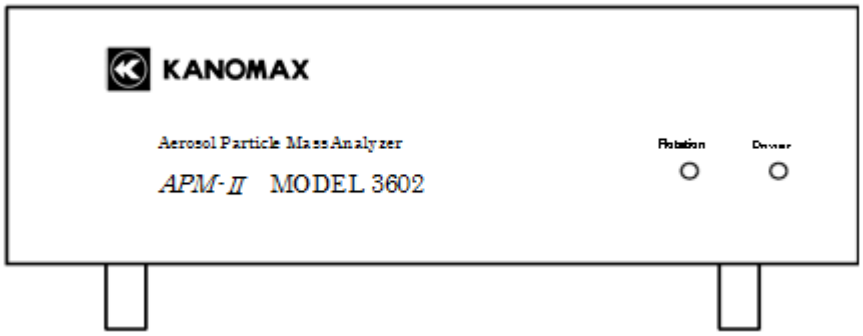
KANOMAX

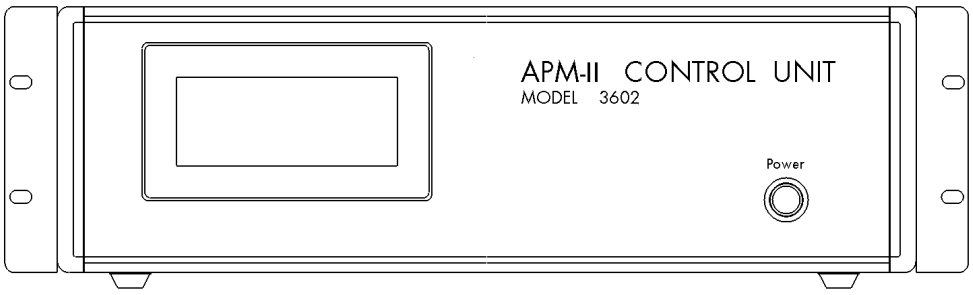
Aerosol Particle Mass Analyzer

APM-Ⅱ

MODEL 3602

Operation Manual





Read this manual carefully and understand the warnings described in this manual before operating the product.
Keep this manual handy for future reference.

01002

17.10

Component List

■ Standard Items

Item	Model	Qty	Function
Classifying Unit	3602-00	1	APM-II Classifying Unit for Conducting Measurement
Control Unit	3602-01	1	APM-II Control Unit to control Classifying Unit
Operation Manual	-	1	
Test Sheet	-	1	
Power Cable	-	1	Power supply cable (AC100-240V)
Motor Control Cable	-	1	To control motor of Classifying Unit
High Voltage Power Cable	-	1	To apply and control high voltage to Classifying Unit
Motor Power Cable	-	1	To supply motor power to Classifying Unit
Measurement Software DVD-ROM	-	1	Software to run APM-II and acquire measurement results
Magnetic Fluid	3601-07	1	For maintenance (Sealing material of rotating part and fixed part)
Hexagon Wrench	-	1	For maintenance (Used to remove high voltage cable)
Magnet	-	1	Used upon replenishing magnetic fluid

Power Cable

Motor Control Cable

High Voltage Power Cable

Motor Power Cable

■ Consumables

Item	Model	Qty	Function
Magnetic Fluid	3601-07	1	For maintenance (Sealing material of rotating part and fixed part)
Replacement Carbon Brush	3601-08	1	Used as a contact for igniting the voltage at the rotating part 4 pcs in one set

For more details about the consumables, please contact your sales representative.

Please contact the distributor Kanomax Japan, Inc.

Important Safety Information

Types and definitions of warning signs used in this operation manual are described as below.

[Classifications]

Danger: To Prevent Serious Injury or Death

Indicating a potentially hazardous situation which, if not avoided, may result in serious injury or death

Caution: To Prevent Damage to the Product

Indicating a potentially hazardous situation which, if not avoided, may result in damage to the product that may void the product warranty

[Description of Symbols]

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

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

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

⚠ WARNING

Do not modify/disassemble

- Never disassemble, modify or repair the instrument.

--- Except for the parts on which you are allowed to carry out maintenance, do not disassemble, modify or repair the instrument.

Handle Properly

- Use the instrument properly by carefully following this operation manual.

--- Misuse of the instrument may result in electric shock, fire, damage to the instrument, etc.

- If any abnormal noise, unusual odor or smoke is emitted, or any liquid enters into the instrument, turn the power off immediately and disconnect the power cable.

--- It may result in electric shock, fire or damage to the instrument.
Contact your distributor or your KANOMAX service center for repair.

⚠ WARNING

Electrical Shock Warning

- When power is supplied, do not touch the monitor terminal on the rear panel of the Control Unit.

--- Failure to observe the above may cause electric shock because voltage is output from the terminal.

Rotation Warning

- While the rotating unit is rotating, do not open the cover of the Classifying Unit or touch the rotating unit.

--- If you touch the rotating unit, your fingers may be caught/injured.

Prohibited Installation

- Do not use this instrument where the ambient temperature is 35 ˚C or higher.

--- Failure to observe the above may negatively affect the performance dramatically. Also, dielectric degradation may occur, which may result in short circuit or fire.

Handle Properly

- Unplug the power cable when the instrument is not in use.

--- Failure to observe the above may result in electric shock, fire or damage to the internal circuitry.

- Install the instrument where you can pull the power cable out anytime.
- When using the power cable, ensure that there is no dust on the power plug. The AC outlet used must be within the specified power requirement of 100 to 240 V.

--- Failure to observe the above may result in fire.

- When using a power cable, make sure to use the one provided with this instrument.

--- Other commercially available cables may have different voltage specifications and polarity which could result in short circuit, fire or damage to the instrument.

⚠ Caution

Prohibition

- Do not place the instrument and perform a measurement in an environment exceeding the specified temperature and RH level. Also the instrument should not be exposed to direct sunlight for a prolonged period.

--- The instrument may not function properly outside the specified environment. (10 to 35 ˚C, 20 to 85 % RH, non condensing)

Prohibition

- 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.

- Discharge any built-up static electricity from your body before touching the instrument.

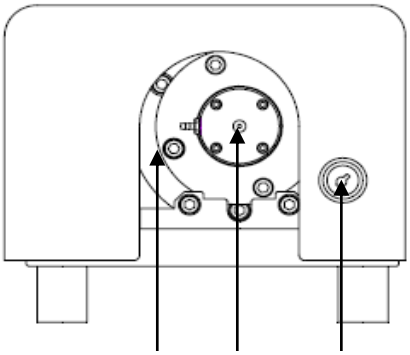
--- The built up static electricity may influence the readings and cause damage to the circuit.

Table of Index

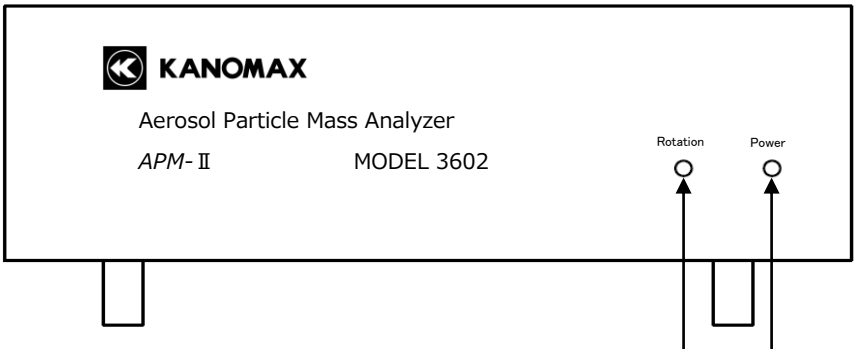
1. Description of Components

1.1 Classifying Unit

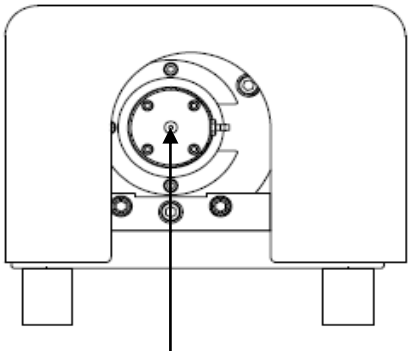
- Left Side -



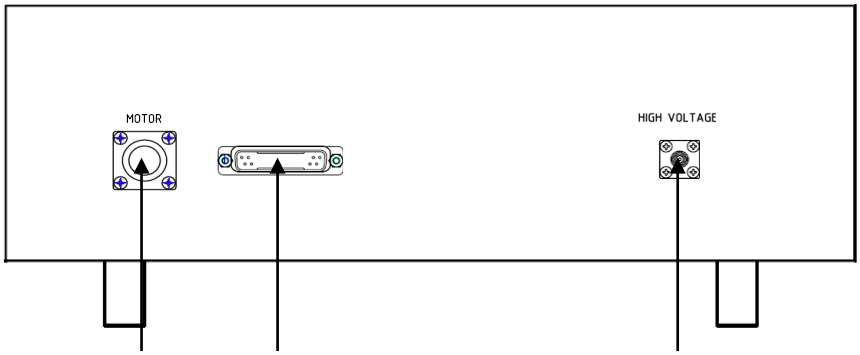
- Front Panel –



- Right Side -



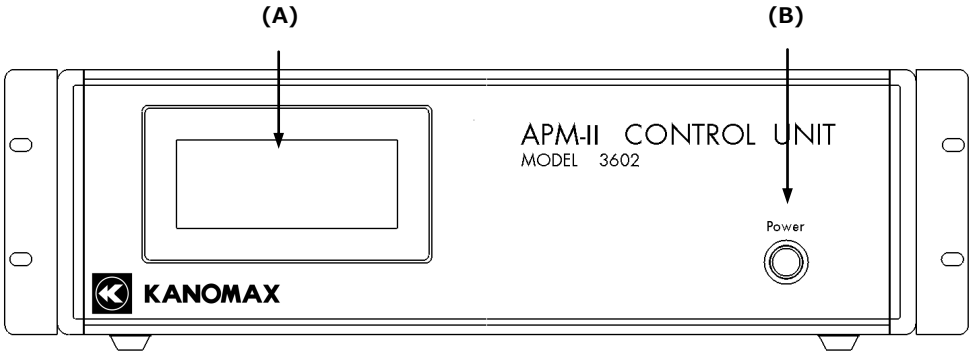
- Rear Panel -

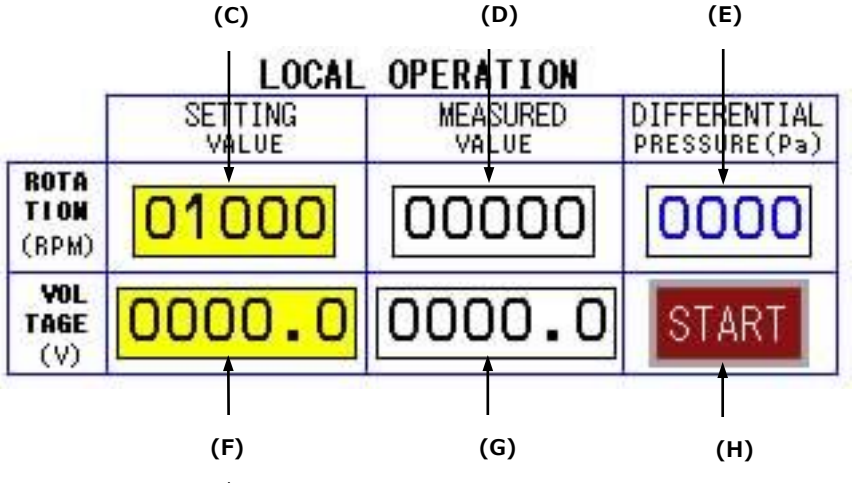


(1)	Inlet	Inlet for sampling particles
(2)	Classifying Unit	This is where sampled particles are classified.
(3)	Key Switch	The switch is used to lock the cover. If the cover is not locked, the instrument cannot start rotating.
(4)	Rotation LED	Red lamp is lit when rotating.
(5)	Power LED	Green lamp is lit when the power is supplied.
(6)	Outlet	This is where the classified particles are extracted.
(7)	MOTOR POWER	This connector supplies power to the motor. Connect the Motor Power Cable to *(*J) of the Control Unit.
(8)	MOTOR CONTROL	This connector controls the motor. Connect the Motor Control Cable to *(*K) of the Control Unit.
(9)	HIGH VOLTAGE	High voltage is applied from the Control Unit. Depending on the voltage to be applied, connect the cable to the 10V or 2kV of the HIGH VOLTAGE Connector *(N)*.

1.2 Control Unit

- Front Panel –





CONTROL UNIT Front Panel

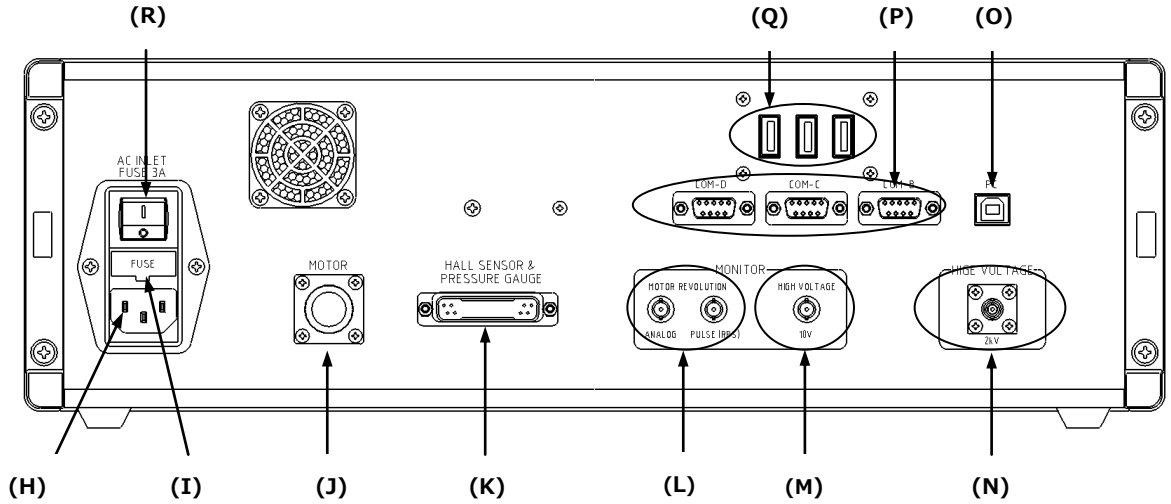
(A)	LCD	Displays rotational speed, voltage and differential pressure.
(B)	POWER	Power switch for the control unit. Switch the power on (light will turn blue)

LCD PANEL (TOUCH PANEL) Display

(C)	Rotational Speed Display	Displays set rotational speed from 1000 to 14000 [rpm]
(D)	Measured Rotational Speed Display	Displays the actual rotational speed.
(E)	Differential Pressure Display	Displays the differential pressure between the inlet and the outlet. 0 to 1000[Pa]
(F)	Applied Voltage Display	Displays the applied voltage to the Classifying Unit. Indicates 0 to -2000V as 0 to 2000V.
(G)	Measured Applied Voltage Display	Displays the actual applied voltage.
(H)	START/STOP	Starts and stops a measurement.

