Liquid Particle Counter

LMLPC-A200

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1. Introduction

Liquid Particle Counter LMLPC-A200 is configured with a light resistance method for accurate particle counting within the particle size range of 0.8μm to 600 μm in liquids. Includes a high-precision laser sensor that maintains stability at sampling speeds of 5 to 80mL/min. Ensures stable performance with low noise and high resolution. Equipped with viscosity, moisture, and temperature sensor modules for detailed analysis.

2. Features

- Offering a wide test range to accommodate various fluids and viscosities
- Features an air purification system to prevent test contamination
- Designed for testing hydraulic oil, lubricating oil, anti-fuel oil, insulating oil, and turbine oil
- Adjustable cups accommodate testing requirements across different industries
- Improved dual interface design ensures easy and convenient operation
- Appropriate for inspecting products with different viscosities
- Featuring multiple calibration curves compatible with international standards
- Integrated data analysis system for comprehensive test data from a single test

3. Specifications

Model No.	LMLPC-A200
Light Source	Semiconductor Laser
Particle Size Range	0.8 μm to 600 μm
Detection Channels	8 to 64 channels are optional
Sensitivity	0.8μm or 3μm
Resolution	
Sample Detection Viscosity	≤650cSt
Sampling Volume	0.2 to 1000mL, interval 0.1mL
Sampling Accuracy	Better than ±0.5%
Sampling Speed	5 to 80mL/min
Power Supply	110 to 245V AC,50Hz,70W
Dimensions (L × D × H)	340 × 410 × 650 mm
Net Weight	25 Kg

4. Applications

Liquid Particle Counter LMLPC-A200 plays a vital role in pharmaceuticals, and semiconductor manufacturing enables counting of suspended particles in liquids for product quality and compliance

5. Instrument Introduction

5.1 System Composition

The instrument is made up of the following components:

1) The main instrument is the primary device or mechanism designed to perform the core function.
2) The pump is a secondary component that assists in the instrument's operation by moving fluids or gases as needed.

5.2 Front Panel

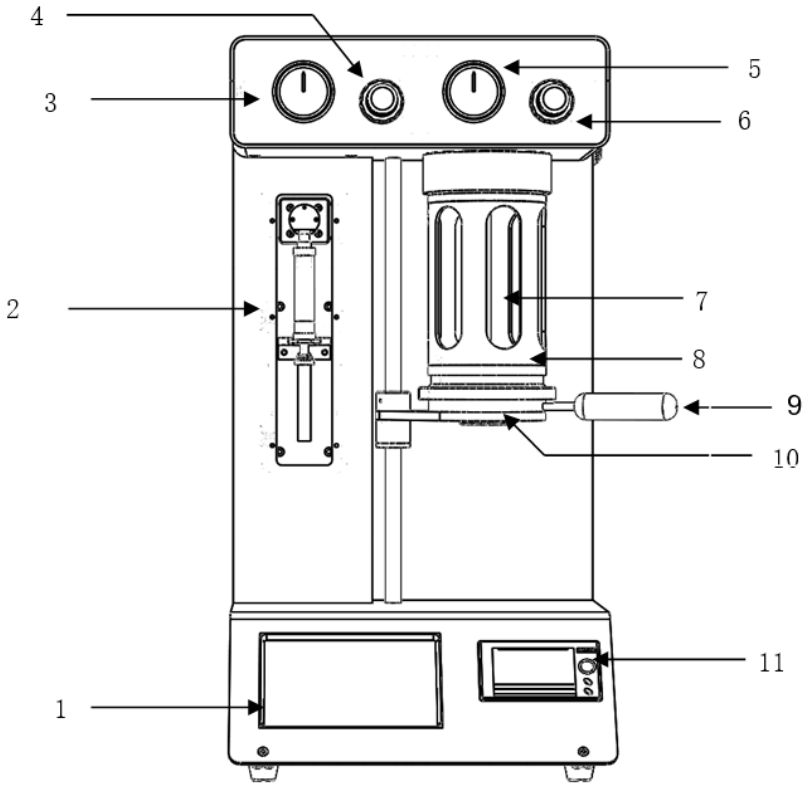


Figure-1

1) **LCD Display:** Indicates the menu touch interface realizes the operation of the instrument.
2) **High-pressure precision syringe:** Used by sampling.
3) **Pressure gauge:** Indicate the pressure value in the dome.
4) **Pressure valve:** Adjust the maximum pressure value.
5) **Vacuum gauge:** Indicate the vacuum value in the dome.
6) **Vacuum valve:** Adjust the maximum vacuum value.
7) **Sampling needle:** Used for sampling.
8) **Dome:** Sealed with the pressure or vacuum.
9) **Handle:** Operates the opening and closing of the dome.
10) **Inspection desk:** To place the sample during the measurement.
11) **Printer:** Print the measurement data.

5.3 Back Panel

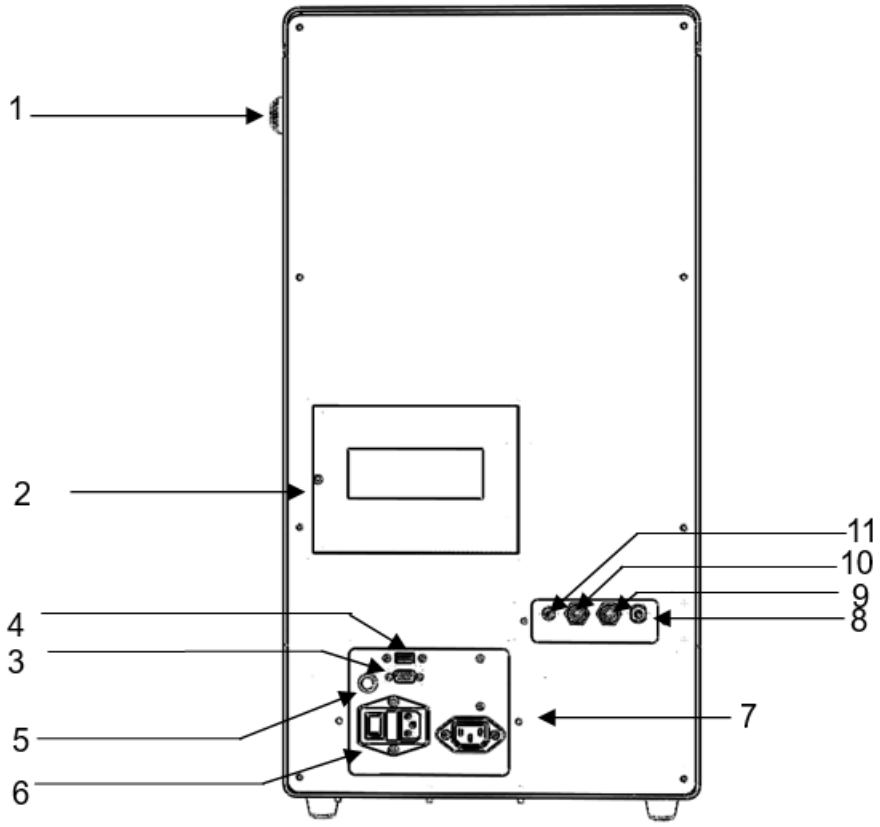


Figure-2

1) **Emergency pressure relief button:** Release the Pressure in the dome when emergency. (**Note:** Besides the instrument)
2) **Observation window:** Observe the filter combinations.
3) **Serial port:** Be connected with the computer to transmit data.
4) **USB port:** USB disk storage port.
5) **Reset button:** Reset the instrument. (Reserved function)
6) **Input voltage & switch:** Connect with the power.
7) **Pump input voltage:** Supply power for the pump.
8) **Outlet of liquid drain tubing:** Connect with the drain tubing.
9) **Outlet of vacuum tubing:** Connect with the vacuum outlet of the pump.
10) **Outlet for pressure tubing:** Connect with the pressure outlet of the pump.
11) **Outlet sewage:** Connected with sewage discharge device.

