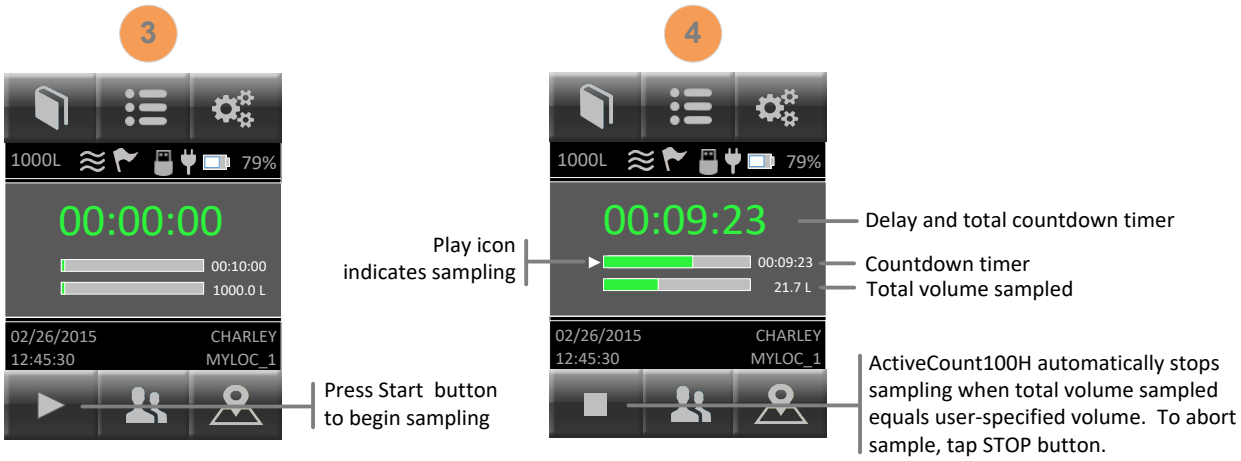


Continuous Sampling Exercise

Select Constant mode: At the Home screen, press CONFIGURATION button. Select Constant in Mode menu item, then select total sampling volume. If desired, also select an optional delay time (in seconds). Press HOME button to return to the Home screen.



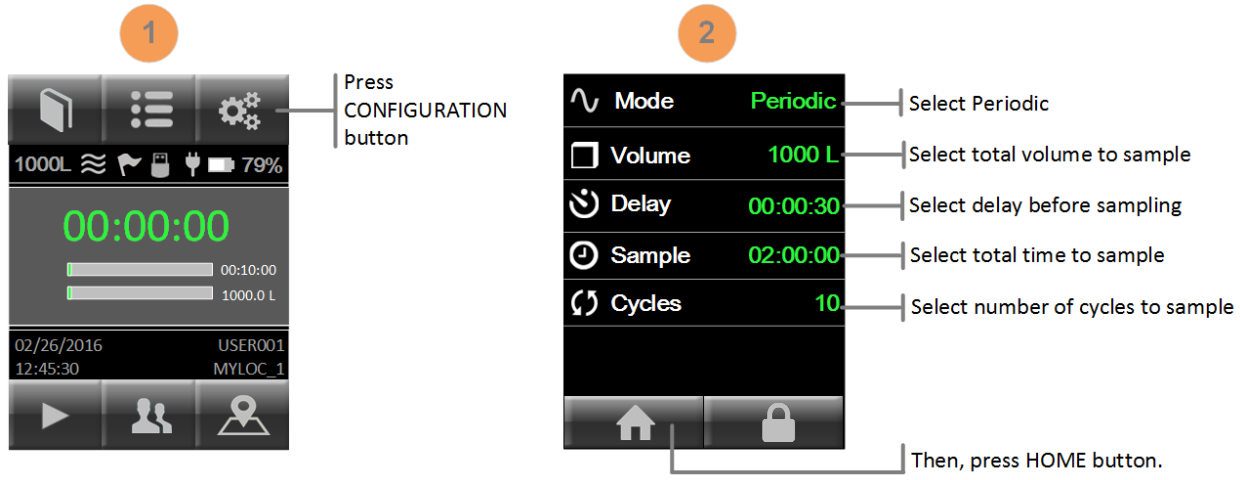
Begin sampling: Press START button to begin sampling.



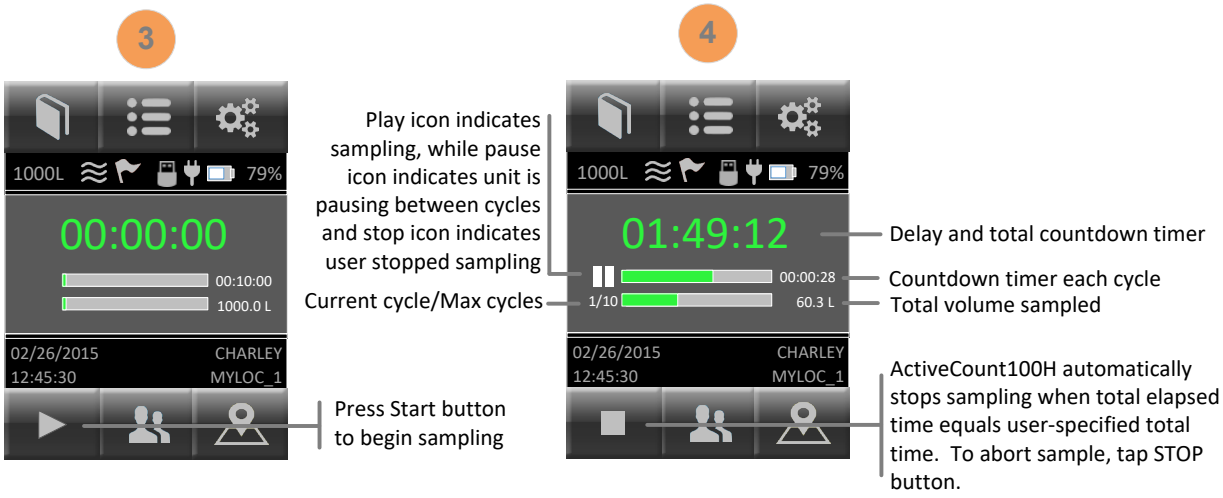
Save sampling metadata: To save data for each sampling run, insert the included USB flash drive into the USB port.

Periodic Sampling Exercise

Select Periodic mode: At the Home screen, press CONFIGURATION button. Select Periodic in Mode menu item, then select total sampling volume, delay time, total time to sample and the number of cycles. Press HOME button to return to the Home screen.



Begin sampling: Press START button to begin sampling.



