KANOMAX

Handheld Laser Particle Counter
Model 3886 GEO – α

Operation Manual

Please read this manual carefully and understand the warnings described in this manual before operation.

Kanomax Japan Inc.

Please keep this manual handy for future reference.

02001
06.08

Thank you for purchasing a product of Kanomax, Inc.

Please read this operation manual carefully and operate the instrument properly by following the instructions given in this manual.

Important safety Information

Danger: For prevention of accidents resulting in injury or death
Items under this heading show measures to prevent serious injury or death, which may result if the instructions in this manual are not observed and the instrument is operated inappropriately.

Caution: For prevention of the damage of product
Items under this heading show measures to prevent damage to the product and conditions that affect our product warranty.

[Definition of Signs]

This symbol indicates a condition (including danger) that requires caution.
The subject of each caution is illustrated inside the triangle (e.g., high temperature caution symbol shown on the left).

This symbol indicates prohibition. Do not take a prohibited action shown inside or near this symbol (e.g., disassembly prohibition symbol shown on the left).

This symbol indicates a mandatory action. A specific action is given near the symbol.

⚠ Danger

○ Do not disassemble or heat the batteries

⋯ There is danger of explosion.

Explosive

Handle Properly

○ For AC power supply, do not use the AC adapter other than the one supplied with the instrument.

Forbidden

⋯ An inappropriate adapter may damage the instrument.
⋯ It may generate heat and cause fire.

⚠ Danger

○ Never disassemble, modify or repair the instrument and its accessories.

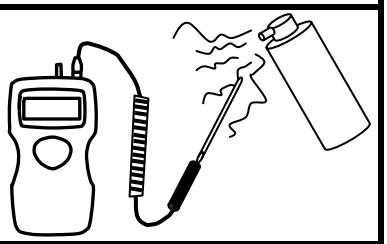
⋯ This instrument uses a Class 3B laser diode as the light source. Exposure to the laser may cause loss of eyesight and other injury.

⋯ Disassembly may cause short circuit and/or other failure.

○ Never bring the probe close to a flammable gas atmosphere.

⋯ The heated sensor may cause fire or explosion.

Do not use near Flammable gas

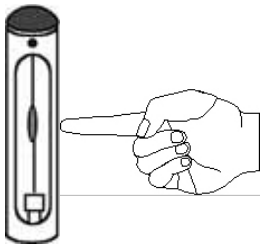


○ Never touch the sensor

⋯ The sensor is heated during operation. Touching the heated sensor may cause burns, and may also damage the sensor itself.

Hot surface

Don't touch

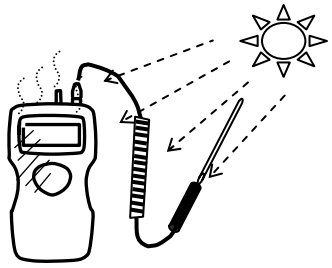


⚠ Caution

○ Do not use or leave the instrument in a high temperature/ humidity environment, or in a dusty environment.
Do not leave the instrument under direct sunlight for a prolonged period.

⋯ This instrument may not function properly outside of the operating temperature range.

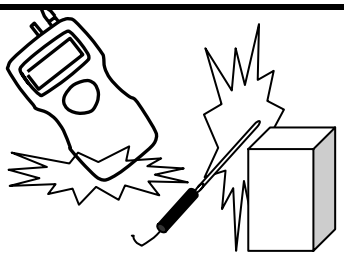
Forbidden Use



○ Do not apply strong shock or place/drop anything heavy on the instrument.

⋯ Failure to observe the above may cause damage or malfunction to the instrument

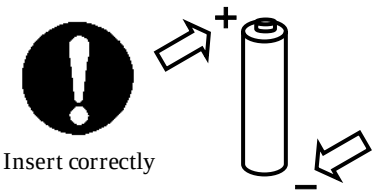
Forbidden



⚠ Caution

○ Set the batteries in the correct direction

⋯ Setting the batteries in the wrong direction may cause leakage, leading to contamination of the instrument and surroundings.



○ Do not wipe the body with solvent

⋯ The body may deform or deteriorate. Use soft dry cloth to remove stains.
If stains persist, soak the cloth in a neutral detergent and wipe the instrument with a soft cloth.
Do not use volatile solvents such as thinner and benzine.

○ Do not use the instrument near equipment emitting high radiation noise.

⋯ The instrument may malfunction due to the noise. The Air velocity sensor is especially sensitive to radiation noise.

○ Connect the AC adapter to a power source with minimum noise.

⋯ The noise may cause malfunctioning.

○ Do not pull the probe cable strongly, or suspend the unit by holding the cable.

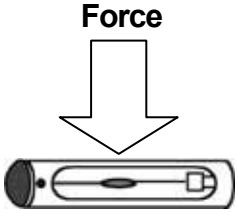
⋯ It may cause malfunctioning and breaking of the wire.

○ Do not use the instrument in a water vapor atmosphere.

⋯ The heat dissipation rate will change, preventing correct measurement.
It may also damage the sensor.

○ Do not apply strong force to the sensor

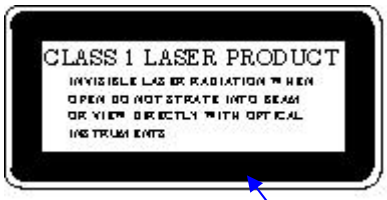
⋯ Deformation of the sensor will prevent accurate measurement. It may also break the wire of the sensor.



※Air Velocity probe and Temp.& Humidity probe are options (sold separately)

SAFTY OF LASER PRODUCTS

Model 3886 GEO-α is Class 1 LASER PRODUCT.



CLASS 1 LASER PRODUCT
INVISIBLE LASER RADIATION WHEN
OPEN DO NOT STRATE INTO BEAM OR
VIEW DIRECTLY WITH OPTICAL
INSTRUMENTS

This instrument is classified into the class 1 laser product as defined by safety of the laser product JIS C 6802(IEC 60825-1).
Never, decompose this instrument to preventive exposed you to the laser radiation.

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1. Check of Components

When unpacking, check the contents in the box using the list below

1.1 Standard accessories

Name	Model No.	Functions
Filter	Model 3886-03	Used to clean the air flow route inside the instrument with clean air.
AC Adapter	Model 3886-01	Used for AC powered operation. To be used especially for continuous measurements.
Ni-MH (Nickel Metal Hydride) Batteries	FNH HR AA 4BF (Fuji Film Battery)	Used for battery powered operation. *The dedicated battery charger listed below must be used for charging the batteries. The AC adapter cannot be used for charging the batteries.
Quick Charger	FNW 1 BX D (Fuji Film Battery)	For charging the Ni-MH batteries. Charging time is approx. 260 minutes.

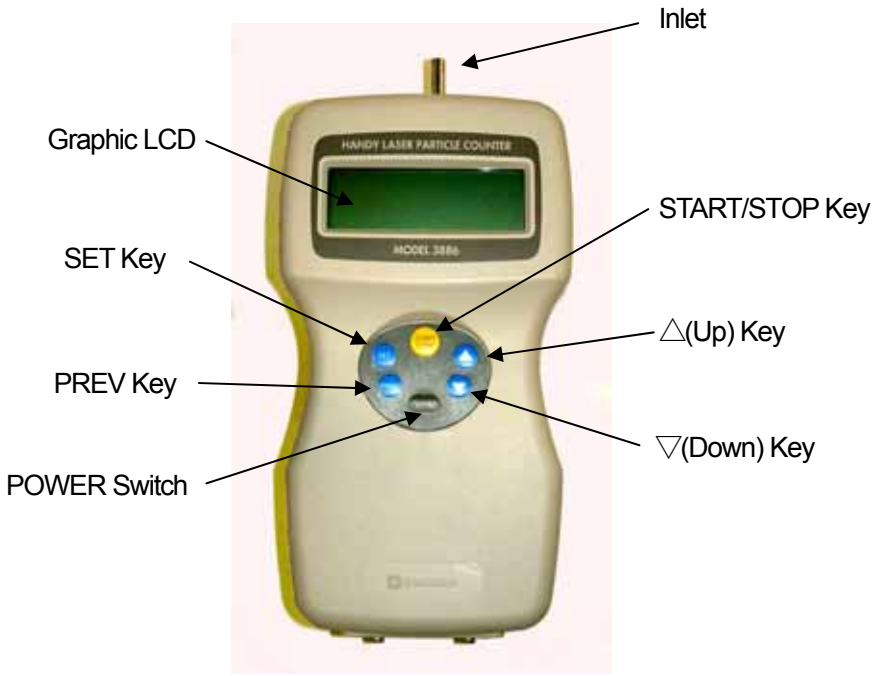
1.2 Options

Name	Model No.	Functions
Temp. & Humidity probe	Model 0842	For measuring temperature and humidity.
Air Velocity probe	Model 0843	For measuring air velocity.
Extension rod for air velocity probe	Model 0843-01	For measuring air velocity at high locations.
Printer	DPU-201GS	For direct printing of measured data.
Printer cable	Model 3886-07	For connecting the instrument and the printer.
Application soft	Model S388-61	For transferring data stored in the instrument to a PC, and remote control of the instrument from the PC.
RS-232C cable	Model 3886-08	For connecting the instrument and the PC
Carrying Case	Model 3886-02	For storing and carrying the instrument.
Tripod		For fixing the instrument for a measurement.

2. Description of Components

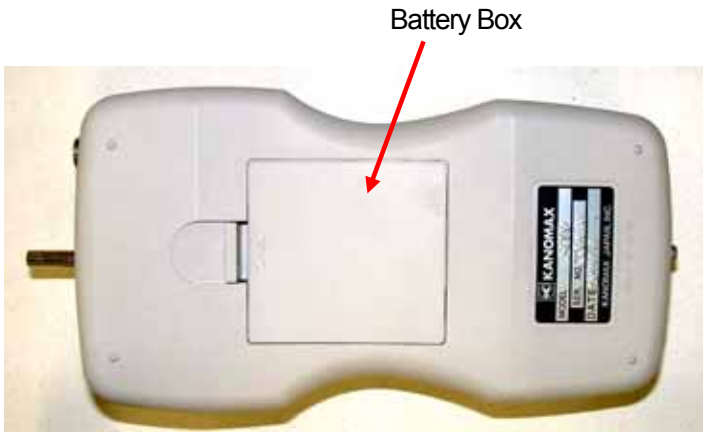
Name and functions of each component are explained in this chapter.