6. Installation

6.1 Installation Environment

1) The instrument should be placed in an environment with relatively stable air flow less dust, and far away from electromagnetic interference sources.
2) **Suitable working temperature:** 10~35℃, relative humidity: ≤80%.
3) The power supply of the instrument should comply with AC100~240V.
4) The grounding end of the instrument power socket should be equipped with a reliable grounding wire to ensure personal safety and reliable instrument operation.

6.2 Connect with Pump

1) Connect the outlet of pressure which is the back of the instrument with the pump use tube.
2) Connect the outlet of the vacuum which is the back of the instrument with the pump use tube.

6.3 Install the High-Precision Syringe

1) Before the operation, the lifting arm should be in a lower position. If it is not, turn on the instrument then run the lifting arm down.
2) Take the syringe from the packing case. First, make connecting hole under the syringe set on the lifting arm and screw the retaining screw. (**Note:** Don't lock the screw, see figure).

Figure-3

3) Pull up the syringe vertically, aligning the upper end of the syringe with the three-way valve, and screw the syringe carefully (see figure).

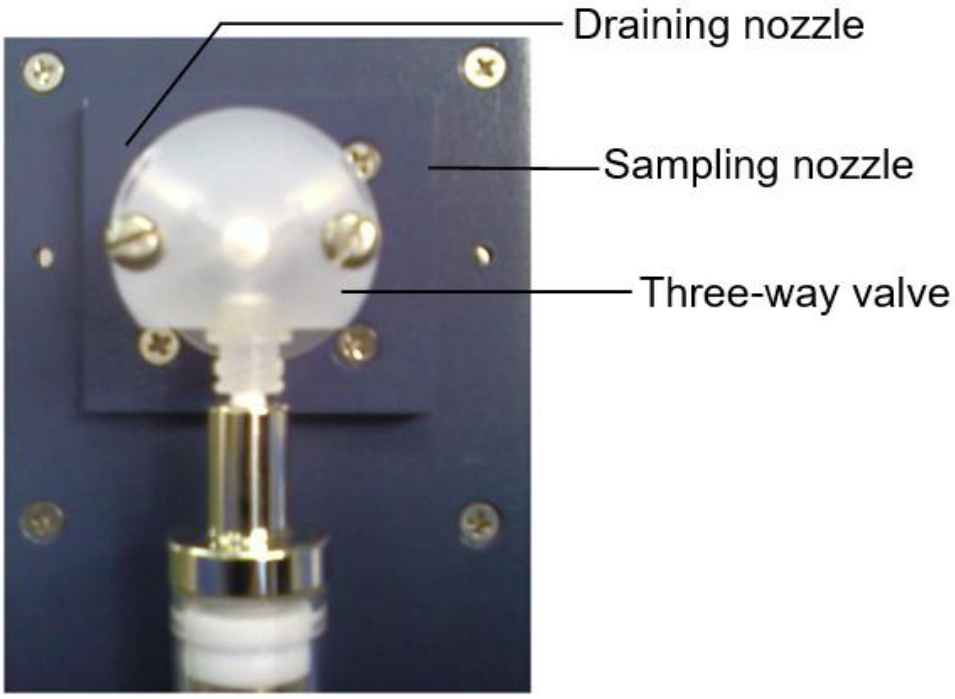


Figure-4

4) Lock the screw (see figure).

Figure-5

7. Working Principle

7.1 Theory of the Instrument (Sensor)

The theory is described as follows:

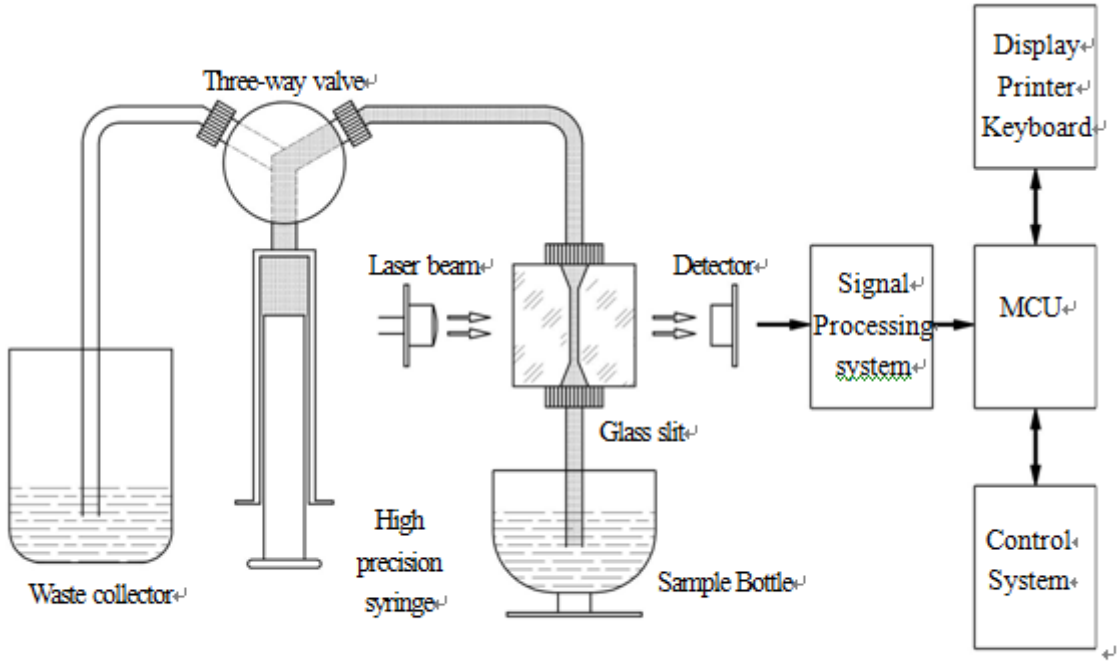
The sensor is composed of a glass slit and a laser beam. The Laser beam is profiled for optimal illumination and responsiveness. The detector gathers the laser beam to produce a current. When the sample with particles through the glass slit from the bottom up due to negative pressure, the particle block part of the laser beam. This block leads to the detector's output current being changed, the value of the changed current is proportional to the particle's projected area. The formula is as follows:

$$I_p = -I_O \frac{a}{A}$$

I_p- Blocked current(μA)
I_o - Normal current(μA)
A - Area of the glass slit(μm2)
a - Projected area of particle(μm2)

7.2 Working Diagram of the Instrument

The working diagram of the instrument is as follows:



The working diagram of instrument

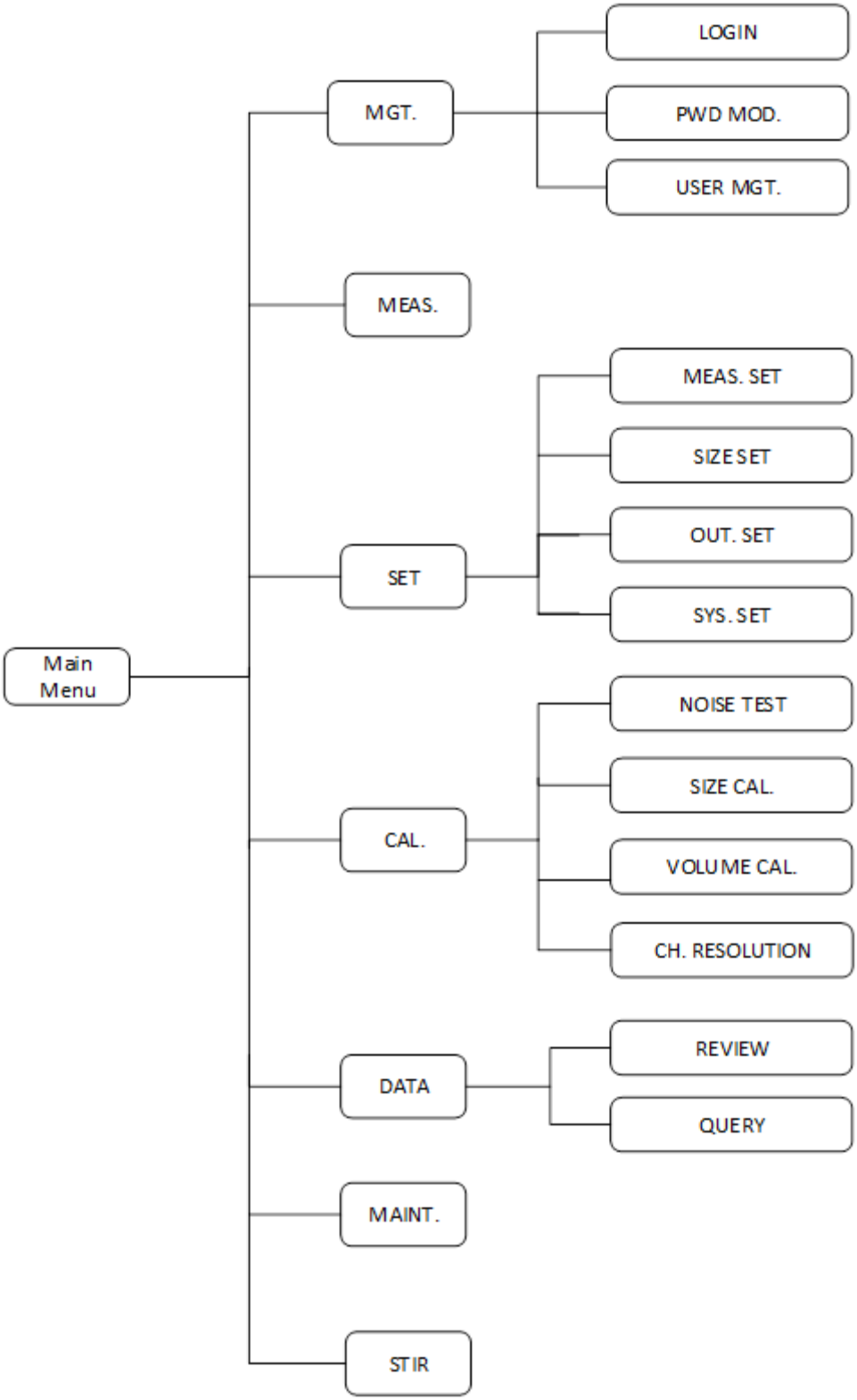
Figure-6

1) When the instrument is sampling, the three-way valve is turned to the sampling position, then the high-pressure precision syringe moves, the sample passes through the sampling needle through the sampling slit, and the particles in the sample block the laser light source, causing the photoelectric receiving end to produce electrical signals, the electrical signals through the amplification collection system to determine the size of the particles and count, and then transmitted to the single chip microcomputer.
2) MCU control system, display, printing, and keyboard control. After sampling is completed, the three-way valve turns to the drain position, the high-pressure precision syringe moves, and the sample is discharged into the waste liquid (recoil) cup.
3) During the recoil, the three-way valve turns to the drain position, the high-pressure precision syringe moves, and the recoil liquid is flushed from the waste liquid (recoil) cup to the injection slit to achieve the effect of cleaning the injection slit.

8. Operations

Instrument Usage

8.1 Menu Structure



8.2 Menu Button Description

In the menu, there will be a keyboard and some fixed functions of the keys, now it is explained.

8.2.1 Key Board

OK: Change the data and exit the keyboard;
ESC: Do not change the data and exit the keyboard.

Figure-7

8.2.2 Key Instructions

Sidebar keys: Users can switch between management, measurement, setup, calibration, data, maintenance menus, and the stirring speed adjustment button. There are secondary menus for management, setup, calibration, and data. Click 》 to exit the secondary menu.
ESC: Not save the settings and return to the previous menu;
OK: Save Settings.

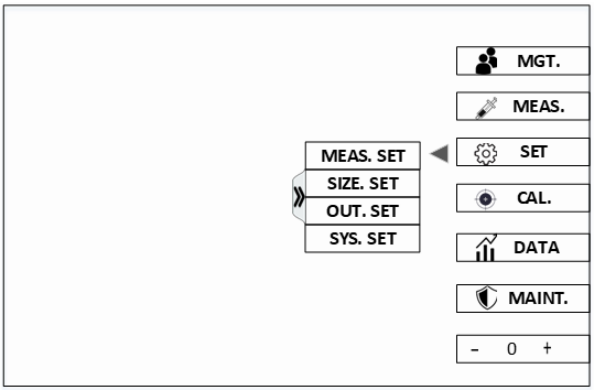


Figure-8

8.3 Management

8.3.1 Login

After the instrument is powered on, the login interface is displayed. Enter the user's name and the password through the keyboard. If the username and password are correct, the main interface will be entered. The name of the administrator is admin, the initial password is 0.

Remark: Nothing can be done without logging in!

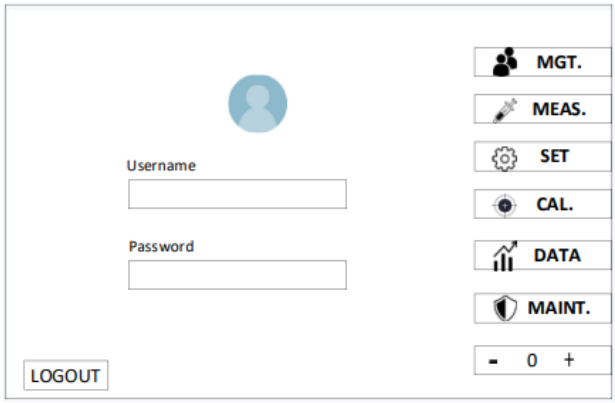


Figure-9

8.3.2 Modify Password

Click the "MGT. and PWD MOD." button, then enter the interface of modify password. Enter the initial password, new password and confirm the password, and click the save button to save the new password.

8.3.3 Operator Management

Notice: This function can only be used after logging in as an administrator.