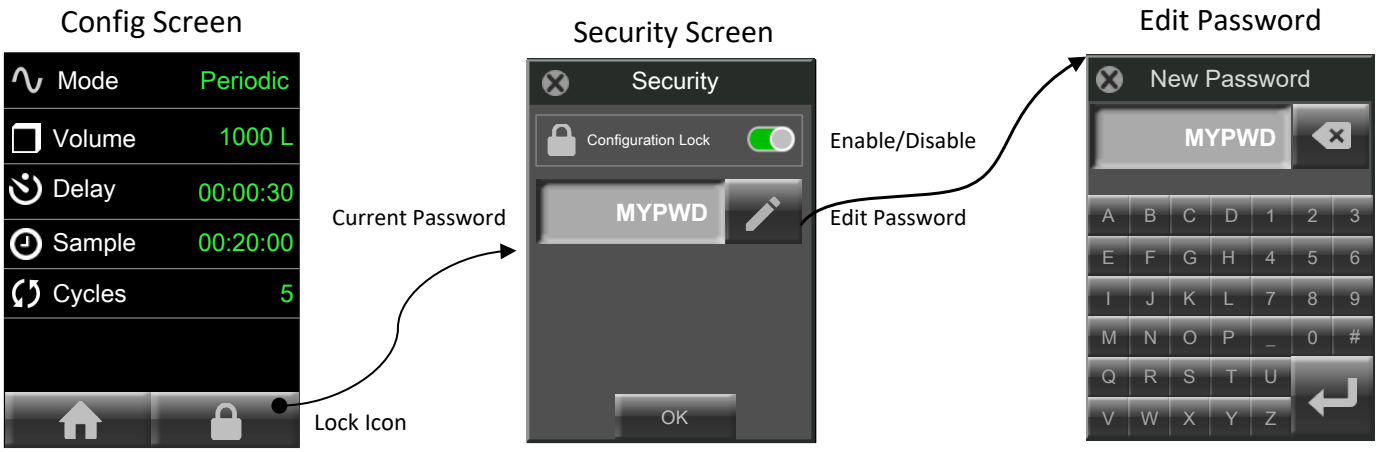
Store sampling data: To store sampling data for each sampling run, insert the included USB flash drive into the rear USB port.

Security: Configuration Lock

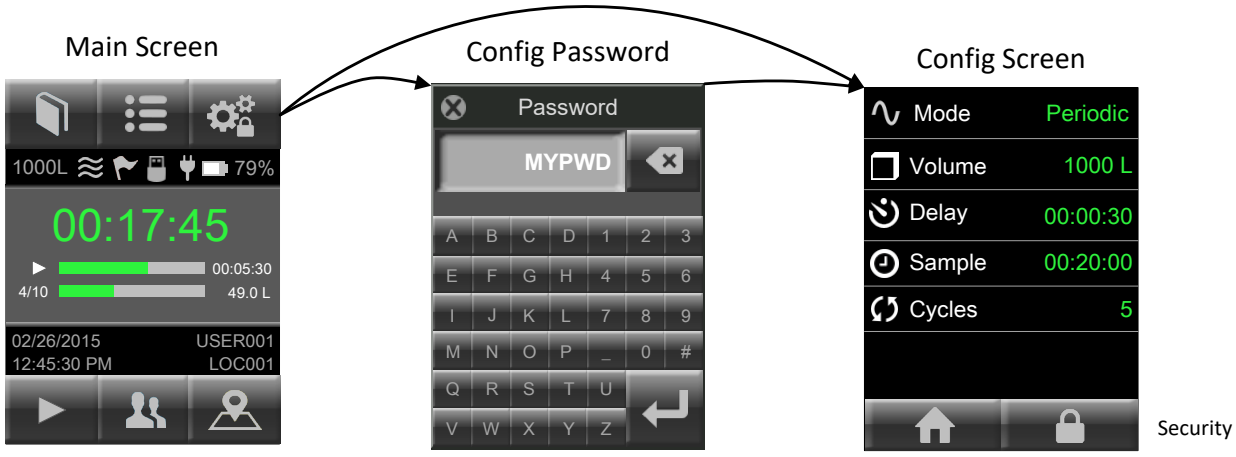
ActiveCount100H Sampling Modes can be restricted by locking the Configuration Screen. Before locking the configuration screen; select the sample mode and sample settings to be locked.

Configuration Lock: With the configuration screen locked; users are restricted to the preselected sample mode (Constant/Periodic/Gas). The user may not select any other sample mode and may not change any sample parameters. The user may run the selected sample only.

- From the Home screen press Configuration and then press the LOCK icon button. This will bring up the Security screen.



- Press the Edit Password button (pencil icon) to bring up the New Password screen
- Enter the new password and press the return key to save and return to the Security screen.
- Slide the Configuration Lock toggle button to the right for ON or to the left for OFF.
- Press OK to save the Security Settings.



Status LED: Sampling Status

The following table describes the Status LED color and blink feature.

Status	Color	Blink
Idle	Off	Off
Sampling	Blue	Solid
Delay/Pause	Green	Solid
Flow Error	Red	Blinking
Writing to USB	White	Solid
Service/Calibration Required	Yellow	Solid

Status LED: Color and Blink table:



White LED Indicates Writing To USB Flash Drive: Do not remove USB flash drive and do not power off ActiveCount100H while LED is white and downloads are in progress.

Sampling Status Screens

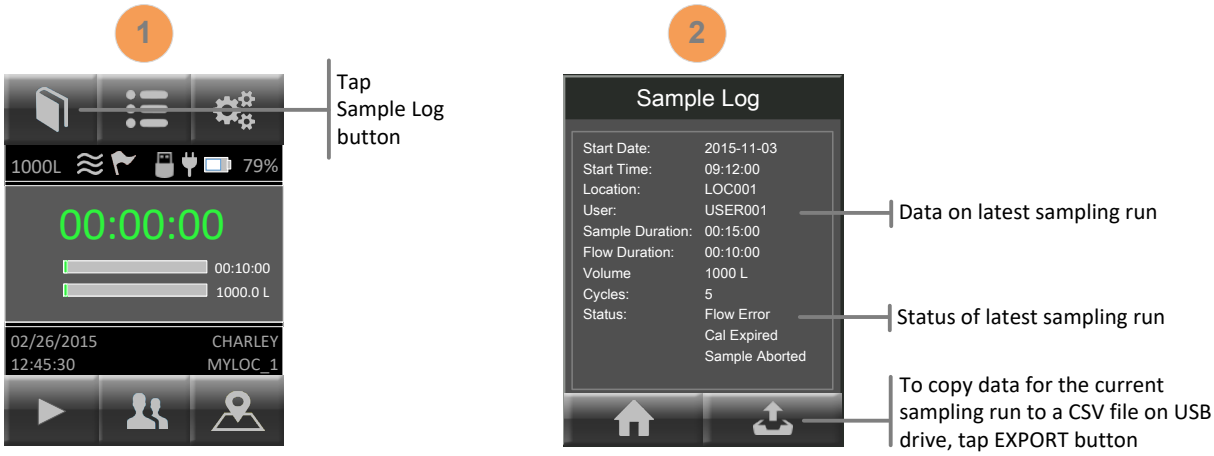
Display Sampling Status Screens: When a sampling run completes, ActiveCount100H displays a dialog box to indicate (a) success, (b) manual abort by user, or (c) flow error. The sample will be aborted if the instrument is unable to maintain 100 L/min due to flow blockage.



(a) Success (b) Manual abort by user (c) Flow error

Sampling Run Metadata

Display Sampling Results: To display sample data results for the most recent sampling run, press the Sample Log button.



Copy sample data to USB Flash Drive: To append data for the current sampling run to a CSV (Comma Separated Value) file, press COPY button. For more information on ActiveCount100H CSV files, see Appendix A, *Data Files*.

Total Sampling Volume

Select Total Sampling Volume

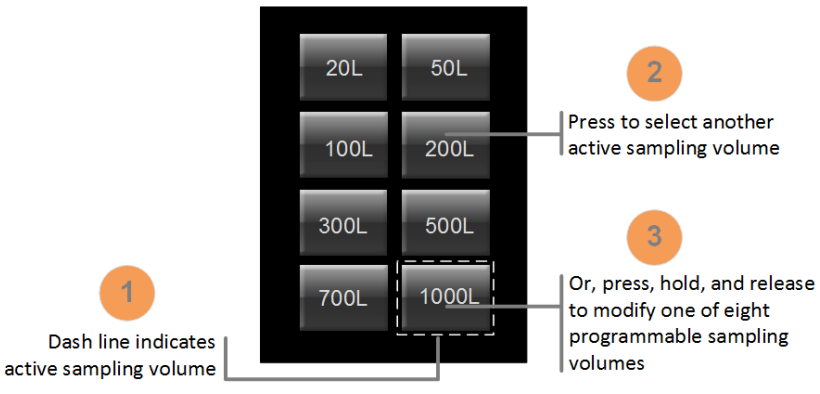
Constant and Periodic sampling volumes: ActiveCount100H supports up to eight programmable sampling volumes.