If the LCD panel (touch panel) display indicates [The Emergency Shutdown Contents] or [Warning], refer to **8. Trouble Shooting**. To understand the display and how to use the LCD panel (Touch panel) in the Remote Mode, refer to **3.4 Remote Mode** and **4., 5., 6.**

- Rear Panel -



(H)	AC INLET	Supplies AC power.
(I)	FUSE	A 6A fuse is mounted.
(J)	MOTOR	This connector supplies voltage to the motor. Connect the Classifying Unit (7) to the Control Unit with the Motor Power Cable.
(K)	HALL SENSOR & PRESSURE GAUGE	This connector controls the motor and connects the differential pressure sensor. Connect the Classifying Unit (8) to the Control Unit with the Motor Control Cable.
(L)	−MONITOR− MOTOR REVOLUTION	Output terminal for monitoring rotational speed
		[ANALOG] 0 to 10V output corresponds to 0 to 14,000 rpm.
		[PULSE (RPS)] 1 Pulse is output per one rotation. (e.g., When rotational speed is 6,000 rpm, 100 Hz is output.)
(M)	−MONITOR− HIGH VOLTAGE	Output terminal for monitoring applied voltage
		[10V] 0 to 10 V output corresponds to 0 to -30.0 V. 0.15 to 10 V output corresponds to -30.0 to -2,000 V.
(N)	HIGH VOLTAGE	Connector for applying voltage
		[2kV] Connect the High Voltage Power Cable to the Classifying Unit (9). This can be used for both LOCAL and REMOTE modes. 0 to 2000 V can be applied.
(O)	PC	This is used for remote control by a computer.
(P)	RS232C Connector	Connector to install DMA, CPC, and various sensors Port to connect the RS232C cable connector
(Q)	USB Connector	Connector to install DMA, CPC, and various sensors Port to connect the USB cable connector
(R)	POWER	Power switch for the control unit

2. Before Starting a Measurement

Connect the Classifying Unit and the Control Unit before starting the APM.

2.1 Power Supply Line

The Control Unit requires power supply of at least AC100-264 V, 50-60Hz 10A.
Connect the provided Power cable to the AC INLET (H) on the rear panel of the Control Unit.

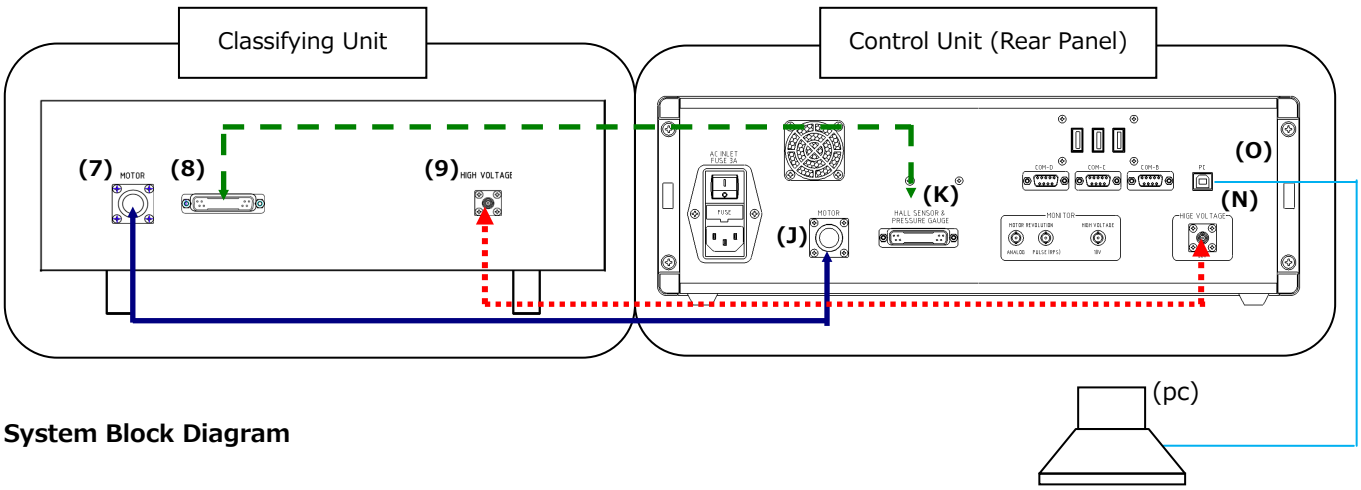
2.2 Connecting Classifying Unit and Control Unit

Connect the Classifying Unit with the Control Unit before starting the APM. There are three connections as listed below.

Be sure to connect the cables before turning on the instrument for your safety.

When changing the terminal, make sure that the control unit is turned OFF. Failure to do so may result in electric shock.

Classifying Unit (Rear Panel)	Control Unit (Rear Panel)	Cable to be used
(7) MOTOR POWER	(J) MOTOR	Motor Power Cable
(8) MOTOR CONTROL	(K) HALL SENSOR & PRESSURE GAUGE	Motor Control Cable
(9) HIGH VOLTAGE	(N) HIGH VOLTAGE (10V)	High Voltage Power Cable
-	(O) PC	USB Cable To be used in REMOTE mode For connecting to a computer



System Block Diagram

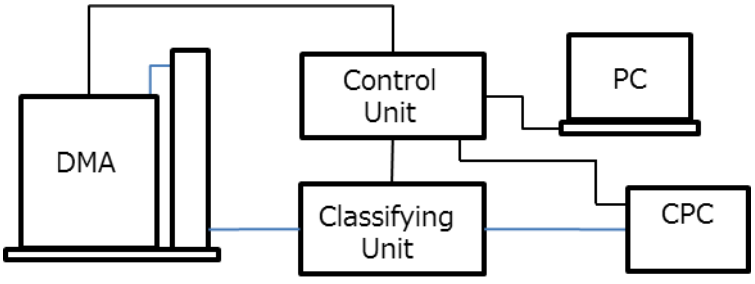


Table 1: CPCs that can transfer data to PC

Maker	Model	Maker	Model
Kanomax	3800	TSI	3775
TSI	3010	TSI	3776
TSI	3022A	TSI	3787
TSI	3025A	TSI	3768
TSI	3771/3772	BMI	1720

2.3 Startup and shutdown

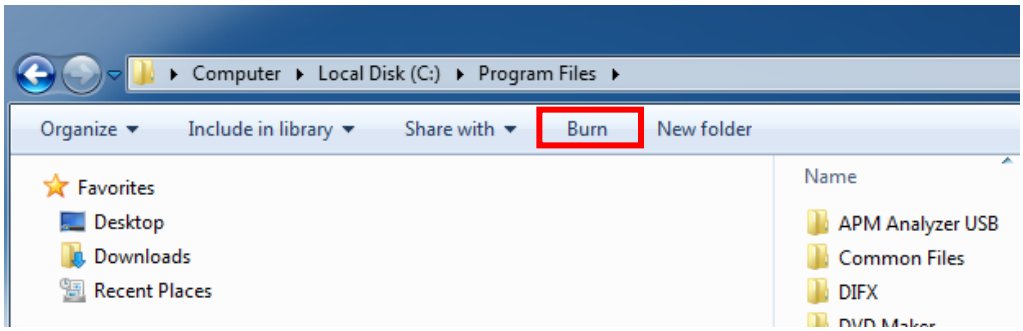
Start-up: By turning on the (R) switch from the front / rear panel in the previous section and turning on the (B) switch, the POWER LED will light up (see the left figure of the next page, under 3.1). The liquid crystal panel will start up and the figure on the right will be displayed.

Shutdown: Stop by turning off (B) on the front panel. If it is not used for 2 or 3 days, (R) on the rear panel will also turn off.

2.4 APM-Ⅱ software installation

2.4.1 Product common notes

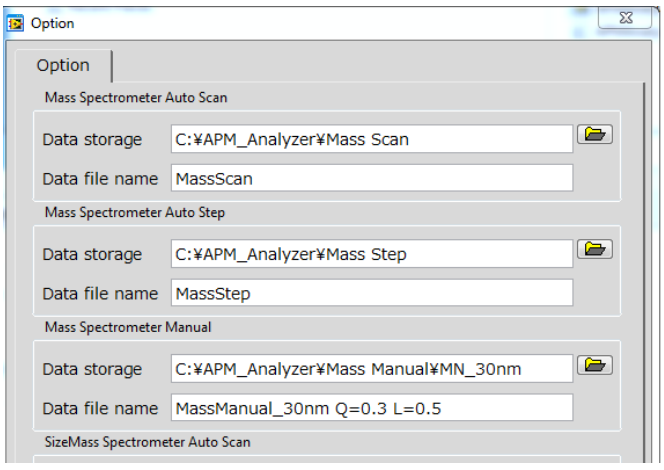
When saving data to "C: ¥" or "Folder under Program Files (64-bit Program Files (x86))" saved data may not be displayed in Windows Explorer. It is displayed by clicking "compatibility file" in the explorer.
If you cannot perform this operation, or if there is no display of "compatibility file", you need to save data to a folder in which users can read and write, such as My Documents.



2.4.2 Precautions by Product

It is necessary to change the data save destination "C: ¥" that is set by default to a folder such as My Documents from which users can read and write data. Data must be saved unless this change is made.

Click "Tools" - "Options".
Please change the "data storage folder" from C: ¥ to a folder in which users can read / write such as My Documents.

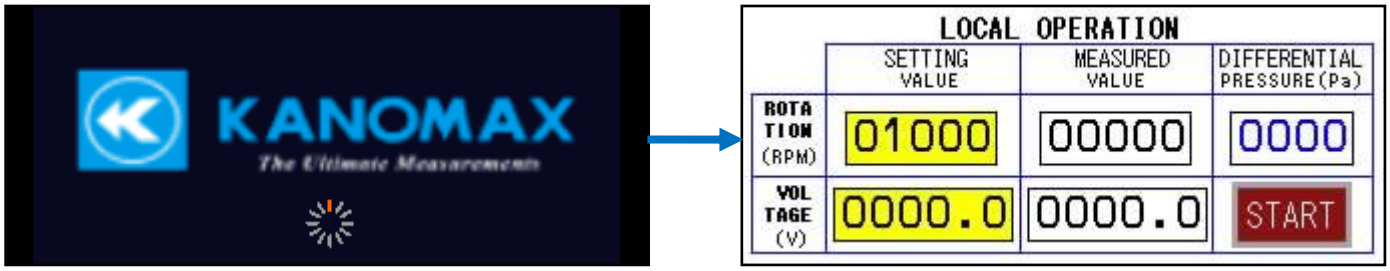


3. Getting Started

Two modes, LOCAL and REMOTE, are available for carrying out a measurement.

1. LOCAL Mode: Mode for setting rotation speed and high voltage by using the LCD (Touch) panel
2. REMOTE Mode: Mode for controlling the instrument from a PC by using the provided software

3.1 Power On

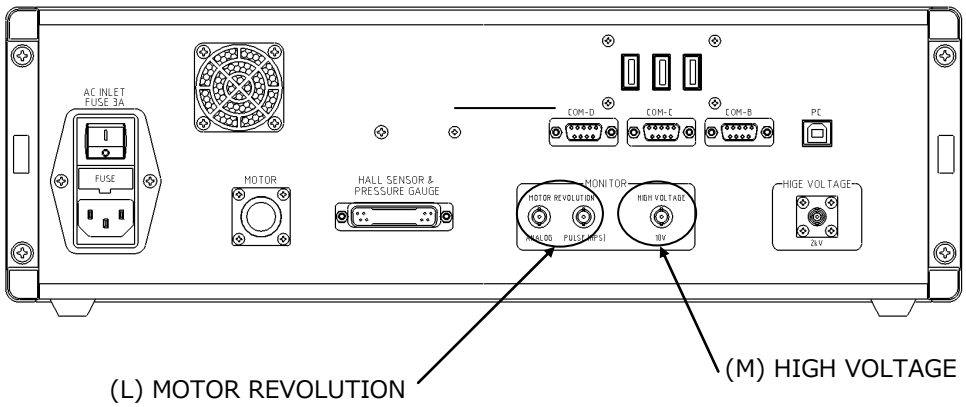


1) Supply AC100-240V to the AC INLET (H) of the Control Unit.
2) Turn on the POWER Switch (B) of the Control Unit. Then the Power LED (5) of the Classifying Unit will light up and the LCD panel (Touch panel) of the Control unit is activated (See the picture shown in the upper left).
3) On the LCD panel (Touch panel), Rotational Speed display (C), Measured Rotational Speed display (D), Applied Voltage display (F), Measured Applied Voltage display (G), Differential Pressure display (E), and START/STOP (H) will be displayed (See the picture in the upper right).
4) The instrument is now ready to perform a measurement.

3.2 Output

Three signals, as listed below, can be taken out from the Control Unit by using a device such as a multimeter.

Location	Item	Output Item	Output
(L)	MOTOR REVOLUTION ANALOG	Rotational Speed Analog Output	0 to 14000rpm → 0 to 10 V
	MOTOR REVOLUTION PULSE (RPS)	Rotational Speed Pulse Output	1 Pulse per rotation e.g. 100 Hz when 6,000 rpm
(M)	HIGH VOLTAGE	Applied Voltage Output	0 to -2000V → 0 to 10 V

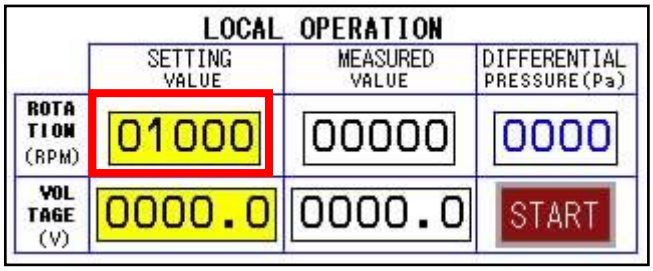


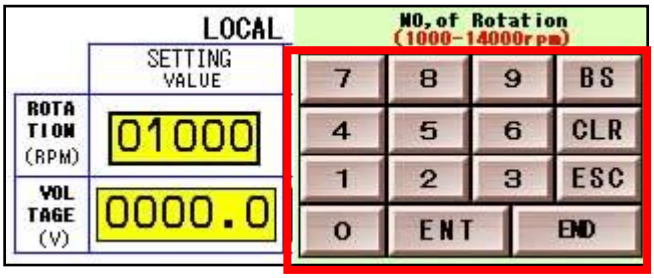
3.3 Local Mode

Mode for setting the rotational speed and high voltage by touch panel operation.

3.3.1 Starting a Measurement

Location	Description
	Connect a tube for sampling particles to flow to the INLET (1) and set another tube from the OUTLET (6) to connect to a measurement instrument such as a particle counter. Do not apply a negative pressure exceeding 3kPA to the Classifying Unit. When sucking sampling particles, applying a negative pressure exceeding 3kPA to the Classifying Unit may cause the dispersion of the sealing material, resulting in abnormal operation of the Classifying Unit. Refer to **7. Maintenance** (page29) or details of the sealing material.