2.1 Front

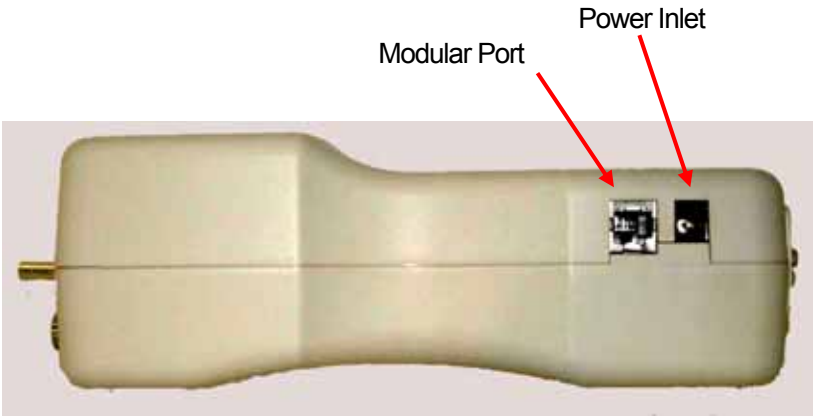


Name of component	Functions
Inlet	Inlet for sampling air.
Graphic LCD	Displays measured data and status of operation.
SET Key	To execute a specified item.
PREV Key	To return to the previous screen
POWER Switch	To turn on/off the power
△(Up) Key ▽(Down) Key	To set parameters and values.
START/STOP Key	To start/end a measurement.

2.2 Rear

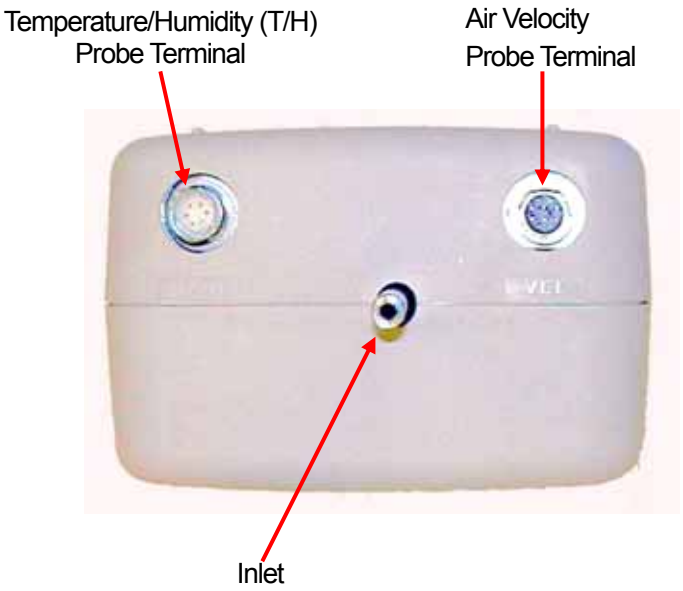


2.3 Side



Component	Functions
Modular Port	Communication port to transfer data to a printer or PC.
Power Inlet	Connection for the AC adapter.

2.4 Top



Component	Functions
Inlet	Inlet for sampling air.
Temperature/Humidity (T/H) Probe Terminal	Connection for Temperature/Humidity probe.
Air Velocity Probe Terminal	Connection for air velocity probe.

3. Handling & Cautions

3.1 Power supply

Please use the supplied AC adapter and refrain from the battery operation for the long consecutive measurements (more than 2 hours)

This instrument has the monitoring function of operating voltage, and battery alarm will be indicated when the voltage goes down below the specified value.

If you leave the instrument in such a conditions for a few minutes, the power automatically goes off. In some of measuring mode, the data of measurement in process will not be stored. (Please refer to Chapter 8 for details)

If the alarm sign is shown, please stop the measurement and charge the batteries, or replace with the charged batteries.

◆Use of AC Adapter

Insert the plug of the supplied AC adapter into the power inlet at the side of instrument.

The AC power should be in the range of 86-264V 50/60Hz. Do not use the AC power outside of this range.

◆Use of Ni-MH Batteries

Prepare 4 pieces of Ni-MH batteries (1.2V, 2500mAh) and fully charge them. Charging time is approx. 260 minutes.

When charging is completed, put the batteries into the instrument in the correct directions.

Battery life is about 3 hours, but it will vary by the type and capacity of battery, or status of charging. When optional Temp.&Humidity probe and Air velocity probe are used at the same time, there will be the cases that operating hours will become less than 2 hours.

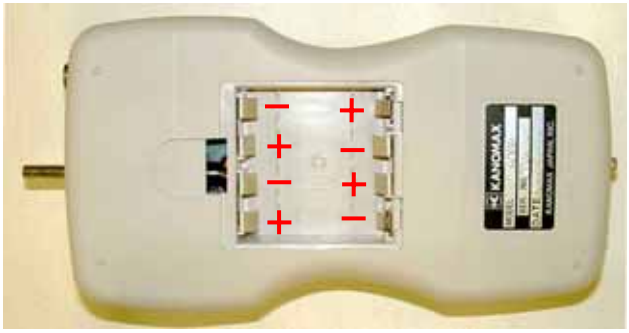


Figure: Direction of Inserting Batteries

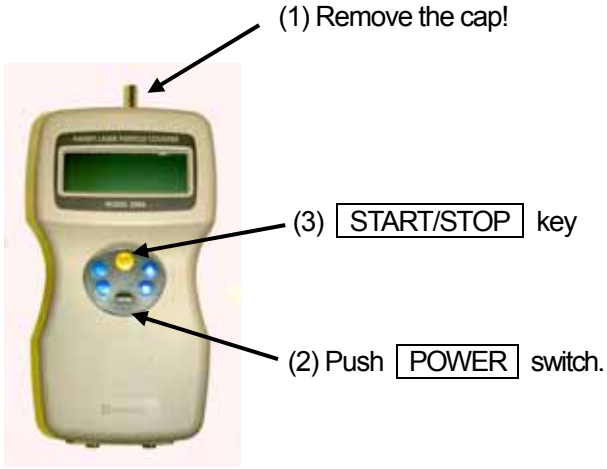
※Though alkaline batteries can also be used, please note that the battery life for alkaline batteries will be approx. 1.5 hours which is shorter than the Ni-MH batteries.

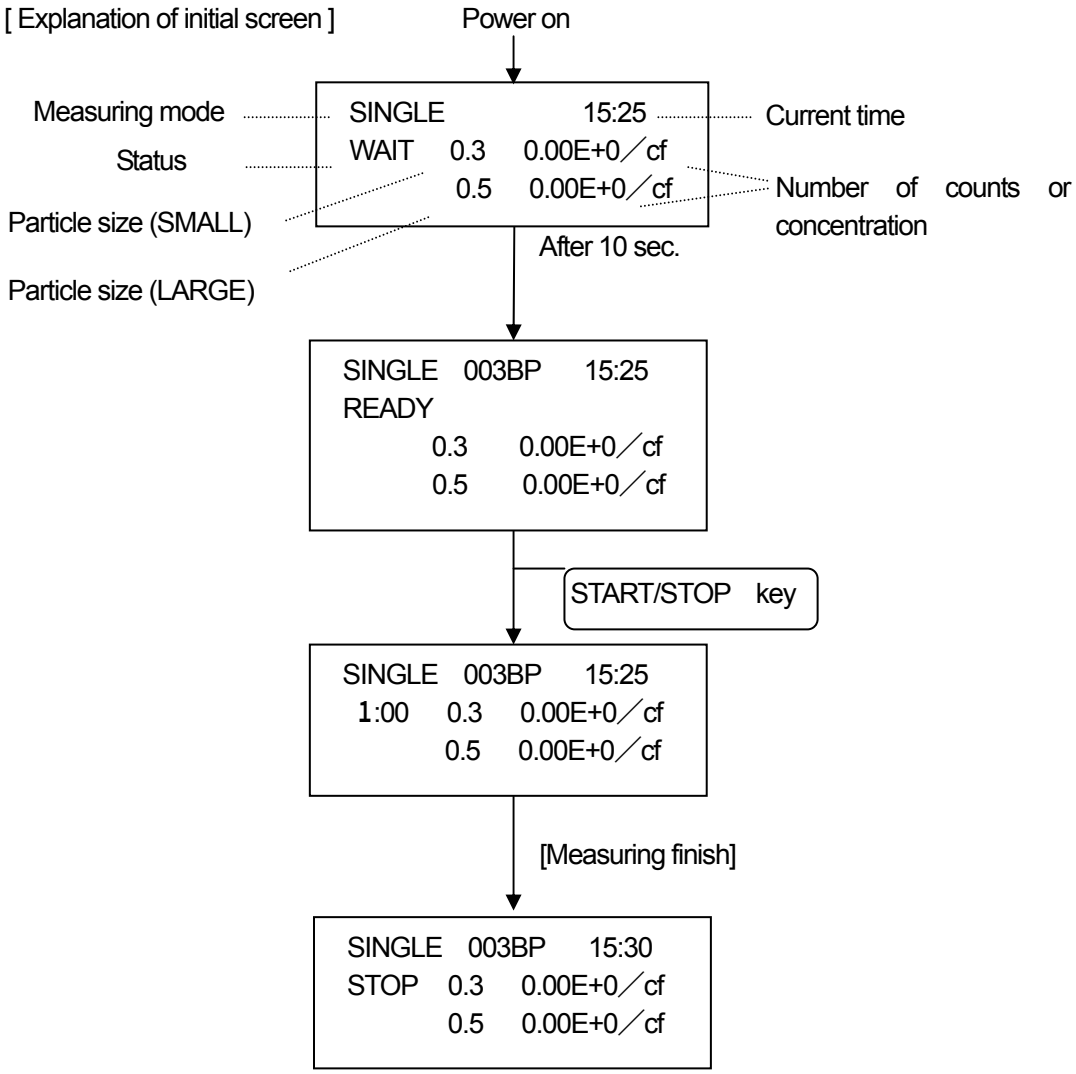
3.2 Turning the power on

(1) Make sure to remove the cap of air inlet at the top of the instrument.

(2) Push POWER switch in the function key. Initial display shows the mode and setup data of previous measurement in WAIT status (Set at SINGLE mode at the time of delivery).
Please refer to Chapter 4 for the customizing of measuring mode or method.