1) Click the "MGT. and User MGT." button, then enter the interface of user management.
2) After logging in to the system, the administrator can set some operators and permissions on the System Settings page. The user can set the following permissions: Measure set, System set, Calibrate and delete data. (Maximum 5 users)

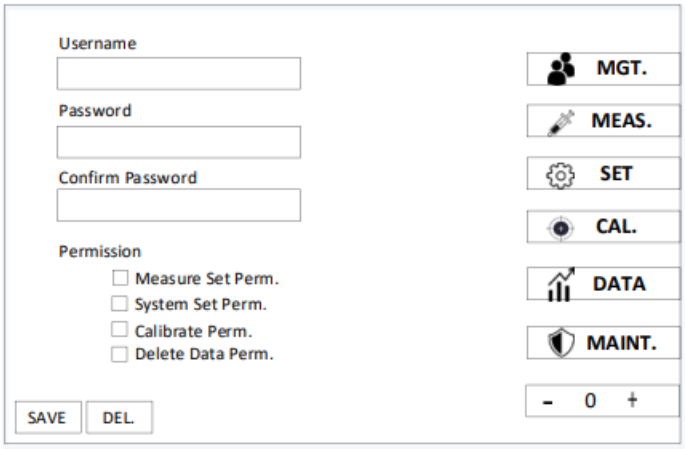


Figure-10

3) The right side of the display area displays the names of all current users, and the left side displays the user names and user permissions.
4) **Set up new user:** Enter the corresponding information in the "**User Name**", "**Password**" and "**Confirm password**" input boxes in the left display area. Choose the permission content in the permission checkbox and click Save. (**Note:** Maximum 8 characters for username and maximum 8 characters for password)
5) **Delete an existing user:** Click the right display area to select the user's name to be deleted, and click the DEL. button and click the Delete button again.
6) **Modify existing user permissions:** Click the user's name on the right, take "**operator**" as an example, and the user name "o**perator**" and the permissions of the user "**operator**" are displayed on the left. Choose the permissions checkbox to change the user's permissions; Click the "**SAVE"** button to save the changes to the user's "**operator**" permission.

8.4 Setup

In the main menu press the SET button to display the Setup main menu. Meas. SET, Size SET, Out. SET and SYS. SET.

8.4.1 Measurement Setup

In the Setup main menu, click MEAS. button to display the measurement setup menu.

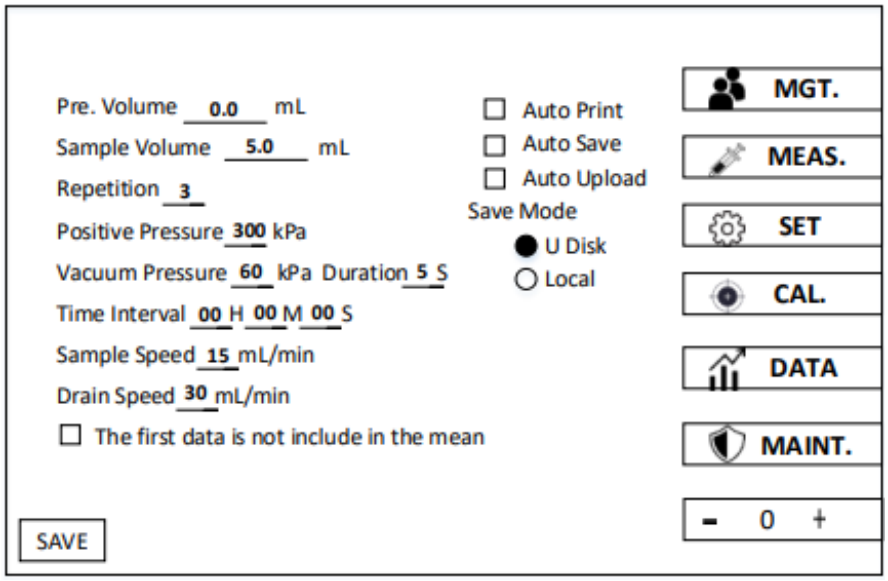


Figure-11

1) **Predicted volume:** Volume used for pipeline flushing before test, not counted. For automatic testing, only one predictive flush is performed before a set number of tests. For manual testing, a predictive flush was performed before each test.
2) **Sample volume:** 0.2~6000mL test will be carried out according to the set test volume.

3) **Repetition:** 1~9 times, the test will be carried out according to the set test times.
4) **Positive pressure:** 0~800kPa, the automatic test will be by the set pressure value.
5) **Vacuum pressure:** 0~80kPa, degassing will be done according to the set pressure value during the automatic test.
6) **Duration:** 0~59s, the automatic test will maintain the vacuum pressure according to the set time.
7) **Time interval:** The interval time of each test in automatic testing; Sample speed: the flow rate during sampling.
8) **Drain speed:** The flow rate during drainage. Click the corresponding selection box to set whether the first data is included in the mean value, automatic storage, automatic printing, automatic data uploading, and data storage mode (local storage, USB disk storage).

8.4.2 Size Setup

In the Setup main menu, click the SIZE SET button to display the Size setup menu. In this menu, the sizes of custom measurements can be set. The input particle size should be within the set range of particle size, otherwise, when saving, a prompt "Setting out of range! Please reset". (Maximum 50 custom channel sizes can be entered)

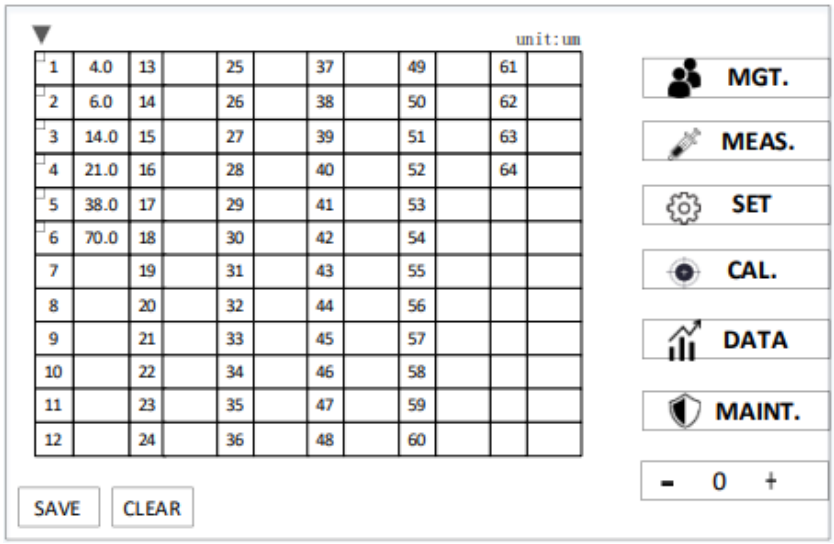


Figure-12

8.4.3 Output Setup

In the Setup main menu, Click OUT. SET button to display the output setup menu. In this menu, the output contents and the sample messages can be set, such as Sample Name(20 words Max), and Batch Number(10 letters or numbers Max). Click the corresponding text box to set up another item of output (Include "Sample Name", "Batch Number", "Sample Volume", "Repetition", "Test Time", "Tester", "Data", "Mean" and "Level"). Finally, click the SAVE button to save all settings.

