Handheld Laser Particle Counter

Model: P311

Operation Manual

Ver: 1.80

AIRY TECHNOLOGY INC

Warranty

AIRY TECHNOLOGY INC warrants to the original user that this instrument shall be free from defects in material and workmanship for **one year** from the date of shipment.

Airy's obligations under this warranty, and the sole remedy for its breach, are limited to repair or, in Airy's sole discretion, replacement of the instrument or any of its parts. Should it become necessary to return the instrument for repair during or beyond the warranty period, user shall contact Airy Technology, Inc. (USA). **E-mail: info@airytechnology.com**. User is responsible for shipping charges, freight, insurance and proper packaging to prevent damage in transit.

This warranty shall be void in the event of user actions including misuse, improper wiring, operation outside of specification, improper maintenance or repair, unauthorized modification, or any other defect caused by the user' neglect or accident.

This warranty is the sole and exclusive warranty for this instrument, and no other warranty, whether written or oral, is expressed or implied. Airy specifically disclaims any implied warranties of merchantability or fitness for a specific purpose and will not be liable for any direct, indirect, incidental, consequential, or punitive damages. Airy’s total liability is limited to repair or replacement of the product.

Safety information

This section gives instructions for promoting safe and proper handling of the Particle Counter.

Laser Safety

The Handheld Laser Particle Counter is a Class I laser- based instrument.

- During normal operation, you will not be exposed to laser radiation.
- Precaution should be taken to avoid exposure to hazardous radiation in the form of intense, focused, invisible light.
- Exposure to this light may cause blindness.

Take these precautions:

- **DO NOT** remove any parts from the particle counter unless you are specifically told to do so in this manual.
- **DO NOT** remove the housing or covers. There are no user serviceable components inside the housing.

DANGER

◆ **The use of controls, adjustments, or procedures other than those specified in this manual may result in exposure to hazardous optical radiation.**

WARNING

Precautions for power use

- **AC Adaptor**
  The AC adapter accommodates voltage of AC 100~240V and frequency of 50/60Hz.
- **Batteries**
  Use four AA Batteries.

DANGER

◆ **Driving voltage should be kept within specified range. Failure to follow this instruction may cause electric shock and instrument damage.**

PROHIBITION

CAUTION

◆ **Do not start sampling when the instrument is connected to a personal computer.**
Failure to follow this instruction may cause the instrument to work abnormally.

WARNING

Product Overview

Carefully unpack the Handheld Laser Particle Counter from the shipping container and verify that all the items shown in the photos below and listed in the following tables are present.
Contact us immediately if any items are missing or broken.

Handheld Laser Particle Counter parts list:

Qty.	Item Description	Reference Picture
1	Handheld Laser Particle Counter	
1	Isokinetic inlet	
1	Probe for tubing	
1	Cap	
1	AC Power adapter	
1	Zero filter	 or 
1	USB cable USB type A to mini USB-B	
1	Battery Charger	
1	Application CD	
1	Quick Start Guide	
1	Calibration Report	
1	Carrying Case	

Getting Started

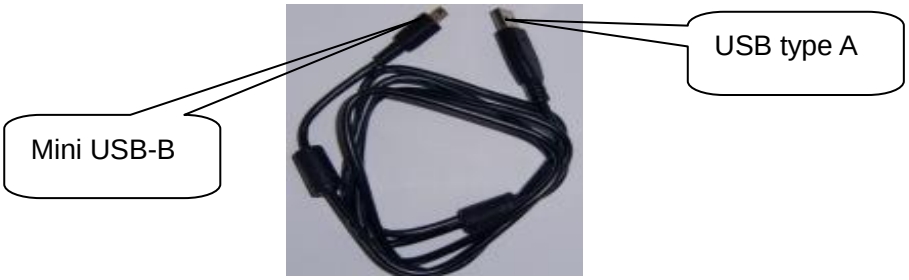
The Handheld Laser Particle Counter (particle counter) is a lightweight, handheld particle counter with a TFT LCD display. It operates on battery or AC power. This model has a 0.1 CFM (2.83 L/min) flow rate and counts in user-adjustable bin sizes of 0.3/0.5, 0.5/1.0/2.0/2.5 and 5 microns (channel 1 and 2 are selectable). Up to 8000 data sets can be stored and downloaded for analysis and reporting using the utility included with the device.

- **Inlet nozzle:**
  User can replace the Inlet nozzle between the isokinetic inlet and the probe for tubing. The isokinetic inlet is used for ambient air sampling. To use the isokinetic inlet, detach the red cap from the inlet nozzle and attach the isokinetic probe. After all the samples are completed, please detach the isokinetic inlet and put the red cap back before placing the unit into the carrying case. If you are planning to use a tube for sampling, please contact Airy Technology or your local distributor.
- **Zero filter**
  The zero filter cleans the sensor after your sampling at contaminated places. The zero filter also checks whether the particle counter is counting electrical noises. To use the zero filter:
  1. Detach the isokinetic inlet from the main unit
  2. Connect the zero filter to the main unit using the tube (There is a tube in the plastic bag containing the zero filter)

3. Start sampling
4. Wait until the counter does not detect any particles
5. Stop sampling and detach the zero filter

If the counter keeps detecting particles after 1 minute of sampling, please contact Airy Technology or your local distributor.

- **AC power, USB port, and USB cable**



1. AC Power

When using AC power, must use the affiliated AC adapter, shown below.
Connect Mini USB-B plug to the instrument.

2. Data Communication

When using the USB cable to transfer data records to a PC, set it up as follows:
Connect Mini USB-B plug to the instrument.
USB type A plug to the type A receptacle of PC.

- **Battery**

Loading the batteries:

1. The batteries have to be loaded before use.
2. Remove the battery cover on the back of the shell.

3. Insert four AA of Ni-MH type or alkaline batteries.
4. When using Ni-MH batteries, charge the battery fully before use.

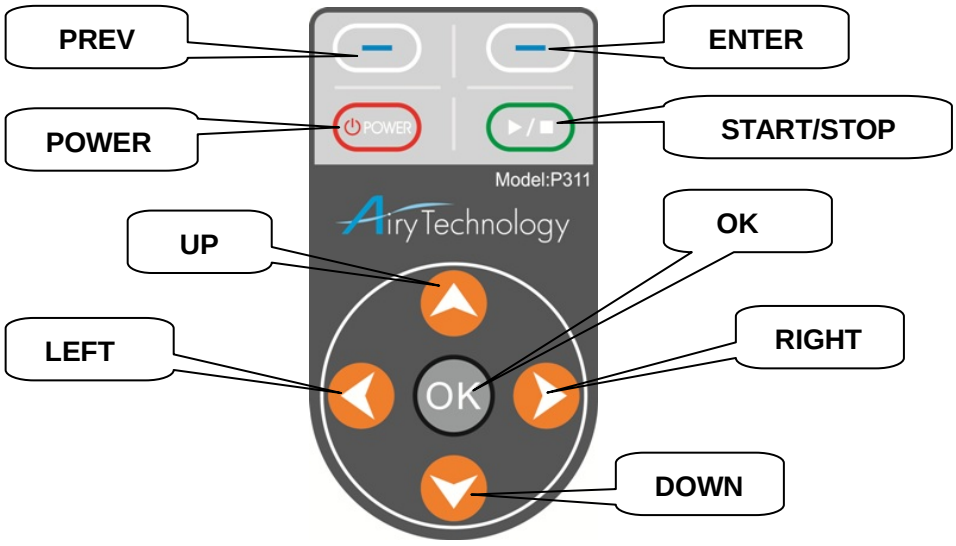
Q u i c k S t a r t

The best way to start quickly is to refer to the printed "**Quick Start Guide**" that comes with the instrument. It will help you to quickly set up the instrument and start sampling. Refer to the sections below for more detailed information on configuring and running the instrument.