- 20 liters
- 50 liters
- 100 liters
- 200 liters
- 300 liters
- 500 liters
- 700 liters
- 1000 liters (default)

Select Active Sampling Volume: When you press on the Volume menu item, ActiveCount100H displays eight sampling volumes. ActiveCount100H indicates the active sampling volume with a dashed line.

Active Volume Applies to Sampling Runs

ActiveCount100H uses active sampling volume for subsequent sampling runs: To select a new active sampling volume, press the desired volume button.

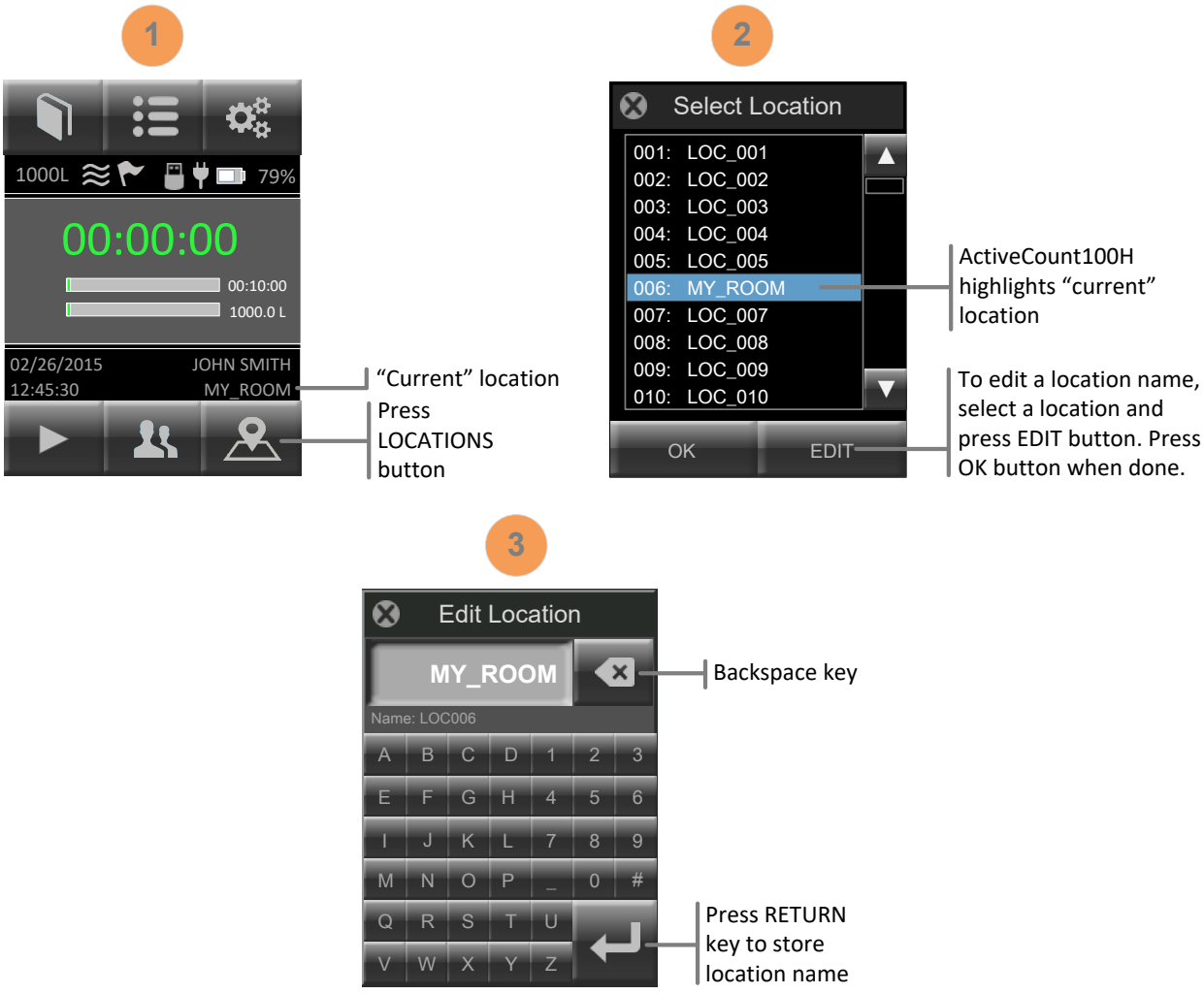


Modify Sampling Volume Preset Values: To modify a sampling volume value, press and hold then release a sampling volume button. ActiveCount100H then displays a keypad to enter a new sampling volume value. The new value then becomes the active sampling volume.

Locations and Users

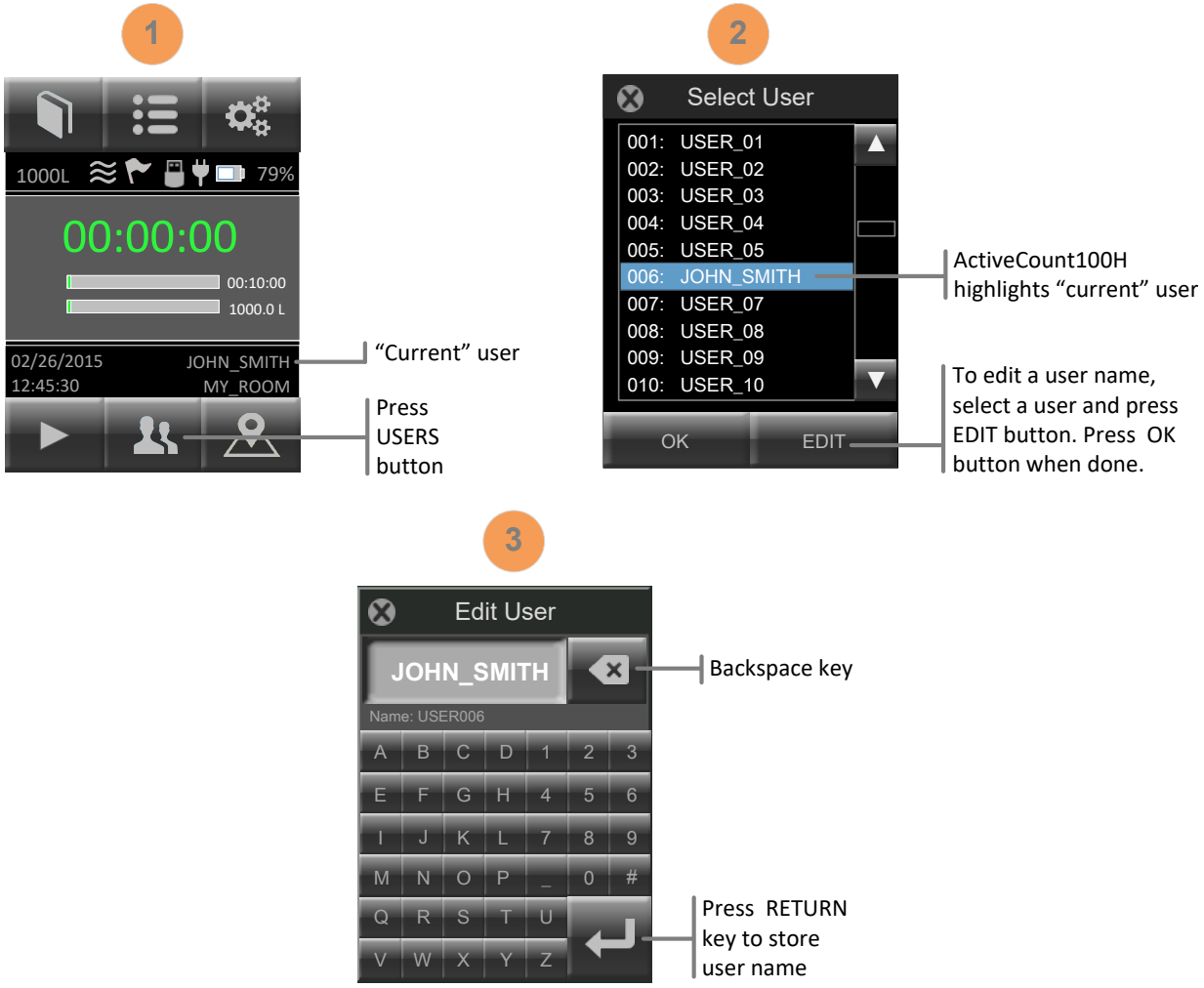
Assigns Active Location to Sampling Runs

