Organization of this manual

This manual describes the features and operation method of the particle counter KM-27. In sections related to the configuration of a measurement system comprising the KM-27 and other equipment, this manual also touches upon operation of the other equipment, but to assure safe and correct operation, always consult the documentation of the other equipment as well.

This manual contains the following sections.

Outline
  Gives basic information on the unit.

Panel Explanation
  Briefly identifies and explains all panel keys, indicators, and other parts of the unit.

Preparations
  Describes installation location, power cord connection, and sampling tube connection.

Setting
  Describes how to set up the various functions using the front panel controls.

Measurement
  Describes the basic procedures for measurement.

Using the Printer
  Describes how to load paper and use the internal printer to create hard copy of measurement data.

ISO-14644 Processing
  Describes how to use the function for creating statistical data according to ISO-14644.
Maintenance
  Describes how to clean the sensor and gives information on the service life of the light source.

Serial Interface
  Describes how to use the serial interface and explains the related commands and data.

Specifications
  Lists the technical specifications of the unit.

* All company names and product names mentioned in this manual are trademarks or registered trademarks of their respective owners.
FOR SAFETY

In this manual, important safety instructions are specially marked as shown below. To prevent the risk of death or injury to persons and severe damage to the unit or peripheral equipment, make sure that all instructions are fully understood and observed.

⚠️ WARNING
Disregarding instructions printed here incurs the risk of death or severe injury to persons.

⚠️ Caution
Disregarding instructions printed here incurs the risk of injury to persons and/or damage to peripheral equipment.

Important
Disregarding instructions printed here incurs the risk of damage to the product.

Note
Mentioned about the tips to use this unit properly. (This messages do not have to do with safety.)
Laser Precautions

Normal condition (cover closed)

This unit incorporates a laser for particle detection. It uses a dual blocking design which fulfills the IEC 825-1 emission safety requirements for class 1 laser products. The class 1 label reproduced at right is affixed to the rear panel.

Cover open

When the cover is open, this unit corresponds to a class 3B laser product. The laser is incorporated in the particle sensor mechanism protected by an internal cover. The laser source can cause blindness if viewed directly, and can cause skin injuries if the skin is exposed directly to the beam.

The cover must therefore not be opened.

The warning label and class 3B identification label reproduced at right are affixed to the internal cover (particle sensor cover).
WARNING

Do not pass reactive gases through the unit, to prevent the possibility of an explosion.

**Measurement limitations**

This unit is designed only to measure the size and number of particles in air with an atmospheric pressure of approximately 1 atm, such as for example in clean rooms or clean benches.

To prevent the possibility of accidents or damage to the unit, never use the unit with substances or in conditions as described below:

- With gases which are explosive, combustible, inflammable, or harmful to humans.
- With gases which may corrode the parts composing the unit.
- With gases which contain mist, droplets, coarse particles, fibers, or a very high number of particles.
- In ambient conditions which exceed the temperature and humidity limits listed in the section "Specifications".

When intending to use the KM-27 to measure other gases besides air, please consult the supplier.
Precautions

- Operate the unit only as described in this manual.
- Do not touch any parts of the unit other than necessary for operation.
- The ambient conditions for operation of the unit are as follows:
  Temperature range 12 to 29°C, relative humidity range 20 to 85% RH.
- Do not pass reactive gases through the unit, to prevent the danger of explosion.
- Do not pass gases through the unit which contain a high contamination. Otherwise the internal sensor may excessively be contaminated.
- Do not pass gases through the unit which may corrode the component parts.
- Do not turn the unit on with the inlet cap in place or with the inlet blocked. Otherwise the internal pump may be damaged.
- Do not attempt to use the internal printer when no paper is loaded. Otherwise the print head may be damaged.
- When the unit is reset, all internally stored data and settings for all functions (date, time, alarm level, etc.) will be cleared.
- When the "Clear Stored Data" key is kept depressed, all stored data will be lost. Take care when using this function.
- Do not disassemble the unit or attempt internal alterations.
- Operate the unit where the power requirements (100 V AC, 50/60 Hz) are met.
- To prevent the risk of electric shock, use only a grounded AC outlet.
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The particle counter KM-27 is designed to measure the concentration of particles in air using the light-scattering method. The air flow rate is 28.3 L per minute, and particles are displayed in six size ranges: \( \geq 0.3 \, \mu\text{m} \), \( \geq 0.5 \, \mu\text{m} \), \( \geq 1 \, \mu\text{m} \), \( \geq 3 \, \mu\text{m} \), \( \geq 5 \, \mu\text{m} \), and \( \geq 10 \, \mu\text{m} \).

The built-in standard RS-232-C serial interface allows transferring measurement data to a computer or performing continuous monitoring. Up to 400 data records can be stored in the buffer and the data records can be read out by the computer. A printer is also built in, to produce hard copy of measurement results.