Operation

● Key Pad

The instrument is controlled by key pad and its functions are shown as follows:



KEY	Function
ENTER	Enter a menu or execute
START/STOP	Start or stop sampling
PREV	Return to previous screen Or Start or stop sampling
POWER	Power On/Off
	Regulate backlight
UP/DOWN/LEFT/RIGHT	Move the cursor or change the values
OK	Execute

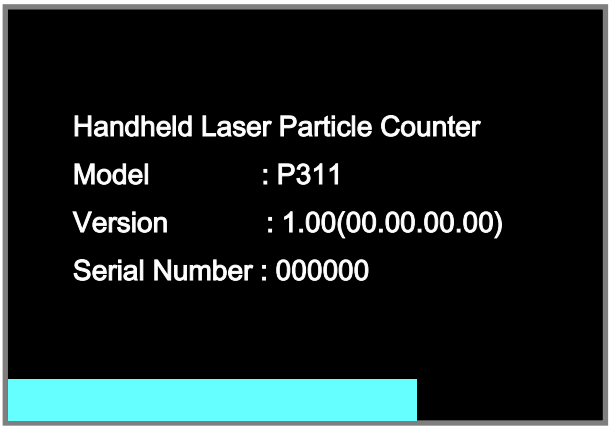
Use the **up** and **down** keys to highlight a menu or a menu option. Use the **left** and **right** keys to enter the sub item or leave the sub item.
Use the **up** and **down** keys to perform operations such as increasing a value. Use the **right** key and **left** keys to move right and left.
The **PREV** key always brings you back to the previous screen.

● Power On/ Off

Press the **POWER** key to turn on the instrument.
Press the **POWER** key to regulate backlight of LCD.
Press the **POWER** key for more than one second, and the message "**Power off…**" will appear on the bottom of current screen.
Press the **POWER** key for more than two seconds, power will be off.

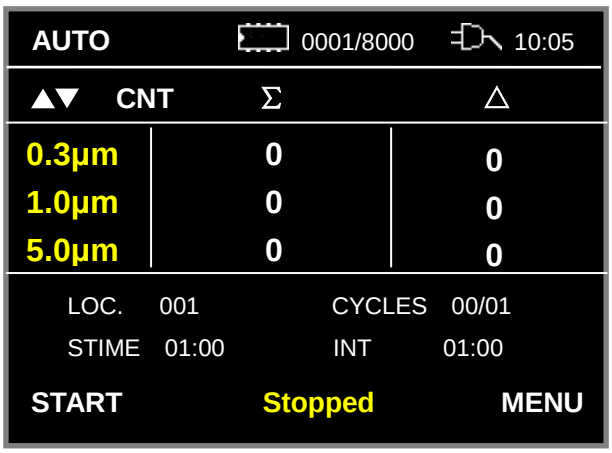
● Splash Screen

To turn the instrument on, press the **Power** key. A splash screen will appear for three seconds, displaying the company logo, model number, serial number, and firmware version number (see below). The first time the instrument is turned on, the clock setting screen will show up.



Splash Screen

The default screen will appear. The instrument is ready for operation.

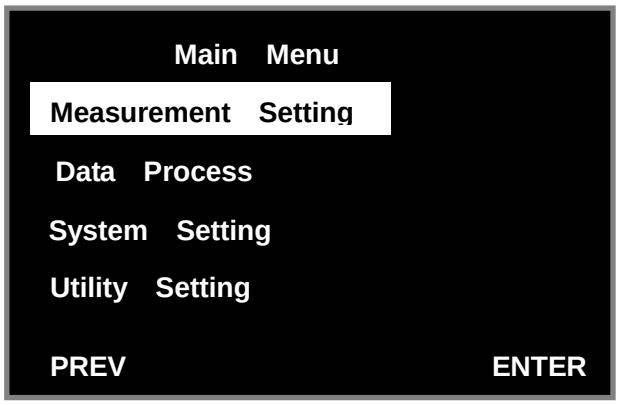


Default Screen

The parts of the default screen are explained as follows:

【AUTO 】	Measure mode (AUTO , MANUAL, ISO)
【0001/8000】	Current number of data records indicated (Max 8000)
【10:05 】	Current time indicated (hour& minute)
【▲▼ CNT 】	Change the measurement unit by the pressing the **UP/DOWN** key (CNT, m3, cf)
【 ∑ 】	Cumulative count - the number of all the particles equal or larger than selected particle size
【 △ 】	Differential count - the number of particles between the selected size and the next selected size
【0.3um 】	Particle size (Channel 1 0.3μm, 0.5μm）
【0.5um 】	Particle size (Channel 2 0.5μm, 1.0μm, 2.0μm, 2.5μm)
【5.0um 】	Particle size （Channel 3 5.0μm）
【LOC. 】	Location/site number
【STIME】	Sampling time (Setting range is 1sec~99min 59sec)
【CYCLES】	Cycle count (1~2000)
【INT 】	Interval time (Setting range is 1sec~99min 59sec)
【Stopped】	Operating status (Stopped, Sampling, Waiting, Holding)
【START】	Sampling start or stop by using **ENTER** or **START** key
【MENU 】	Pressing PREV key to go to Main Menu

● Main Menu



Main Menu Screen

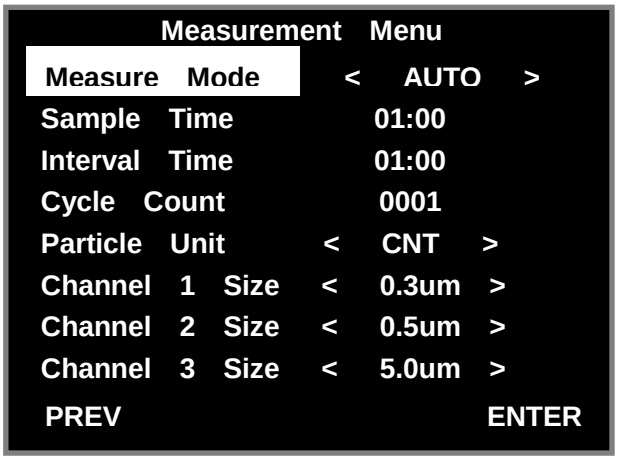
1. Use the **UP/DOWN** key to select an item, the **ENTER/OK** key to select a sub item and the **PREV** key to return to the default screen.