Locations Database: ActiveCount100H stores up to 400 locations in its locations database. When ActiveCount100H completes a sampling run, it saves the active location in a data record for the most recent sampling run. Each location can consist of up to 16 characters.



Assigns Active User to Sampling Runs

Users Database: ActiveCount100H stores up to 50 users. When ActiveCount100H completes a sampling run, it saves the active user in a metadata record for the most recent sampling run. Each user name can consist of up to 16 characters.

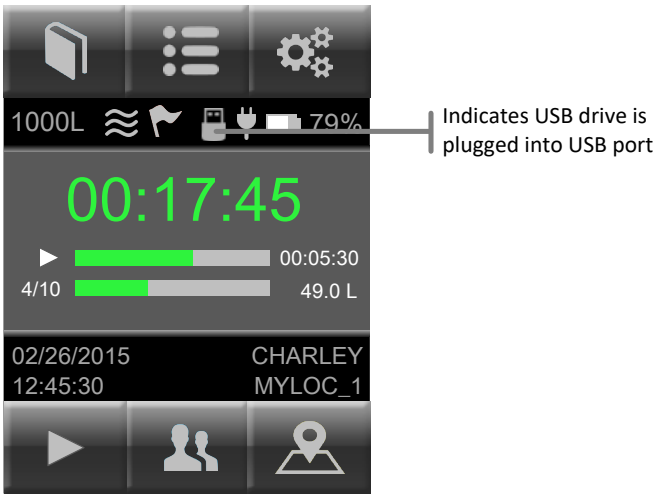


Data Logging – Sampling Data

Save sampling data to USB flash drive.

No USB Flash Drive: If no USB flash drive is plugged into the rear USB port, ActiveCount100H stores sample data only for the most recent run in volatile memory, which ActiveCount100H deletes when turned off. For information on displaying sample data for the most recent sampling run, see Section *Display Sampling Data*.

USB Flash Drive: When a USB flash drive is plugged into the rear USB port, ActiveCount100H displays a USB flash drive icon on the HOME screen.



Save sampling data to USB flash drive: ActiveCount100H appends one line of data for each sample to a comma-separated value (CSV) file on the USB flash drive.

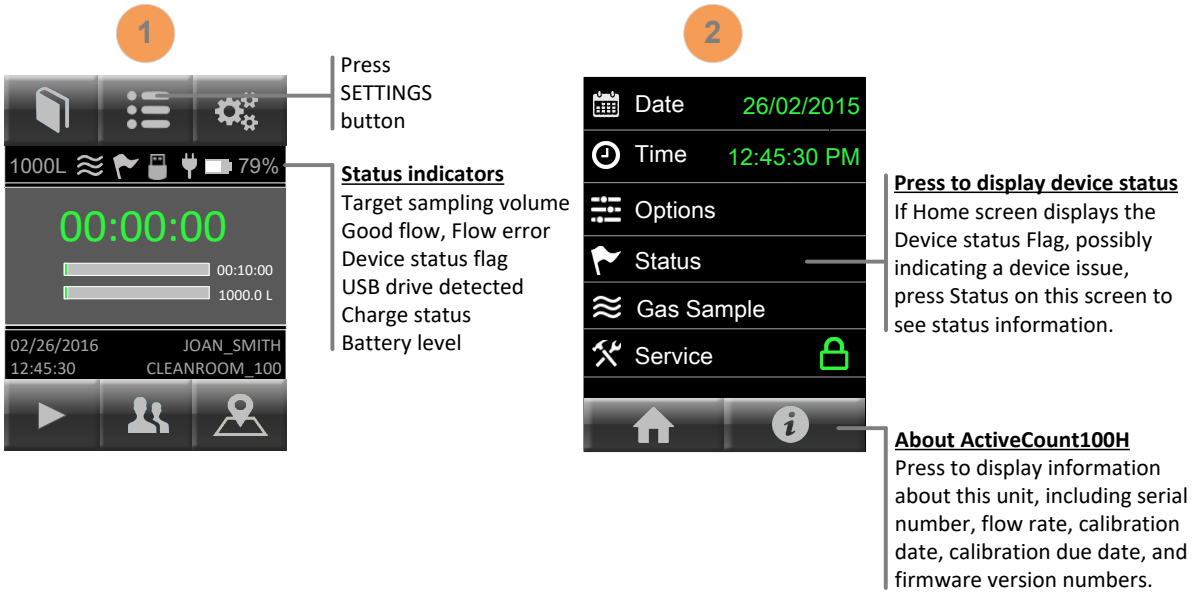
Export sample data stored on the USB flash drive to third-party software, such as laboratory information management (LIM) systems.

For information on ActiveCount100H CSV files, see Appendix A, *Data Files*.

Status Indicators

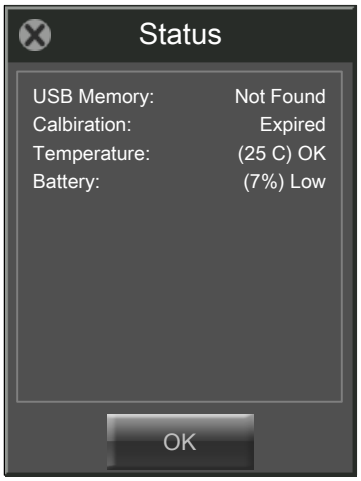
Device Status Indicators

Status Indicators: ActiveCount100H displays status indicators on the Home screen. If ActiveCount100H displays Device status flag, it may indicate a device issue or problem. To display more device status information, press SETTINGS button, then press the Status menu item.

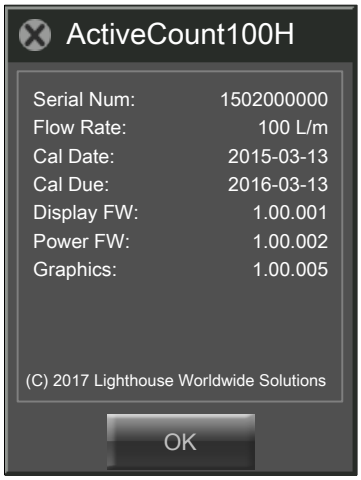


Sample status screens are shown below.