**Particle Size Detection**

The unit is calibrated at the factory, using particles of known diameter and refractive index (polystyrene latex spheres). As the amount of scattered light by such particles is used as reference to determine the particle size, the measured size corresponds to the light-scattering size of polystyrene latex spheres.

**Unit Indication**

This product uses cubic feet (CF) for some functions. CF is not part of the International System of Units (SI).
Front panel

The controls and indicators on the front panel are divided into four functional groups: display section, mode section, display/program section, and printer section. Keys are provided for mode selection, alarm level and particle size range setting, date/time setting, etc. Some keys are designed to be used in conjunction with other keys. This chapter explains the use of these controls and indicators.
Panel Explanation

Display section

RUN key
Starts the measurement. When the measurement begins, the key LED lights up.

STOP key
Stops the measurement. When the measurement stops, the RUN key LED turn off. In this case, data are not stored in the buffer and will not be printed.

Counting indicator
This indicator lights up during measurement.

Seven-digit display
Shows the particle count, time and date, etc.

Three-digit display
Shows the selected particle size range.

Limit indicator
Flashes when the particle count has exceeded the alarm level.

Sensor indicator
Flashes when the power of the laser diode has fallen below 80% of the initial level, due to aging.

Airflow indicator
Flashes when the volume of air moving past the sensor is too high or too low.
Mode section

Mode key

Allows selection among the following four modes. The indicator for the selected mode lights up. Pressing the RUN key causes measurement start in the selected mode.

Manual

The unit performs one measurement and then stops.

Automatic

The unit performs a preset number of measurements, with hold (pause) intervals in between. After all measurements are completed, the pump is turned off.

Concen. (Concentration)

The counter will calculate particle concentration in counts/ft³ or counts/1000 liter) of air.

Beep

A single beep is emitted whenever the particle count exceeds the alarm level or an integer multiple of the alarm level. Measurement continues until the STOP key is pressed.

Count Mode key

Allows selection among the following two modes. The indicator for the selected mode lights up.

Cumulative

The cumulative particle count (all particles of the size for the selected channel and larger) is shown on the display.

Differential

Only the count for particles whose size falls between the selected channel and the next higher channel is shown on the display.
Display/Program section

↑ key, ↓ key
Select the item to show on the seven-digit display. The following items can be selected: particle count, measurement location number, measurement cycles, date/time, period/hold, options.

← key, → key
If the item selected with the ↑ and ↓ keys has further subdivisions, these are selected with the ← and → keys (particle size range for particle count, date or time for date/time, measurement period or hold time for period/hold, optional function).

While the Program key indicator is lit, the keys select which digit to change.

Program key
Pressing this key sets the unit to program mode. In program mode, you can set the alarm level, measurement cycles, date and time, and various options. You can also display the alarm level setting of the selected size range. The appropriate indicator light must be on to make a change within the program functions.

Enter key
In program mode, this key serves to make a new setting active (see previous section on program key) and store that setting in memory.

Count indicator
This indicator is lit when the three-digit display shows particle size range. To program the alarm level for the displayed particle size range, this indicator must be lit. If it is flashing, the particle count for that range has exceeded the alarm level.

Location indicator
Lights up when the measurement location number is shown. For setting a new measurement location number, this indicator must be lit.
Cycles indicator
Lights up when the measurement cycles setting is shown. For changing the measurement cycles setting, this indicator must be lit.

Date/Time indicator
Lights up when the current date/time is shown. For setting a new date or time, this indicator must be lit.

Period/Hold indicator
Lights up when the measurement period or hold time is shown. For setting a new measurement period or hold time, this indicator must be lit.

Temp/RH indicator
Currently not supported.

Spare indicator
Currently not supported.

Options indicator
Lights up when any of the options below is shown on the display.

AFb: Key beep on/off
FLO: Flow rate
Prn: ALL Measurement results are printed at the end of each measurement.
14644-1 ISO-14644 processing is carried out and results are printed.
ALr Measurement results are printed when alarm level is exceeded.
bd: Communication baud rate
UOL: Selects whether to use a cubic foot (CF) or 1000 (L) as unit for the Concentration mode and for printing ISO-14644 processing results.
Printer section

Enable key
   Enables printout of measurement results as selected under Options. The indicator lights up when the printer is enabled.

Print Stored Data key
   Serves to print out measurement data stored in the buffer. The data remain in the buffer also after being printed.

Clear Stored Data key
   Briefly tapping this key causes the number of measurement data that are currently stored in the buffer to be shown on the display. Keeping the key depressed for 2 seconds or more clears the contents of the buffer.

Paper Feed key
   When the printer is enabled, pressing this key moves the printer paper forward.
Rear panel

Power switch
Set to "-" to turn the unit on and to "O" to turn the unit off.

AC connector
Connect to a 100 V AC outlet, using the supplied power cord.

AIR VELOCITY connector
Currently not supported.

RH/TEMP connector
Currently not supported.