From the Main Menu you can select other menus:

Menu	Description
Measurement Setting	Set measure mode, sample time, interval time, cycle count, particle units, and channel size.
Data Process	Display data records, clear data records and transmit the data.
System Setting	Set time and date, screen settings and location number.
Utility Setting	Set delay time, key sound and pump speed

Each of these menus is described in the remainder of this chapter.

➢ Measurement Setting



Measurement menu

1. **UP/DOWN** key to select an item, and press the **ENTER** key to select a sub item ;
2. **UP/DOWN/LEFT/RIGHT** key to set and press **OK** to execute. **PREV** key to go back to Main Menu screen.

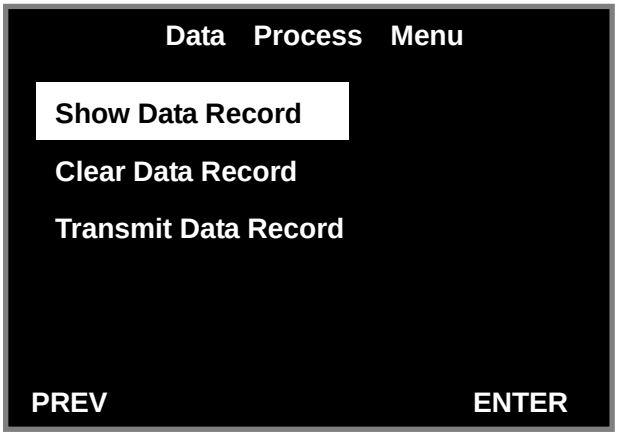
The following table describes this menu's options and the available parameters.

Option	Description
Measure Mode	Auto: After pressing **START** at the default screen, the particle counter begins sampling based on the parameter values (*Sample Time*, *Interval Time*, and *Cycle Count*). Manual: In this mode, the instrument is started & stopped manually, in the default screen, by pressing **START** and/or **FINISH**. The parameter values of *Sample Time*, *Interval Time*, and *Cycle Count* will not affect the sampling. ISO: This mode is designed for testing according to the ISO 14644 standard, as *Particle Unit,* /m3 or /cf can be selected. If CNT (count) is selected as *Particle Unit*, the result will be shown in /m3.
Sample Time	Setting range from 1sec to 99 min 59 sec. (*Sample Time* needs to be set equal to or less than *Interval Time*. In order to set *Sample Time* longer than *Interval Time*, modify *Interval Time* prior to changing *Sample Time*)
Interval Time	Setting range from 1 sec to 99 min 59 sec (*Interval Time* needs to be set equal or longer than *Sample Time*. *Interval Time* is the sum of sampling and pause time. For example, if you would like to sample for 1 minute each and 4 times an hour, please set *Sample Time* to be 1 minute and *Interval Time* to be 15 minutes (*Cycle Count* to be 4 times x 24 hours = 96 in order to keep repeating for 1 day). The particle counter samples 1 minute and pauses 14 minutes, so one cycle takes 15 minutes.)

Cycle Count	1~2000 times (Automatically repeats the sampling and pause until it has completed the required number of samples).
Particle Unit	CNT (This count is the actual number of particles detected by the particle counter). /m3 (The particle counter calculates the number of particles per cubic meter). /cf (The particle counter calculates the number of particles per cubic foot).
Channel 1 Size	0.3μm, 0.5μm
Channel 2 Size	0.5μm, 1.0μm, 2.0μm, 2.5μm
Channel 3 Size	5.0μm

➢ **Data Process**

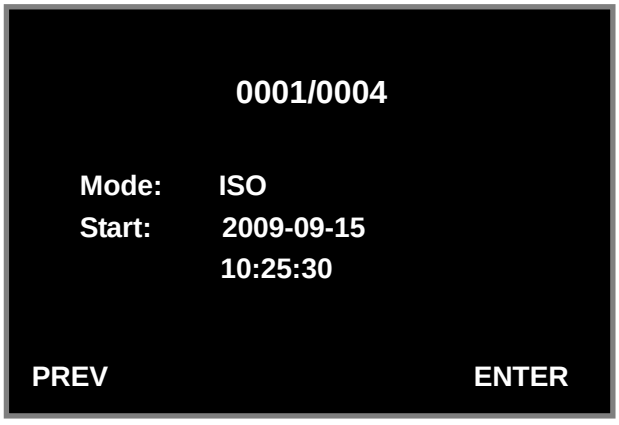
At the data process screen you can view the number of records stored in the instrument, display data records, and clear the data. You can also transmit the records to computer with a USB cable.



Data Process Menu

【Show Data Record】

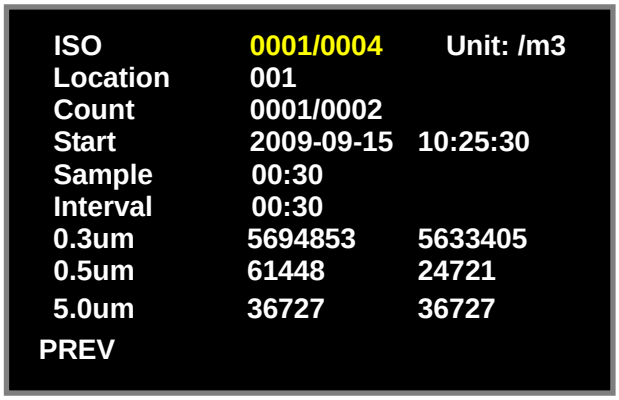
Press the **Enter** key to go to secondary screen where you can select the record (by sampling number) to review.



When “Show Data Record” is selected and the data mode is ISO, the sampling result will be displayed.

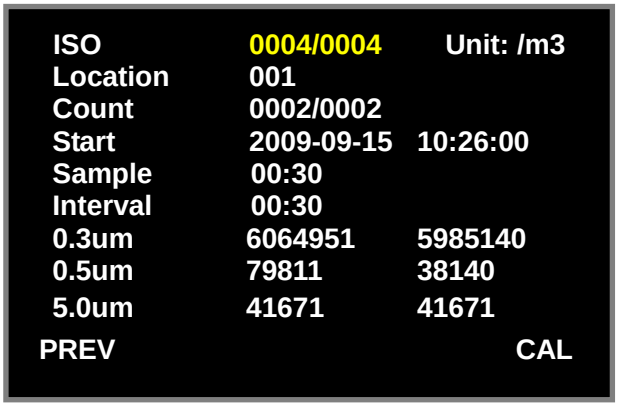
For example:

1. When data # 0001 is selected, the display will show as follows (In this example the total number of samples is 4):

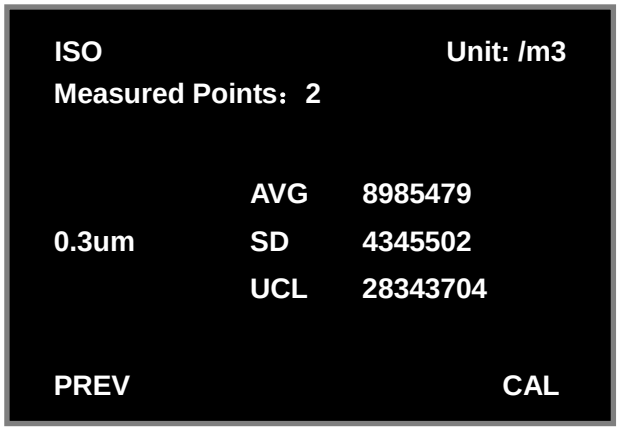


2. Use the **UP/LEFT** and **DOWN/RIGHT** keys to scroll through the records, **PREV** to go back to the select record screen. In this example, data # 0004 is the last sample of consecutive samplings for ISO mode.