Device Status screen



About ActiveCount100H screen



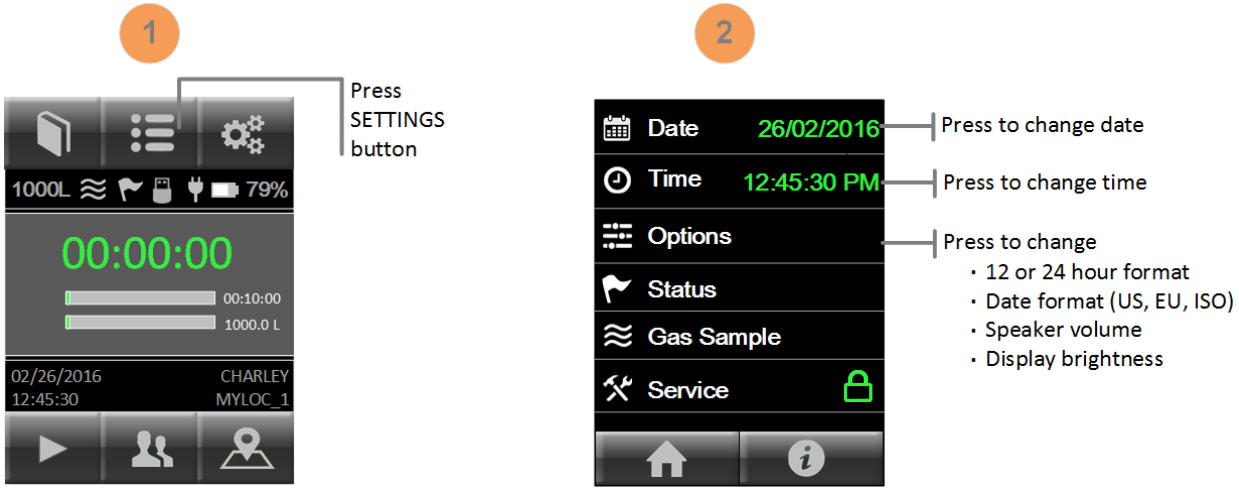
The following table describes status icons.

Icon	Status Indicator	Description
1000L	Target Sampling Volume	Target flow volume.
	Good flow or Flow error	Flow status while sampling. If a flow error condition persists, contact Lighthouse Service and Support. See Section *Technical Specifications* for contact information.
	Device status flag	Possible device error, e.g., flow error, calibration due, etc. To display the device status, press SETTINGS button and Status menu item. The sampling database stores these errors in CSV files. See subsection *Sampling databases* in Appendix A, *Database files*. If this condition persists, contact Lighthouse Service and Support. See Section *Technical Specifications* for contact information.
	USB flash drive	USB flash drive inserted into rear USB port.
	Power adapter connected	Power adapter plugged in and charging battery.
	Battery	Current battery level.

Settings

ActiveCount100H Settings

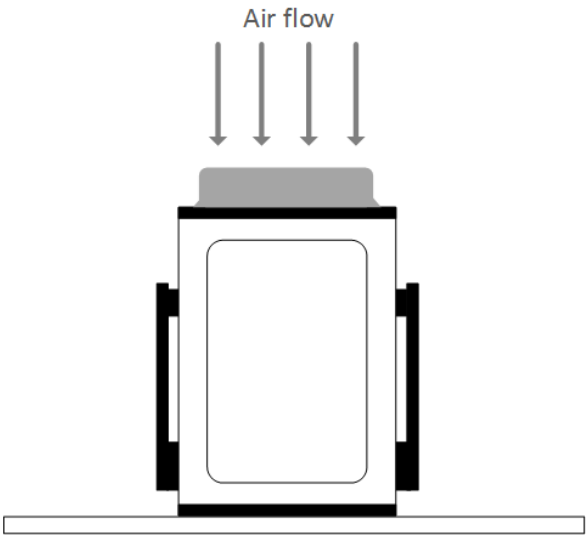
Device Settings: Press SETTINGS button to display and edit device settings.



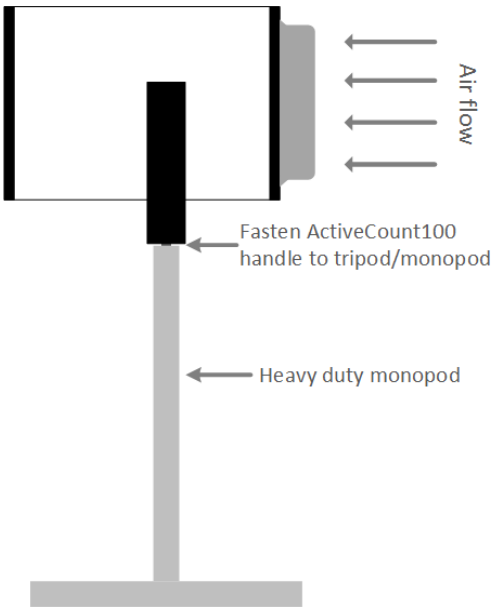
Tripod/Monopod

Vertical and Horizontal Sampling

Vertical Sampling: Place ActiveCount100H on a horizontal surface to sample vertically.



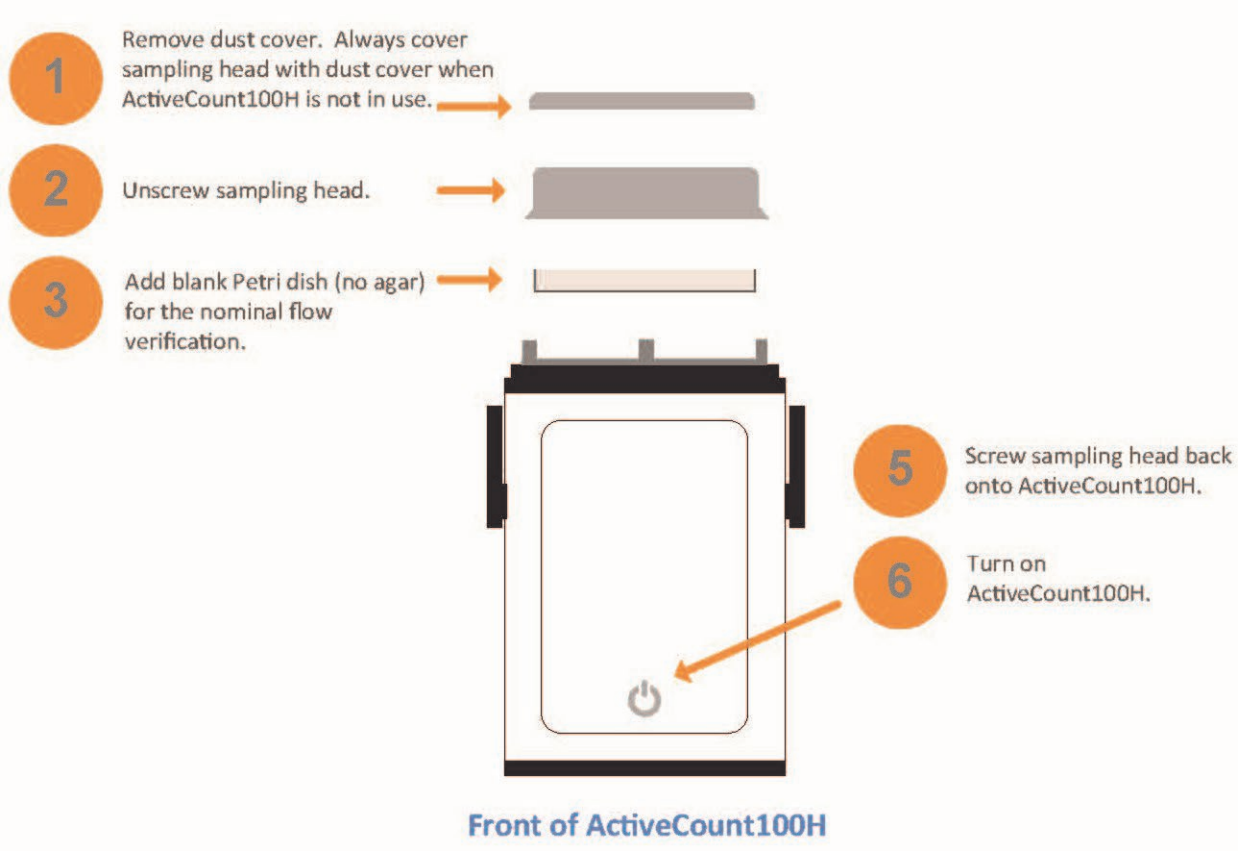
Horizontal Sampling: Mount ActiveCount100H on a tripod/monopod and turn the instrument to sample horizontally. ActiveCount100H supports 3/8” tripod/monopod screws and ¼” tripod/monopod screws using the included adapter.