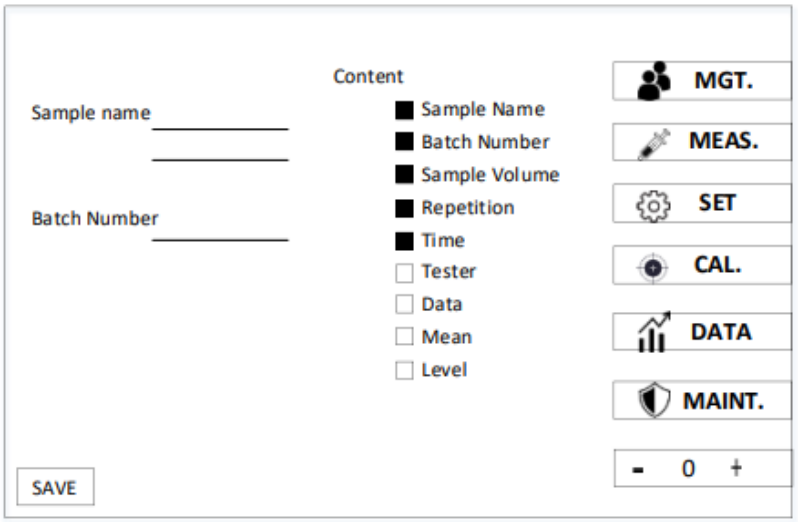


Figure-13

8.4.4 System Setup

In the Setup main menu, press SYS. SET button to display the System setup menu. The user can modify the instrument system language and time.

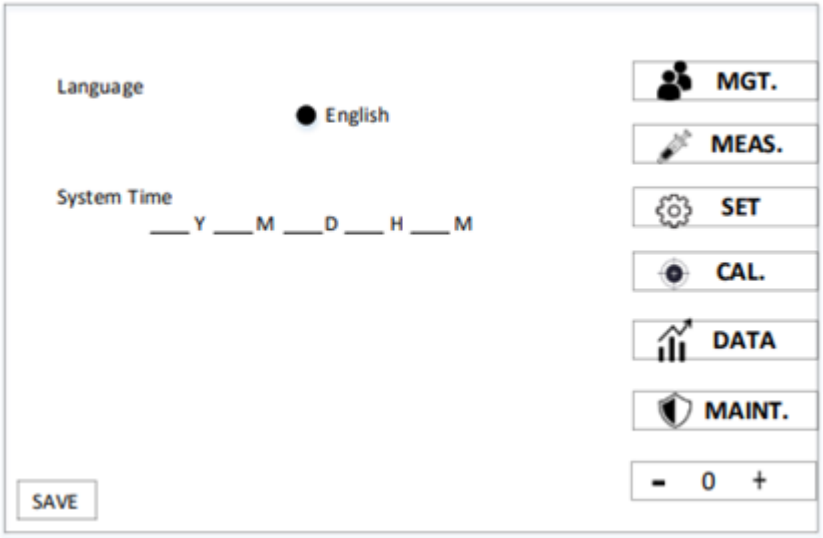


Figure-14

8.5 Measurement

In the main menu press MEAS. button to display the Measurement Menu. All the measurement parameters can be set in the Measurement setup menu (Measurement Setup). There are two modes of measurement: Auto and Manual.

The user can switch the test standard through the drop-down arrow, and set whether to select the automatic test mode. After the test, users can switch different standards to view, print, and store test data. When automatic testing is not selected, manual pneumatic operations such as pressure, pause, vacuum, and exhaust can be carried out before, during, and after testing. When the automatic test is selected, the instrument automatically carries out pressure pause, vacuum and other operations according to the pressure set value in the test setting.

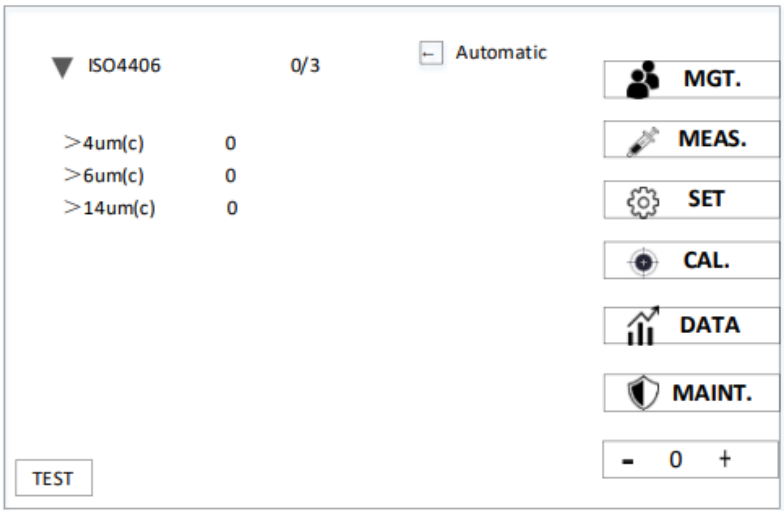


Figure-15

The channel particle sizes of the 13 standard tests are as follows:
NAS1638: 5-15μm, 15-25μm, 25-50μm, 50-100μm, >100μm
SAE4059F: 5-15μm, 15-25μm, 25-50μm, 50-100μm, >100μm
SAE4059CPC: >4μm(c), >6μm(c), >14μm(c), >21μm(c), >38μm(c), >70μm(c)
ISO4406: >4μm(c), >6μm(c), >14μm(c)
SAE749D: 5-10μm, 10-25μm, 25-50μm, 50-100μm, >100μm
Custom test: No. of channels and channel particle size in custom settings.

8.6 Data

In the main menu press the "**DATA**" button to display the saved data Menu. The data that is saved in measurement can be reviewed and queried in this menu.

8.6.1 Data Review

In the DATA menu, Click the "**REVIEW**" button to display the Data Review menu. In this menu, the measurement data can be reviewed. Users can switch standards and view data and means for different test times under each group of data. Also, can delete the current group, clear all data, export the current group data, print the current group data, upload the current group data, and view the current group data information.

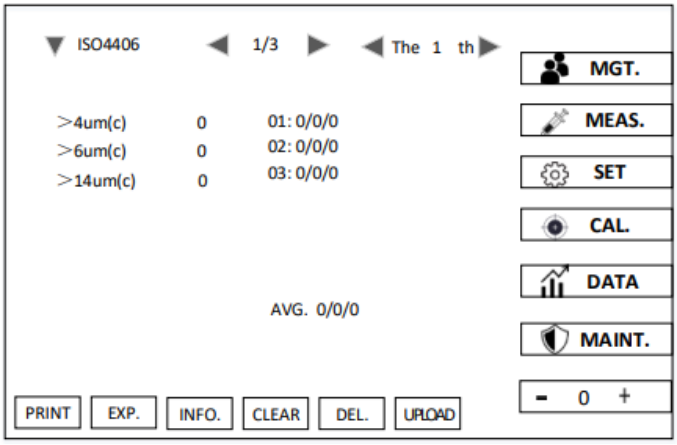


Figure-16

8.6.2 Data Query

In the DATA menu, click the "**QUERY"** button to display the data query menu. In this menu, click the textbox to edit the measurement time to query. Click the **"QUERY"** button to filter the saved data, the filtered data will be displayed. Turn the page by pressing the PgUp and PgDn buttons, and click the number of groups to display the specific test data and level on the right side of the interface. Click the left and right arrows to switch the number of times in the current group. Click the PRINT button to print the data of the current group. Click the EXP. button to export the group data to a USB drive. Click the "**UPLOAD"** button to upload the group data to the PC side. Click the "**INFO**" button to view the details of the current group data.