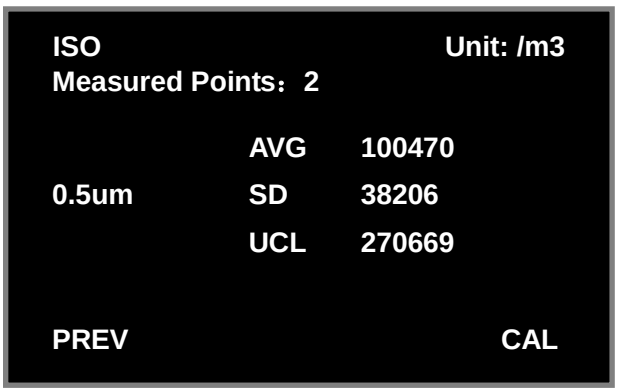
   At the bottom right of the screen, “CAL” appears. "CAL" appears only in the last sampling result of consecutive ISO samplings.



3. Select “CAL” to go to the ISO calculation result screen.



This screen shows the average, standard deviation, and UCL. At this calculation results display, Press “UP” or “DOWN” to select different channel size calculation results. Press “PREV” to return to the “Show Data Record” screen.

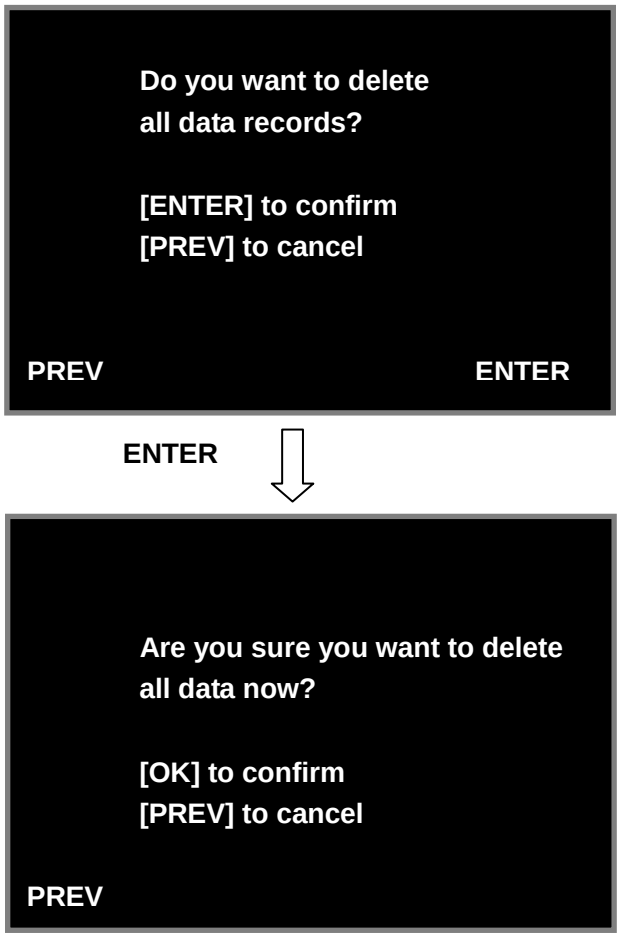


N o t e

If the buffer is filled with more than 7900 data record sets, the instrument still continues to count and save data but the number of data records shown on the default screen will be red and the buzzer will beep as an alarm. When the buffer is filled with the maximum capacity of 8000 records, the instrument will continue to count but the data will not be saved. The user must write down the data and clear the buffer (if necessary, please download the data to PC to save before deleting data from the instrument).

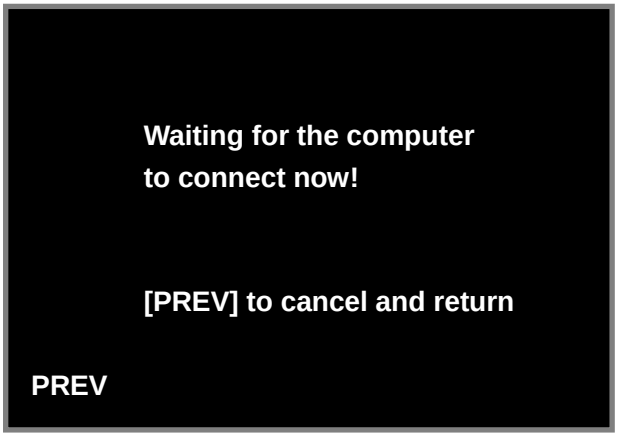
【Clear Data Record】

Press the **Enter** key to clear all sampled data in the buffer. The screen will ask you to confirm your request.

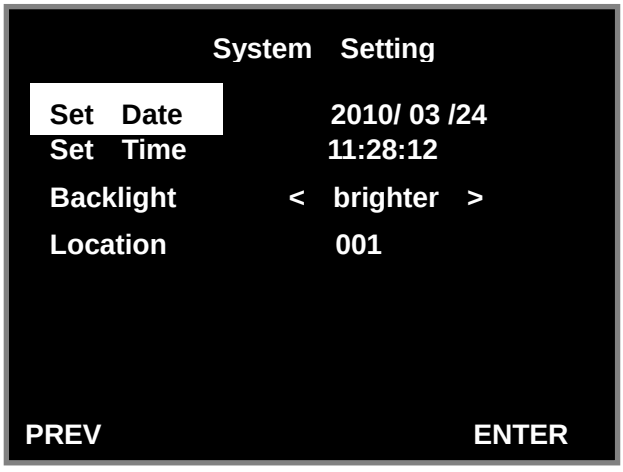


【Transmit Data Record】

Downloading the data to PC can be performed in the screen below. Please plug the USB cable to the instrument and your PC.



➢ **System Setting**



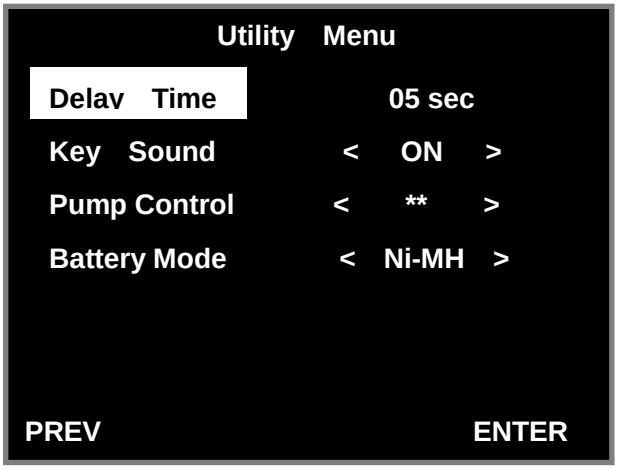
System Setting Screen

1. **UP/DOWN** key to select item and press the **ENTER** key to go to sub item ;
2. **UP/DOWN/LEFT/RIGHT** key to set and press **OK** key to execute; Press the **PREV** key to go back to Main Menu.