(3) WAIT sign will change to READY after 10 seconds. Then, measurement can be started by pushing the START key.
At the time of delivery, sampling time is set at 1 minute, so the measurement will be automatically stopped after 1 minute.





3.3 Cautions before starting the measurements

3.3.1 Location

This product is designed and produced for the operations in clean room environment. Please refrain from using in the dressing room of clean suits, or in the ordinary environment (e.g. offices, turnery, outdoors, smoking rooms etc.)

It will contaminate the internal components and increase the maintenance frequency.

3.3.2 Connection of sampling tube

Connect the sampling tube to air inlet for the collection of the air at distant place.

—Requirement for sampling tube —

■Material

Material of tube should be metal (stainless, copper, alloy steel), glass or synthetic resin which will not generate the plastic deposit.

■Length, Inner Diameter

Long or narrow sampling tube may be bent or pinched, causing pressure loss or clogging, which will damage the vacuum pump and increase the maintenance frequency.

It also causes the deposit loss of particles and lowers the accuracy of measurements.

Length of sampling tube must be less than 1m and the inner diameter must be over 1/4 inch (φ6.4mm).

■Pressure Loss

Large pressure loss will prevent the instrument to maintain the 0.1cfm (+/-10%) flow rate.

Pressure loss at sampling tube must be less than 1kPa (approx. 100mmH_2O).

3.4 After the measurement

[Cleaning of internals]

Internals of the instrument may be contaminated after measurement.

Please carry out the following cleaning procedure after finishing the measurement.

—The method of cleaning and storage—

① Stop the measurement before cleaning

② Connect the filter to the air inlet at the top of the instrument, using the supplied tube.

＊ There is a possibility that the tube will be folded and inlet will be blocked when connecting the tube to the inlet. Operation of the instrument in such a condition will overload the vacuum pump and shorten the operating life.

③ Change UNIT to counts (CNT) and start the measurement

④ Finish the operation only after the confirmation that the count value gets stable and doesn't increase or decrease for more than 10 seconds.

⑤ Turn the power off and put the cap over the inlet

※ To prevent the contamination during storage, do not fail to cover the inlet by cap.

Caution

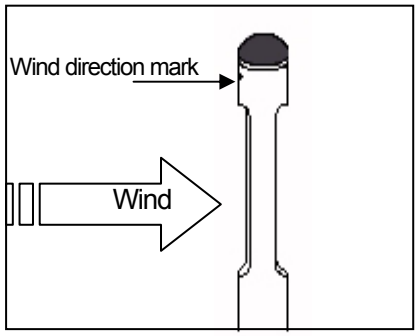
If cleaning is continued in a high concentration environment, the dust will accumulate on the filter and clog the filter. In such case, the error indication (F) may be displayed indicating an insufficient flow volume.
In addition, this may lead to abnormal count with unstable readings as the particles accumulated on the filter will flow in the instrument by vibrations.

3.5 Measurements using optional probes (Temperature & Humidity, Air velocity)

◆Air velocity probe

＊ When measuring, set wind direction mark against the wind direction.

＊ Check the tip of probe periodically to confirm that it is kept clean.
Dust attached to the sensor will affect the accuracy of the measurement.



—Cleaning of the air velocity probe—

◇ Rinse tip of probe in alcohol if sensor is oily, dry it in low wind.
◇ When you get rid of dust, blow them off by blow blush for camera or rinse in water and dry them completely.

※ Turn off power when you wash sensor.
※ Do not dry probe with heat.
（ Heat damages sensor and became impossible to restore.)

◆Temperature & Humidity probe

＊As for measurements of air temperature, accurate value will not be given in the still air.
(Exempt from performance-guarantee range.)
You can get correct value in velocity of 0.1m/s or over. (Move probe slowly.)

＊Response time in the air temperature measurement becomes quicker when the velocity is high.
For example, when air velocity is 1m/s the response time is 20 seconds. Please keep the data when indications become stabile.

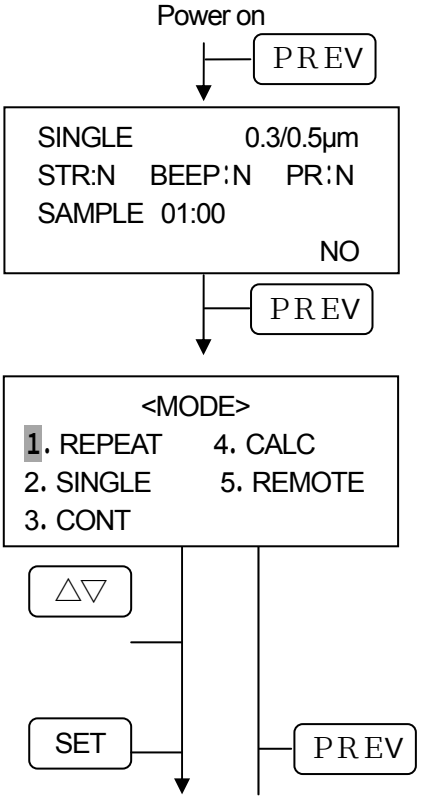
＊The humidity measurement value might rise abnormally by the condensation of the humidity sensor.
In case of the measurement in rapid temperature change or long use in high humidity, keep probe for 24 hrs in 40%RH or less and dry probe when wet.

—Humidity measurement … Comparison with ASSUMANN type psychrometer—

Because the humidity measurement function is strictly proofread using a standard humidity generation device (two temperature difference method), you will find it is handy.
And, because a steady measurement can be done as an electronic hygrometer, this unit can take the place of ASSUMANN type psychrometer.
When the comparison measurement is done between T/H probe and the ASSUMANN type psychrometer, the ASSUMANN type psychrometer occasionally display high humidity.
Since handling conditions like dust, dew, or how to lap gaze can in flvence the result of ASSUMANN.
Therefore, it is necessary to be careful when you handle the ASSUMANN type psychrometer.
Please refer to Japan Industrial Standards concerning notice in the measurement with the ASSUMANN type psychrometer etc. (JIS-Z8806 "Method of measuring humidity") etc.

4. Setting before Measurement

4.1 Selection of measuring mode



(1) Push POWER key to input the power supply. Then PREV key.

(2) Push PREV key again to proceed to the setup screen

(3) Use △ ▽ key to move the cursor, and push SET key to select the mode you need.

[1.REPEAT]

REPEAT		0.3/0.5μm
STR:N	BEEP:N	PR:N
SAMPLE	01:00	2TIMES
INT	00:05:00	NO

[2.SINGLE]

SINGLE		0.3/0.5μm
STR:N	BEEP:N	PR:N
SAMPLE	01:00	
		NO

(4) Push PREV key to go back to the MODE screen.

[3.CONT]

CONT		0.3/0.5μm
STR:N	BEEP:N	PR:N

[4. CALC]

CALC		0.3/0.5μm
STR:N	BEEP:N	PR:N
SAMPLE	01:00	2TIMES
		NO

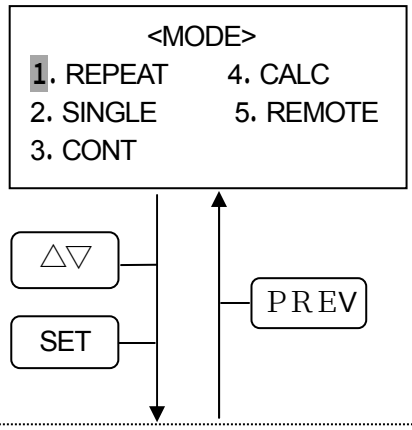
[5. REMOTE]

REMOTE	0.3/0.5μm
BEEP:N	
	NO

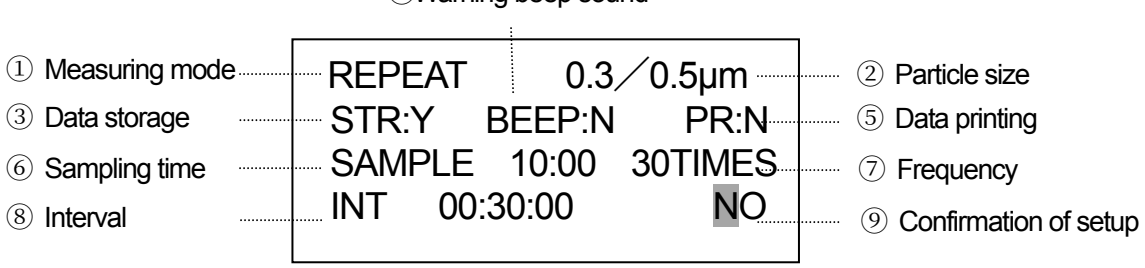
Measuring mode	Content of measurement	SAMPLE (Time Setting)	TIME (Frequency Setting)	INT (Interval Setting)
Repeat [5.2]	Measurement repeatedly	○	○	○
Single [5.3]	Measurement once	○	Once	○
Continuous [5.4]	Continuous measurement ; The measurement ends if STOP is pushed.	—	—	—
Calculation [5.5]	It measures repeatedly, and mean value, a standard deviation, the maximum value are calculated from data. Only result is done and the store is not done in the data store as for the store doing and each measurement result.	○	○	—
Remote [5.6]	Measurement by remote control from computer. (The application software of the option is necessary)	—	—	—

4.2 Setting the measuring condition

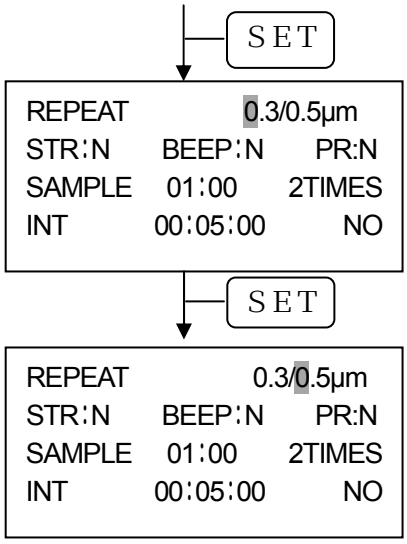
In the case of REPEAT mode (other mode even same)