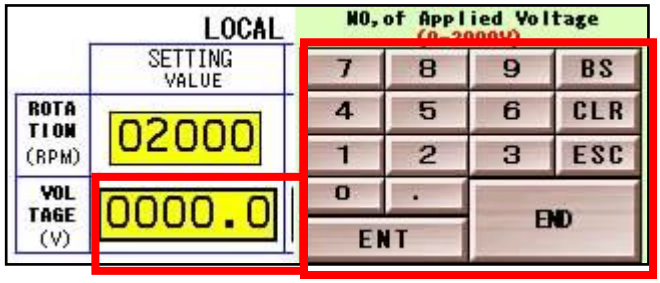
Setting rotational speed of the motor

Touch the ROTATION section of the SETTING VALUE (C) highlighted in yellow to display a numeric keypad for entering value. Enter the desired value (The range of settable value is from 1000 to 14000rpm. If you try to enter a value out of the settable range, the display will indicate [OVERFLOW] or [UNDERFLOW], and prompt you reset the value.)

After entering the value, press the ENT (ENTER) button to confirm your entry.

After the confirmation, press the END button to navigate back to the original screen.

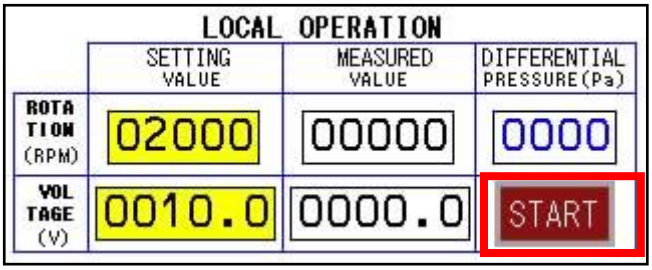
(BS: BACK SPACE, CLR: CLEAR, ESC:ESCAPE)



Setting high voltage

High voltage range is from 0 to -2000V, which will be indicated as 0 to 2000 V on the display.

Touch the VOLTAGE section of the SETTING VALUE (F) highlighted in yellow. Going through a similar process of the rotation speed, enter desired value using the displayed numeric keypad. (The settable range is from 0 to 2,000V. If you try to enter a value out of the settable range, the display will indicate [OVERFLOW], and prompt you reset the value.



Measurement

After entering values, press the [START] button (H) in the lower right of the touch panel.

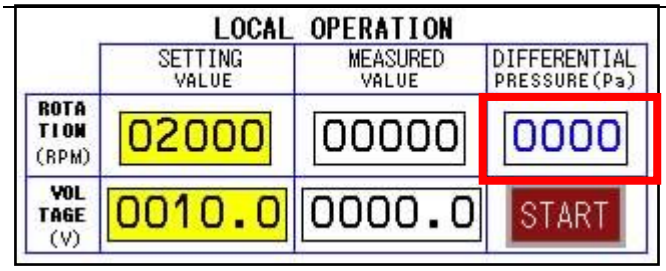
Confirm that the measured values are displayed in the section of MEASURED VALUE (D, G).

To adjust the values, you do not have to stop operation. Re-entering the values of the rotational speed and high voltage will adjust the values.

The particle with the specific mass-to-charge ration which is determined according to the rotational speed and voltage set above will be classified in the Classifying Unit and taken out from the outlet (6) of the Classifying Unit.

*Re-entering values and adjusting the rotational speed before the measured values are stabilized will overload the motor and cause failure.

*If the LCD panel (touch panel) indicates [The Emergency Shutdown Contents], refer to 8. Troubleshooting.



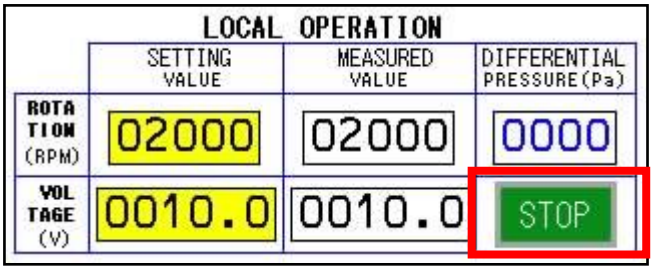
Confirming the differential pressure

Differential pressure between the INLET (1) and the OUTLET (6) of the Classifying Unit will be displayed.

This value changes in accordance with the suction flow from the OUTLET and the rotational speed of the motor. Please refer to the test sheet.

3.3.2 Ending a Measurement

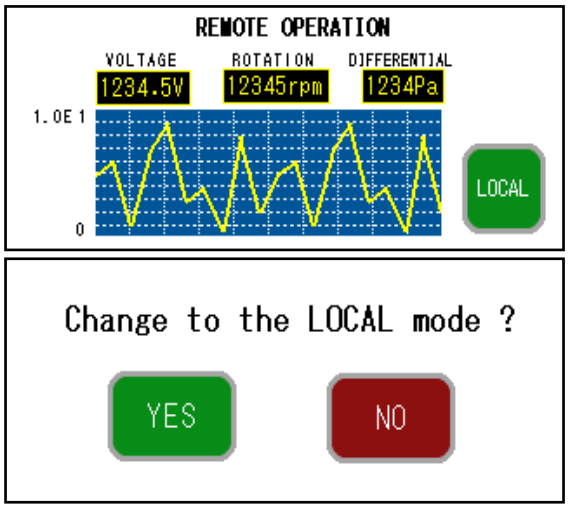
Location	Description



Ending the measurement

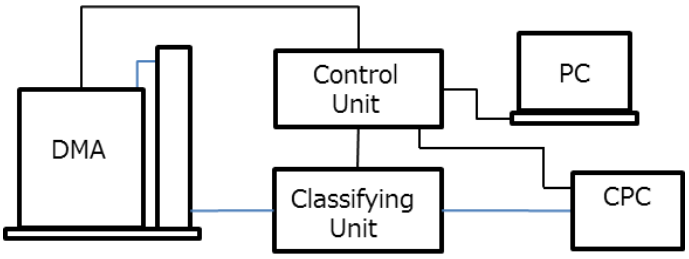
Press the [STOP] button (H) in the lower right of the LCD panel (touch panel) of the control unit. Confirm that the measured rotational speed and measured applied voltage turn to "0". To start a measurement again, confirm the measured values (D, G) turn to "0" and then press the [START] button again.

3.4 REMOTE Mode



The supplied measurement software allows you to remotely control the unit from a computer and to transfer data from the Classifying Unit to a computer. Connect the PC to the Control Unit with the USB cable and activate the software. The LCD panel (Touch panel) display will change as shown in the right pictures. (The upper right picture is displayed during a measurement.) Entering values on the software allows you to operate the Classifying Unit. Pressing the [LOCAL] button on the LCD Panel (Touch panel) of the Control Unit will automatically return to the Control Unit operation (The lower right picture is displayed during switching modes).
*Switching the modes will stop the measurement.

System block diagram



3.4.1 Confirmation of packing items

This software is stored in the DVD-ROM. If there are scratches on the DVD-ROM recording surface, please contact the dealer promptly. The following item is included in this package.

・ Aerosol Particle Mass Analyzer Software DVD-ROM 1

3.4.2 Required system environment

Please ensure the computers being used meet the following requirements to operate this software Environment of computer used

Type	Desktop or laptop computer
OS	Windows 7, 8, 10 (32 bit or 64 bit)
Memory	4 GB or more
Hard disk capacity	Free space of 20 GB or more
USB port	1 port available for the software
LCD	1366×768 dots or higher

3.4.3 Install software

[Installation of device driver]

When connecting the APM-Ⅱ control unit and the PC for the first time, installation of the device driver is necessary. Please install the device driver from the APM-Ⅱ Device Driver in the DVD.

【APM-Ⅱ Analyzer_USB installation】

When the PC you are using is a 32 bit type, from the APM-Ⅱ V 2 32 bit folder, in the case of the 64 bit type, click on the "Installer" folder and the "Volume" folder from the APM-Ⅱ V 2 64 bit folder in that order, Click to launch and install.

4 . Start-up, closing, main screen and menu of software

4.1 Start-up

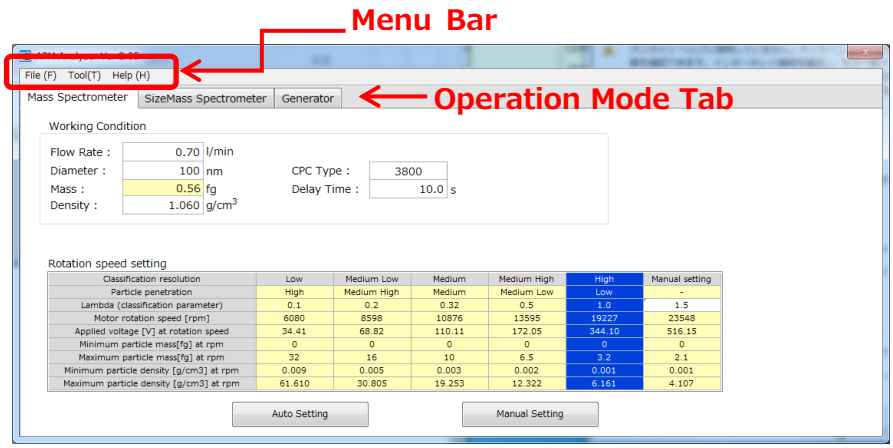
Please start with "All Programs" → "APM-Ⅱ Analyzer USB" → "APM-Ⅱ Analyzer - USB" from the start menu.

4.2 End

Please exit with "File" -> "Exit (X)" in the startup menu bar.

4.3 Main Window

When the software is activated, the main window will appear as shown:



4.4 Menu Bar

The menu bar provides file operation, settings, and help menus.

Item	Function
File (F)	To load and save the set values, read the measured data, and exit the program.
Tool (T)	To set the communication with the peripherals, size of the APM/DMA classification, and the destination folder and file name of measurement data.
Help (H)	To display the version information of the software.

4.5 Operation Mode Tab

This software operates the Classifying Unit by using the three operation modes.
Select each operation tab to switch the operation modes.

Tab	Function
Mass Spectrometer	To scan the applied voltage in a certain rotation speed and classify aerosol particles by mass.
SizeMass Spectrometer	To control a DMA (TSI Model) and to perform mass classification of each particle classified by the DMA.
Generator	To set the rotation speed and applied voltage to output particles of a certain mass.

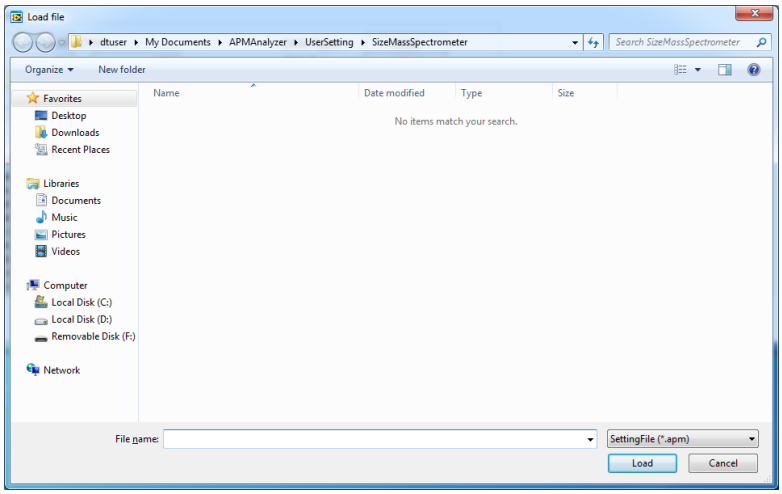
5. Operating Menu

This chapter explains how to operate each menu displayed on the menu bar.

5.1 File (F)

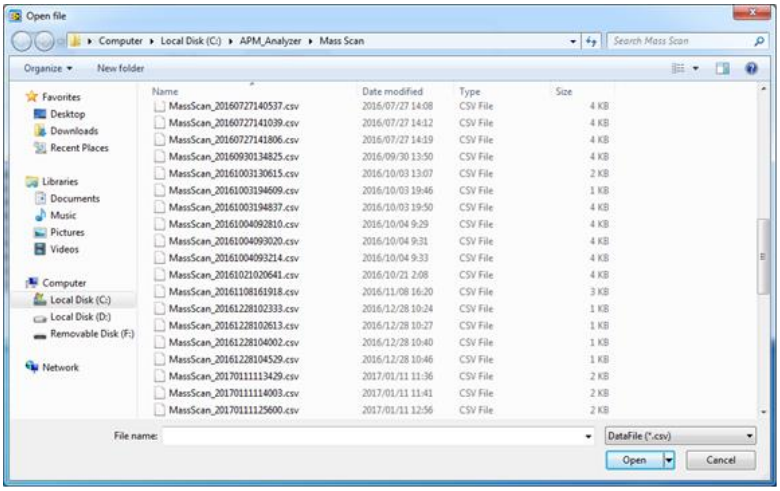
5.1.1 Load Setting Data (L)

This menu is to load the set values. Click [File] → [Load Setting Data] to open the following window. Select the file of set values to load, and then click the [load] button.



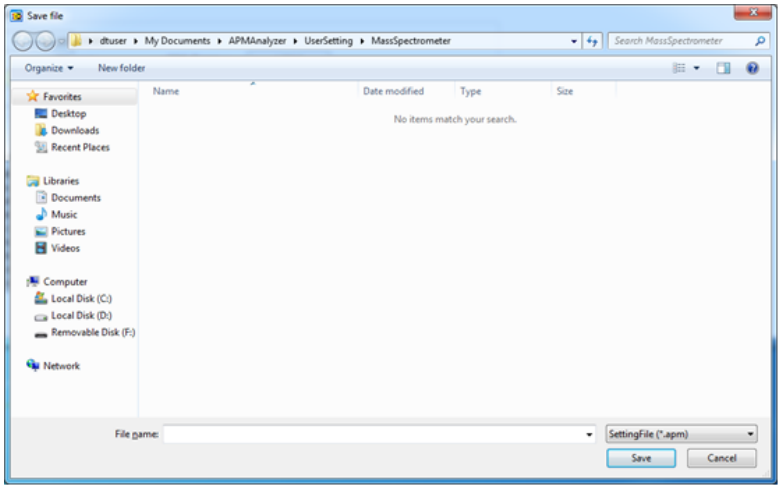
5.1.2 Read Measured Data (R)

This menu is to read the saved measurement data. Click [File] → [Read Measured Data] to display the following window. Select the file of measured data to read, and then click the [Open] button.