Option	Description
Set Date	System Date(year, month , day)
Set Time	System Time (24 hours, hour, minute, second)
Backlight	Brighter, Normal, Darker
Location	1~199

➢ **Utility Setting**

You can set delay time, key sound, pump speed and battery mode in this screen.



Utility Menu

Option	Description
Delay Time	Period from starting pump to beginning sample (5~99s).
Key Sound	Sound of key. (On/Off)
Pump Control	Press the **Enter** key to increase or decrease the pump speed. (The pump may slow down with age, or it may be necessary to increase speed if there are flow restrictions – such as long tubing). Use a flow meter to check the flow. When taking critical measurements, adjust the pump speed as necessary. (10~83)
Battery Mode	Select the battery mode. (Ni-MH or Alkaline)

- **Sample Procedure**

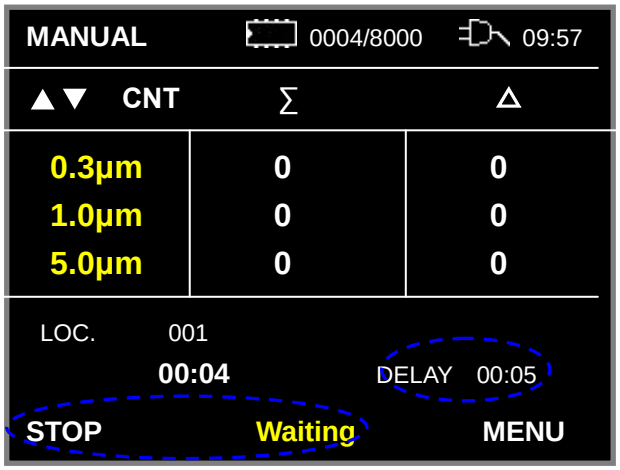
  Note: when sampling

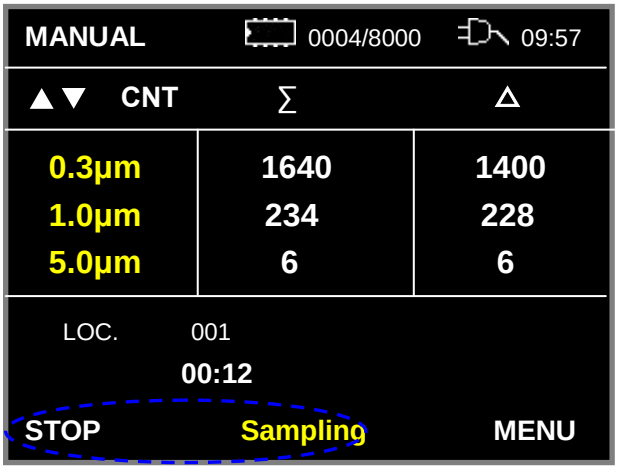
  * press **UP/DOWN** key to convert the particle unit.

➢ **Manual mode**

Press **START/ENTER** to start sampling.