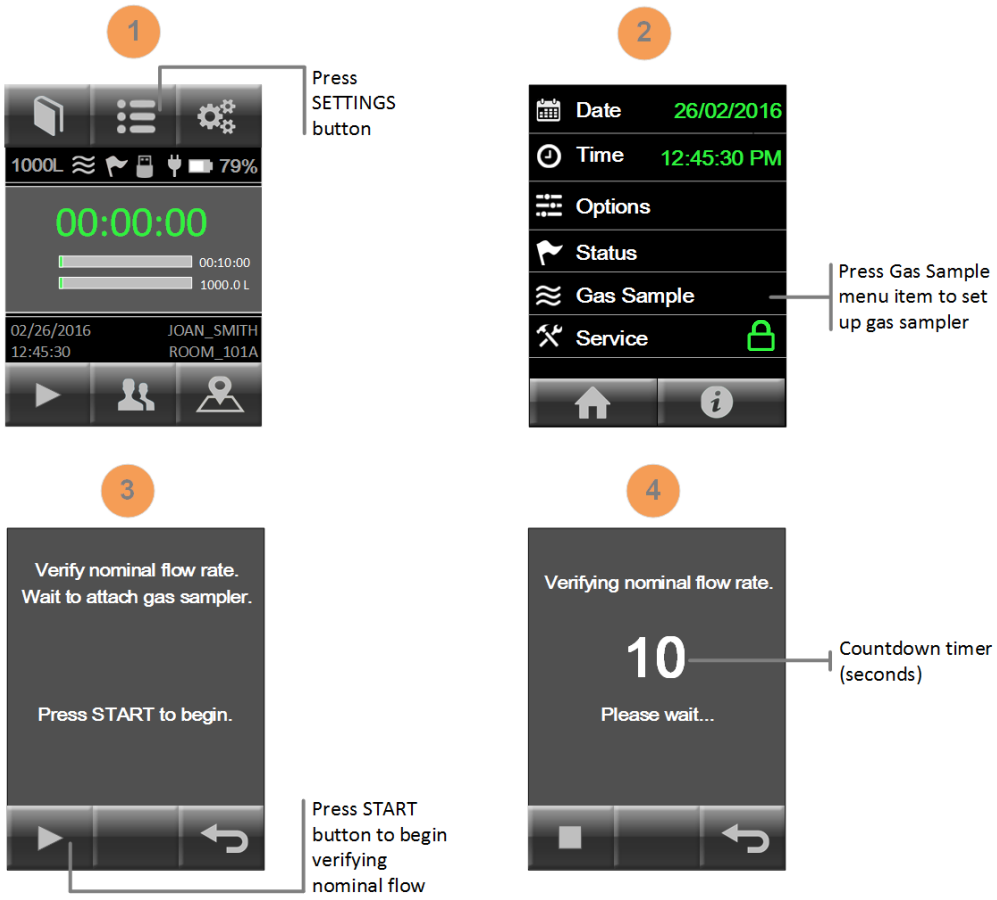
Optional Compressed Gas Sampler

Verify Nominal Flow before Gas Sampling

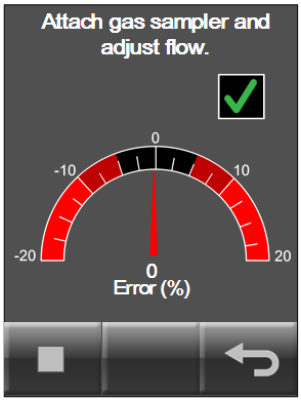
Before using the optional compressed gas sampler, first verify nominal flow of ActiveCount100H without the gas sampler.

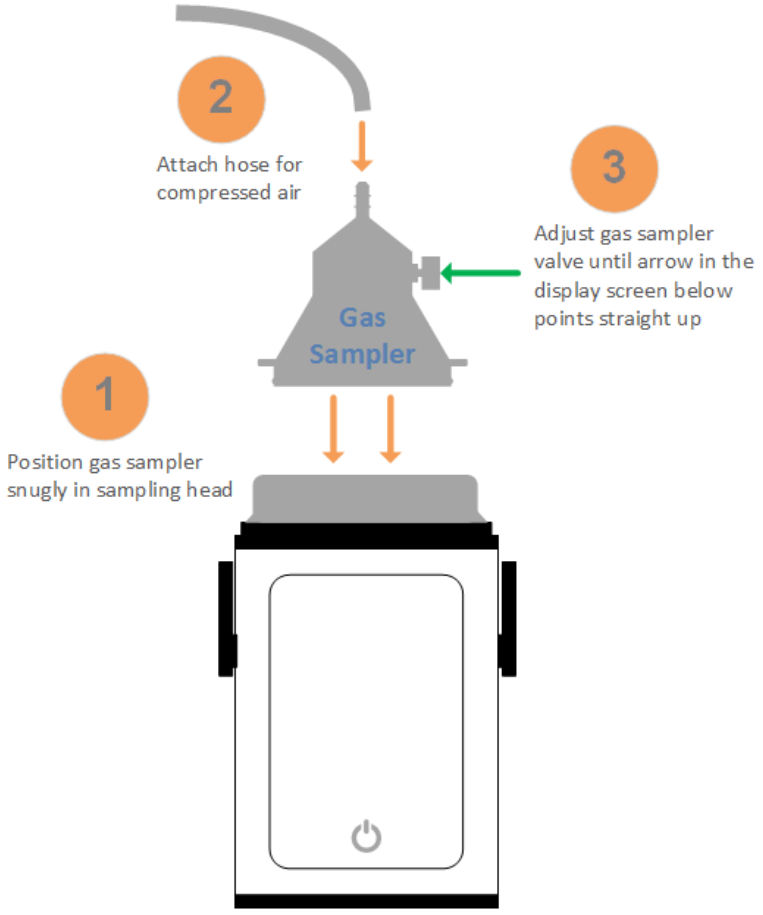


To verify ActiveCount100H nominal flow rate, follow the steps below.