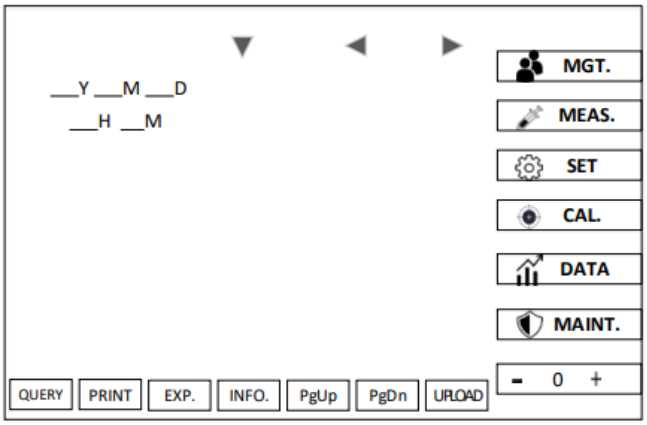


Figure-17

8.7 Maintenance

In the main menu click the **"MAINTENANCE"** button to display the maintenance menu. In this menu, the Flush and Back Flush can be operated. This is very important to the maintenance of the instrument. Users can read the prompt information on the maintenance interface carefully and operate according to the prompt information. Users can choose whether to carry out a cleaning test. If you choose the cleaning test, the instrument will stop cleaning after judging that the actual particle concentration meets the requirements according to the calibration curve, particle size, and corresponding particle concentration. If the cleaning test is not selected, stop cleaning when the cleaning volume is reached.

Note: Ensure to make it empty before backflushing!

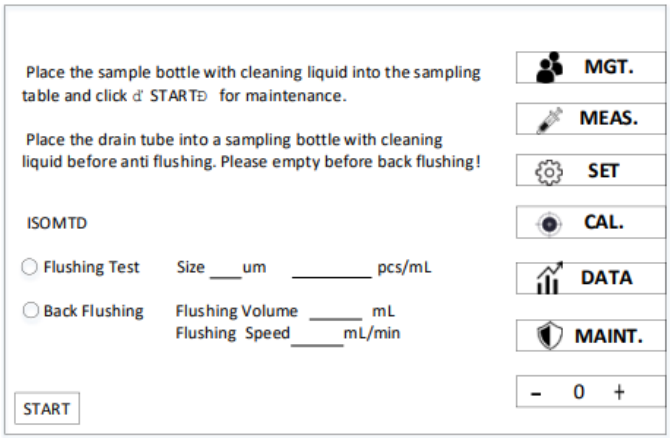


Figure-18

8.8 Calibration

In the main menu click the **"CAL"** button to display the Calibration Menu. Noise test, Size calibration, Volume calibration, and channel Resolution can be carried out. Click the corresponding button to enter the corresponding interface.

8.8.1 Noise Test

In the Calibration main menu, click the **"NOISE TEST"** button to display the Noise Level menu. The noise test is used to check the electrical noise of the instrument. The threshold level of the minimum calibration particle size can be set according to the noise test value.

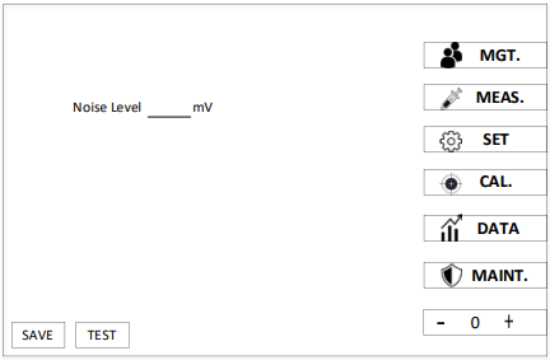


Figure-19

Click the TEST button to start the Noise test. Fill the sensor with clean and non-flowing liquid, start the instrument to count the 60s, adjust the threshold level until the measured value meets the range, and then the threshold level is the noise level of the instrument.

8.8.2 Size Calibration

In the Calibration main menu, click SIZE CAL. button to display the SIZE calibration menu. The user can enter the setting interface through the SET button, then can set the calibration volume, speed, and calibration curve and can calibrate up to three curves of ACFTD, ISOMTD, and custom.

Take the manual calibration of the ISOMTD curve as an example: In the particle size column (μm), the particle size value required for calibration is entered, and the corresponding threshold level (mV) is entered after this particle size value.

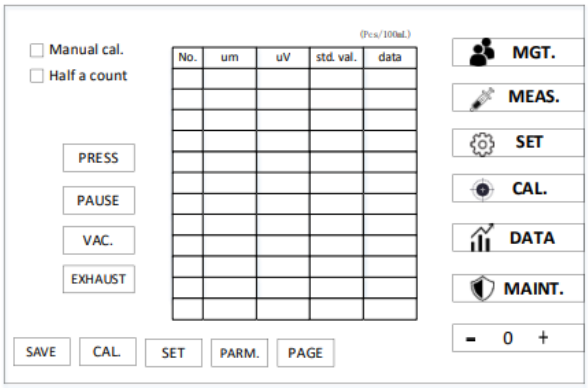


Figure-20

Click the **"CAL"** button, the instrument will automatically extract the calibration solution, and give the measured value of each particle size per unit volume after the end. According to the deviation between the measured value and the calibration liquid standard value, the user can increase (or decrease) the particle size threshold level and test again until the deviation between the measured value and the calibration liquid standard value meets the corresponding national standard calibration requirements. Click the **"SAVE"** button to complete the instrument calibration operation.

8.8.3 Volume Calibration

In the Calibration main menu, click the "**VOLUME CAL**" button to display the Volume calibration menu. The sampling volume can be calibrated, and the calibrated volume is fixed at 5mL.

The calibration steps are as follows:

1) Take a clean and dry beaker and fill it with about 100ml purified water (or other calibrated volume solution), taking care that there are no water droplets on the outer wall of the beaker. They were weighed on a balance and the values were recorded.
2) Clean the inspection table to make it clean and dry.
3) Place the beaker containing pure water on the inspection table and move the inspection table upward so that the needle is submerged in the pure water.
4) Click the "**CAL**" button on the volume calibration interface, and the instrument will take samples automatically.
5) After sampling, the instrument enters the volume difference input interface. The beaker was removed, weighed again on the balance, and the data recorded.
6) The difference between the two weighing results is converted into volume and then input to the volume difference input interface of the instrument.
7) Click the SAVE button to complete the volume calibration. If the injection volume is not accurate, the sampling operation can be repeated several times. If the volume calibration fails, you can initialize the volume parameters by pressing the RESET button.

8.8.4 Channel Resolution

In the Calibration main menu, click CH. RESOLUTION button to display the channel resolution menu. Enter the threshold value, click the TEST button, and wait for the instrument to complete the test of channel resolution.

Note: This item can only be operated by the manufacturer or unit of measurement.

8.8.5 Stir Setup

The mixing speed can be adjusted directly through the + and - buttons on the interface, and the adjustment range is 12 gears.