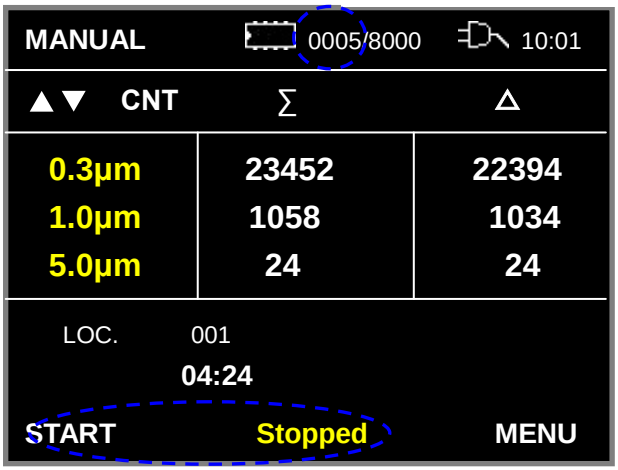
START





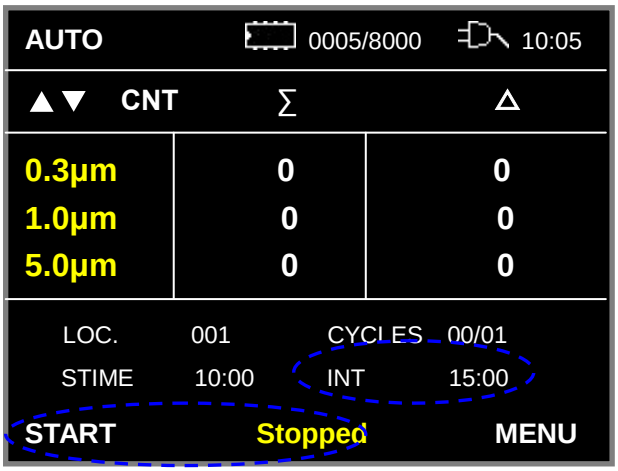
STOP

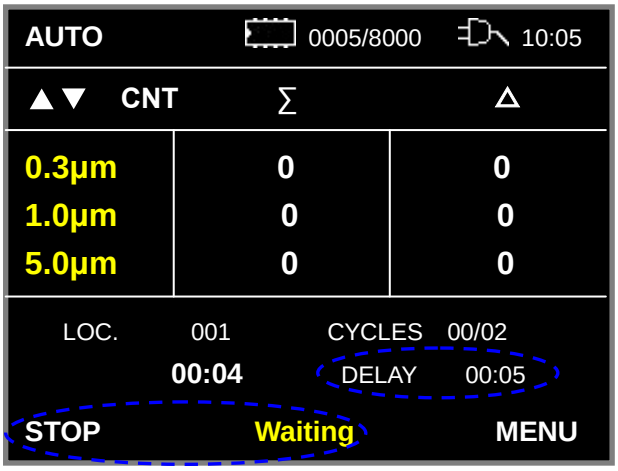
（Stop and data are saved automatically）

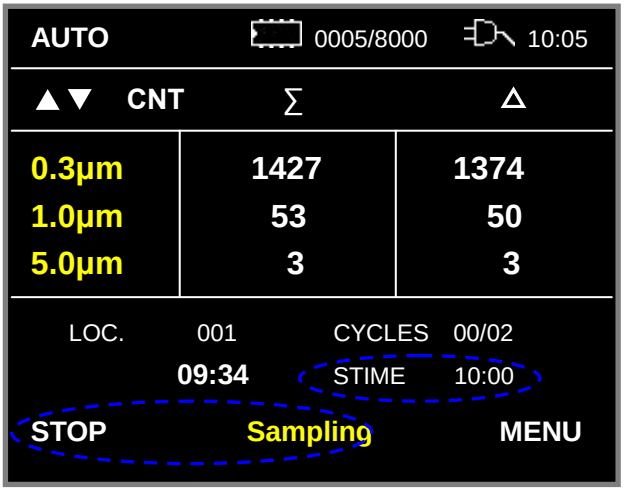


➢ **Auto mode**

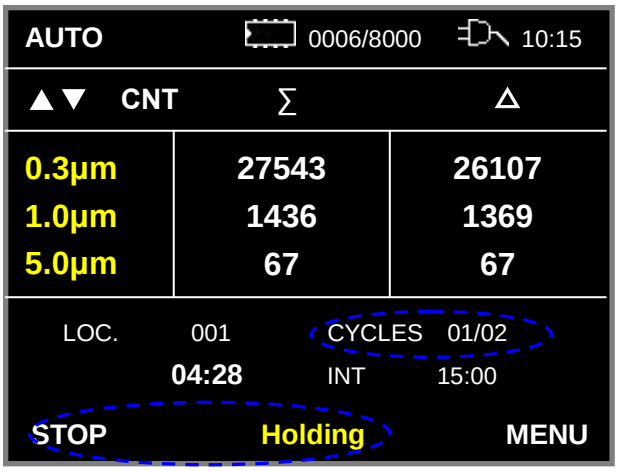
START



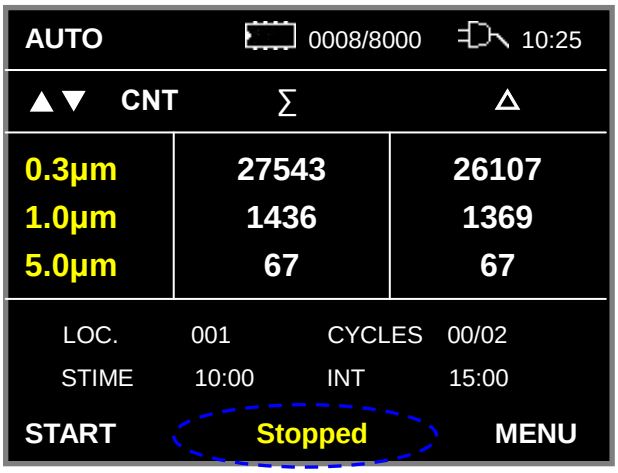




Caution: When the difference between interval time and sampling time is longer than 15 sec, the pump will stop after each sampling and restart before the next sampling.



The data is saved automatically after every sampling. Pressing "**STOP**" will finish sampling at anytime except during "**Waiting**" period.

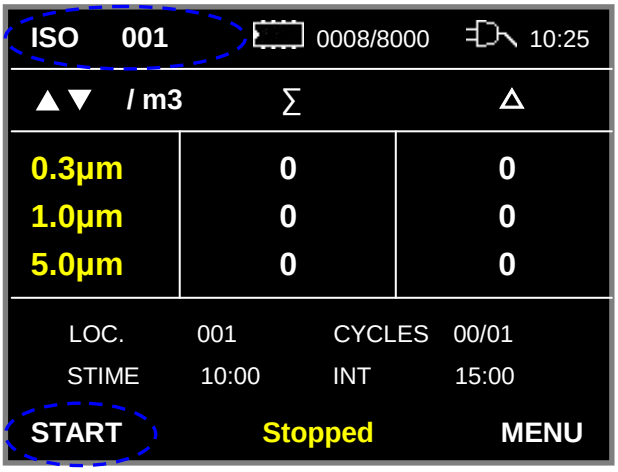


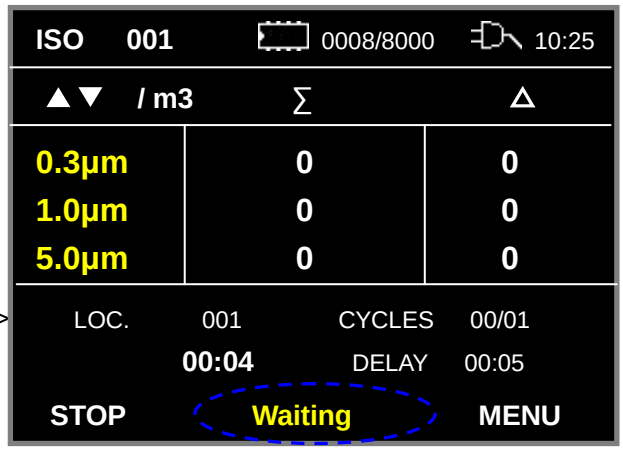
The sampling stops automatically when all cycles have finished.

➢ **ISO mode**

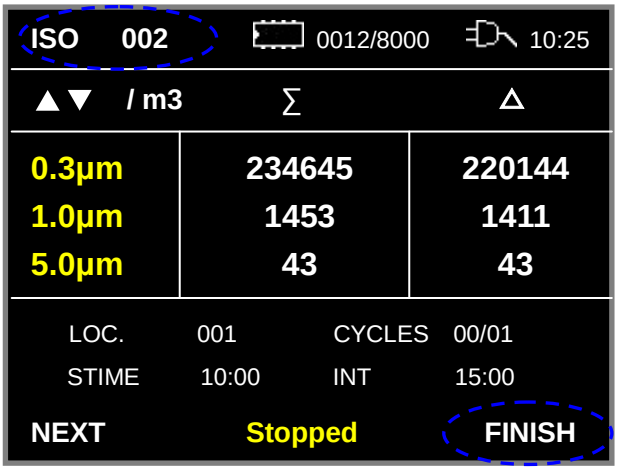
Caution: There are only **m3/cf** units in this mode.

START





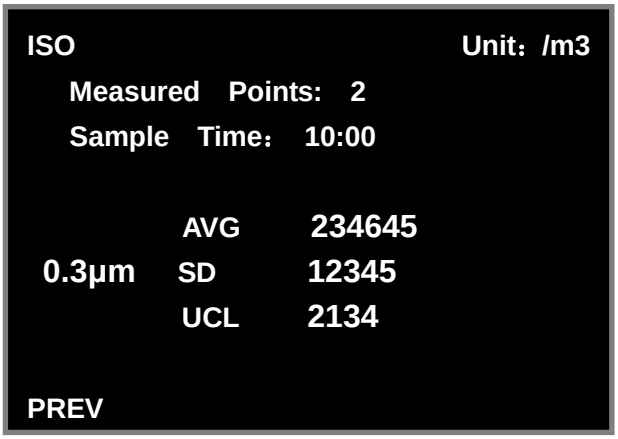
The measurement process of ISO executes as **AUTO** mode. Please refer to the above instruction.



Press the "**FINISH**" key to finish this measurement. It will calculate and run into the ISO result interface.

After the current sampling is finished, press "**NEXT**" to start the next sampling.

FINISH



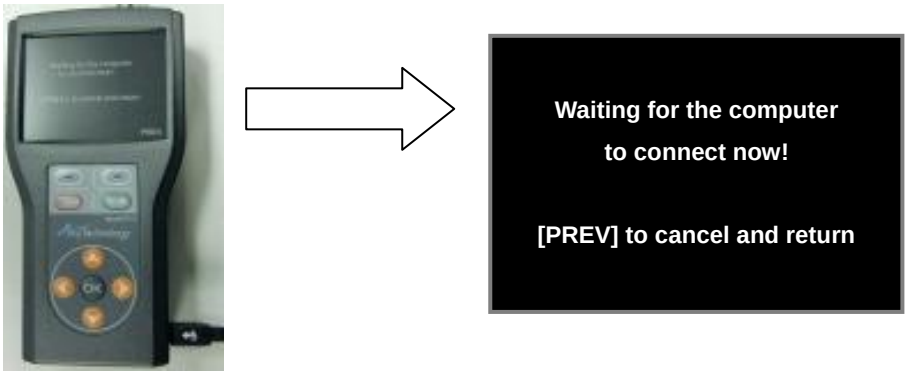
Press the "**PREV**" key to return to default screen. Press **UP/DOWN** to select the channel size shown.