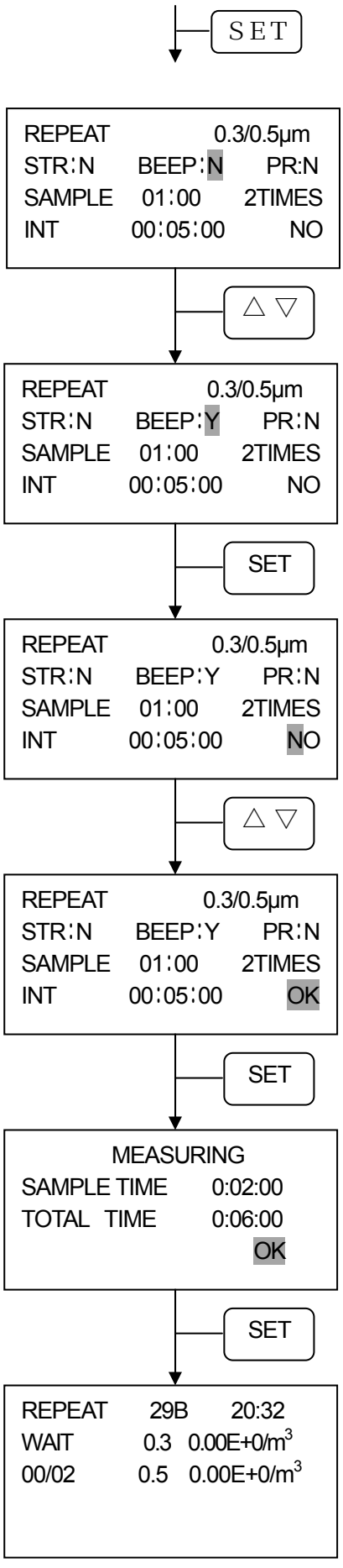
Use the △ ▽ key to move the cursor, and push the SET key to select the mode you require.



	Name	Explanation
①	Measuring mode	Five kinds of REPEAT, SINGLE, CONT, CALC, REMOTE
②	Particle size	Two kinds selection from 0.3, 0.5, 1.0, 3.0, 5.0μm
③	Data storage	Y：data stored N：data not stored
④	Warning beep sound	Y：beep sounded N：beep not sounded
⑤	Data printing	Y：data printed after the measurement N：data not printed (refer to 6.4)
⑥	Sampling time	1 second～99 minites59 seconds
⑦	Frequency	1～99 times and continuous (CNT)
⑧	Interval	1 second～24 hours
⑨	Confirmation of setup	NO：not confirmed OK：confirmed. Press SET key to shift measurement screen.



(1) For change setting, push SET key to move the cursor.



(2) Push SET key to the item you need to change.

(3) Use △ ▽ key to change the setting condition.

(4) If you finished your set up , push SET key to move the cursor to the position of **"NO"**.

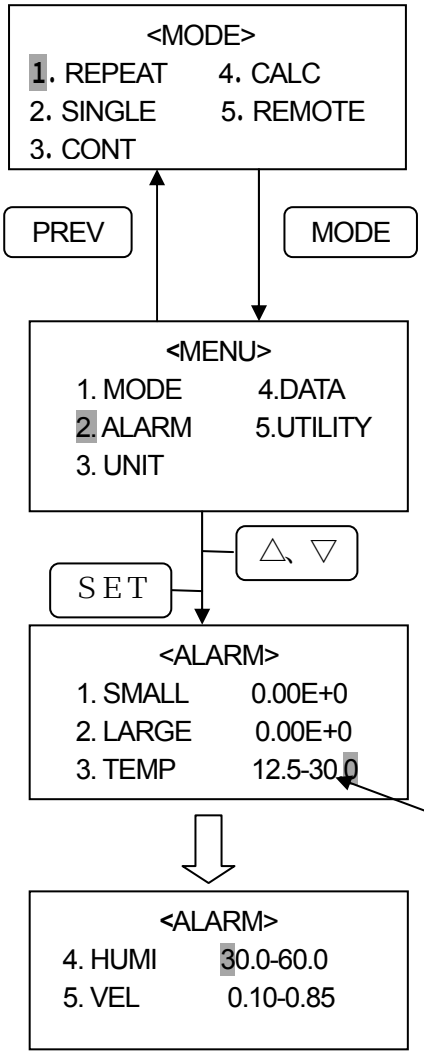
.

(5) Change **"NO"** to OK using △ ▽ key.

(6) Push SET key.

(7) Push SET key to proceed to the measuring screen.

4.3 Setting of Alarm level



When PREV key is pushed at <MODE> screen, the screen will switch to the <menu> screen.

1. MODE ····· Selection of measurement mode and setup of parameter
2. ALARM ····· Setup of alarm level
3. UNIT ····· Selection of optional probe and unit
4. DATA ····· Request for stored data in built-in memory
5. UTILITY ····· Calendar and computer communication setting

In case the particle concentration exceed the acceptable level, or temperature,
Relative humidity or air velocity go out of the specified range, this unit can notify the occurrence of these alarm situation.
This menu is to preset the alarm level.

If SET key is pushed when the cursor is here, it moves to the following page.

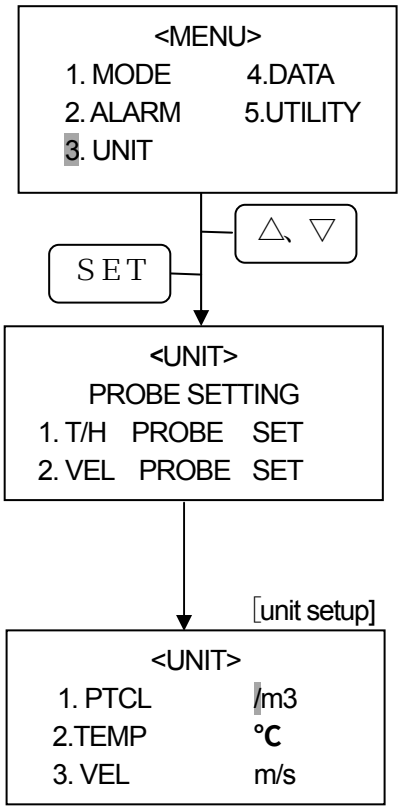
△ ▽ key	Adjust the value
SET key	Move the cursor
PREV key	Go back to MENU after the setup

			Lower bound	Upper bound	unit	Setting range
1	SMALL	Small particle	—	○	＊	0～7.00E+7
2	LARGE	Large particle	—	○	＊	0～7.00E+7
3	TEMP	Temperature	○	○	＊	0～122.0
4	HUMI	Humidity	○	○	%RH	0～100.0
5	VEL	Air velocity	○	○	＊	0～200.0

＊：Selected unit (refer to 4.4)

To activate the alarm buzzer, change the “BEEP: N” to “BEEP: Y” on the setup screen of the measurement mode.
When the sampling time has expired, the measured value will be compared with the setting range, and the measured value will blink if it is out of the setting range.
Once you have an alarm condition, the alarm will not be reset unit the data of the following measurement falls in the setting range.
When the unit of particle data is set to “COUNT”, the reading will blink at the time the measured value exceeds the setting range.
To stop the buzzer, push any key except the POWER key.

4.4 Selection of option and units



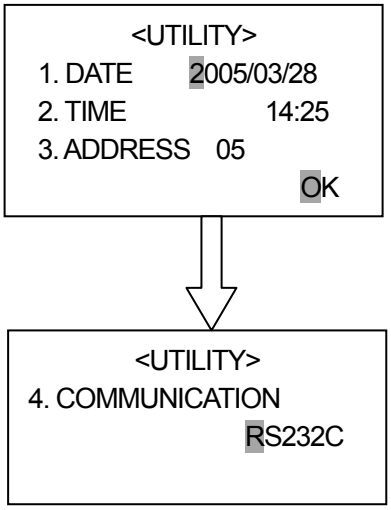
This menu is to select the optional probes and the units of particle, Temperature and air velocity.

△ ▽ key	Move the cursor
SET key	Shift the screen of the selected menu
PREV key	Go back to MENU after the setup

1	T/H PROBE	T/H probe	SET : use NO : not use
2	VEL PROBE	Velocity probe	SET : use NO : not use

1.PTCL : particle …… CNT : count, /m^3 : concentration in $1m^3$/cf : concentration in 1cf
2.TEMP : temperature …… ℃, ° F
3.VEL : air velocity …… m/s, FPM

4.5 Calendar and computer communication setting

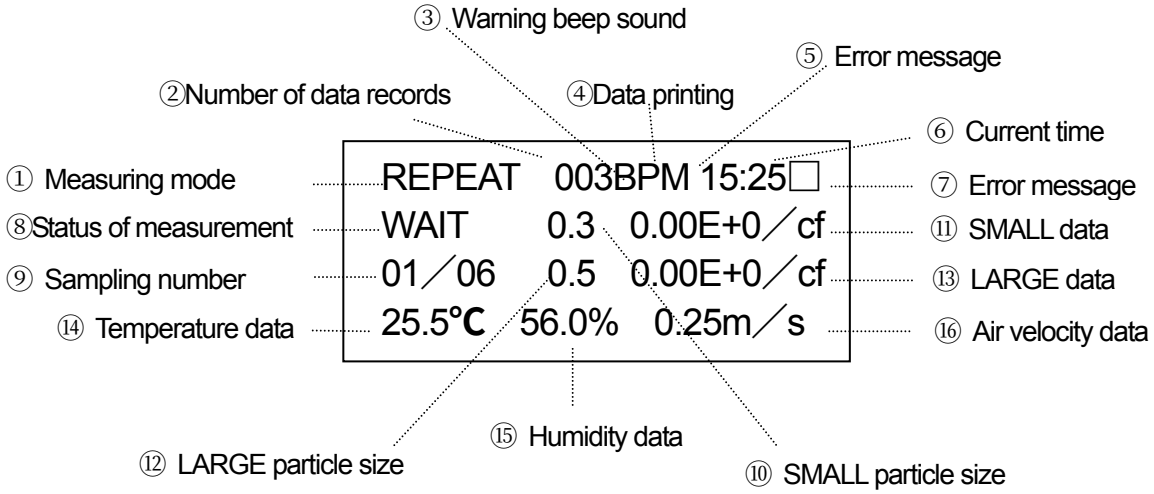


1	DATE	Year/ Month/ Date
2	TIME	Time
3	ADDRESS	Address computer communication through RS-485terminal
4	COMMUNICATION	Communication with PC