8.9 Test Operation

1) Connect to an electrical outlet and turn on the instrument. The instrument will conduct a self-test. After the self-check is completed, the login page is displayed. Enter the correct user's name and password, and then should be preheated for 10 minutes before measuring.

2) Place a sampling bottle containing petroleum ether solution (grade 6 or below, or other suitable cleaning solution) on a sampling table and close the air pressure chamber (Dome operate), enter the flushing interface, set the flushing times, and carry out flushing.
3) **Dome operation:**

The operation of sealing the dome

- A hand holds the handle and rotates the handle to align the two signs.
- The other hand moves up the test sets to the stop position.
- Rotate the handle to the stop position to seal the dome.

The operation of open the dome

- A hand holds the handle and the other hand holds the test sets.
- Rotate the handle counterclockwise until the two signs align.
- Move the test sets down slowly to open the dome.

Warning: Before opening the dome, make sure there is no pressure in the dome. If there is pressure in the dome, press the manual pressure relief valve to relieve the pressure manually!

4) Setup the instrument, set the Test times, Sample volume and others (Measurement Setup), print format (Output Setup), channel particle size and channel number (Custom Setup), system time (System Setup), etc.
5) Disperse the samples to be tested: tighten the cap and put it into the ultrasonic cleaning tank (with power of at least 4000W/m2) to vibrate for at least 1 minute. The liquid in the ultrasonic cleaning tank should be the same as the liquid level of the sample bottle to be tested.
6) After the ultrasonic vibration, shake the sample bottle vigorously by hand for 5 minutes. Then again ultrasonic wave mu vibration or the use of negative pressure degassing, time should be as short as possible. Let stand for 2-3 seconds.
7) Enter the measure interface to select the standard test type displayed, and click the TEST button to conduct the test. If the test sample is viscous and cannot be tested properly, pressure can be applied to assist the test during the test (Measurement).
8) At the end of the test, the previous test data of the current group can be viewed, it can be stored, and print test data.
9) After completion of the test, perform at least 10 times cleaning operations with petroleum ether flushing solution or other suitable solution (Maintenance). After flushing, test the next sample or shut it down

9. Maintenance

1) The sensor assembly shall not be disassembled by itself under any circumstances.
2) The sampling window and case should be kept clean and dry to prevent the inspection liquid from corroding the instrument components and case.
3) When the instrument is not in use, the power supply of the instrument should be turned off to extend the usage life of the laser parts.
4) The high-pressure syringe should be cleaned regularly to prevent the high-pressure syringe from being contaminated and causing inaccurate measurement volume. Remove the high-pressure syringe before cleaning, and then use methanol, dichloromethane, acetonitrile, acetone, and other solutions for cleaning.
5) The instrument often detects the inspection liquid with large viscosity or large particle size, which is easy to cause the blockage of the slit of the injection glass. The performance is as follows prolonged injection time.
6) In the process of sample injection, the speed of sample injection is slower than that of the high-pressure syringe, and a large amount of gas is pumped into the high-pressure syringe. The data is too large and unstable, etc., and the processing methods are as follows:
   Reverse flushing method: Backflushing to reverse cleaning in maintenance.

   Alternate cleaning method: Enter the flush interface to input the cleaning times. At the beginning of cleaning, remove the sample liquid level from the injection needle, and make the air and sample enter the injection glass slit alternately. Repeat several times to remove the substances blocking the injection glass slit and make it unblocked.

   Flushing with cleaning agent: Use a neutral cleaning agent or other suitable solvent for cleaning. Enter the flush interface and input the cleaning times to clean the slit and pipeline of the sample injection glass, which is used to clean the remaining samples, oil stains, and impurities in the pipeline. Rinse the pipeline again.

10. Appendix

10.1 Sensor Removal

When the instrument gives out false results, the sensor blocking can be taken into consideration. When the block is exited, flush the instrument with flush liquids times. If the problem cannot be solved, the operation of removing the sensor can be done. Then Use suitable tools to clean the blocked sensor. The procedure for sensor removal is as follows:

1) Flush the instrument times and drain out.
2) **Open the lid of the instrument:** Use a screwdriver to screw the two retaining screws, then lift the lid.
3) **Disconnect the data line:** Use a screwdriver to screw the retaining screw to off the data line.
4) **Remove the top joint of the sensor:** A hand holds on the sensor; the other hand uses a spanner to unlock the joint anticlockwise.
5) **Remove the sensor:** A hand holds the sensor, and the other hand uses the spanner to unlock the lower-end joint.

10.2 Air Clean Combination Treatment

1) Air filter combined drain out

- When the instrument is in a certain period, especially in the air humidity of the environment, the air filter combination may be the remnants of a certain amount of water.
- Through the observation window back of the instrument to see whether it needs to drain out.
- When the drain-out operation is needed, firstly, exhaust the pressure or vacuum in the dome, then power off the instrument.
- Secondly, Use the screwdriver to unlock the retaining screw of the view window, and put a vessel in the lower end of the air filter.
- Thirdly, screw the black lid to drain.

  Note: Make sure there is no water leakage into the inside of the instrument. After the drain-out operation, screw the black lid tightly to avoid leakage.)

2) Replace the dryer

- Firstly, remove the back panel of the instrument.
- Secondly, screw the retaining screw of the drying cylinder, pull off the pressure tube on the drying cylinder, then screw off the sealing lid on the other side.
- Replace the dryer, then screw the sealing lid and the pressure tube. Screw the drying cylinder tightly using the screwdriver.
- Finally, fix up the back panel of the instrument.

3) Replace the filtration module

When the pressure pump is inefficient, replacing the filtration module should be considered. The procedure is as follows:

- Firstly, remove the back panel of the instrument using the screwdriver.

- Secondly, pull off the pressure tube of the filtration module, then screw the retaining screw of the filter, and replace the filter.
- Thirdly, install the filtration module with the reverse procedure.
  Note: When replacing the filter, make sure both O-rings are placed in the middle.

10.3 Cleanliness Class

Cleanliness Class	Size/μm				
	5-15	15-25	25-50	50-100	>100
00	125	22	4	1	0
0	250	44	8	2	0
1	500	89	16	3	1
2	1000	178	32	6	1
3	2000	350	63	11	2
4	4000	712	126	22	4
5	8000	1425	253	45	8
6	16000	2850	506	90	16
7	32000	5700	1012	180	32
8	64000	11400	2025	360	64
9	128000	22800	4050	720	128
10	256000	45600	8100	1440	256
11	512000	91200	16200	2880	512
12	1024000	182400	32400	5760	1024

Class	Less than or equal to (Particles/100ml)									≥ %
	>0.5-1	>1-2	>2-5	>5-10	>10-25	>25-50	>50-100	>100-200		
00	800	400	32	8	4	1		A.O		
0	1600	800	63	16	8	2				
1		1600	125	32	16	3				
2			250	63	32	4	1		A.O	
3				125	63	6	2			
4				250	125	12	3			
5				500	250	25	4	1		
6				1000	500	50	6	2	1	0.000032
7				2000	1000	100	12	4	2	0.000064
8				4000	2000	200	25	6	3	0.000125
9				8000	4000	400	50	12	4	0.00025
10				16000	8000	800	100	25	5	0.0005
11				31500	16000	1600	200	50	10	0.001
12				63000	31500	3150	400	100	20	0.002
13					63000	6300	800	200	40	0.004
14					125000	12500	1600	400	80	0.008
15						25000	31500	800	160	0.016
16						50000	63000	1600	315	0.032
17							125000	3150	630	0.064