AIR FLOW ADJUST knob
Serves for adjusting the sample air flow. Turning the control clockwise increases the air flow and turning the control counterclockwise decreases it.

RETURN AIR connector
For connection to Sample Manifold when optional manifold system is used.

ISO PROBE
Currently not supported.
ANALOG
  Currently not supported.

SERIAL I/O connector
  Serial interface connector, to be linked with the SERIAL (or RS-232-C) connector on a computer.

PRINTER
  Currently not supported.

MANIFOLD connector
  For connection of optional manifold system.
Preparations

Installation Location

Install the unit only on a stable, level surface. Leave sufficient clearance around the unit, so that ventilation holes are not blocked. Ensure that the temperature and relative humidity at the installation location do not exceed the values given in the specifications for this unit.

Power Cord Connection

1. Set the power switch to OFF.
2. Insert the power cord connector into the AC connector on the KM-27 and plug the other end into a grounded AC outlet.

<table>
<thead>
<tr>
<th>Caution</th>
</tr>
</thead>
<tbody>
<tr>
<td>To reduce risk of electric Shock, use grounding type (3-wire) power cord and plug the cord to grounded power outlet.</td>
</tr>
</tbody>
</table>

Sampling Tube Connection

Remove the inlet cap from the inlet on top of the unit and insert the sampling tube.

<table>
<thead>
<tr>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>When using the sampling tube, place it vertically on the inlet and do not bend it. Use only the sampling tube that is supplied with the unit.</td>
</tr>
</tbody>
</table>
The functions of the KM-27 (alarm level, measurement period, hold time) can be set or changed with the front-panel keys of the unit. If the unit is connected to a computer via the SERIAL I/O (RS-232-C) port, some functions can also be set from the computer.

The setting procedures for the various functions are described on the following pages.
Alarm Level Setting

The alarm level is a freely programmable threshold for the particle count of the unit. When this threshold is exceeded, an alarm tone sounds. The setting range is 0 (no alarm) to 9,999,999. The alarm level can be set for each channel individually. The alarm tone will be heard when the alarm level is exceeded in any channel. To set the level, proceed as follows.

1. Turn the unit on.
   If the unit is in RUN mode, press the STOP key.
2. Press the ↑ key until the Count indicator is lit.
3. Use the ← and → keys to call up the particle size range for which you want to make the setting.
4. Press the Program key. The Program indicator lights up.
   The lowest digit of the alarm level indication flashes.
5. Press the ← key until the digit you want to change is flashing.
6. Each push of the ↑ or ↓ key changes the value to the next increment.
   Keeping a key depressed causes a rapid change.
7. To change another digit, press the ← key again and repeat steps 4 to 6.
8. Press the Enter key to store the new alarm level setting and to terminate the Program mode. The Program indicator goes out.
9. To set the alarm level for another particle size range, repeat steps 2 to 8.

<table>
<thead>
<tr>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>To disable the alarm, set the alarm level for all particle size ranges to 0 (no alarm).</td>
</tr>
<tr>
<td>To stop the alarm tone when it has been triggered, press any key except the RUN and STOP keys.</td>
</tr>
<tr>
<td>When the Beep mode has been selected, the alarm tone sounds once when the particle count reaches the alarm level and again when it reaches every integer multiple of the alarm level.</td>
</tr>
</tbody>
</table>
**Measurement Location Number**

A measurement location can be assigned a number from 0 to 999 for easier identification. This number will be printed out along with the stored measurement data for that location.

To change the measurement location number, proceed as follows.

1. Turn the unit on.
   
   If the unit is in RUN mode, press the STOP key.

2. Press the ↓ key until the Location indicator is lit. The current measurement location number is shown on the display.

3. Press the Program key. The "1" digit starts to flash. Each push of the ↑ or ↓ key changes the value to the next increment. Keeping a key depressed causes a rapid change.

4. To change the "10" or "100" digit, use the ← key to cause the digit to flash, and change the value with the ↑ and ↓ keys. Keeping a key depressed causes a rapid change.

5. Press the Enter key to store the new measurement location number and to terminate the Program mode. The Program indicator goes out.
Measurement Cycles

The measurement cycles setting refers to the number of times the measurement/hold cycle is repeated in automatic mode. The maximum possible setting is 999. A setting of 0 results in endless repetition of the measurement/hold cycle. To change the measurement cycles setting, proceed as follows.

1. Turn the unit on.
   If the unit is in RUN mode, press the STOP key.
2. Press the down arrow key until the Cycles indicator is lit. The current measurement cycles setting is shown on the display.
3. Press the Program key. The "1" digit starts to flash. Each push of the up or down arrow key changes the value to the next increment. Keeping a key depressed causes a rapid change.
4. To change the "10" or "100" digit, use the left arrow key to cause the digit to flash, and change the value with the up and down arrow keys. Keeping a key depressed causes a rapid change.
5. Press the Enter key to store the new measurement cycles setting and to terminate the Program mode. The Program indicator goes out.
Date and Time

To change the date and time setting, proceed as follows.