△ ▽ key	Adjust the value
SET key	Move the cursor
PREV key	Go back to MENU after the setup

5. Measurement Method

5.1 Explanation of measurement screen



	Name	Explanation
1	Measuring mode	Five kinds of REPEAT, SINGLE, CONT, CALC, REMOTE
2	Number of data records	003: Storage No. No display : No data records (e.g. 003: three data records)
3	Warning beep sound	B: Beep sounded Display no: Beep not sounded
4	Data printing	P: Data printed Display no: Data not printed (refer to 6.4)
5	Error message	M: The buffer memory is over loaded when printing the data (refer to 8)
6	Current time	Refer to 4.5
7	Error message	F: Flow error L: Laser error O：Maximum concentration is exceeded (refer to 8)
8	Status of measurement	WAIT: Starting up READY: Ready for measurement STOP: Measurement finished (refer to 5.2-5.6)
9	Sampling time	Tag number of the current measurement/ the specified sampling frequency.
10	SMALL particle size	Smaller of 2 particle sizes chose at setup screen.
11	SMALL data	The number of counts or concentration of the particle size on 10. (refer to 4.4)
12	LARGE particle size	Lager of 2 particle sizes chose at setup screen.
13	LARGE data	The number of counts or concentration of the particle size on 10. (refer to 4.4)
14	Temperature data	Show the data by selected the T/H probe uses (refer to 4.4)
15	Humidity data	Show the data by selected the T/H probe uses (refer to 4.4)
16	Air velocity data	Show the data by selected the Air velocity probe uses (refer to 4.4)

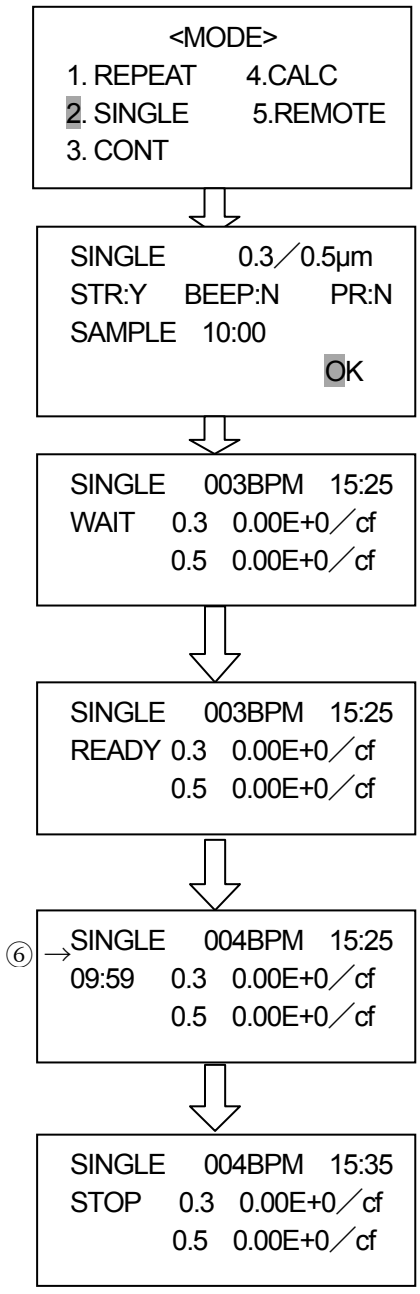
5.2 REPEAT Mode

By setting the sampling time, frequency and interval of each measurement, this unit automatically measures as specified and stops after measurements. Interval is the time between the beginning of first measurement and the next. The setting of the particle size (um), data storage (STR), alarm (BEEP) and printout (PR) are possible.

Display screen	Operation key	Operation explanation
<MODE> 1. REPEAT 4.CALC 2. SINGLE 5.REMOTE 3. CONT	POWER	Push POWER key to input the power supply.
	PREV	Push PREV key twice to proceed MODE screen
	△ ▽ SET	Select 1.REPEAT
REPEAT 0.3／0.5μm STR:Y BEEP:N PR:N SAMPLE 10:00 30TIMES INT 00:30:00 OK	△ ▽ SET	■Setup the particle size, requirement of data storage , alarm , printout, sampling time, frequency and interval of measurement. Use △ ▽ key to change the setting condition, then push SET key. After the input is done, change NO to OK and push SET key.
MEASURING SAMPLE TIME 5:00:00 ← ① TOTAL TIME 14:40:00← ② OK	△ ▽ SET	①：sum total of sampling time ②：total length of time from the beginning to the end of measurement After confirming these TIMEs, change NO to OK and push SET key.
REPEAT 003BPM 15:25 WAIT 0.3 0.00E+0／cf 01／30 0.5 0.00E+0／cf	WAIT Mode	WAIT sign is shown for the stabilization of internal pump.
REPEAT 003BPM 15:25 READY 0.3 0.00E+0／cf 01／30 0.5 0.00E+0／cf	READY Mode	WAIT sign turns to READY in 10 seconds and measurement can be started.
REPEAT 004BPM 15:25 ③ →09:59 0.3 0.00E+0／cf ④ →01／30 0.5 0.00E+0／cf	START／STOP	Push START/STOP key to start the measurement. The display shows the real-time data. ③： remaining time of each measurements ④： measurement number
NEXT 004BPM 15:35 ⑤ →15:55 0.3 0.00E+0／cf 02／30 0.5 0.00E+0／cf	Interval menu	Screen changes to interval mode after the sampling time are over. ⑤： starting time of next measurement
REPEAT 004BPM 15:55 09:59 0.3 0.00E+0／cf 02／30 0.5 0.00E+0／cf	Measuring	Measurement is automatically started from the indicated starting time. ★ The data is printed after the sampling time is over if you chose printout. (refer to 6.4) ★ To stop the measurement halfway Push START/STOP key. Only the data of finished previous measurement before pushing the STOP key will be stored if you chose data storage

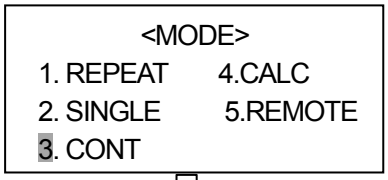
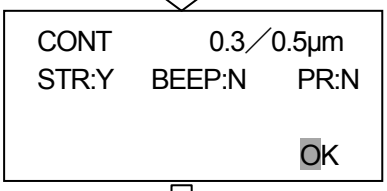
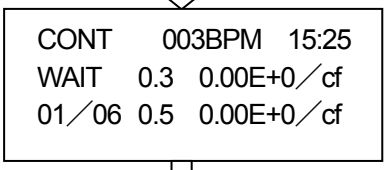
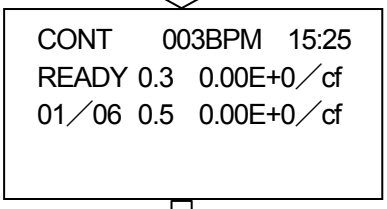
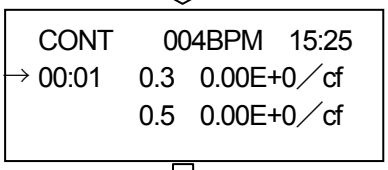
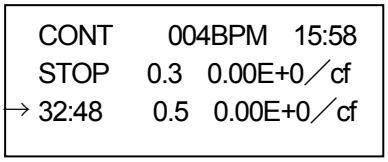
5.3 SINGLE Mode

By setting the sampling time, this unit automatically stops after the specified time.
The setting of the particle size (um), data storage (STR), alarm (BEEP) and printout (PR) are possible.

Display screen	Operation key	Operation explanation
	POWER	Push POWER key to input the power supply.
	PREV	Push PREV key twice to proceed MODE screen
	△ ▽ SET	Select 2. SINGLE
	△ ▽ SET	■Setup the particle size, requirement of data storage , alarm , printout, sampling time. Use △ ▽ key to change the setting condition, then push SET key. After the input is done, change NO to OK and push SET key.
	WAIT Mode	WAIT sign is shown for the stabilization of internal pump. The particle size can be switched with the △ ▽ key on the measurement screen. UNIT: [CNT] [/m^3] [/cf]
	READY Mode	WAIT sign turns to READY in 10 seconds and measurement can be started. Push START/STOP key to start the measurement
	START／STOP	The display shows the real-time data. Remaining time of each measurements ⑥ : measurement number
	INTERVAL menu	Screen changes to interval menu after the sampling time are over. ★ The data is printed after the sampling time is over if you chose printout. (refer to 6.4) ★ To stop the measurement halfway Push START/STOP key. Only the data of finished previous measurement before pushing the STOP key will be stored if you chose data storage

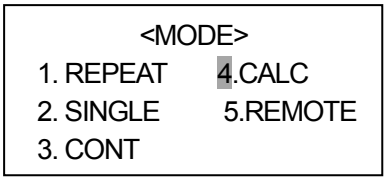
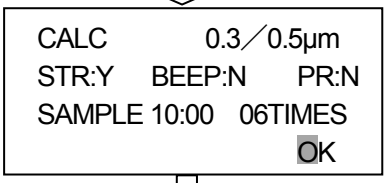
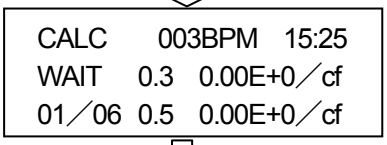
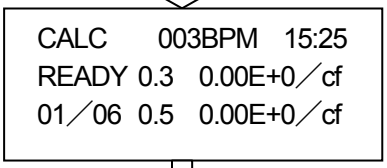
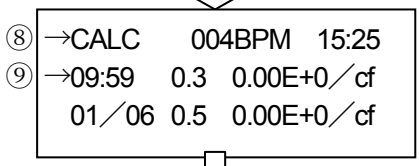
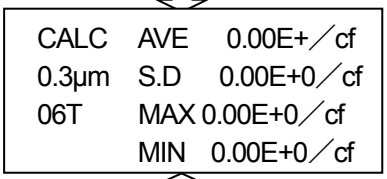
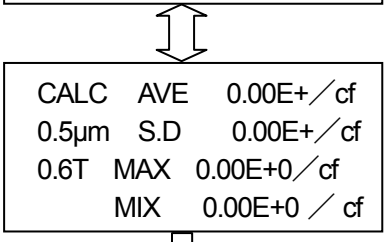
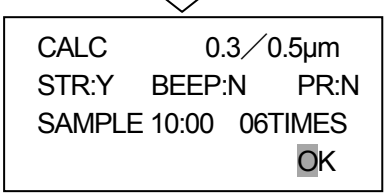
5.4 CONTINUOUS Mode

It is a mode not to set the sample time, and nor to begin, and to end the measurement with the START/STOP key. Particle size(μm)、data store(STR)、Warning(BEEP)、Printer(PR) can be set.