Data Handling

USB Computer Communication

Mini USB Port

The Model P311 is equipped with a USB-compatible cable for uploading and downloading information to a PC. Plug the cable into the right side of the instrument as shown below.



Software Installation

The Airy P311 Software (Data Transfer Utility) comes as a CD including software and USB drivers for the particle counter.

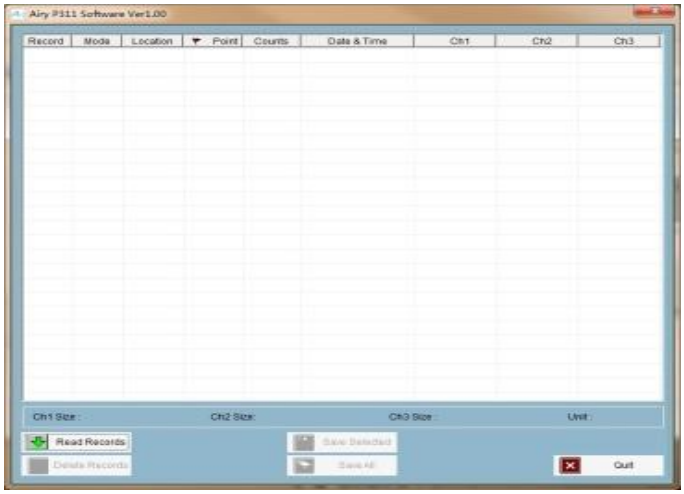
Note: this version of the software only guarantee use in the Windows XP (SP2) or Windows Vista or Windows7 (32bits) OS.

Installation consists of two parts:

- Installation of Airy P311 Software.
- Installation of Custom USB Device.

Downloading Data

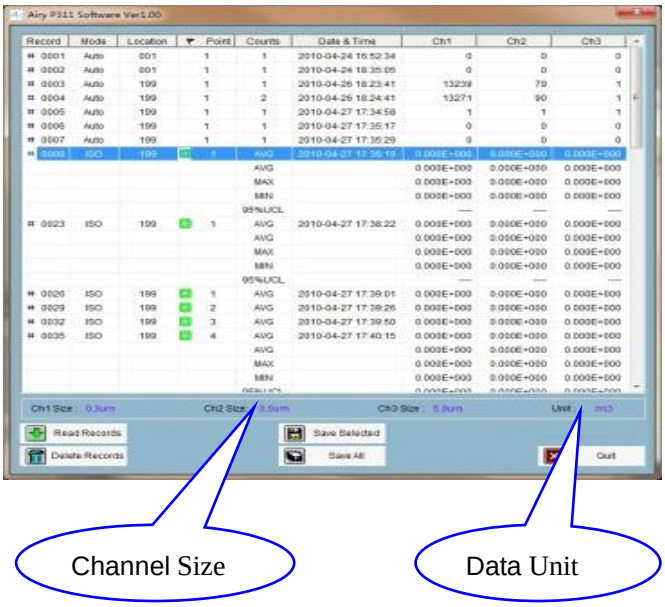
Connect a USB cable to the instrument and PC. Go to **[Data Process]** and then to **[Transmit Data Record]**. Double click [Airy P311 Software] icon, and the main application screen will show up.



➢ **【Read Data】**

【Read records】

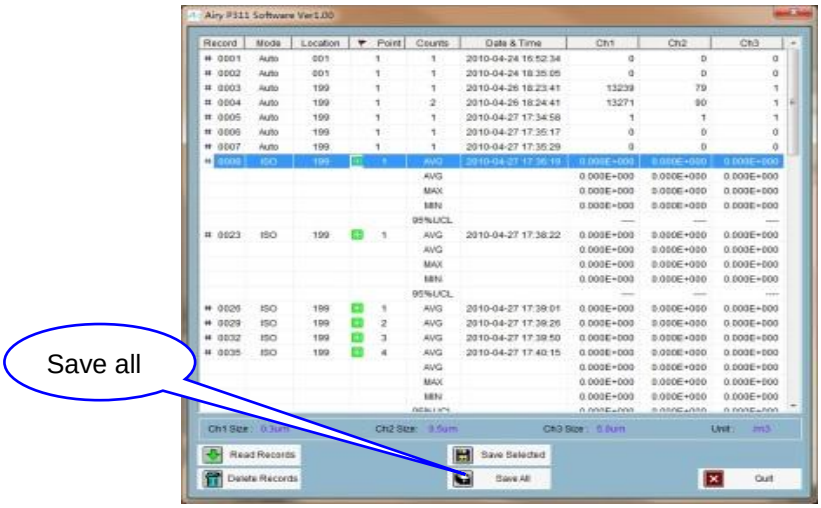
Click **Read Records.** It takes a few moments to download all the data depending on the number of samples stored in instrument. When it is finished, the main application screen will display as follows:



➢ **【Save Data】**

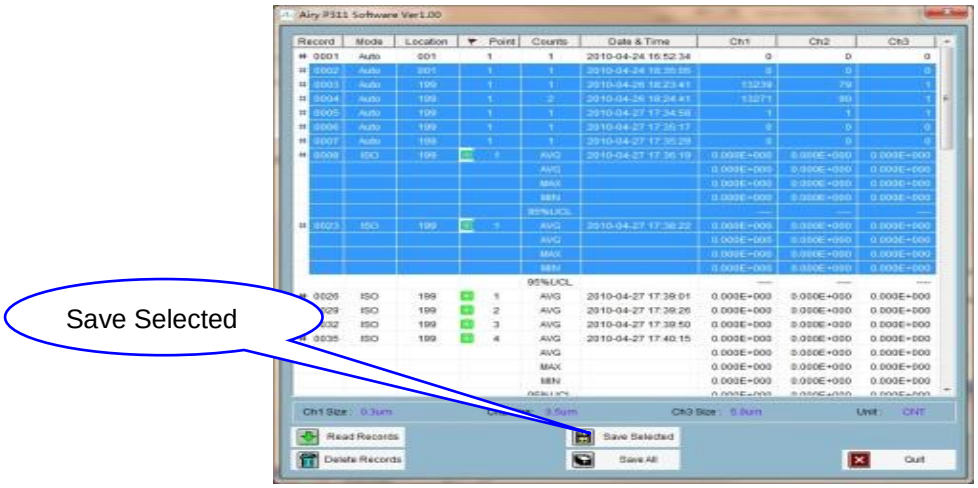
【Save all records】

After downloading data to PC, the other functions will be enabled. If you want to save all records, click **Save All**. You can select the file location and decide the file name.