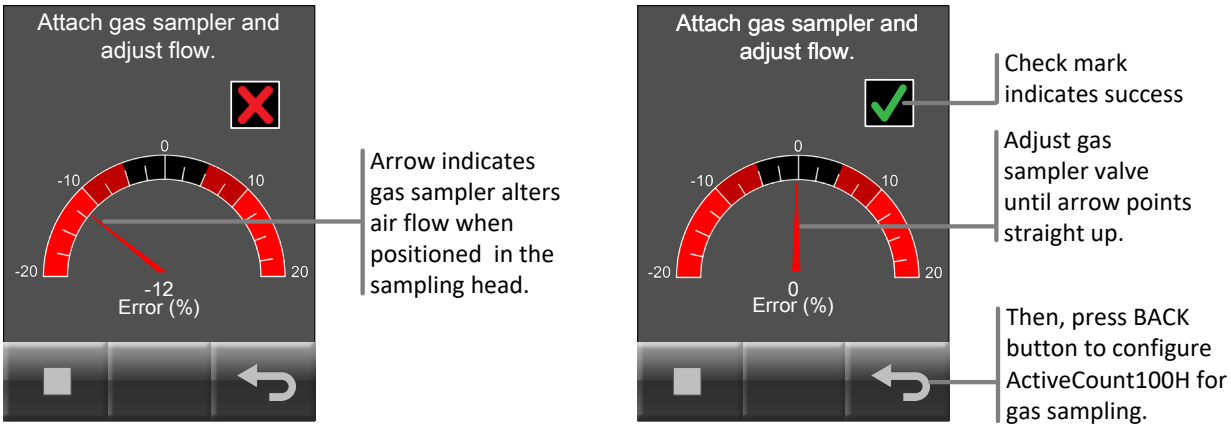


When ActiveCount100H displays the following screen, position gas sampler snugly in the sampling head while ActiveCount100H blower is running.





Then, adjust gas sampler valve until the arrow in the display screen points straight up, indicating ActiveCount100H has nominal flow for gas sampling. You're now ready to sample compressed air!



Do not sample explosive nor corrosive gases. ActiveCount100H gas sampler is designed to sample compressed air only, and is not designed for sampling of explosive nor corrosive gases.

Clean and Disinfect

Avoid Cross Contamination

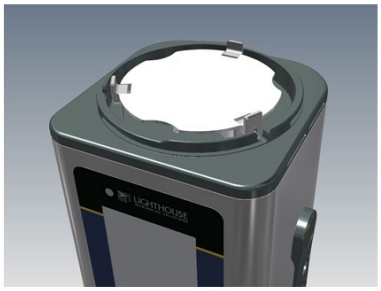
Sterilize ActiveCount100H after each cycle to avoid cross-contamination, which can adversely affect reliability of microbial samples. Always wear a pair of sterile gloves when sterilizing ActiveCount100H. Sanitize gloved hands first, with a disinfectant solution.

Use a commercial disinfectant solution, such as 70% - 90% ethanol solution or 60% - 80% isopropanol/water solution.

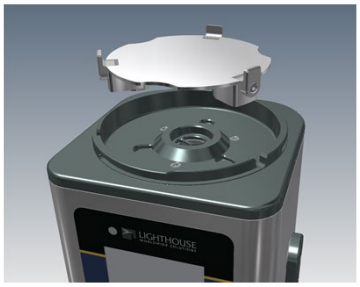
External Enclosure

Remove dust cover, sampling head and petri dish assembly from ActiveCount100H. Use the blower inlet seal to plug the blower inlet. After the blower inlet is sealed, the instrument is ready to be cleaned.

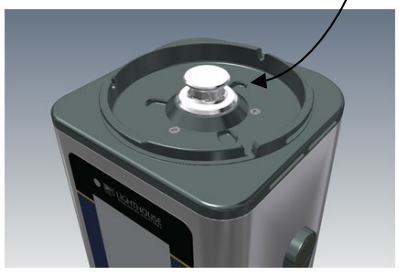
Remove Dust Cover and Sample Head



Remove magnetically attached petri dish assembly



Insert Blower Inlet Seal



To clean the external surface, spray a commercial disinfectant solution or 60% - 80% isopropanol/water solution on a sterile tissue or wipe. Then, wipe the enclosure and petri dish holder with the damp tissue. Wipe dry with another sterile tissue. Always fully remove and wipe dry the disinfectant solution before reusing ActiveCount100H. Let dry at room temperature.

Sampling Head, Dust Cover and Petri Dish Assembly

Partially or fully blocked sampling head holes require an ultrasonic bath to remove the particles. Use an autoclave to sterilize the sampling head, dust cover and petri dish assembly parts; follow a standard sterilization procedure, e.g., 134°C at 18 minutes for hospital applications. Let dry at room temperature.

It is important to sterilize the sampling head, dust cover and petri dish assembly between samples. If an autoclave is not available, use a sterile cloth with disinfectant to wipe down the sampling head and dust cover. Let dry at room temperature.

Transport

When transporting ActiveCount100H, clean and disinfect as described in this Section. Then, transport ActiveCount100H in a sterile plastic bag.

Warnings



- **To minimize the chance of electric shock, turn off and disconnect power adapter during sterilization.**
- **Do not submerge ActiveCount100H in any liquids.**
- **Do not spray disinfectant solution directly into ActiveCount100H enclosure.**
- **Do not use gases to disinfect ActiveCount100H.**
- **Lighthouse will void the warranty if an unsuitable disinfectant solution damages ActiveCount100H.**

Calibration

Calibration – Contact Authorized Facility

ActiveCount100H is factory calibrated to 100 liters/min.

Contact a factory authorized facility to calibrate ActiveCount100H and replace HEPA filter annually.

To display calibration due date, see Section *Settings*.

Technical Specifications

Benefits

- Compact design
- User-friendly and easy to use
- Reliable measurements
- Low cost of ownership
- Includes calibration certificate

Features

- Uses standard ISO 24998 90mm (85mm to 91mm) petri dishes
- Airflow 100 liters/min
- Active flow control
- HEPA filtered exhaust
- Large 3.5-inch color touchscreen
- Eight programmable volumes
- 50 programmable users
- 400 programmable locations
- Programmable start delay
- Constant mode with programmable delay, sample duration, and volume
- Periodic mode with programmable cycles, delay, sample duration and volume
- Body made from stainless steel
- Stainless steel sample head
- Autoclave-able sampling head
- Battery status indicator
- Internal rechargeable battery, approximately 6 hours typical usage
- Alarm on flow fault and low battery
- Status Indicators
- USB Port
- Speaker for alerts and notifications
- Download sampling metadata to USB flash drive
- Real time clock
- CE approval
- Operating conditions 0 to 35° C, humidity 0 to 80% RH
- Weight 5.3 lbs. (2.4 kg)
- Dimensions: 7.6”(h) x 4.7“(w) x 4.7”(d) [19.4 (h) x 12.0 (w) x 12.0 (d) cm]
- Power 100-240 VAC, 50-60Hz external DC power adapter
- Limited 2 Year Warranty

Package Contents

- ActiveCount100H with stainless steel sampling head, dust cover.
- USB flash drive with Lanyard.
- 24V 3A DC power adapter.
- Allen wrench to adjust petri dish holder (non-cassette version only).
- Tripod/monopod adapter.
- Calibration certificate.
- Operating Manual (this document) supplied on USB flash drive.
- Carrying case (carrying only, not shippable case).
- Optional Gas Sampler.
- Optional Remote Adapter.

Conforming Specifications

- CE.
- ISO 14698-1, Bio contamination Control, Cleanrooms, Associated Control Environments.
- ISO 14698-2, Bio contamination Control, Cleanrooms, Associated Control Environments.
- Good Automated Manufacturing Practice, GAMP of December 2001.
- Good Manufacturing Practice, GMP, Volume 4, rules governing medicinal products.

Additional Help

For more information, contact Lighthouse Worldwide Solutions.