1. Turn the unit on.
   Date/Time parameters can be displayed while in the RUN or STOP mode.

2. Press the \( \downarrow \) key until the Date/Time indicator is lit. The current date is shown on the display.

3. The \( \leftarrow \) and \( \rightarrow \) keys switch back and forth between date and time display.
   Select the display for which you want to make the setting.

4. Press the Program key. The month or hour display flashes.

5. Press the \( \leftarrow \) or \( \rightarrow \) key until the digit you want to change is flashing.

6. Each push of the \( \uparrow \) or \( \downarrow \) key changes the value to the next increment.
   Keeping a key depressed causes a rapid change.

7. Repeat steps 5 and 6 to change the other digits.

8. Press the Enter key to store the new setting and to terminate the Program mode. The Program indicator goes out.

9. To change the other item (date or time), repeat steps 3 to 8.
Key Beep On/Off (AFb)

The key beep (beep sound other than the alarm, heard whenever a key is pressed) can be turned on and off, as follows.

1. Turn the unit on.
   If the unit is in RUN mode, press the STOP key.

2. Press the ↑ or ↓ key until the Options indicator is lit.

3. Press the ← or → key until the indication "AFb" (audible feedback) is shown. The current setting is shown as "on" or "off".

4. Press the Program key. The "on" or "off" indication starts to flash. Each push of the ↑ or ↓ key changes the setting.

5. Press the Enter key to store the new setting and to terminate the Program mode. The Program indicator goes out.
Measurement Period, Hold Time

The measurement period (measurement time) can be set in the range from 0 to 23 hours 59 minutes 59 seconds. The hold time (pause interval between measurements) can be set in the range from 1 second to 23 hours 59 minutes 59 seconds. A measurement period setting of 0 means that measurement continues until the STOP key is pressed.

In manual mode, measurement is carried out for the measurement period and then stops.

In automatic mode, the measurement/hold cycle is carried out for the number of times determined by the "Cycles" setting. During the hold interval, the result of the preceding measurement is shown.

To set the measurement period and hold time, proceed as follows.

1. Turn the unit on.
   If the unit is in RUN mode, press the STOP key.

2. Press the ↓ key until the Period/Hold indicator is lit. The current measurement period setting is shown in hours, minutes, and seconds.

3. The ← and → keys switch back and forth between measurement period and hold time display. Select the display for which you want to make the setting.

4. Press the Program key. The seconds display flashes.

5. Press the ← or → key until the digit you want to change is flashing.

6. Each push of the ↑ or ↓ key changes the value to the next increment. Keeping a key depressed causes a rapid change.

7. Repeat steps 5 and 6 to change the other digits.
   When no more change is required, press the Enter key to store the new setting and to terminate the Program mode. The Program indicator goes out.

8. To change the other item (measurement period or hold time), repeat steps 3 to 7.
Unit Volume

In Concentration mode and for ISO-14644 processing, the number of particles is converted into a volumetric count. The unit can be either one cubic foot (CF) or one cubic meter (1 m³ = 1000 L). To select the unit, proceed as follows.

1. Turn the unit on.
   If the unit is in RUN mode, press the STOP key.
2. Press the ↑ or ↓ key until the Options indicator is lit.
3. Press the ← or → key until the indication "UOL" is shown. The current setting ("CF" or "1000L") is shown.
4. Press the program key. The indication starts to flash. Each push of the ↑ or ↓ key changes the unit setting.
5. Press the Enter key to store the new setting and to terminate the Program mode. The Program indicator goes out.

Communication Baud Rate

The communication baud rate can be set to 300, 1200, 2400, or 9600 bps. To make the setting, proceed as follows.

1. Turn the unit on.
   If the unit is in RUN mode, press the STOP key.
2. Press the ↑ or ↓ key until the Options indicator is lit. Press the ← or → key until the indication "bd" is shown. The current baud rate setting is shown on the display.
3. Press the Program key. The indication starts to flash. Each push of the ↑ or ↓ key changes the baud rate setting.
4. Press the Enter key to store the new setting and to terminate the Program mode. The Program indicator goes out.
Flow Rate (FLO)

The rated flow rate for the sensor is 1 CF/minute (28.3 L/minute). During measurement only, the flow rate can be monitored and adjusted. To adjust the flow rate, proceed as follows.

1. Turn the unit on.
   If the unit is in RUN mode, press the STOP key.
2. Press the ↑ or ↓ key until the Options indicator is lit. Press the ← or → key until the indication "FLO" is shown.
3. Press the RUN key to start the measurement.
4. When the flow rate has stabilized, adjust the AIR FLOW ADJUST knob on the rear panel until the indication becomes "1.00". Turning the knob clockwise increases the flow rate.
5. Press the STOP key to terminate the measurement.