Display screen	Operation key	Operation explanation
	POWER	Push POWER key to input the power supply.
	PREV	Push PREV key twice to proceed MODE screen
	△ ▽ set	Select 3. CONT
	△ ▽ set	■ Setup the particle size, requirement of data storage , alarm , printout. Use △ ▽ key to change the setting Condition, then push SET key. After the input is done, change NO to OK and push SET key.
	WAIT Mode	WAIT sign is shown for the stabilization of internal pump The particle size can be switched with the △ ▽ key on the measurement screen. UNIT: [CNT] [/m^3] [/cf]
	READY Mode	WAIT sign turns to READY in 10 seconds and measurement can be started. Push START/STOP key to start the measurement
⑦ → 	START／STOP	The display shows the real-time data. Remaining time of each measurements ⑦：Measurement time（Count up） ★ “ 01h00m ” and the display change into the following of 59:59 (It is 59second of 59 minutes.)
⑧ → 	START／STOP	START/STOP key is pushed, and the measurement is ended. ⑧：Measurement time ★ The data is printed after the sampling time is Over if you chose printout. (refer to 6.4)

5.5 CALCULATION Mode

It is a mode by which measures repeatedly, and mean value from the measurement data, a standard deviation, the maximum value, and minimum value are calculated. Only result is preserved, and each measurement result is not preserved in the data store. The measurement frequency can be set at the grain size, the data store, warning, the printer, and the sample time.

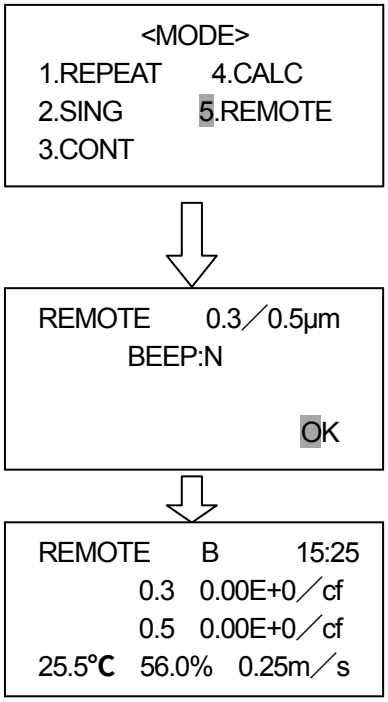
Display screen	Operation key	Operation explanation
	POWER	Push POWER key to input the power supply.
	PREV	Push PREV key twice to proceed MODE screen
	△ ▽ SET	Select 4. CALC
	△ ▽ SET	■ Setup the particle size, requirement of data storage , alarm , printout, sampling time, frequency. Use △ ▽ key to change the setting Condition, then push SET key. After the input is done, change NO to OK and push SET key.
	WAIT Mode	WAIT sign is shown for the stabilization of internal pump
	READY Mode	WAIT sign turns to READY in 10 seconds and measurement can be started. Push START/STOP key to start the measurement
	START／STOP	The display shows the real-time data. Remaining time of each measurements ⑧ : The sample time of the remainder is displayed. ⑨ : Present measurement frequency The last measurement data is maintained on the screen for five seconds though the following measurement begins at the same time as ending measuring time.
	Display of result. SET	After the last data is displayed for five seconds, result is displayed when the set measurement frequency ends. The data of the small<SMALL> particle is displayed first . It is possible to switch with the data of the large<LARGE> particle in the SET key. ★ Data changes in order saying the temperature, humidity, Air velocity , the small particle, and the large particle whenever the SET key is pushed when the temperature humidity and Air velocity probe are used.
		
	PREV	It returns to measuring the set screen with the PREV key. ★ When the measurement ends when setting the printer is Y, the result is printed at once .(refer to 6.4) ★ When the START STOP key is pushed while measuring, the measurement is stopped, and the measurement data of times ahead of that is used and operated.

5.6 REMOTE Mode

From computer to measurement mode by remote control

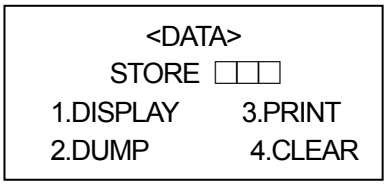
（The application software of the option is necessary.）

The connection method with the computer is the same method as forwarding the record data. (Refer to 6.3)

Display screen	Operation key	Operation explanation
	POWER	Push POWER key to input the power supply.
	PREV	Push PREV key twice to proceed MODE screen
	△ ▽ SET	Select 5. REMOTE
	△ ▽ SET	■ Setup the particle size, alarm ,. Use △ ▽ key to change the setting Condition, then push SET key. After the input is done, change NO to OK and push SET key.
		The measurement begins automatically when the application software is operated.

6. Data Processing

6.1 Request for stored data in built-in memory… <4.DATA>

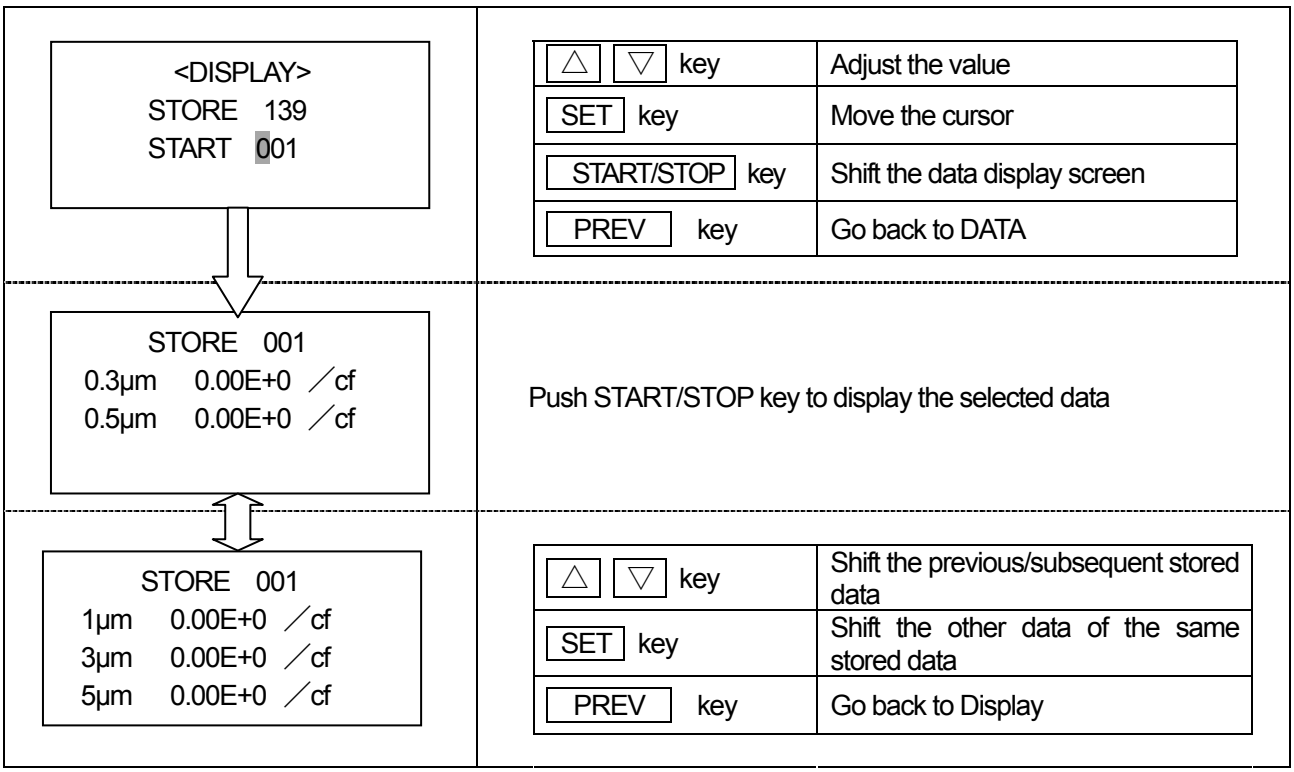


Maximum 500 data can be stored, but the one measurement of CALC mode is regarded as 4 data. For example, if the first data is stored at number 016, next one is stored at number 020.

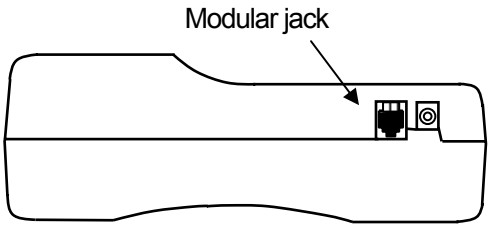
	STORE □□□	Indicates the current total number of stored data
1	DISPLAY	Display of stored data on the screen
2	DUMP	Dump of stored data
3	PRINT	Printout of stored data
4	CLEAR	Delete of stored data

△ ▽ key	Move the cursor
SET key	Shift the setting screen of the selected function
PREV key	Go back to MENU after the set up

6.2 Display of stored data on the screen… <4.DATA>→<1.DISPLAY>



6.3 Dump of stored data… <4.DATA>→<2.DUMP>



Put the optional RS-232C cable into the modular jack of GEO-α, and connect the other end of the cable with the PC to transfer the stored data.
Do the communication setting of the PC and make the condition that the PC can readout the data.