Cleanliness Class	5-15um	15-25um	25-50um	50-100um	>100um
	6-14 $um_{(c)}$	14-21 $um_{(c)}$	21-38 $um_{(c)}$	38-70 $um_{(c)}$	>70 $um_{(c)}$
00	125	22	4	1	0
0	250	44	8	2	0
1	500	89	16	3	1
2	1000	178	32	6	1
3	2000	356	63	11	2
4	4000	712	126	22	4
5	8000	1425	253	45	8
6	16000	2850	506	90	16
7	32000	5700	1012	180	32
8	64000	11400	2025	360	64
9	128000	22800	4050	720	128
10	256000	45600	8100	1440	256
11	512000	91200	16200	2880	512
12	1024000	182400	32400	5760	1024

Cleanliness Class	>1µm	>5µm	>15µm	>25µm	>50µm
	>4$µm_{(c)}$	>6$µm_{(c)}$	>14$µm_{(c)}$	>21$µm_{(c)}$	>38$µm_{(c)}$
000	195	76	14	3	1
00	390	152	27	5	1
0	780	304	54	10	2
1	1560	609	109	20	4
2	3120	1217	217	39	7
3	6250	2432	432	76	13
4	12500	4864	864	152	26
5	25000	9731	1731	306	53
6	50000	19462	3462	612	106
7	100000	38924	6924	1224	212
8	200000	77849	13849	2449	424
9	400000	155698	27698	4898	848
10	800000	311396	55396	9796	1696
11	1600000	622792	110792	19592	3392
12	3200000	1245584	221584	39184	6784

/ml		Code
Greater than	Less than or equal to	
2500000		>28
1300000	2500000	28
640000	1300000	27
320000	640000	26
160000	320000	25
80000	160000	24

40000	80000	23
20000	40000	22
10000	20000	21
5000	10000	20
2500	5000	19
1300	2500	18
640	1300	17
320	640	16
160	320	15
80	160	14
40	80	13
20	40	12
10	20	11
5	10	10
2.5	5	9
1.3	2.5	8
0.64	1.3	7
0.32	0.64	6
0.16	0.32	5
0.08	0.16	4
0.04	0.08	3
0.02	0.04	2
0.01	0.02	1
0.00	0.01	0

Cleanliness Class	**Particle size range (μm)**				
	5～15	15～25	25～50	50～100	>100
0	2700	670	93	16	1
1	4600	1340	210	28	3
2	9700	2680	380	56	5
3	24000	5360	780	110	11
4	32000	10700	1510	225	21
5	87000	21400	3130	430	41
6	128000	42000	6500	1000	92

10.4 Changing Printer's Thermo-paper Roll

The procedure is as follows:

1) Press the open-door button to open the printer's door. Take out the rest paper roll.

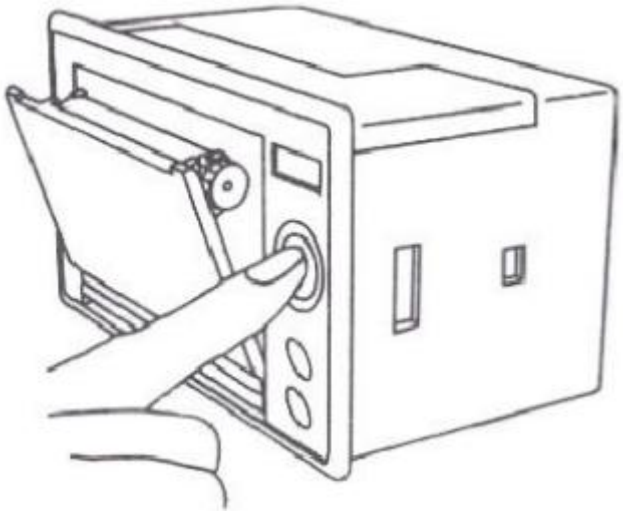


Figure-21

2) Changing the new paper roll followed the right picture.
Be caution! Take note of the right direction, otherwise, the paper will not be printed.

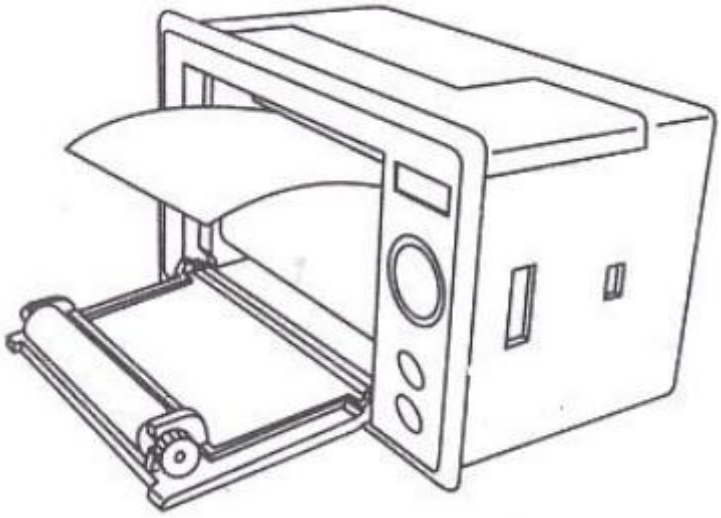


Figure-22

3) Close the printer's door as the picture shows.
Note: before closing the door, make sure, the paper is out of the door a little, then the printer will print correctly.

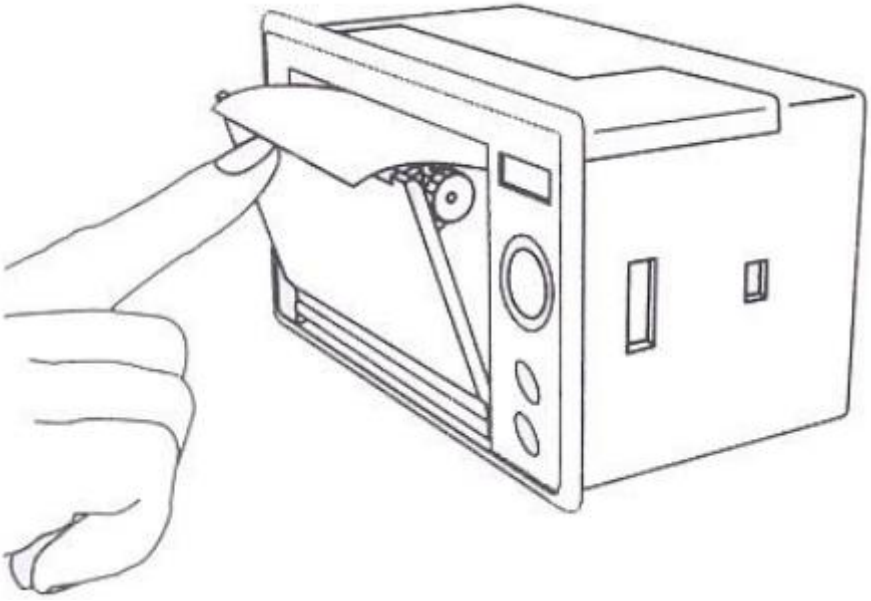


Figure-23