Mode Selection

This particle counter has the following four measurement modes:
   Manual, Automatic, Concentration, Beep
(For details on the modes, please refer to the section "Measurement" starting on the next page.)

To select a mode, proceed as follows.

1. If the unit is in RUN mode, press the STOP key.
2. Press the Mode key until the indicator for the desired mode is lit.
This particle counter has the following four measurement modes:
- Manual
- Automatic
- Concentration
- Beep
In all of these modes, the RUN key is used to start the measurement. The measurement starts at the moment the RUN key is released.

<table>
<thead>
<tr>
<th>Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never operate the counter with the inlet cap attached as damage can occur to the internal pump.</td>
</tr>
<tr>
<td>Before measurement, be sure to perform flow rate adjustment, as described on page 19.</td>
</tr>
</tbody>
</table>

The measurement results are shown on the two displays of the unit. The three-digit display shows the particle size range and the seven-digit display shows the numeric count.
To switch the particle size range, press the ↑ and ↓ keys until the Count indicator is lit and then press the ← and → keys to select the range.
Manual Mode

In this mode, a single measurement is carried out for the preset measurement period. If a printer is connected, measurement results are printed out after the measurement is completed. Because the results are stored in memory, later printout is also possible.

1. Turn the unit on.
   If the unit is in RUN mode, press the STOP key.
2. Press the Mode key until the Manual indicator is lit.
3. Select the measurement location number (see page 13).
4. Set the measurement period and alarm level (see pages 12 and 17).
5. Press the RUN key to start the measurement.
   While the measurement is in progress, the indicator of the RUN key is lit.
   When the preset measurement period has elapsed, the measurement is terminated automatically and the indicator of the RUN key goes out.

<table>
<thead>
<tr>
<th>Note</th>
<th>The sample air volume is calculated as follows: 28.3 (L/minute) × measurement period (minutes)</th>
</tr>
</thead>
</table>

| Important | If a reset becomes necessary due to any kind of problem with the unit, all measurement data in the buffer will be lost. As a precautionary measure, it is therefore recommended to print out measurement data stored in the buffer at a suitable time or to transfer the data to a computer. |
Automatic Mode

In this mode, the preset number of measurements cycles (measurement period/hold time) are carried out. If a printer is enabled, measurement results are printed out after each measurement is completed. Because measurement results are stored in memory, later printout is also possible.

1. Turn the unit on.
   If the unit is in RUN mode, press the STOP key.
2. Press the Mode key until the Automatic indicator is lit.
3. Select the measurement location number (see page 13).
4. Set the measurement period and hold time, cycles setting, and alarm level (see pages 12, 14, and 17).
5. Press the RUN key to start the measurement.
   While the measurement is in progress, the indicator of the RUN key is lit. When the preset number of measurement cycles has been carried out, the measurement is terminated automatically and the indicator of the RUN key goes out.

<table>
<thead>
<tr>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>The sample air volume is calculated as follows:</td>
</tr>
<tr>
<td>28.3 (L/minute) × measurement period (minutes)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Important</th>
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<tbody>
<tr>
<td>If a reset becomes necessary due to any kind of problem with the unit, all measurement data in the buffer will be lost. As a precautionary measure, it is therefore recommended to print out measurement data stored in the buffer at a suitable time or to transfer the data to a computer.</td>
</tr>
</tbody>
</table>
Concentration Mode

In Concentration mode, the particle concentration is calculated every second. This is done by converting the measured particle count into the number of particles for a given volumetric unit (1 cubic foot or 1000 liters). Measurement is carried out using the preset measurement period and cycles setting, without a hold interval. During measurement, the display is updated every second. If a printer is enabled, concentration mode results are printed out after each measurement is completed. Because the results are stored in memory, later printout is also possible.

<table>
<thead>
<tr>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>In this mode, the KM-27 cannot be controlled from a computer.</td>
</tr>
</tbody>
</table>

1. Turn the unit on.
   If the unit is in RUN mode, press the STOP key.
2. Press the Mode key until the Concen. indicator is lit.
3. Select the measurement location number (see page 13).
4. Select the volumetric unit: 1 cubic foot (CF) or 1000 liters (L) (see page 18).
5. Set the measurement period, cycles setting, and alarm level (see pages 12, 14 and 17).
6. Press the RUN key to start the measurement.
   While the measurement is in progress, the indicator of the RUN key is lit. When the preset number of measurements has been carried out, the measurement is terminated automatically and the indicator of the RUN key goes out.

<table>
<thead>
<tr>
<th>Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>If a reset becomes necessary due to any kind of problem with the unit, all measurement data in the buffer will be lost. As a precautionary measure, it is therefore recommended to print out measurement data stored in the buffer at a suitable time or to transfer the data to a computer.</td>
</tr>
</tbody>
</table>
Beep Mode

In Beep mode, the alarm tone sounds once when the particle count reaches the alarm level and again when it reaches every integer multiple of the alarm level. The beep is triggered by reaching the particle count in any particle size range. When wishing to focus on one range only, set an alarm level only for that range and set the alarm level for the other ranges to 0 (no alarm).