<DUMP>
STORE 139
1. START 001
2. END 139

⇩
Start transmitting

1	START	The first tag number of the stored data to be transmitted
2	END	The last tag number of the stored data to be transmitted

△ ▽ key	Adjust the value
SET key	Move the cursor
START/STOP key	Start transmitting of the stored data
PREV key	Go back to DATA

Required Items
- Computer
- Application software, Model S388-61 (Optional): Measurement software
- RS-232C cable, Model 3886-08 (Optional): Communication cable for connecting GEO-α and PC

Setting up the computer

Function	GEO-α Setting
Word length	8 bit
Parity bit	None
Set parity	Odd number
Baud rate	9600

Signal cable

GEO-α		Connection	Computer (D-sub 9 pin)	
Pin number	Signal name		Pin number	Signal name
1	TXD	⟷	2	RXD
3	RXD	⟷	3	TXD
5	CTS	⟷	7	RTS
6	GND	⟷	5	GND
		⟷	4	DTR
		⟷	6	DSR

◆Forwarding data format

(1) Repeat, Single, Continuous mode

Format	Byte	Explanation
999 crlf	5	Store No
9 crlf	3	Measurement mode (1：Repeat、2：Single、3：Continuous)
99,99,99 crlf	10	Measurement start date
99,99,99 crlf	10	Measurement start time
99,99,99 crlf	10	Sampling time（hours, minutes, seconds）
xxx crlf	5	Particle unit （ CNT , /cf , /m^3 ）
x crlf	4	Temperature unit （ C , F ）
xxx crlf	5	Air velocity unit （ m/s , FPM ）
x,x,x crlf	7	Error message (L：Light source, F：Flow rate, O：Over the maximum concentration)
999999999 crlf	11	Count data of 0.3μm, 90999E+99crlf using /cf or /m^3 as unit
999999999 crlf	11	Count data of 0.5μm, 90999E+99crlf using /cf or /m^3 as unit
999999999 crlf	11	Count data of 1μm, 90999E+99crlf using /cf or /m^3 as unit
999999999 crlf	11	Count data of 3μm, 90999E+99crlf using /cf or /m^3 as unit
999999999 crlf	11	Count data of 5μm, 90999E+99crlf using /cf or /m^3 as unit
＊999.9 crlf	7	Temperature data
＊999.9 crlf	7	Humidity data
＊9.999 crlf	7	Air velocity data, 999.9 crlf using FPT as unit
Total	135	

＊）・T./H or Air velocity probe is not selected it becomes " ***** crlf".

・It becomes "###.#" when the value of T/H probe exceeds measurement range.

・It becomes "###.#" using m/s as unit (when the value of Air velocity probe exceeds measurement range.)

Using FRM as unit, it becomes "###. #".

(2) Calculation mode

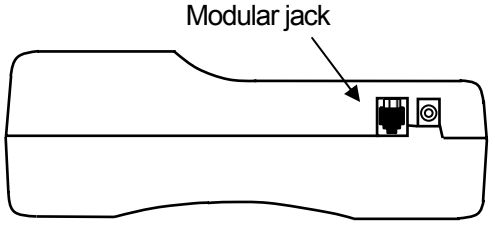
Format	Byte	Explanation
999 crlf	5	Store No
9 crlf	3	Measurement mode (4：Calculation)
99,99,99 crlf	10	Measurement start date
99,99,99 crlf	10	Measurement start time
99999 crlf	7	Measurement number
99,99,99 crlf	10	Sampling time（hours, minutes, seconds）
xxx crlf	5	Particle unit（ CNT , /cf , /m^3）
x crlf	4	Temperature unit（ C , F ）
xxx crlf	5	Air velocity unit（ m/s , FPM ）
x,x,x crlf	7	Error message (L：Light source, F：Flow rate, O：Over the maximum concentration)
9.999E+99,	10	Average of 0.3μm
9.999E+99,	10	Standard deviation of 0.3μm
999999999,	10	Maximum data of 0.3μm, 9.999E+99 crlf using /cf or /m^3 as unit
999999999 crlf	11	Minimum data of 0.3μm, 9.999E+99 crlf using /cf or /m^3 as unit
9.999E+99,	10	Average of 0.5m
9.999E+99,	10	Standard deviation of 0.5μm
999999999,	10	Maximum data of 0.5μm, 9.999E+99 crlf using /cf or /m^3 as unit
999999999 crlf	11	Minimum data of 0.5μm, 9.999E+99 crlf using /cf or /m^3 as unit
9.999E+99,	10	Average of 1μm
9.999E+99,	10	Standard deviation of 1μm
999999999,	10	Maximum data of 1μm, 9.999E+99 crlf using /cf or /m^3 as unit
999999999 crlf	11	Minimum data of 1μm, 9.999E+99 crlf using /cf or /m^3 as unit
9.999E+99,	10	Average of 3μm
9.999E+99,	10	Standard deviation of 3μm
999999999,	10	Maximum data of 3μm, 9.999E+99 crlf using /cf or /m^3 as unit
999999999 crlf	11	Minimum data of 3μm, 9.999E+99 crlf using /cf or /m^3 as unit
9.999E+99,	10	Average of 5μm
9.999E+99,	10	Standard deviation of 5μm
999999999,	10	Maximum data of 5μm, 9.999E+99 crlf using /cf or /m^3 as unit
999999999 crlf	11	Minimum data of 5μm, 9.999E+99 crlf using /cf or /m^3 as unit
999.9,	6	Average of Temperature
999.9,	6	Temperature data standard deviation
999.9,	6	Maximum data of Temperature
999.9 crlf	7	Minimum data of Temperature
999.9,	6	Average of Humidity
999.9,	6	Standard deviation of Humidity
999.9,	6	Maximum data of Humidity
999.9 crlf	7	Minimum data of Humidity data
9.999,	6	Average of Air velocity 999.9 using FRM as unit
9.999,	6	Standard deviation of Air velocity 999.9 using FRM as unit
9.999,	6	Maximum data of Air velocity 999.9 using FRM as unit
9.999 crlf	7	Minimum data of Air velocity 999.9 using FRM as unit
Total	346	

＊)・T./H or Air velocity probe is not selected it becomes " ***** crlf".

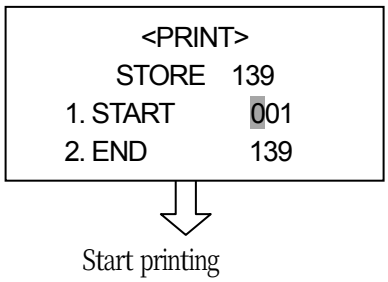
・It becomes "###.#" when the value of T/H probe exceeds measurement range.

・It becomes "###.#" using m/s as unit
(when the value of Air velocity probe exceeds measurement range.)

6.4 Printout of stored data… <4.DATA>→<3.PRINT>



Put the optional Printer cable into the modular jack of GEO–α, and connect other side of the cable with the Printer to print the stored data.



1	START	The first tag number of the stored data to be printed
2	END	The last tag number of the stored data to be printed

△ ▽ key	Adjust the value
SET key	Move the cursor
START/STOP key	Start printing of the stored data
PREV key	Go back to DATA

Preparations

Printer (Option) ・・・・・・・・ Recommendatory Printer Model. DPU-201GS (SEIKO CO., LTD),
Signal cable (Model 3886-07: Option), Signal cable connect GEO-α with Printer

DIP Switch Setting

Switch Number	Function	GEO-α Setting	Printer
SW1	Word length	8 bit	ON
SW2	Parity bit	None	ON
SW3	Set parity	Odd number	ON
SW4～6	Baud rate	9600	following table

Baud rate	SW4 Setting	SW5 Setting	SW6 Setting
9600	OFF	OFF	ON

* When using DPU-H245, please use it with the manufacturers default setting.

Signal cable

GEO-α		Printer	
Pin number	Signal name	Pin number	Signal name
1	TXD	3	DATA
6	GND	4	GND
5	CTS	8	BUSY
6	GND	5	GND

<<Caution>>

When the measurement interval (INT) in REPEAT mode is set at 15 seconds or less, there is a possibility of Buffer error when printing is executed during a measurement. To print during a measurement, please set the measurement interval over 15 seconds.

◆ Example of printout

(1) Repeat, Single, Continuous mode

```
2000/03/21  16:40:00   E=
REPEAT         STORE  10  05:30
 0.3um  564700 CNT
 0.5um   10457 CNT
 1.0um     323 CNT
 3.0um      36 CNT
 5.0um       8 CNT
  23.2℃  45.7%RH  0.64m/S
```

(3) During measurement

(Repeat, Single, Continuous mode)

```
2000/03/21  16:40:00   E=LFO
REPEAT          1          05:30
0.3um  564700 CNT
0.5um   10457 CNT
23.2℃  45.7%RH  0.64m/S
```

Only two particle sizes are printed.

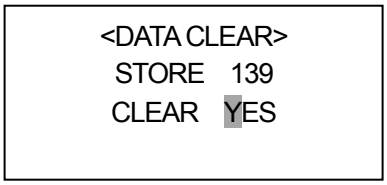
(2) Calculation mode

```
 2000/03/21 16:40:00   E=LFO
CALCULATION STORE 13 05:30
                        10TIMES
0.3um AVE   6.66E+04 CNT
      STD   3.94E+03 CNT
      MAX      71334 CNT
      MIN      60875 CNT
0.5um AVE   2.78E+03 CNT
      STD   2.76E+02 CNT
      MAX       3096 CNT
      MIN       2422 CNT
1.0um AVE   9.83E+01 CNT
      STD   3.90E+01 CNT
      MAX        156 CNT
      MIN         67 CNT
3.0um AVE   3.76E+00 CNT
      STD   3.46E+00 CNT
      MAX          9 CNT
      MIN          0 CNT
5.0um AVE   3.00E-01 CNT
      STD   4.56E-01 CNT
      MAX          1 CNT
      MIN          0 CNT
TEMP  AVE   23.5 ˚C
      STD    0.3 ˚C
      MAX   24.0 ˚C
      MIN   23.2 ˚C
HUM   AVE   52.9 %RH
      STD    1.2 %RH
      MAX   54.4 %RH
      MIN   51.5 %RH
VEL   AVE   0.20 m/S
      STD   0.03 m/S
      MAX   0.25 m/S
      MIN   0.18 m/S
```

(4) During measurement（Calculation mode）

```
 2000/03/21 16:40:00   E=
CALCULATION           05:30
                        10TIMES
0.3um AVE   6.66E+04 CNT
      STD   3.94E+03 CNT
      MAX      71334 CNT
      MIN      60875 CNT
0.5um AVE   2.78E+03 CNT
      STD   2.76E+02 CNT
      MAX       3096 CNT
      MIN       2422 CNT
TEMP  AVE   23.5 ˚C
      STD    0.3 ˚C
      MAX   24.0 ˚C
      MIN   23.2 ˚C
HUM   AVE   52.9 %RH
      STD    1.2 %RH
      MAX   54.4 %RH
      MIN   51.5 %RH
VEL   AVE   0.20 m/S
      STD   0.03 m/S
      MAX   0.25 m/S
      MIN   0.18 m/S
```

6.5 Deletion of stored data… <4.DATA>→<4. CLEAR >



ALL the stored data will be deleted by executing this function.