Service and Support
Tel: 1-800-945-5905 (Toll Free USA)
Tel: +1-541-770-5905 (Outside USA)
techsupport@golighthouse.com
www.golighthouse.com

Appendix A: Database Files

Databases in Comma-Delimited Files

ActiveCount100H stores data in comma-delimited files on a USB flash drive in folder:

`/ActiveCount100H_<serial-number>/`

where <*serial-number*> is the ActiveCount100H serial number. To display the serial number, see Section *Settings*.

```
08/05/2015 15:02:14,LOC012,6,0.10,0,0,0,0,None,Good,Good,None
08/05/2015 15:02:36,LOC013,6,0.10,0,0,0,0,None,Good,Good,None
08/05/2015 15:02:56,LOC014,6,0.10,0,0,0,0,None,Good,Good,None
08/05/2015 15:04:57,LOC015,6,0.10,0,0,0,0,None,Good,Good,None
08/05/2015 15:05:19,LOC016,6,0.10,0,0,0,0,None,Good,Good,None
```

Location Database

Locations in CSV File: ActiveCount100H stores locations in the following file:

`/ActiveCount100H_<serial-number>/aclocations.csv`

A sample location file follows:

```
Location
"LOC001"
"LOC002"
"LOC003"
"ROOM AC 1"
"ROOM AC 2"
"TEST LAB A"
"TEST LAB B"
"TEST LAB C"
 . . .
```

User Database

Users in CSV File: ActiveCount100H stores users in the following file:

`/ActiveCount100H_<serial-number>/acusers.csv`

A sample user file follows:

```
User
"USER001"
"USER002"
"A Jackson"
"L Abrams"
"J Smith"
"P Brown"
"Alice Chow"
"Ray Lopez"
  . . .
```

Sampling Run Databases

Sampling Metadata in CSV Files: ActiveCount100H stores sampling metadata in the following files:

`/ActiveCount100H_<serial-number>/acsamples_<date>.csv`

Where <*date*> is today's date, e.g., YYYY-MM-DD. ActiveCount100H appends one line of sampling data for each sampling run.

Export sampling data to third-party software, such as Laboratory Information Management (LIM) systems, to complement data from other monitoring systems.

Each sampling database file contains the following comma-delimited fields for each sampling run.

	CSV Field	Description	Sample Value
1	Timestamp	Date format – set in Settings menu • US (MM/DD/YYYY) • EU (DD/MM/YYYY) • ISO (YYYY-MM-DD) Time (local 24-hour time) • HH: MM	7/16/2015 9:48
2	Location	Current location	LOC004
3	User	Current user	Ray Lopez
4	Sample Duration	Total duration of sampling run in minutes	0:10:00
5	Flow Duration	Actual sampling time in minutes	0:10:00
6	Volume	Liters of air sampled	1000
7	Cycles	Constant sampling = 1 Periodic sampling = number of user-specified cycles	1
8	Status	No errors detected = Success At least one error detected = Error	Success
9	Flow	Flow good = OK Flow error = Error	OK
10	Service Needed	No service needed = OK Service needed = Error	OK
11	Calibration	Calibration not yet due = OK Calibration due = Error	Error
12	Sample Aborted	User did not abort sampling run = OK User aborted run (no sample) = Error	Error
13	Temperature	Temperature normal = OK Temperature too high = Error	OK
14	Battery	Battery normal = OK Battery low (sample stopped) = Error	OK

	CSV Field	Description	Sample Value
15	USB Memory	USB flash drive detected = OK USB flash drive not detected = Error	Error
16	Model Name	ActiveCount100H model name	ActiveCount100H
17	Serial Number	ActiveCount100H serial number	0123456789
18	Flow Rate	ActiveCount100H flow rate	100 L/m
19	Last Calibration	ActiveCount100H date last calibration	1/1/2016
20	Calibration Due	ActiveCount100H date for next calibration	1/1/2017
21	Firmware 1	ActiveCount100H display firmware version	0.01.004
22	Firmware 2	ActiveCount100H power firmware version	0.0.002
23	Firmware 3	ActiveCount100H graphics firmware version	1.0.006

Appendix B: Feller Conversion Table

Sampling Head with 300 Holes x 0.6mm

- R = number of Colony Forming Units (CFU) counted on 90 mm petri dish agar after incubation
- P_R = Most Probable Number (MPN) of microorganisms in volume of air sampled
- N = number of holes in ActiveCount100H sampling head (300)

R	P_R	R	P_R	R	P_R	R	P_R	R	P_R	R	P_R
1	1	51	56	101	123	151	209	201	332	251	541
2	2	52	57	102	124	152	211	202	335	252	547
3	3	53	58	103	126	153	213	203	338	253	553
4	4	54	59	104	127	154	216	204	341	254	560
5	5	55	61	105	129	155	218	205	344	255	566
6	6	56	62	106	131	156	220	206	347	256	573
7	7	57	63	107	132	157	222	207	350	257	580
8	8	58	64	108	134	158	224	208	353	258	587
9	9	59	66	109	135	159	226	209	357	259	594
10	10	60	67	110	137	160	228	210	360	260	601
11	11	61	68	111	138	161	230	211	363	261	609
12	12	62	69	112	140	162	232	212	367	262	616
13	13	63	71	113	142	163	235	213	370	263	624
14	14	64	72	114	143	164	237	214	374	264	632
15	15	65	73	115	145	165	239	215	377	265	641
16	16	66	74	116	146	166	241	216	381	266	649
17	17	67	76	117	148	167	243	217	384	267	658
18	19	68	77	118	150	168	246	218	388	268	667
19	20	69	78	119	151	169	248	219	391	269	677
20	21	70	80	120	153	170	250	220	395	270	686
21	22	71	81	121	155	171	253	221	399	271	696
22	23	72	82	122	156	172	255	222	403	272	707
23	24	73	83	123	158	173	257	223	407	273	717
24	25	74	85	124	160	174	260	224	410	274	728
25	26	75	86	125	161	175	262	225	414	275	740
26	27	76	87	126	163	176	264	226	418	276	752
27	28	77	89	127	165	177	267	227	422	277	765
28	29	78	90	128	167	178	269	228	427	278	778
29	30	79	92	129	168	179	272	229	431	279	791
30	32	80	93	130	170	180	274	230	435	280	805
31	33	81	94	131	172	181	277	231	439	281	820
32	34	82	96	132	174	182	279	232	444	282	836
33	35	83	97	133	175	183	282	233	448	283	853
34	36	84	98	134	177	184	284	234	452	284	871
35	37	85	100	135	179	185	287	235	457	285	889
36	38	86	101	136	181	186	289	236	462	286	909
37	39	87	103	137	183	187	292	237	466	287	931
38	41	88	104	138	184	188	295	238	471	288	954
39	42	89	105	139	186	189	297	239	476	289	979
40	43	90	107	140	188	190	300	240	481	290	1006
41	44	91	108	141	190	191	303	241	486	291	1036
42	45	92	110	142	192	192	306	242	491	292	1069
43	46	93	111	143	194	193	308	243	496	293	1107
44	47	94	113	144	196	194	311	244	501	294	1150
45	49	95	114	145	198	195	314	245	507	295	1200
46	50	96	115	146	200	196	317	246	512	296	1260
47	51	97	117	147	202	197	320	247	518	297	1335
48	52	98	118	148	203	198	323	248	523	298	1435
49	53	99	120	149	205	199	326	249	529	299	1585
50	55	100	121	150	207	200	329	250	535	300	1885

NOTE: Table values calculated from $P_R = N [1/N + 1/(N-1) + 1/(N-2) + 1/(N-R+1)]$ (Feller, 1950)

Appendix C: 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. 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 WITHRESPECT TO THE EQUIPMENT AND ANY DEFECTS THEREIN OF ANY NATURE WHATEVER, 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 COMMERCIALLY 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.

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