1. Turn the unit on.
   If the unit is in RUN mode, press the STOP key.
2. Press the Mode key until the Beep indicator is lit.
3. Select the measurement location number (see page 13).
4. Select the alarm level (see page 12).
5. Press the RUN key to start the measurement.
   While the measurement is in progress, the indicator of the RUN key is lit.
   The measurement continues until the STOP key is pressed.
**Alarm function**

When an alarm level has been set, an alarm tone will sound when the measurement value exceeds the alarm level. For information on how to set the alarm level, see page 12.

The alarm function works as follows in the various measurement modes.

**Manual or Automatic mode**

When the measured particle count exceeds the alarm level, the Limit indicator flashes and an alarm sound (succession of short beeps) is heard.

**Concentration mode**

When the measured particle count converted into a concentration value exceeds the alarm level, the Limit indicator flashes and an alarm sound (succession of short beeps) is heard.

**Beep mode**

When the measured particle count reaches the alarm level, a single alarm beep is heard. Subsequently, an alarm beep is heard every time the measured particle count reaches an integral multiple of the alarm level. In this case, the Limit indicator does not flash.

Example : When the alarm level is set to 100, an alarm sound is heard at a count of 100, 200, 300 and so on.
Clearing the Measurement Data Buffer

Measurement results obtained with manual or automatic measurement are stored in the buffer of the unit. The buffer can hold up to 400 data records. When this number is exceeded, the oldest data will be overwritten. Data are not deleted from the buffer also after having been printed. To delete all data from the buffer, proceed as follows.

1. Press the Clear Stored Data key once. The number of currently stored data is shown.

2. Keep the Clear Stored Data key depressed for 2 seconds or longer. The display now shows 0, indicating that no more data remain in the buffer.

### Important

| Make sure that the stored data are no longer required before pressing the Clear Stored Data key for 2 seconds or more. |
Unit Reset

If the front panel controls have become inactive due to a problem with peripheral equipment or due to external noise interference, you can perform a reset of the unit to restore normal operation.

When the unit is reset, all stored measurement data are cleared. The settings for all functions (date/time, measurement period, alarm level, etc.) are also cleared.

<table>
<thead>
<tr>
<th>Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before performing a reset, make sure that measurement data and settings are no longer needed.</td>
</tr>
</tbody>
</table>

1. Turn the unit off.
2. Hold down the Mode key and turn the unit on.
3. When you hear a beep, release the Mode key. The front panel indication becomes as follows.
   - Manual indicator: Lit
   - Cumulative indicator: Lit
   - [dEF] [4265-1F]: EPROM number and version (version may be different than the example shown here)
4. Press the Enter key and set up the program functions again.

<table>
<thead>
<tr>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>If step 2 does not succeed, disconnect all external equipment (such as external printer etc.) and repeat the above steps. Then reconnect the external equipment one by one to pinpoint the source of the problem.</td>
</tr>
</tbody>
</table>
Using the Printer

This unit incorporates a printer. To allow printout of measurement results, one of the printer functions must be selected as described on page 30, and the printer must be enabled.

This section describes various aspects of operating the printer.

- Loading printer paper
- Selecting the printer function
- Printing ISO-14644 processing results
- Clearing data stored in the buffer
- Setting up an external printer

<table>
<thead>
<tr>
<th>Important</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do not attempt to use the printer while no paper is inserted. Otherwise the print head may be damaged. When using the KM-27 while no paper is inserted, make sure that the printer is not enabled.</td>
</tr>
</tbody>
</table>

Do not pull the printer paper in the opposite direction from its normal path. Otherwise the printer may be damaged.
Loading Printer Paper

<table>
<thead>
<tr>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>TF50KS-R (thermosensitive paper) and SCS057N-R (lint-free thermosensitive paper) are available as replacement printer paper.</td>
</tr>
</tbody>
</table>

1. Open the printer paper compartment cover. If there is still remaining paper from product testing at the factory, remove the paper by pressing the Paper Feed key.

2. Cut the tip of the new printer paper into a triangle, as shown below.

3. Place the paper roll into the compartment, so that the paper is fed to the print head from below.

4. Insert the tip of the paper into the paper feed slot at the bottom of the paper compartment. Pressing the Paper Feed key should now pull the paper into the printer housing. Verify that the paper is properly set and close the printer paper compartment cover.

Because the paper used for this printer has a thermosensitive coating on one side, it must be inserted as shown above.

Use the printer paper in the original rolled-up condition. This will ensure proper passage through the printer.
Selecting the Printer Function

When the Option indicator is lit and the indication "Prn" is shown on the three-digit display, the printer function can be selected. The following three options are available:

- **ALL**: Results are printed after each measurement cycle that lasts longer than 11 seconds.
- **ALr**: Results are printed only if the alarm level was exceeded.
- **14644-1**: ISO-14644 processing results are printed.