CLEAR	YES：data deletion NO：delete not

△ ▽ key	Adjust the value
START/STOP key	Shift the data display screen
PREV key	Go back to DATA

7. How to Use Option Probes

7.1 Option probes

Temperature/Humidity probe Model 0842

Air velocity probe Model 0843

7.2 Installation of probes

The T/H probe and Air Velocity probe must be inserted into “T/H” (refer to 2.4) and “VEL”, respectively, and the lock screw cap must be provided.

Make sure to turn OFF the instrument before inserting and removing the probe.

GEO-α with the T/H probe and Air velocity probe installed

7.3 Setting of display

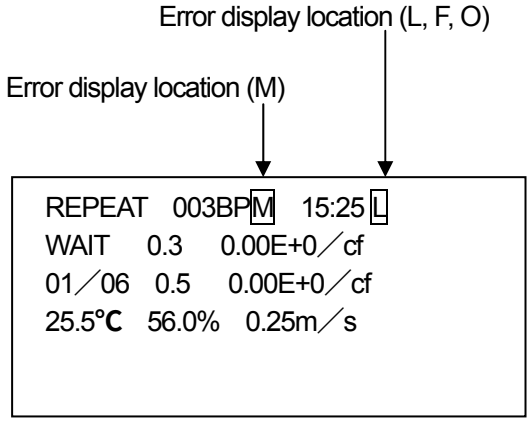
To provide the installation and display setting of each probe, please refer to 4.4.
To set the alarm, please refer to 4.3.

7.4 Extension rod for air velocity probe

When you want to measure the air velocity right under the filter which is located at a high position, extension rod Model 0843-01 (optional) can be used. Insert the probe into the rod from the side of the sensor. When inserting, please pay close attention not to touch the velocity sensor.

Extension rod for air velocity probe

8. Error Message



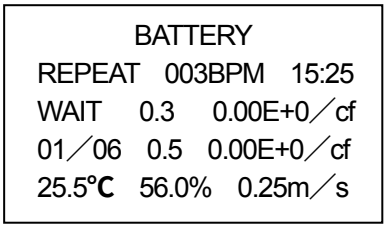
The error message will be displayed at the right of the time display as shown left.
The initial letter of each error will be displayed according to the priority order of errors. (Priority order: L→F→O)

Error message	Content of error	Action
L	Laser Error	Failure of the laser luminescence part. Please contact your local distributor or our service center for information.
F	Flow Error	Displayed when the absorption flow rate is out of the specified range of 2.83L/min ±10%. If a filter or a tube is attached to the inlet of the instrument, please remove it. If the "F" error sign still remains, it is a failure of the flow route system including the pump. Please contact your local distributor or our service center for information. (Please refer to section 3.3.2.)
O	Maximum Concentration Exceeded	Displayed when the measurable concentration of the instrument is exceed. Please move to a cleaner place, or install the filter and measure. If the "O" error sign still remains, please contact your local distributor or our service center for information.
M	Printer Buffer Exceeded	Displayed when the printer buffer is exceeded Please note that once this error is displayed, the remaining data will not be displayed.

<<Caution>>

When the measurement interval (INT) in REPEAT mode is set at 15 seconds or less, there is a possibility of Buffer error when printing is executed during a measurement.
To print during a measurement, please set the measurement interval over 15 seconds.

9. Battery Check

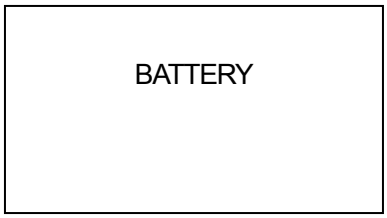


(1)First Alarm

When the battery voltage becomes less than 4.5 V, the message "BATTERY" will be indicated at the top of the display (First Alarm). In approx. 5 minutes after the First Alarm, the display will switch to the following screen (Second Alarm). When the Second Alarm is given, the pump, laser radiation and software will stop, and the POWER key will become ineffective.
If the battery level becomes low during a measurement, the battery must be replaced with an AC adapter. Power supply will automatically switch to AC power supply when the AC adapter is inserted in the power inlet.

For continuous measurements for long periods, please use the AC adapter.

■ Please refer to the following table for the data storage conditions when battery alarm is indicated.
While the First Alarm is displayed, data storage is possible.



(2)Second Alarm

Measurement Mode	Data Storage
REPEAT	Every data measured before the Second Alarm will be stored
SINGLE	If the measurement is finished before the Second Alarm, the data will be stored.
CONTINUOUS	Data will be stored if the "stop" key is pressed during the First Alarm.
CALCULATION	The calculation result which is provided based on the data measured before the Second Alarm will be stored.

10. Specification

Measuring particle size	0.3, 0.5, 1.0, 3.0, 5.0μm
Light Source	Laser Diode
Counting Efficiency	Meets JIS B9921
Zero Count	Meets JIS B9921
Coincidence Loss	Less than 5% at 2,000,000 particles/cf
Flow Rate	0.1 cfm (2.83 L/min)
Sampling Time	1 second-99 minutes 59second (adjustable in second)
Sampling Frequency	1-99 times, or Continuous
Mode of measurement	Single/Repeat/Continuous/Calculation
Display	20 letters, 4lines LCD
Error sign	Counts beyond max concentration, Drop of laser power, Out of regulated flow rate (+/-10%), Low battery
Interface	RS-232C or RS-485 (Selectable on menu page), RJ-11 Connector N.B. RS-485 is for cascade connection
Communication protocol	Baud Rate 9600bps
Buffer Memory	500 data (In Calculation mode, 1 measurement is counted as 4 data)
Power supply	4 pieces of AA-size Ni-MH batteries (1.2V-2.5Ah) or AC adapter (Input 100-240V). The batteries must be charged with the dedicated charger. They cannot be charged with the AC adapter.
Operating hours	Max. 3 hours (By Ni-MH batteries)
Dimensions	115(W)×70(H)×211(D) mm
Weight	Approx. 980 g (without batteries)
Environment operation condition	Ambient temperature range:10-35℃
Standard Accessories	AC adapter, Filter, Tube, Handle, Operation manual
Options	Printer, Printer cable, Temperature/Humidity probe, Air velocity probe, Extension rod for Air velocity probe, Carrying case, Tripod, Application software, RS-232C cable

Temperature/Humidity Probe	**Model 0842**
Temperature range	0～50℃(32～122°F)
Accuracy	+/-0.5℃ (at over 0.2 m/s air velocity)
Humidity range	3-98%RH
Accuracy	+/-3%RH (+/-5% at the outside of 30-85%RH)
Dimensions	φ20×150mm

Air velocity Probe	**Model 0843**
Air velocity range	0～1m/s(0～197FPM)
Accuracy	±0.05m/s(10FPM)
Dimension	φ20×150 mm Curl cord 0.2m(Max. extended length 1.5m)

Carrying case	**Model 3886-02**

Extension rod for air velocity probe	**Model 0843-01**

Application software	**Model S388-61**

11. Troubleshooting

Symptom	Possible Cause / Corrective Action	Reference
The display does not appear even when the power is turned ON.	AC adapter is not inserted properly. → Confirm the AC adapter Batteries level is low or empty → Replace the batteries, or → Charge the batteries (Ni-MH)	3.1
Measurement time with the Ni-MH battery is short.	Charging is insufficient → Charge the batteries Battery deterioration → Replace with new Ni-MH batteries	3.1
Displayed reading blinks.	Alarm level is exceed → Change the alarm level setting.	4.3
Measurement data of the optional probe cannot be displayed.	Probe setting is not made → Provide the probe setting	4.4
Measurement does not start.	If display is ”WAIT” → Wait until the display changes to “READY” , and press the ”START” key If display is “READY” → Press the “START” key If display is “STOP” → Press the “START” key. Wait until the display changes to “READY”, and then press the ”START” key again.	4
The particle count or particle concentration is high	The ambient particle concentration is high. → Attach the filter to the inlet of the instrument.	
The particle count or particle concentration is low	Laser error or flow error. → Confirm the error status.	8
Flow error (F) is displayed when internal cleaning is provided.	Filter is clogged. → Filter must be replaced with a new filter.	3.4
Reading is displayed as “##. #”	Displayed when measurable range is exceeded.	
The velocity reading is low	The wind mark of the probe is not faced against the wind direction.	3.5
The temperature reading is high	Proper measurement cannot be done when there is no wind. Measurement must be performed where wind velocity is over 0.1m/s.	3.5
Printing error	・The setting of the BAUD rate is not correct. → Confirm the setting of the printer. ・Improper cabling. (RS232C cable cannot be used.)	6.4
In “DUMP” mode, data cannot be read.	・The setting of the BAUD rate is not correct. → Confirm the setting of the PC. ・Improper cabling (RS232C cable cannot be used.) ・The PC is not in a condition to take in data.	6.3
Incorrect data	Output format is not correct → Reset the format	6.3, 6.4

12. Warranty and After Service

Warranty

- A warranty card is not included in this product.
- The instrument (excluding consumables such as batteries) is warranted against defects in materials and workmanship under normal use for a period of one year from the date of original purchase.

After Service

- When you have a problem with your unit, please check out the “Troubleshooting” section first.
- If that does not help, please contact your local distributor, or call our service center (See last page for contact information).
- During the warranty period, we will repair at no charge a product that proves to be defective due to material or workmanship under normal use. The limited warranty covers all defects encountered in normal use of the product, and does not apply in cases such as; loss or damage to the product due to abuse, mishandling, or alternation by the customer, or natural disaster. All return shipping charges are the responsibility of the customer.
- Repair after warranty expiration:
  Upon request, we will repair the instrument at the customer’s expense, if the instrument’s performance is found to be recoverable by providing the repair.
- Replacement parts are available for a minimum period of five (5) years after termination of production. This storage period of replacement parts is considered as the period during which we can provide repair service. For further information, please contact our service center.

When making an inquiry, please provide the following information.

* Product Name: Handy Laser Particle Counter
* Model Number: xxxxxx
* Serial Number: xxxxxx
* Date of Purchase: Day, Month and Year
* Description of Symptom in Detail:

13. Contact Information

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