5.1.3 Save Setting Data (S)

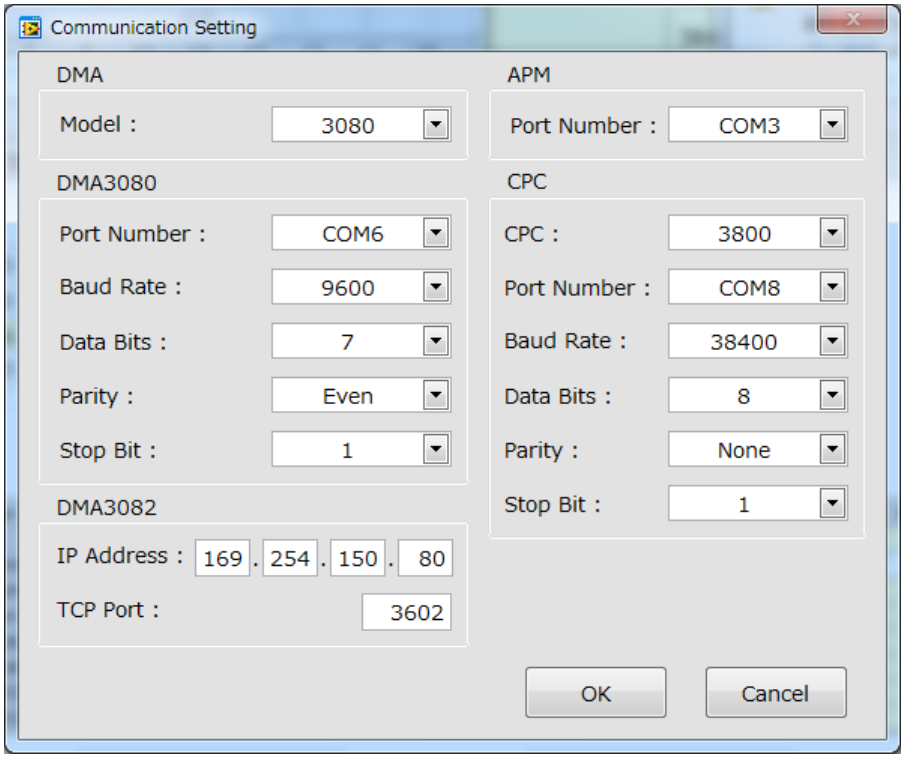
This menu is to save the setting data.　Click [File] → [Save Setting Data] to display the following window. Set the File name and click the [Save] button.



5.2 Tool (T)

5.2.1 Communication (C)

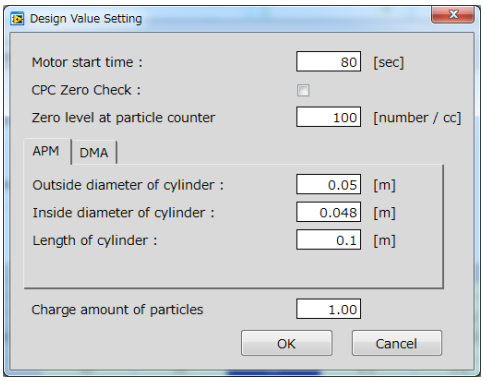
This menu is to set the communication with the peripherals of CPC and DMA.
Click [Tool] → [Communication] to display the following window.



Item	Operation and Confirmation
Selecting DMA	
Model	Press the pulldown button ▼ to display the list. Select the DMA to use for SizeMass Spectrometer.
Setting DMA3080	
Port Number	Port number must be separately set for each computer. Confirm the number by using the Device Manager. The same numbers as the APM and CPC cannot be used.
Baud Rate	Make sure it is 9600.
Data Bits	Make sure it is 7.
Parity	Make sure it is EVEN.
Stop Bit	Make sure it is 1.
Setting DMA3082	
IP Address	Make sure it is 169-254-150-80 (the default set by TSI). If the setting is altered, input the above value.
TC Port	Make sure it is 3602 (the default set by TSI). If the setting is altered, input the above value.
Setting the APM	
Port Number	Port number must be set separately for each computer. Confirm the number by using the Device Manager. The same numbers as the DMA and CPC cannot be used.
Setting the CPC	
CPC	Select the CPC to use. Check the connectable CPC from the list.
Port Number	Port number should be set for each computer. Confirm it by using device manager. The same numbers as the DMA and APM cannot be used.
Baud Rate Data Bits Parity Stop Bit	The selected CPC enters the values automatically.

5.2.2 Design Value (D)

This menu is to set time for motor rotation speed-up, zero check prior to measurements, and the inner dimension of the APM/DMA classifiers. Click [Tool] → [Design Value] to display the following window.



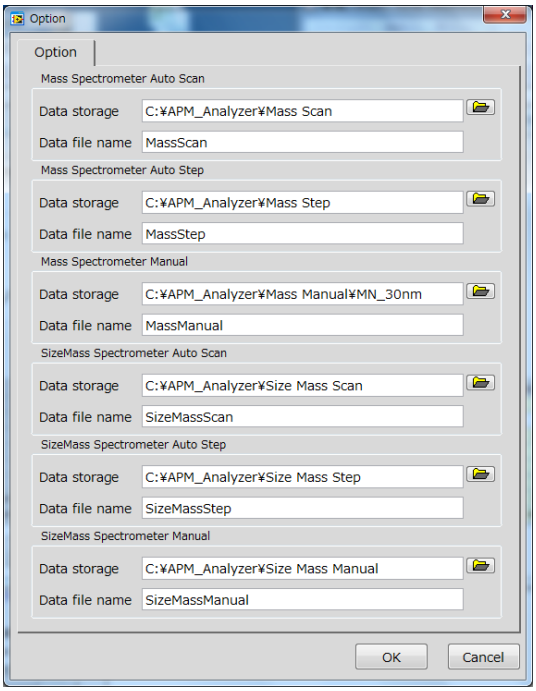
Click the DMA tab to display the DMA parameter settings.

Item	Operation and Confirmation
Motor start time	Set the length of time required to stabilize the motor rotation. If the setting is less than 80 seconds, the motor rotation may fail to stabilize.
CPC Zero Check	Tick the box to start measuring after the value becomes less than [Zero Level at Particle Counter].
Zero level at particle counter	Enter the acceptable concentration level to start a measurement. If the aerosol concentration is greater than the set value, the concentration will be monitored up to 1 minute. If the aerosol concentration is still greater than the set value after a lapse of 1 minute, the window to start or stop the measurement will appear.
APM Outside diameter of cylinder	Make sure it is 0.05.
APM Inside diameter of cylinder	Make sure it is 0.048.
APM Length of cylinder	Make sure it is 0.10.
DMA Outside diameter of cylinder	The diameter varies with the connecting DMA. For each value, refer to TSI manual. (0.009 for Model 3081A)
DMA Inside diameter of cylinder	The diameter varies with the connecting DMA. For each value, refer to TSI manual. (0.02 for Model 3081A)
DMA Length of cylinder	The length varies with the connecting DMA. For each value, refer to TSI manual. (0.444 for Model 3081A)
DMA Wait time	Make sure it is 0.2.
Charge amount of particles	Enter the number of the charges applied to particles. Enter 1 under normal conditions.

5.2.3 Option (O)

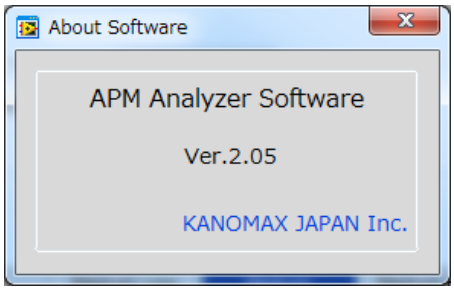
This menu is to set a destination file to save the measured data in each operation mode. Click [Tool] → [Communication] to display the following window. Those set values are default. The format of data file name is:

Set text to Data file Name (as prefix) + date and time (YYYYMMDDhhmmss).
Example) Mass Spectrometer MassScan20161212140352.CSV



5.2.4 Help (H)

The software version information is displayed.



6. Measuring

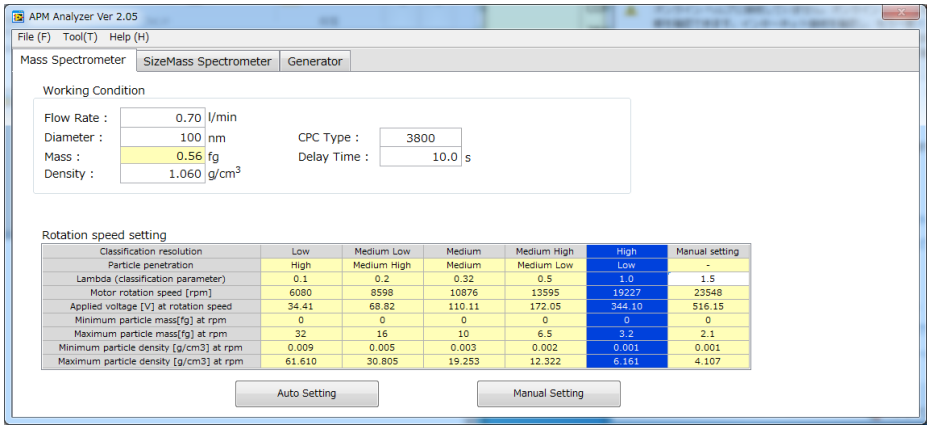
This software controls the Mass Spectrometer and DMA to separate particles of the arbitrary size and perform mass classification.

6.1 Mass Spectrometer

Mass Spectrometer scans applied voltage under a certain rotation speed and classifies aerosol particles by mass.

6.1.1 Mass Spectrometer (Main Window)

Enter the basic conditions such as Flow Rate and Diameter. Rotation speed settings will be determined by the entered values.

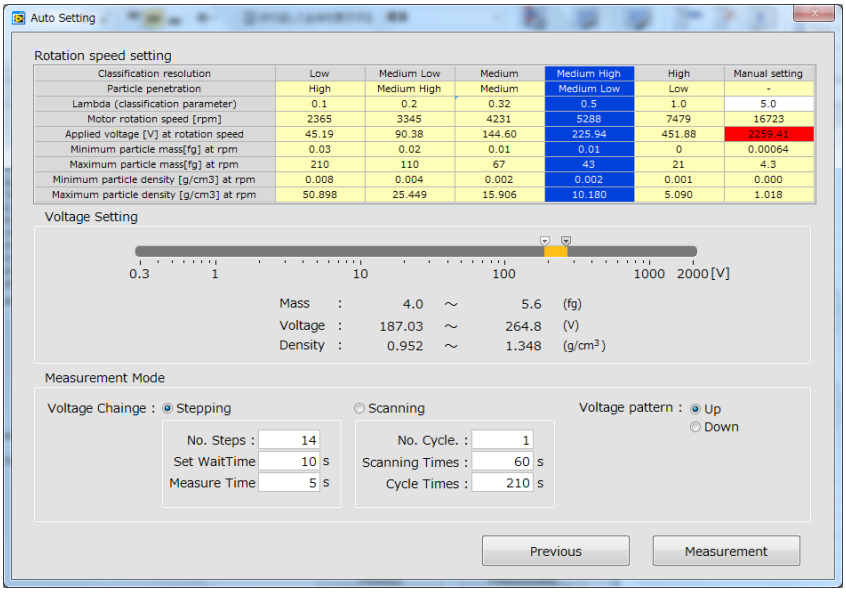


Item	Description
Flow Rate	Enter the flow rate passing the APM Classifying Unit in l/min.
Diameter	Enter the diameter of particles passing the APM classifier in nm. Input range is from 1 to 1000.
Mass	The mass is calculated based on Diameter and Density (particle density). If the value is out of the classification range, it will be displayed in red.
Density	Enter the representing value of particle density. Default is 1.0g/cm^3 and the input range is from 0.1 to 600.0.
Delay Time	Enter the measurement delay time caused by the particle transiting from the exit of APM classifier and to the CPC detector. Input range is from 0.0 to 600.0.

On the extreme right of the table of Rotation speed setting (Manual Setting), arbitrary λ can be entered.
When entering, Rotation speed should not exceed 14000rpm, which is beyond the speed limit of the rotating part; therefore the rotation speed does not reach the set rotation speed and classification cannot be started.

6.1.2 Mass Spectrometer (Auto Setting)

Click the [Auto Setting] button on the Main Window to display the following window.

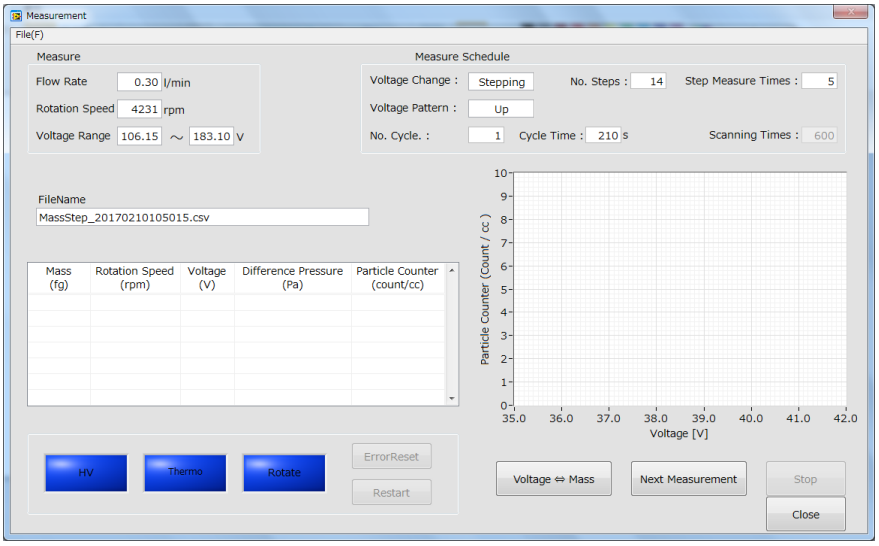


Click the [Previous] button to return to the previous window.

Click the [Measurement] button to move to the Measurement window to start classification measurement.

Item	Function and Operation
Mass	Display the mass (from the minimum to maximum) of the classification range. Input range is from 0.01 to 100. **Confirm that the voltage value does not exceed the range.**
Voltage	Display the voltage (from the minimum to maximum) of the classification range. The voltage range is from 0.3 to 2000. **Confirm that the classification value does not exceed the range.**
Density	Vary with the selected Mass or Voltage. No effect on classification.
Voltage Change	Select [Stepping] when changing the applied voltage step by step. Select [Scanning] when changing the applied voltage smoothly.
Voltage pattern	Select [Up] when changing the applied voltage from low to high. Select [Down] when changing the applied voltage from high to low.
No. Steps	Display the number of steps when the applied voltage is changed step by step. 'No. Steps' cannot be used for Scan.
Set Wait Time	Set the length of time to start a measurement after changing the applied voltage step by step.
Measure Time	Set the measurement time for each step.
No. Cycle	Set the number of cycles.
Scanning Times	Set the length of a scanning time (length of time to change the applied voltage). The scanning time is up to 600 seconds.
Cycle Times	Set the length of time to the next scan starts.