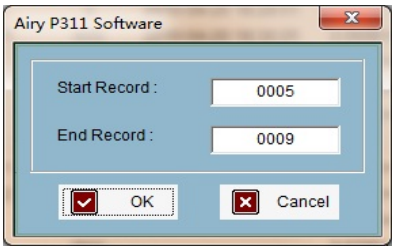


To save the file, click **Save**, and then the data will be saved in the selected location.
To cancel the transfer, select **Cancel**.
Data is stored in a .CSV file format that can be opened by most spreadsheet programs such as Microsoft® Excel®.

【Save selected records】
When you need to save part of the records, you can select the data to save.



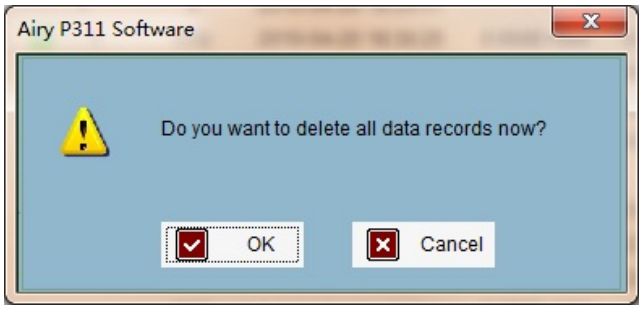
Click **Save Selected**



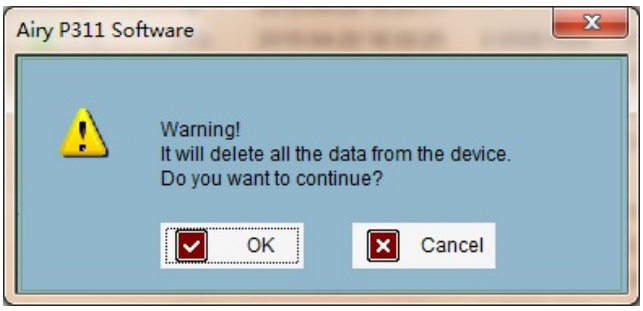
You can specify the record number by typing in the window.
Note: the start number cannot exceed the finish number.
Click **OK** to continue and the specified data range will be saved.

➢ **【Delete Data】**

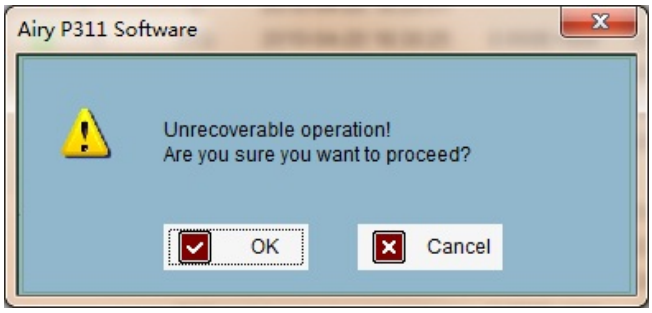
【Delete Records】
This operation will delete all the records saved in device. Please double-check before you delete data. When you click **Delete Records**, the below dialog shows up.



Click **OK** to continue, Click **Cancel** to stop.



Click **OK** to continue, Click **Cancel** to stop.



Click **Cancel** to stop. Click **OK** to delete data.

WARNING!

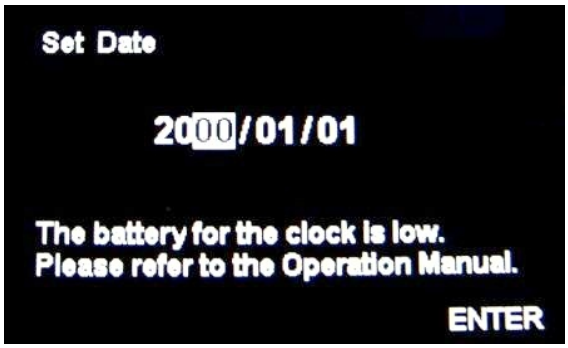
Deleting data is an irreversible operation. Download and save data before deleting in order to have a copy for future use.

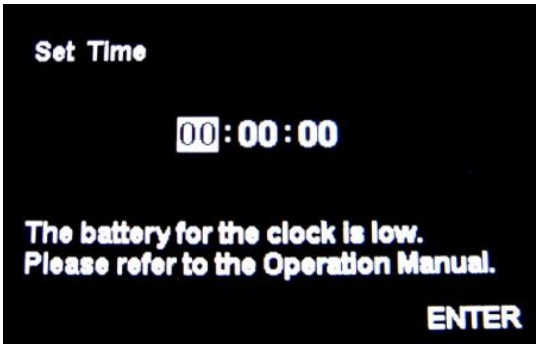
Calibration

Please return the Airy Technology P311 to the manufacturer or the authorized service center for annual calibration.

How to charge the internal battery for the clock

There is a rechargeable battery for the clock inside of the P311. When the power of the P311 is ON, the battery is automatically being charged. If the P311 has not been used for a while, the battery will become low. In that case, the following screen will show up when the P311 is turned on. In order to charge the battery, please connect the P311 to the AC adaptor and keep the P311 ON for 24 hours to fully charge. This battery is only for the clock and this message is not related to 4 x AA batteries. You can still sample without charging the battery for the clock and the sampling data will be saved in the memory.





A P P E N D I X A

Specifications

Specifications

Size Range	0.3 -5.0 μm
Channel Sizes	channel 1: 0.3/0.5μm channel 2: 0.5/1.0/2.0/2.5μm channel 3: 5.0μm
Counting Efficiency	50% at 0.3 μm; 100% for particles > 0.45 μm (per JIS)
Concentration Limits	4,000,000 particles / ft3 at 5% coincidence loss
Light Source	Laser diode
Zero Count Level	<1 count / 5 minutes Meets JIS B9921
Flow Rate	0.1 CFM (2.83 LPM)
Calibration	NIST traceable
Sample Probe/Tubing	Isokinetic sampling probe, probe for tubing
Sampling Modes	Manual, Automatic and ISO
ISO Certification	ISO 5-9 @ 0.3-5.0μm*
Sampling Time	1 second to 99 minutes 59 seconds(Configurable)
Sampling Frequency	1 to 2000 cycles or continuous(Configurable)
Sample Output	Internal HEPA filter
Vacuum Source	Internal pump
Communication Mode	USB
Data Storage	8000 sample records
Status Indicators	battery used, over range alarm
Display	3.5-inch 320 x 240 Color LCD
Power	DC 5V 1A (Mini USB TYPE-B)
Battery	4 x AA
Battery Life	Up to 4.5 hours of continuous use (LCD Backlight low, Included Ni-MH Battery)
Dimensions (L x W x H)	178x90x47mm (without isokinetic inlet)
Weight	480g (without battery)
Standards	CE, JISB9921, ISO 21501-4
Warranty	1 year limited warranty
Operating Conditions	5° to 35°C 20% to 95%RH non-condensing
Storage Conditions	-20° to 50°C Up to 98%RH non-condensing
Included Accessories	AC adapter, Isokinetic inlet, USB cable, Zero filter, Software, 4 x AA batteries with charger, Calibration Certificate, Carrying case

* Exclude ISO 5 @ 5.0 μm