When "ALL" or "ALr" is selected, printing is carried out also during measurement. When "14644-1" is selected, printing is carried out when measurement was performed at two or more measurement locations and the Print Stored Data key was pressed.

In either case, the Enable key in the printer section must be activated (indicator lit). Select the printer function as follows.

1. Press the ↑ and ↓ keys until the Options indicator is lit.
2. Press the ← and → keys until "Prn" is shown. The current setting ("ALL" or "ALr" or "14644-1") is shown on the display.
3. Press the Program key. The Program indicator lights up and the current setting flashes.
4. Press the ↑ and ↓ keys to select "ALL" or "ALr" or "14644-1".
5. Press the Enter key to store the setting and to terminate the Program mode. The Program indicator goes out.
Sample Printout

The printer records the cumulative and differential count values for each particle size range. The printout also includes the date, time, measurement location, measurement period, and measurement cycles setting.

If the alarm was triggered during measurement, this is also recorded.

An example for data printed out by pressing the Print Stored Data key is shown below. (An example for a ISO-14644 printout is shown on page 34.)

In this example, two measurement results are stored in the buffer.

<table>
<thead>
<tr>
<th>CUMULATIVE</th>
<th>PRINTING 002 RECORD(S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOCATION 000, 17:31:00 JUL 18, 97</td>
<td></td>
</tr>
<tr>
<td>CYCLES = 000, PERIOD = 01:00:00</td>
<td></td>
</tr>
<tr>
<td>SIZE CUMULATIVE DIFFERENTIAL</td>
<td></td>
</tr>
<tr>
<td>0.3µ 91 33</td>
<td></td>
</tr>
<tr>
<td>0.5µ 50 4</td>
<td></td>
</tr>
<tr>
<td>1.0µ 54 19</td>
<td></td>
</tr>
<tr>
<td>3.0µ 35 16</td>
<td></td>
</tr>
<tr>
<td>5.0µ 19 8</td>
<td></td>
</tr>
<tr>
<td>10.0µ 11 11</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DIFFERENTIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOCATION 000, 18:31:10 JUL 18, 97</td>
</tr>
<tr>
<td>CYCLES = 000, PERIOD = 01:00:00</td>
</tr>
<tr>
<td>SIZE CUMULATIVE DIFFERENTIAL</td>
</tr>
<tr>
<td>0.3µ 96 60</td>
</tr>
<tr>
<td>0.5µ 36 2</td>
</tr>
<tr>
<td>1.0µ 34 16</td>
</tr>
<tr>
<td>3.0µ 18 7</td>
</tr>
<tr>
<td>5.0µ 11 7</td>
</tr>
<tr>
<td>10.0µ 4 4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COUNT ALARM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicates if the alarm level was exceeded in any of the six ranges.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PRINTING 002 RECORD(S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>This information appears at the start of the printout, when the Print Stored Data key was used to initiate the printing.</td>
</tr>
</tbody>
</table>
The KM-27 incorporates a processing function that can produce statistical data according to the ISO-14644. This can be selected as one of the print modes under Options. Processing uses the data stored for each measurement location (up to 400 data). Data for at least two locations must have been stored to use this function.

When measurement for all measurement locations is completed, the overall mean of the averages (based on the average particle concentration for each location) is calculated, along with the standard deviation, standard error, and 95% UCL (Upper Confidence Limit).

The 95% UCL is only printed if there are nine or fewer measurement locations.

To use ISO-14644 processing, proceed as follows.

**Making the measurement**

1. Install the unit in the first measurement location and turn power on.

2. Keep the Clear Stored Data key depressed for 2 seconds or more to clear any stored data. This is to prevent any previous data from being used erroneously for processing.

   **Important**
   
   Make sure that the stored data are no longer required before pressing the clear Stored Data key for 2 seconds or more.

3. Set the measurement location number for that measurement location (see page 13).

4. Set the measurement mode to "Automatic" or "Concentration" (see page 19).

5. Set the measurement parameters (cycles, measurement period, hold time) for that measurement location (see pages 14 and 17).

   Set the measurement cycles to a setting other than 0.
### Setting precautions

<table>
<thead>
<tr>
<th>Take care that measurement location numbers do not overlap. If a measurement is repeated for the same measurement location number (RUN key is pressed again), only the most recent data will be valid.</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>If any of the following settings is established, ISO-14644 processing will not be carried out.</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Measurement mode set to &quot;Manual&quot;</td>
</tr>
<tr>
<td>- Measurement cycles set to &quot;0&quot;</td>
</tr>
</tbody>
</table>

6. Press the RUN key. While the measurement is carried out, the Counting indicator is lit. Verify that the flow rate is 1 CF/minute (see page 19).