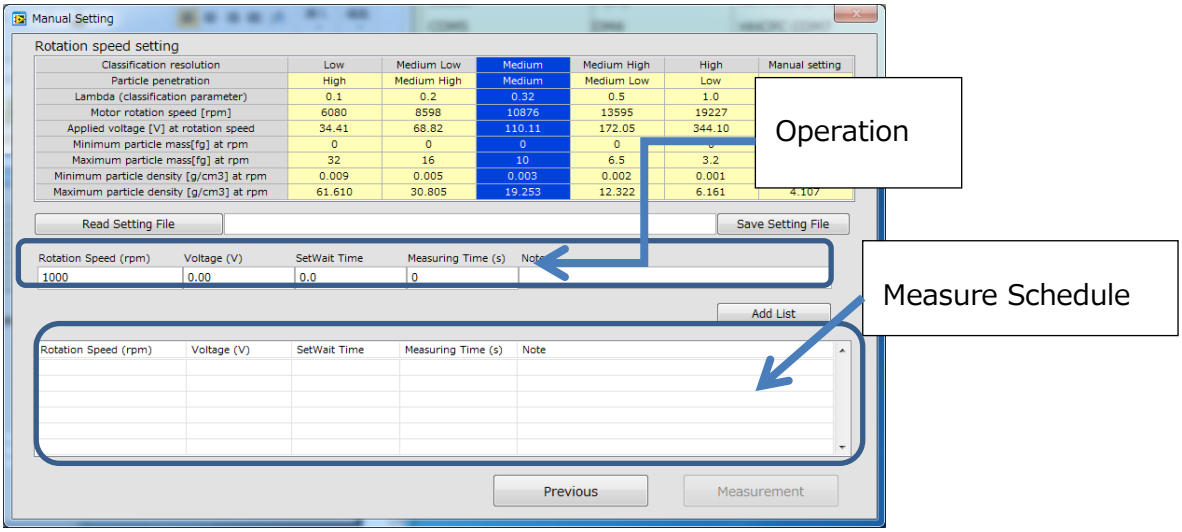
6.1.3 Mass Spectrometer Auto Measurement (Measurement)



Item	Function and Operation
File	Open the window to read the saved data. This function is enabled after completing or stopping a measurement.
Flow Rate	Display the flow rate passing the APM classifier in l/min.
Rotation Speed	Display the value set in the Auto Setting. The window does not allow you to modify the values.
Voltage Range	
Voltage Change	Display the values set in the Auto Setting. This window does not allow you to modify the values. The items of gray background are disabled.
Voltage Pattern	
No. Steps	
No. Cycle	
Cycle Time	
Step Measure Times	
Scanning Times	
FileName	Display the data file name set in [Tool] → [Option] menu. Data file Name＋date and time (YYYMMDDhhmmss)
Voltage ⇔ Mass	Click this button to switch the X-axis of the graph from Voltage to Mass.
Next Measurement	Click this button to perform the next measurement with the same setting.
Stop	Click this button to suspend the measurement.
Close	Click this button to close the measurement window.

6.1.4 Mass Spectrometer (Manual Setting)

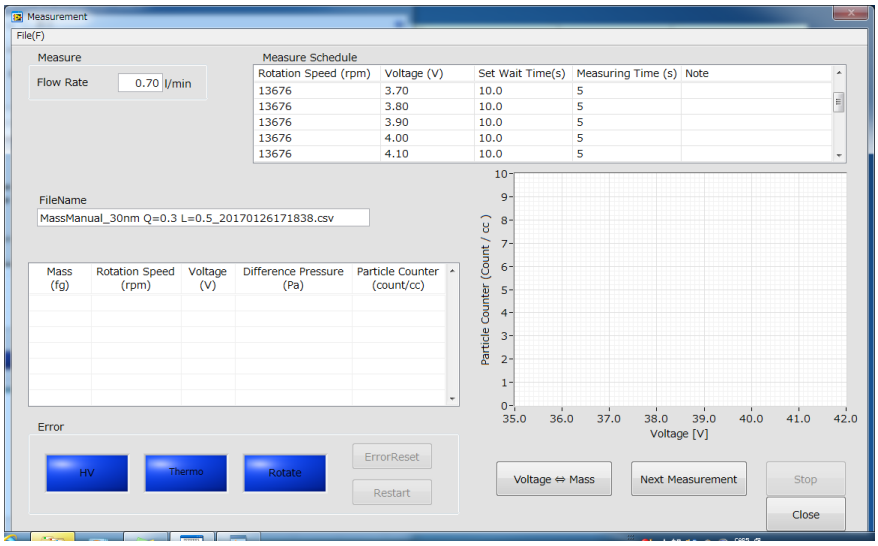
Click the [Manual Setting] button on the main window to display the following Manual Setting window.
Directly input numerical values into the Operation to control the operation of the classification measurement.



Set operation condition in the “Operation Setting Box”. Point and click on each column and enter set value in the half-width number. By clicking [Add List], the entered values are to be copied onto the “Measure Schedule” table.

Item	Function and Operation
Save Setting File	To save the Measure Schedule under the arbitral file name. Format is CSV.
Read Setting File	To read the saved list of operation schedule.
Add List	Click to add each value entered in the operation setting box to the Measure Schedule.
Rotation speed setting	Display reference values.
Rotation Speed	Set the rotation speed of the classifier. The settable range is from 1000 to 14000.
Voltage	Set the applied voltage. The settable range is from 1 to 2000V.
Set Wait Time	Set the wait time to start a measurement after the rotation speed and applied voltage reach the set values. No CPC data during the wait time will be recorded.
Measuring Time	Length of time to measure the value obtained by the CPC. The average value during the Measuring Time will be recorded.
Note	Use this blank for a memorandum. Enter special comments and instructions.
Operation Setting Box	Mouse over each box to select it. Click the box and enter the value in one-byte numbers.
Measure Schedule	Mouse over each box to select it. Click the box to edit. (Directly enter the values without using the operation setting box.)

6.1.5 Mass Spectrometer Manual Measurement (Measurement)



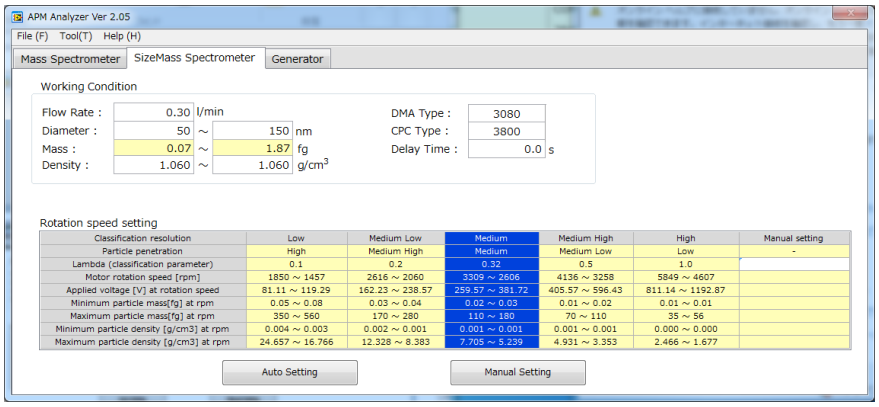
Item	Function and Operation
Flow Rate	Display the flow rate passing the APM classifier set on the Main Window.
Measure Schedule	Display the Measure Schedule set on the Manual setting window.
FileName	Display the data file name set in [Tool] → [Option] menu. Data file Name + date and time (YYYMMDDhhmmss)
Voltage ⇔ Mass	Click this button to switch the X-axis of the graph from Voltage to Mass.
Next Measurement	Click this button to perform the next measurement with the same setting.
Stop	Click this button to suspend the measurement.
Close	Click this button to close the measurement window.

6.2 SizeMass Spectrometer

This menu is to select the diameter of aerosol particles output from the connected DMA（Model 3080 or 3082）and classify those aerosol particles based on mass.

6.2.1 SizeMass Spectrometer（Main Window）

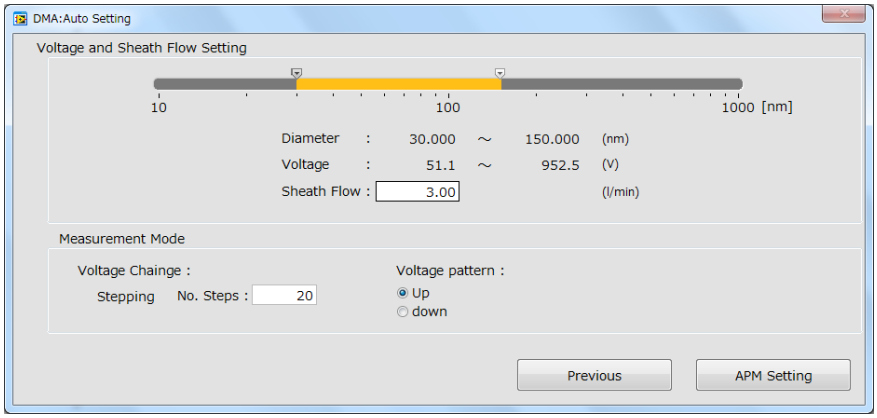
Enter the basic conditions such as Flow Rate and Diameter on this window. Rotation speed settings will be determined by the entered values.



Item	Description
Flow Rate	Enter the flow rate passing the APM classifier in l/min.
Diameter	Enter the diameter of particles passing the APM classifier in nm. Input range is from 1 to 1000.
Mass	The mass is calculated based on Diameter and Density (particle density). If the value is out of the classification range, it will be displayed in red.
Density	Enter the representing value of particle density. Default is 1.0g/cm^3 and the input range is from 0.1 to 600.0.
Delay Time	Enter the measurement delay time caused by the particle transiting from the exit of APM classifier to the CPC detector. Input range is from 0.0 to 600.0.

6.2.2 SizeMass Spectrometer (DMA: Auto Setting)

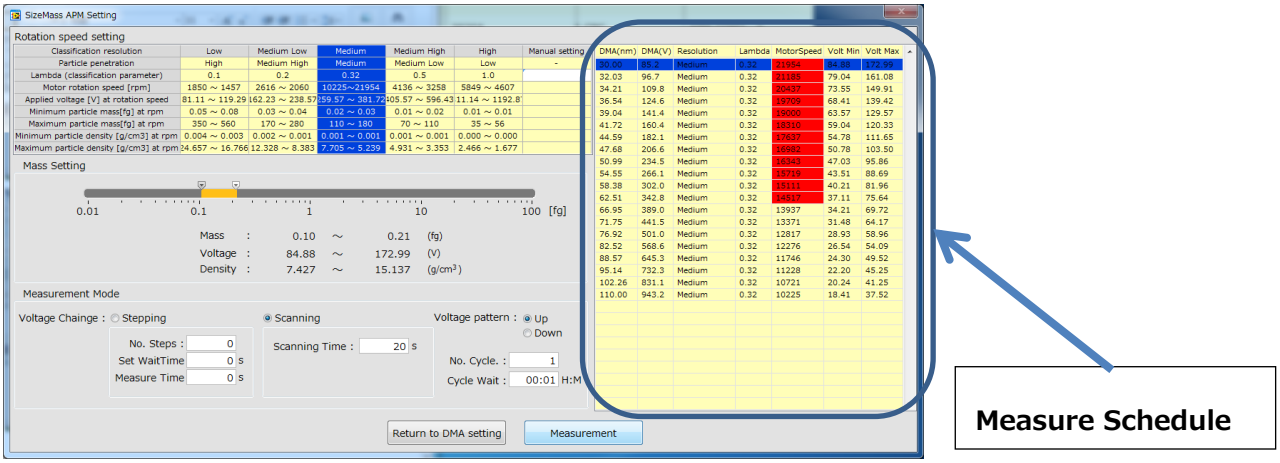
Click the [Auto Setting] button on the SizeMass Spectrometer window to display the following window.
Set the operation of the DMA on this window.



Item	Function and Operation
Diameter	Display particle sizes (from the minimum to maximum) of the classification range, which can be directly entered by clicking. Classification range : From 0 to 500 or from 0 to 1000 (The range varies with the DMA in use.)
Voltage	Classification voltage varies with the set Diameter.
Sheath Flow	Set the sheath flow of the DMA. Changing this value will change the above Voltage.
Stepping No. Steps	Divide* the range of particle diameter set in [Diameter] by the value entered in [No. Steps]. *Equally divide by the logarithm of the mobility equivalent diameter
Voltage Pattern	Select [Up] when changing the applied voltage from low to high. Select [Down] when changing the applied voltage from high to low.

6.2.3 SizeMass Spectrometer (SizeMass APM Setting)

Click the [APM Setting] button on the previous 'DMA : Auto Setting' window to display the following window.

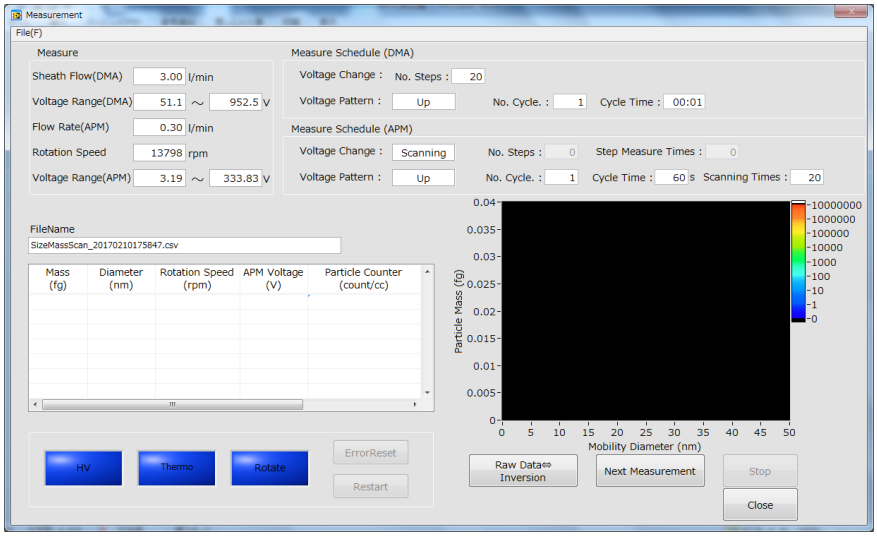


Item	Function and Operation
Mass	Display the mass (from the minimum to maximum) of the classification range. Input range is from 0.01 to 100 **Confirm that the voltage value does not exceed the range.**
Voltage	Display the voltage (from the minimum to maximum) of the classification range. The voltage range is from 0.3 to 2000 **Confirm that the classification value does not exceed the range.**
Density	Varies with the selected Mass or Voltage. No effect on classification.
Voltage Change	Select [Stepping] when changing the applied voltage step by step. Select [Scanning] when changing the applied voltage smoothly.
Voltage pattern	Select [Up] when changing the applied voltage from low to high. Select [Down] when changing the applied voltage from high to low.
No. Steps	Display the number of steps when the applied voltage is changed step by step. 'No. Steps' cannot be used for Scan.
Set Wait Time	Set the length of time to start a measurement after changing the applied voltage step by step.
Measure Time	Set the measurement time for each step.
Scanning Time	Set the length of a scanning time (length of time to change the applied voltage). The scanning time is up to 600 seconds.
No. Cycle	Set the number of cycles.
Cycle Wait	Set the length of time to start the next scan.

- Red-colored highlight in the Measuring Schedule on the right indicates that the value is out of the settable range and the setting should be changed.
- If the Rotation Speed is highlighted in red, change the Rotation Speed Setting (decrease the value of λ) or change the classification range of DMA (increase the setting of the minimum diameter).
- If Volt Min (Minimum Voltage) is highlighted in red, decrease the setting of the minimum value of the classification mass range.
- If Volt Max (Maximum Voltage) is highlighted in red, decrease the setting of the maximum value of the classification mass range.
- Click the [Return to DMA setting] button to return to the previous window.
- Click the [Measurement] button to move to the Measurement window to start classification measurement.

6.2.4 SizeMass Spectrometer Auto Measurement (Measurement)

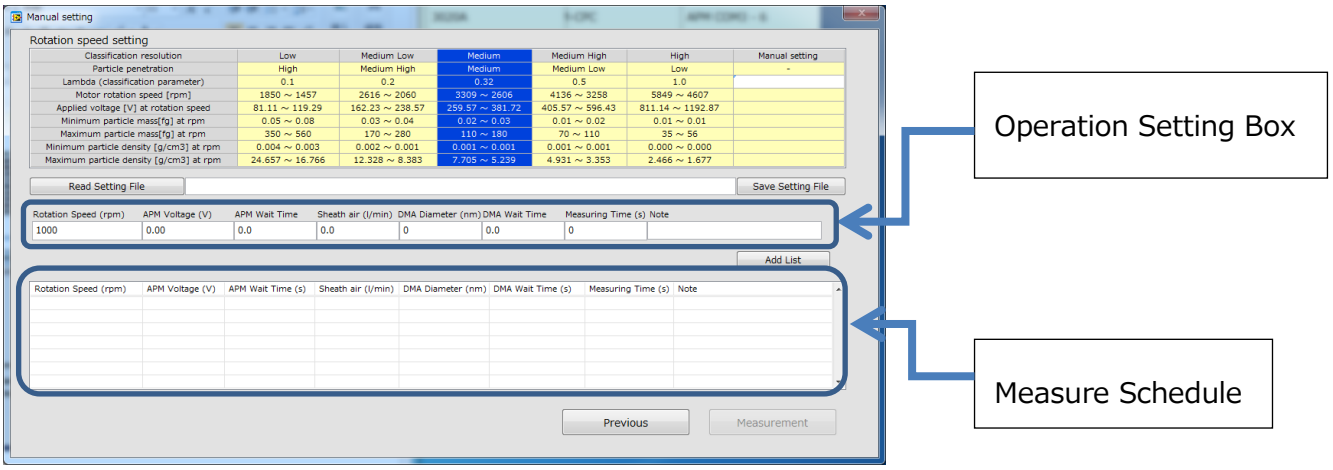
Measurement result is to be shown on the graph. The measurement result is shown in the chart area on the lower right corner of the screen. The graph displays the results with the Mobility Diameter on the X axis and Particle Mass on the Y axis. The particle concentration for each combination of the particle diameter and mass is shown in color.



Item	Function and operation
File	Open the window to read the saved data.
Sheath Flow (DMA)	Display the sheath flow of the set DMA.
Voltage Range (DMA)	Display the voltage range of the set DMA.
Flow Rate (APM)	Display the flow rate passing the APM classifier in l/min.
Rotation Speed (APM)	Display the values set in the APM Setting window of SizeMass Spectrometer.
Voltage Range (APM)	
Voltage Change (DMA)	Display the values set in the DMA: Auto Setting window of Size Mass Spectrometer.
Voltage Pattern (DMA)	
No. Steps (DMA)	
No. Cycle (DMA)	
Cycle Time (DMA)	
Voltage Change (APM)	Display the values set in the Auto Setting. This window does not allow you to modify the values. The items shown with a gray background are disabled.
Voltage Pattern (APM)	
No. Steps (APM)	
No. Cycle	
Cycle Time (APM)	
Step Measure Times (APM)	
Scanning Time (APM)	
FileName	Display the data file name set in [Tool] → [Option] menu. Data file Name+date and time (YYYMMDDhhmmss)
Raw Data⇔Inversion	This button is for the future upgrade.
Next Measurement	Click this button to perform the next measurement with the same setting.
Stop	Click this button to suspend the measurement.
Close	Click this button to close the measurement window.

6.2.5 SizeMass Spectrometer (Manual Setting)

Click the [Manual Setting] button on Size Mass Spectrometer window to display the following window.
Directly input numerical values in the Operation to control the operation of the classification measurement.

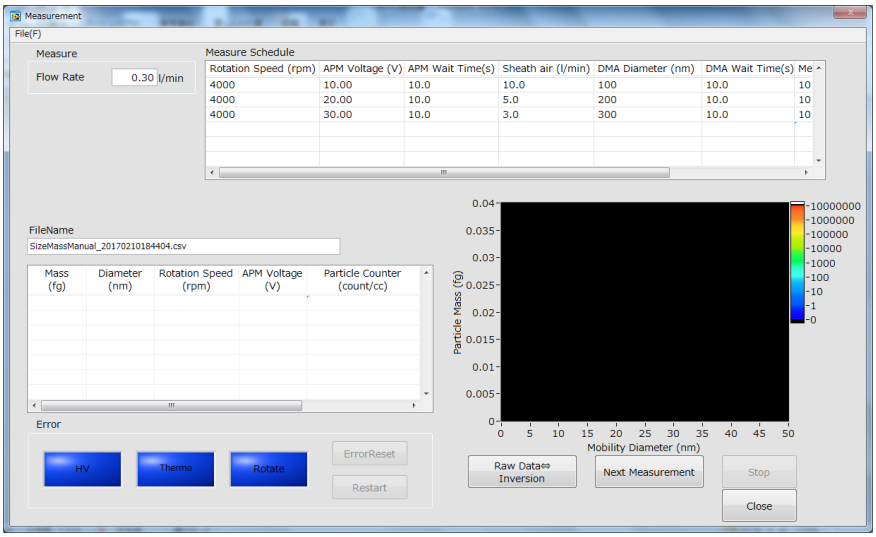


Set operation condition in the “Operation Setting Box”. Point and click on each column and enter the set value in the half-width number. By clicking [Add List], the entered values will be copied onto the “Measure Schedule” table.

Item	Function and Operation
Save Setting File	To save the Measure Schedule under the arbitral file name. Format is CSV.
Read Setting File	To read the saved list of operation schedule
Add List	Click to add each value entered in the operation setting box to the Measure Schedule.
Rotation Speed Setting	Display reference values.
Rotation Speed	Set the rotation speed of the classifier. The settable range is from 1000 to 14000.
APM Voltage	Set the applied voltage. The settable range is from 1 to 2000V.
APM Wait Time	Display the wait time prior to starting the measurement after the rotation speed and applied voltage reach the set values. No CPC data during the wait time will be recorded.
Sheath air	Set the Sheath Flow of the DMA.
DMA Diameter	Set the diameter output from the DMA.
DMA Wait Time	Display the wait time prior to starting the measurement after the applied voltage and sheath flow (for separating particles of the specific diameter) reach the set values. No CPC data during the wait time will be recorded.
Measuring Time	Length of time to measure the value obtained by the CPC The average value during the Measuring Time will be recorded.
Note	Use this blank for a memorandum. Enter special comments and instructions.
Operation Setting Box	Mouse over each box to select it. Click the box and enter the value in one-byte numbers.
Measure Schedule	Mouse over each box to select it. Click the box to edit. (Directly enter the values without using the operation setting box.)

6.2.6 SizeMass Spectrometer Manual (Measurement)

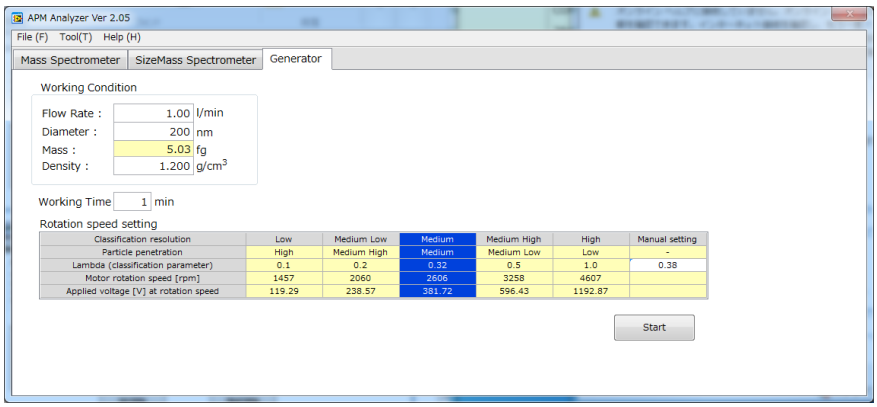
Measurement result will be shown on the graph. The measurement result is shown in the chart area on the lower right corner of the screen. The graph displays the results with the Mobility Diameter on the X axis and Particle Mass on the Y axis. The particle concentration for each combination of the particle diameter and mass is shown in color.



Item	Function and Operation
Flow Rate	Display the flow rate passing the APM classifier set on the Main Window.
Measure Schedule	Display the Measure Schedule set in the Manual setting window.
FileName	Display the data file name set in [Tool] → [Option] menu. Data file Name＋date and time (YYYMMDDhhmmss)
Raw Data⇔Inversion	This button is for the future upgrade.
Next Measurement	Click this button to perform the next measurement with the same setting.
Stop	Click this button to suspend the measurement.
Close	Click this button to close the measurement window.

6.3 Generator

Select [Generator] in the Operation mode to separate and output only particles of single mass.



Item	Description
Flow Rate	Enter the flow rate passing the APM classifier in l/min.
Diameter	Enter the diameter of particles passing the APM classifier in nm. Input range is from 1 to 1000.
Mass	The mass is calculated based on Diameter and Density (particle density). If the value is out of the classification range, it will be displayed in red.
Density	Enter the representing value of particle density. Default is 1.0g/cm^3 and the input range is from 0.1 to 600.0.
Working Time	Time length for classification. Enter the measurement delay time caused by the particle transiting from the exit of APM classifier to the CPC detector. Input range is from 1 to 600.

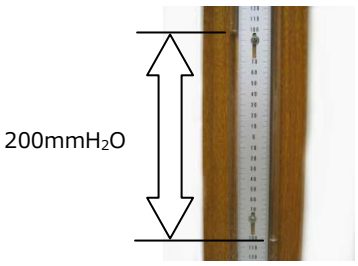
7. Maintenance

Regular maintenance (once a year) is recommended in order to maintain sufficient performance of this product. If you find that the rotation speed or applied voltage does not reach their setting values, or anything else unusual including leakage, be sure to perform the maintenance listed below.

7.1 Leak Test

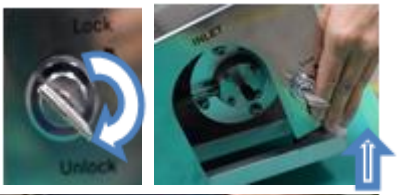
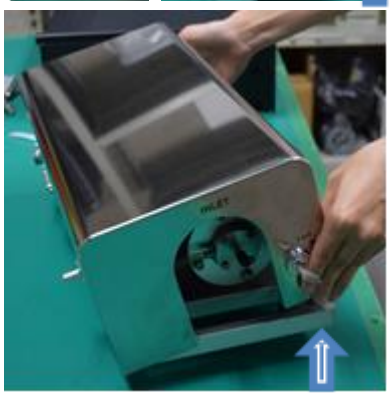
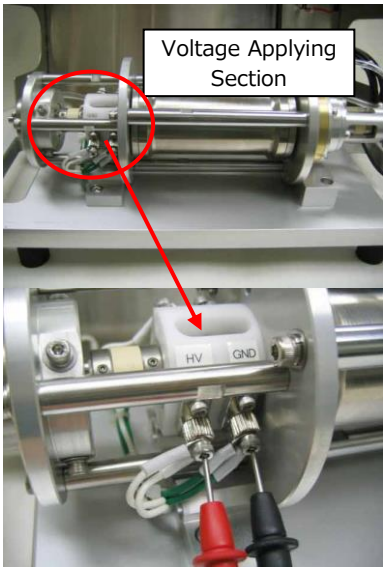
Magnetic fluid is used as a sealing material to prevent an air leakage between the rotating and fixed sections of the Classifying Unit. The long-hour use at high rotation speeds may cause the dispersion of the magnetic fluid, resulting in air leakage.

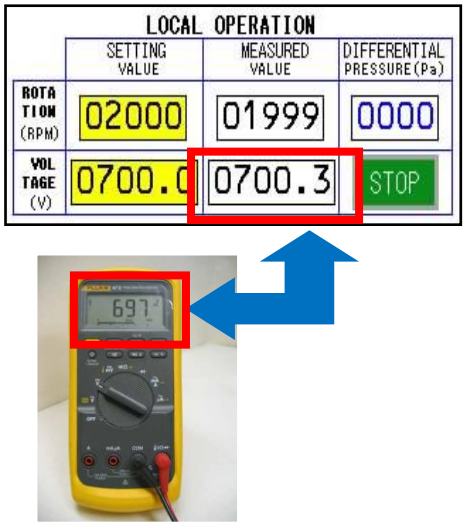
When zero cannot be obtained, leak test must be performed. A differential manometer, which can measure 3kPa (300mmH_2O) such as a U-tube, and a rubber pipette are required for the test.
Connect a differential manometer to the Inlet (1) of the Classifying Unit, vacuum the inside of the Classifying Unit with the rubber pipette connected to the Outlet (6). If leakage is observed, the magnetic fluid must be replenished. Please refer to **7.4 Replenishing Magnetic Fluid (page 33)** for replenishing the magnetic fluid.

Location	Description
	1) Prepare the U-tube.
	2) Connect one side of the U-tube to the Inlet (1) of the Classifying Unit as shown left.
	3) Prepare a rubber pipette. Connect it to the Outlet (6) of the Classifying Unit.
	4) Vacuum air from the inside of the Classifying Unit using the rubber pipette until the inside differential pressure against atmospheric pressure becomes -200±20 mm$H_2$0. Then record the reading. Leave it for 1 minute. After that, read the differential pressure. The acceptable range of variation is 5mm$H_2$0 or less for 1 minute.

7.2 Applied Voltage Test

The applied voltage test is for confirming the consistency between the voltage applied to the Classifying Unit and the voltage indicated on the Applied Voltage Display (F) of the Control Unit. The voltage applied to the Classifying Unit can be measured by connecting a voltage meter directly to the voltage applying section.

Location	Description
	1) Connect the HIGH VOLTAGE Connector (9) on the rear panel of the Classifying Unit and (N) on the rear panel of the Control Unit by the High Voltage Power Cable.
 	2) Set the key switch to UNLOCK and lift up and open the ends of both sides as shown on the left.
	Open the cover of the Classifying Unit. You will see the voltage applying section. Two cables (white one and green one) are respectively connected to the high voltage applying section (white), and the GND section (green). To measure the voltage, make sure to connect the positive (+) side of the voltage meter to the high voltage applying section (white) and the COM side to the GND section (green). Before measuring, confirm the maximum measurable voltage of the voltage meter, and make sure that the applied voltage does not exceed the limit. Turn the POWER switch (A) of the Control Unit and confirm that it is in LOCAL mode.



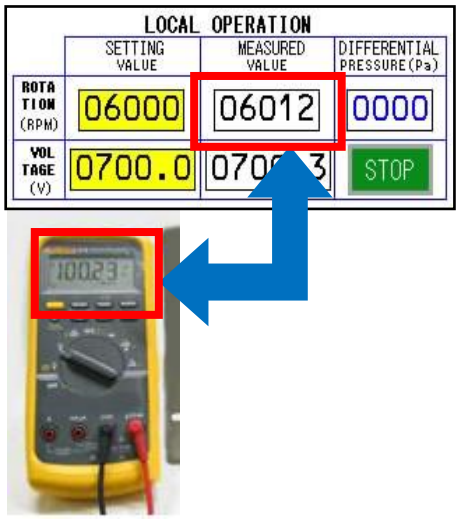
3) Enter the appropriate value in the VOLTAGE section of the SETTING VALUE on the LCD panel (Touch panel). Compare the voltage displayed on the Applied Voltage Display of the Control Unit with the voltage at the voltage applying section of the Classifying Unit. **Make sure that the applied voltage does not exceed the maximum measurable voltage of the voltage meter.** If the voltage at the voltage applying section of the Classifying Unit is significantly different from the voltage displayed on the Applied Voltage Display, there is a possibility of failure.

In addition, if the voltage at the voltage applying section of the Classifying Unit is 0V, cables may be disconnected in the Classifying Unit or Control Unit. If that is the case, repair is required. Please contact your distributor or KANOMAX service center.

After measuring, confirm that the measured applied voltage turns to 0, turn off the POWER switch of the Control Unit and close the cover of the Classifying Unit.

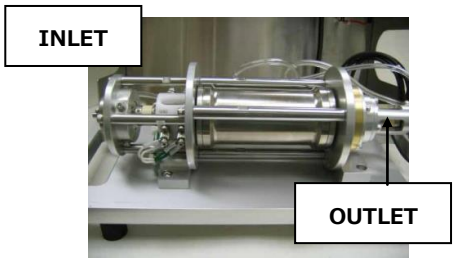
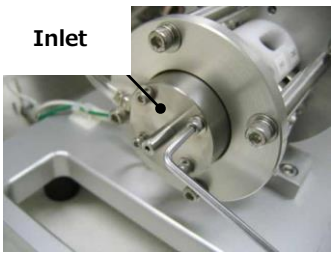
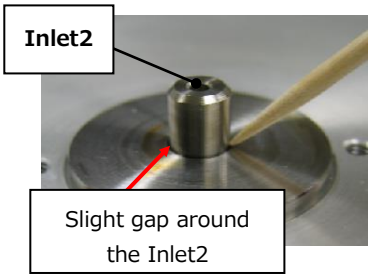
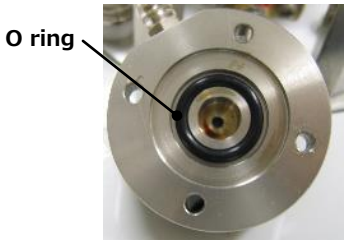
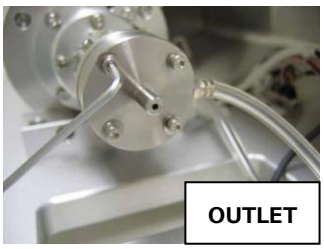
7.3 Rotational Speed Test

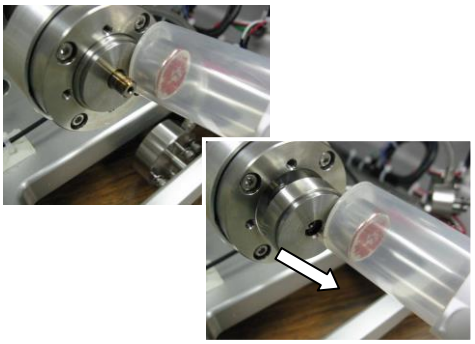
The rotational speed test is for confirming the consistency between the motor rotational speed (rpm) configured in the Control Unit and the rotational speed (rpm) obtained from the MOTOR REVOLUTION [PULSE (RPS)] (L) on the rear panel of the Control Unit. For the measurement, a frequency counter or an instrument such as multimeter, which can measure frequency, is required.

Location	Description
	1) Connect two cables; - Connect the MOTOR Connector (7) of the Classifying Unit and MOTOR Connector (J) of the Control Unit by the Motor Power Cable. - Connect the MOTOR CONTROL Connector (8) of the Classifying Unit and the HALL SENSOR & PRESSURE GAUGE (K) by the Motor Control Cable. Connect a frequency counter to the MOTOR REVOLUTION [PULSE (RPS)] (L) on the rear panel of the Control Unit, and turn ON the POWER Switch (B) of the Control Unit, and then confirm if LOCAL mode is selected.
	2) Enter the appropriate value in the ROTATION section of the SETTING VALUE (C) on the Touch panel. Confirm the consistency between the MEASURED VALUE of ROTATION (D) and the rotation speed obtained from the instrument. From the MOTOR REVOLUTION [PULSE (RPS)] (L) 1 pulse is output per 1 rotation. Rotational speed is indicated as revolutions per minutes [rpm]. In order to obtain the revolutions per second [Hz], the value in rpm must be divided by 60. e.g. 6000 rpm: 6000 rotations per minute (60 sec) i.e., 100 rotations per second → Frequency is 100 Hz. * When the rotational speed is changed between 0 and 14000 rpm, the reading of the multimeter will vary between 0 and 233Hz. When a measurement is completed, confirm that the measured rotation speed turns to 0. Then turn off the POWER Switch (B) of the Control Unit.

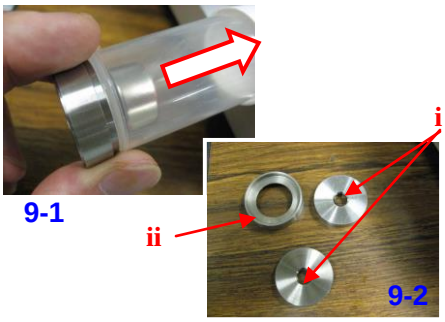
7.4 Replenishing Magnetic Fluid

If air leakage is observed by the Leak Test (P.29), the Magnetic Fluid needs to be reapplied.
The Magnetic Fluid must be supplied in the Inlet and the Outlet. Prepare the Hexagon Wrench and a tapered stick something like a toothpick for the application of the Magnetic Fluid. Be sure to apply the Magnetic Fluid to (1) on the Left Side and (6) on the Right Side of the Classifying Unit. (See 1.1 Classifying Unit) Be sure to add the Fluid to the Inlet as well as the Outlet. There is a possibility that you touch the Magnetic Fluid with your hand during this work. * Wear rubber gloves when handling the Magnetic Fluid.

Location	Description
	1) Open the cover of the Classifying Unit.
	**<INLET SIDE>** 2) Unscrew the screws (4 locations) that fixate the inlet with a hexagon wrench. Then take out the inlet.
	3) When the inlet is removed, you see the Inlet2 (see left). 4) Take a small amount of the magnetic fluid at a tip of a toothpick, and uniformly apply the magnetic fluid on the slight gap around the inlet2. (see left)
	5) Before resetting the inlet, make sure that there is no scattered magnetic fluid around the Inlet2. The magnetic fluid around the inlet must be removed completely before assembling. 6) Before resetting the Inlet, make sure that the O ring is set correctly as pictured on the left.
	**<OUTLET SIDE>** * There are two locations to replenish magnetic fluid. 7) Remove four screws that fixate the outlet using a hexagon wrench. Then take the outlet out.

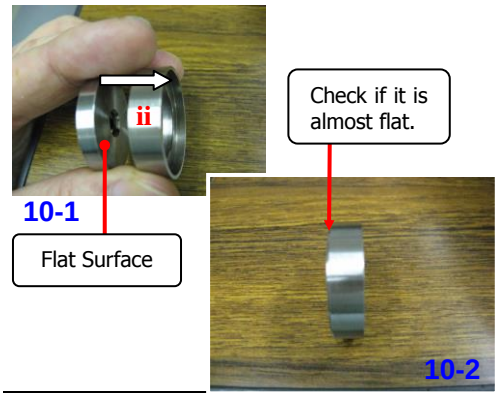


8) Pull the part out using the supplied magnet as shown on the left pictures.



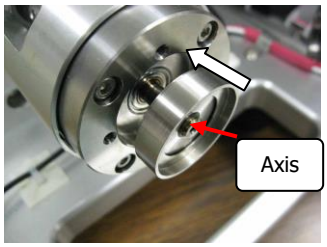
9) The part taken out in the procedure #8 consists of three parts; two pieces of magnets (i) for magnetic sealing and one piece of ring (ii).
In order to separate the three parts, hold the ring (ii) with your fingers and pull out the magnet (i) using the supplied magnet as shown in the picture 9-1. Then separate the parts as shown in the picture 9-2 on the left.

If the parts are dirty, please wipe it off.



10) Insert the magnet (i), as its purpose is to stop an air leakage, into the ring (ii).

As shown in the picture 10-1, face the flat side of the Magnet (i) to the deep hollow of the Ring (ii), and insert the Magnet into the Ring as it is. Once they are combined, the Magnet will never come out of the Ring as shown in the picture 10-2.

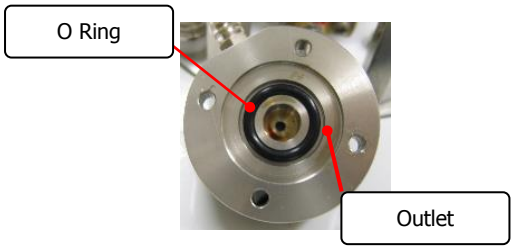


11) Insert the part prepared in the above procedure # 10.

Make sure to insert the part straight into the axis and try not to scratch or damage the axis. After inserting it, wipe off the magnetic fluid around to the axis.

12) Apply a small amount of magnetic fluid on the tip of toothpick and apply the fluid in the gap around the axis evenly. (See the pictures on the left).

13) After applying the magnetic fluid, insert the other magnet for the magnetic sealing (i) trying not to scratch or damage the axis. Then replenish the magnetic fluid as described in the above procedure # 12.

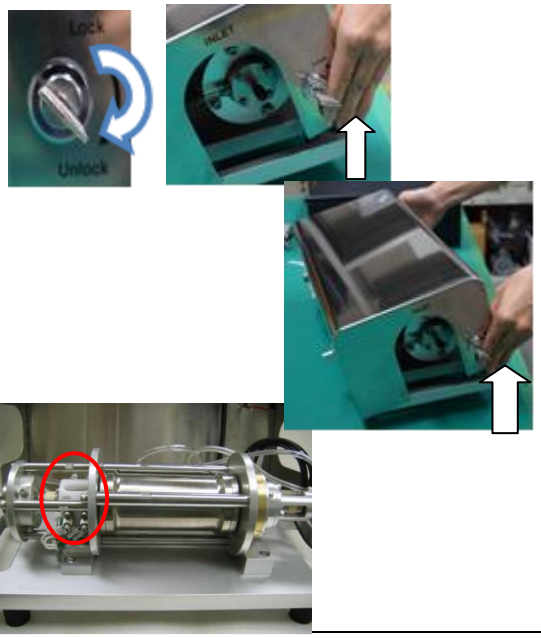
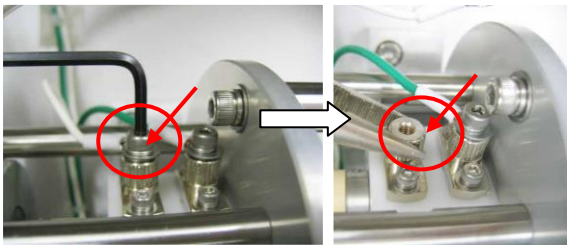
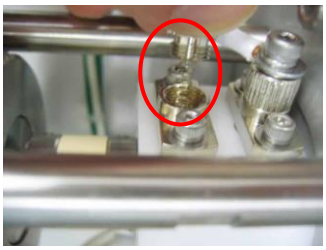
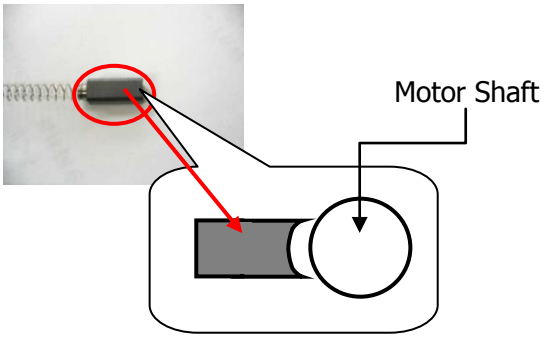


14) In the outlet removed in the procedure #7 dispersed magnetic fluid may be attached. If so, clean it off before reinstalling it.

15) Make sure that the O ring is set correctly on the Outlet, and then set the Outlet.

7.5 Replacing Carbon Brush

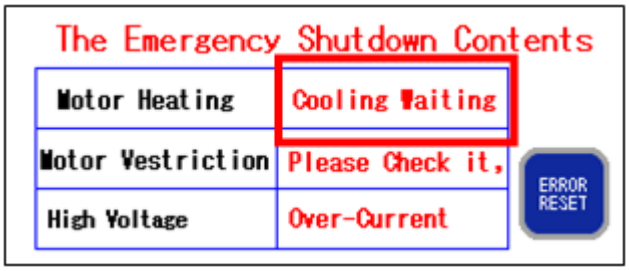
A Carbon Brush is used as a contact because high voltage is applied to the Classifying Unit. The brush touches the shaft of the rotation unit. After the instrument is used for a prolonged time, the carbon brush will become worn since the axis rotates. Replace the brush after using the instrument for about 2500 hours.

Location	Description
	1) Turn the key switch to the Unlock side and hold the ends of both sides (as shown in the left figure) and lift up to open it. Open the cover of the Classifying Unit. Carbon brushes are placed in the white housing where circled in red. (4 locations)
 2-1 3-1	2) Remove screws at two locations using the provided hexagon wrench. Then remove the high voltage cable. (See the picture 2-1 on the left.) 3) Then loosen the bottom screw using a tool such as pliers. (See the picture 3-1 on the left.)
	4) When you unscrew the bottom screw in the picture 3-1, the spring will be bounced. Do not lose the spring. If you pull the spring out, you will find the carbon brush at the tip of the spring. Check the condition of the brush deterioration. Replace the brush with a new one if necessary.
	5) The carbon brush has a very slight dent as shown on the left. When installing the brush, face the slightly dented side to the side surface of the shaft. After inserting the brush, reverse procedure to taking the brush out. When installing the brush, make sure to install the high voltage cable that was removed in the above procedure # 2.

8. Troubleshooting

8.1 Motor overheat

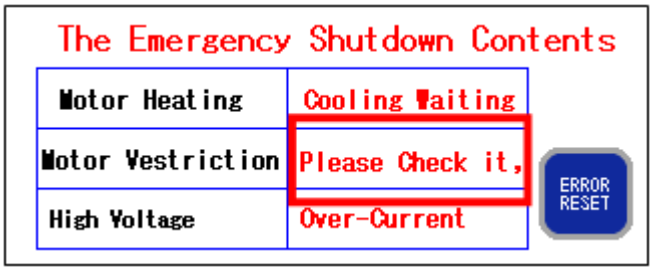
If the motor is overused, the instrument will be overheated. Keep the power on and let the instrument run for a while. When the instrument is cooled down, press the [ERROR/RESET] button again to restart it.



If [Cooling Waiting] is displayed again, please contact your distributor or KANOMAX service center for repair service.

8.2 Abnormal rotation

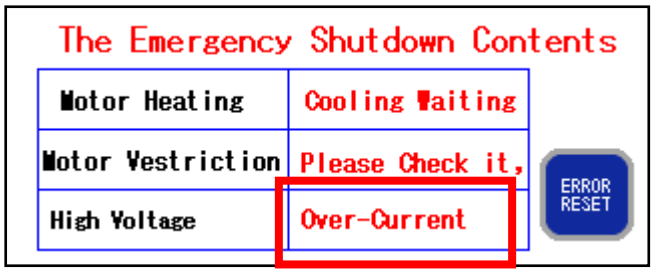
If [The Emergency Shutdown Contents] is displayed on the LCD panel (Touch panel) on the front panel of the Control Unit while rotating, the motor control may have a problem.



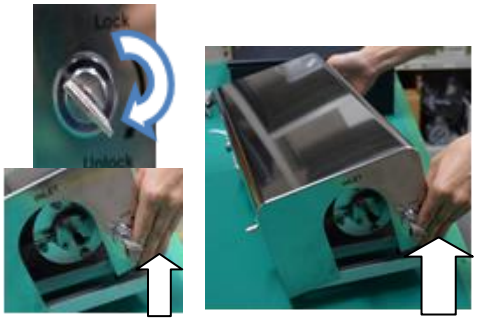
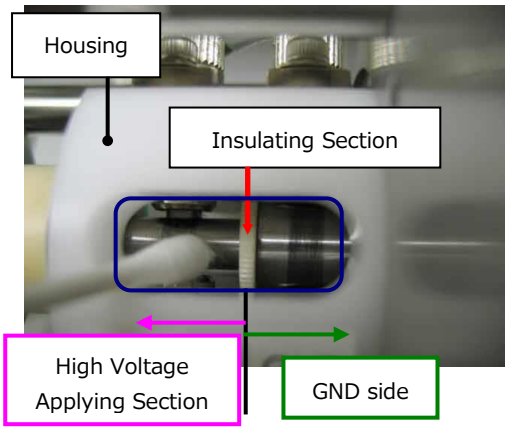
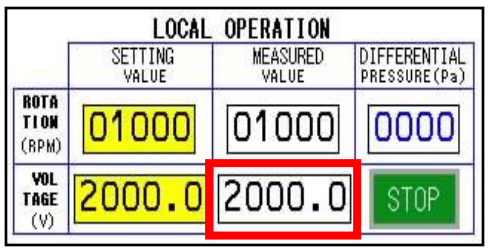
Press the [ERROR/RESET] button.
Start rotating the motor again and confirm that [The Emergency Shutdown Contents] is no longer displayed.

If [The Emergency Shutdown Contents] is displayed again, please contact your distributor or KANOMAX service center for repair service.

8.3 High Voltage Alarm



The carbon brush that is used in the APM becomes worn as the classifier rotates, and abrasive dust will be generated from the brush contacting the rotating section. If the abrasive dust is accumulated on the section insulating the high voltage and earth, the insulation resistance will reduce, which will increase the current when high voltage is applied. Under this condition, the alert as shown in the above picture will be displayed. Press the [ERROR/RESET] button once. If the alert remains, the abrasive dust of the carbon brush must be removed. The cleaning procedure will be provided below. A cotton swab is required for cleaning.

Location	Description
	1) Turn the key switch to the Unlock side and lift up and open the ends of both sides as shown in the left figure.
	2) There is a white housing at the INLET side. It consists of a high voltage applying section, an insulation section and GND section as shown on the left. If the abrasive dust attaches to the insulation section and the high voltage applying section and GND are electrically connected, the alarm will be activated.
	Use a cotton swab to touch the insulation section (white part in the middle). Turn the classifier (2) very slowly to wipe it. Cleaning will become easier if the cotton swab is soaked in ethyl alcohol. Be sure to clean with the cotton swab on the High Voltage Applying Position as well as GND side. Then, clean the abrasive dust attached to the hole on the side of the housing and the inner wall.
	3) Close the cover, and turn the Key Switch to the LOCK position. 4) Set the voltage of (E) 2000V in the LOCAL mode, and press STAR to apply 2000V, and confirm that the [The Emergency Shutdown Contents] is not displayed on the LCD panel (Touch panel). If the [The Emergency Shutdown Contents] sign is displayed again, the APM-II needs repairing. Please contact your distributor or KANOMAX service center.

8.4 Interlock Function

This instrument has an Interlock Function for safety reasons.
This function stops the Motor urgently if the Motor makes an abnormal rotation or the classifier cover is open. If that is the case, the LCD panel (Touch panel) on the front panel of the control unit indicates [Warning].

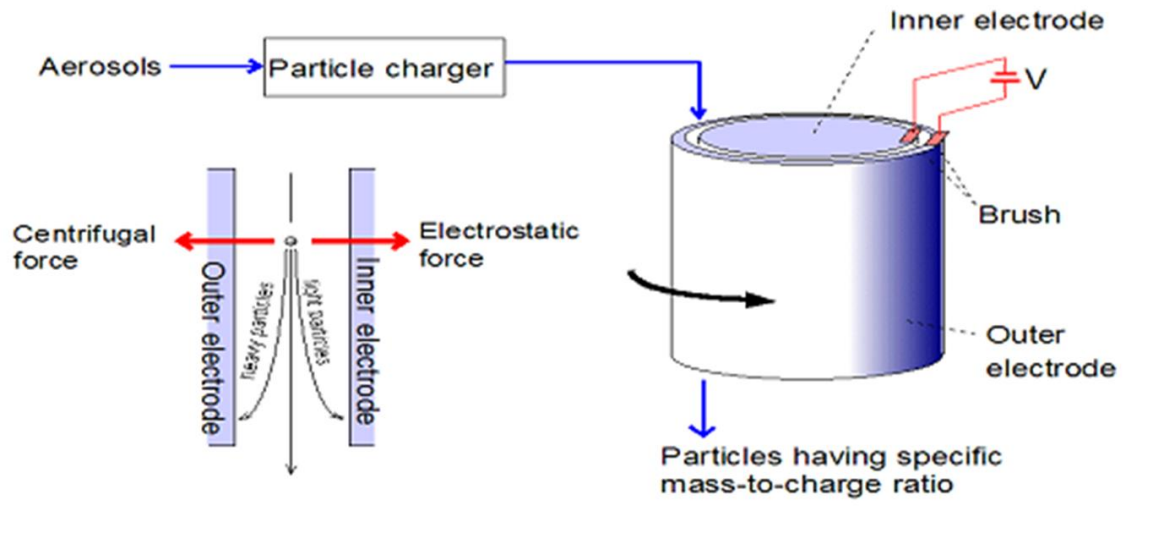
Location	Description
	**Point to be checked and how to unlock when Interlocked** Interlock is on when the cover is opened or the key lock is unlocked. →Close the cover, and turn the key lock to the LOCK position. →Press the [Confirmation] button. When the interlock function is activated in REMOTE mode, change the mode to LOCAL mode and perform the above procedure. If the alert is displayed again, please contact your distributor or KANOMAX service center for repair service.

9. Principle of Measurement

The Aerosol Particle Mass Analyzer (APM) is an instrument that takes in the sample air in which the particles are included, and selectively takes out particles of a specific mass. The particles are introduced into the classifier after passing through a bipolar charger where they are brought into an equilibrium charged state. In the classifier, the particles are taken into an annular space formed between the two coaxial cylindrical electrodes that rotate in high-speed. In between the electrodes, the charged particles flow downwards in the direction of the rotation of axis carried in the ambient air, with its movement in the radial direction being affected by the centrifugal force and electrostatic force. When the centrifugal force exceeds the electrostatic force, the particle is collected on the surface of the outer electrode, and when the electrostatic force exceeds the centrifugal force, the particle is collected on the surface of the inner electrode. Since the centrifugal force is proportional to the particle mass, and the electrostatic force is proportional to the amount of electric charge of the particle, only particles of a specific mass-to-charge ratio will be taken out. That is, only particles of a consistent mass-to-charge ratio with their centrifugal and electrostatic forces balanced will exist in the sample air that exits from the classifier. The force that acts on a particle can be expressed by the following equation.

$$m \cdot \omega^2 \cdot r = n \cdot e \cdot E = \frac{n \cdot e \cdot V}{r \cdot \ln(\frac{r_1}{r_2})}$$

Here, m is the particle mass, ω is the angular velocity, r is the radial distance to the annular space from the axis of rotation, n is the amount of electric charge, e is the elementary charge, E is the electric potential, V is the applied voltage, and r_1 and r_2 are the outer and inner radii of the two rotating cylinders, which are 25 mm and 24 mm.



10. Main Specifications

Product Name	Aerosol Particle Mass Analyzer
Model	3602
Classifying Method	Classifications based on the balance between the centrifugal force and electrostatic force.
Classifying Mass Range	0.01 to 100 femtogram
Rotational Speed of Double Cylinder	1000 to 14000 rpm
High Voltage of Double Cylinder	0 to -2000V
Dimensions of Double Cylinder	- Diameter of inner cylinder: 48mm - Space between inner and outer cylinders: 1mm - Cylinder length: 100 mm
Sampling Flow Rate	0.3 L/min. (recommended)
Differential Pressure Flow Conversion Accuracy	5 % (10% if the rotational speed is 3000rpm or less) Flow conversion error affects the transfer function. Therefore, if additional accuracy is required, prepare a flowmeter separately.
Control Function	Rotational Speed and applied voltage
Interlock Function	The motor makes an emergency stop when the classifier rotates abnormally, or the classifier's cover is open.
Display Function	Applied voltage / Rotational speed / Differential pressure between the INLET and OUTLET (panel display)
Input/Output Function	Input: Settings of applied voltage and rotational speed Output: Applied voltage, Rotational speed, and differential pressure between INLET and OUTLET
Dimensions	Classifying Unit: 400 (W) × 240 (L) × 170 (H) mm (excluding projection) Control Unit: 430 (W) × 350 (L) × 180 (H) mm
Power Supply	AC100V to 240V 50/60Hz 3A
Accessories	Operation Manual ---------- 1 Test Sheet ---------- 1 Power Cable ---------- 1 Motor Control Cable ---------- 1 Motor Power Cable ---------- 1 High Voltage Cable ---------- 1 Measurement Software ---------- 1 PC Communication Cable ---------- 1 Magnetic Fluid ---------- 1 Hexagon Wrench ---------- 1 Magnet ---------- 1

11. Warranty and After-sales Service

KANOMAX Limited Warranty

The limited warranty set below is given by KANOMAX with respect to the KANOMAX brand Aerosol Particle Mass Analyzer, Model 3602, its attachment parts including accessories (hereafter referred to as “PRODUCT”) that you have purchased. PRODUCT you have purchased shall be the only one that the limited warranty stated herein applies to.

Your PRODUCT, when delivered to you in new condition in its original container, is warranted against defects in materials or workmanship as follows: for a period of one (1) year from the date of original purchase, defective parts or a defective PRODUCT returned to your sales representative, as applicable, and proven to be defective upon inspection, will be exchanged for new or comparably rebuilt parts, or a refurbished PRODUCT as determined by your sales representative. Warranty for such replacements shall not extend the original warranty period of the defective PRODUCT.

This limited warranty covers all defects encountered in normal use of the PRODUCT, and does not apply to the following cases:

(1) Use of parts or supplies other than the PRODUCT sold by your sales representative, which cause damage to the PRODUCT or cause abnormally frequent service calls or service problems.
(2) If any PRODUCT has its serial number or date altered or removed.
(3) Loss of damage to the PRODUCT due to abuse, mishandling, improper packaging by the owner, alteration, accident, electrical current fluctuations, failure to follow operating, maintenance or environmental instructions prescribed in the PRODUCT's instruction manual provided by KANOMAX, or service performed by any person(s) or company other than KANOMAX.

NO IMPLIED WARRANTY, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, APPLIES TO THE PRODUCT AFTER THE APPLICABLE PERIOD OF THE EXPRESS LIMITED WARRANTY STATED ABOVE, AND NO OTHER EXPRESS WARRANTY OR GUARANTY, EXCEPT AS MENTIONED ABOVE, GIVEN BY ANY PERSON OR ENTITY WITH RESPECT TO THE PRODUCT SHALL BIND KANOMAX. KANOMAX SHALL NOT BE LIABLE FOR LOSS OF STORAGE CHARGES, LOSS OR CORRUPTION OF DATA, OR ANY OTHER SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES CAUSED BY THE USE OR MISUSE OF, OR INABILITY TO USE, THE PRODUCT, REGARDLESS OF THE LEGAL THEORY ON WHICH THE CLAIM IS BASED, AND EVEN IF KANOMAX HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. IN NO EVENT SHALL RECOVERY OF ANY KIND AGAINST KANOMAX BE GREATER IN AMOUNT THAN THE PURCHASE PRICE OF THE PRODUCT SOLD BY KANOMAX AND CAUSING THE ALLEGED DAMAGE. WITHOUT LIMITING THE FOREGOING, THE OWNER ASSUMES ALL RISK AND LIABILITY FOR LOSS, DAMAGE OF, OR INJURY TO THE OWNER AND THE OWNER'S PROPERTY AND TO OTHERS AND THEIR PROPERTY ARISING OUT OF USE OR MISUSE OF, OR INABILITY TO USE, THE PRODUCT NOT CAUSED DIRECTLY BY THE NEGLIGENCE OF KANOMAX. THIS LIMITED WARRANTY SHALL NOT EXTEND TO ANYONE OTHER THAN THE ORIGINAL PURCHASER OF THE PRODUCT, OR THE PERSON FOR WHOM IT WAS PURCHASED AS A GIFT, AND STATES THE PURCHASER'S EXCLUSIVE REMEDY.

After-sales Service

If the PRODUCT is malfunctioning, please check with “Troubleshooting” to find possible cause first.

Repair parts are retained for a minimum period of five (5) years after production cessation of the PRODUCT. This storage period of repair parts is considered the period during which KANOMAX can provide repair service.

For more information, please contact your sales representative. When you make a call, please have the following information of your PRODUCT at hand:

(1) PRODUCT name;
(2) Model number;
(3) Serial number;
(4) Description of Symptom, and;
(5) Date of purchase

12. Contact Information

JAPAN

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