7. Turn the unit off and move it to the next measurement location.

8. Repeat steps 3 to 6 for all measurement locations.

**Printing the data**

9. Select whether to use a cubic foot (CF) or cubic meter (1000 L) as volumetric unit (see page 18).

10. Select Options, "Prn", and then "14644-1", as described on page 30.

11. Press the Enable key in the printer section on the front panel and press the Print Stored Data key.

   The average particles concentration per unit volume at each location will be printed out, and overall mean of the averages will be printed out followed by ISO-14644 calculations.
### Print sample

**ISO 14644-1 STATISTICS**  
**AVERAGE PARTICLES / CUBIC FOOT**

<table>
<thead>
<tr>
<th>SIZE (μm)</th>
<th>CUMULATIVE</th>
<th>DIFFERENTIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>2640.0</td>
<td>615.0</td>
</tr>
<tr>
<td>0.5</td>
<td>2025.0</td>
<td>210.0</td>
</tr>
<tr>
<td>1.0</td>
<td>1815.0</td>
<td>1835.0</td>
</tr>
<tr>
<td>3.0</td>
<td>780.0</td>
<td>435.0</td>
</tr>
<tr>
<td>5.0</td>
<td>345.0</td>
<td>255.0</td>
</tr>
<tr>
<td>10.0</td>
<td>90.0</td>
<td>90.0</td>
</tr>
</tbody>
</table>

**LOCATION 001, 09:04:11 SEP 30.97**  
**CYCLES = 002, VOL = 0.033 CU FT**

<table>
<thead>
<tr>
<th>SIZE (μm)</th>
<th>CUMULATIVE</th>
<th>DIFFERENTIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>750.0</td>
<td>45.0</td>
</tr>
<tr>
<td>0.5</td>
<td>705.0</td>
<td>75.0</td>
</tr>
<tr>
<td>1.0</td>
<td>630.0</td>
<td>360.0</td>
</tr>
<tr>
<td>3.0</td>
<td>270.0</td>
<td>165.0</td>
</tr>
<tr>
<td>5.0</td>
<td>105.0</td>
<td>90.0</td>
</tr>
<tr>
<td>10.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
</tbody>
</table>

**MEAN OF THE AVERAGES**

<table>
<thead>
<tr>
<th>SIZE (μm)</th>
<th>CUMULATIVE</th>
<th>DIFFERENTIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>1695.0</td>
<td>330.0</td>
</tr>
<tr>
<td>0.5</td>
<td>1365.0</td>
<td>142.5</td>
</tr>
<tr>
<td>1.0</td>
<td>1222.5</td>
<td>697.5</td>
</tr>
<tr>
<td>3.0</td>
<td>525.0</td>
<td>300.0</td>
</tr>
<tr>
<td>5.0</td>
<td>225.0</td>
<td>172.5</td>
</tr>
<tr>
<td>10.0</td>
<td>52.5</td>
<td>52.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SIZE (μm)</th>
<th>STD DEV</th>
<th>STD ERR</th>
<th>95% UCL</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>1336.4</td>
<td>945.0</td>
<td>7658.0</td>
</tr>
<tr>
<td>0.5</td>
<td>933.4</td>
<td>660.0</td>
<td>5529.6</td>
</tr>
<tr>
<td>1.0</td>
<td>837.9</td>
<td>592.5</td>
<td>4961.2</td>
</tr>
<tr>
<td>3.0</td>
<td>360.6</td>
<td>255.0</td>
<td>2134.0</td>
</tr>
<tr>
<td>5.0</td>
<td>169.7</td>
<td>120.0</td>
<td>982.2</td>
</tr>
<tr>
<td>10.0</td>
<td>53.0</td>
<td>37.5</td>
<td>289.1</td>
</tr>
</tbody>
</table>
Maintenance

Light Source

The laser diode used in the KM-27 has a relatively short life. When the laser diode nears the end of its service life, the output will be fall below its rated value. There are considerable differences in service life between individual laser diodes. Some units may fail already after several thousand operation hours.

The KM-27 detects when the laser diode no longer provides the required output and alerts the user through the flashing Sensor indicator on the front panel. In such a case, please contact your supplier.

Air flow error

If the air flow remains under 1.00 and the air flow indicator keeps flashing although the AIR FLOW ADJUST knob has been adjusted, the internal filter or another part of the unit may require servicing. Please contact your supplier.

Sensor contamination, backup batteries

When sensor contamination has been detected, or when the voltage of the backup battery for the memory contents (including the buffer) has dropped, this is indicated by the status prefix at the beginning of measurement data output via the serial interface. For details, please refer to the section "Data Format" on page 41. When such an indication appears in the status prefix, the unit must be checked or the battery must be replaced. Please contact your supplier.

Servicing and Calibration

To assure continued measurement precision, calibration with standard particles (polystyrene latex spheres) should be performed in regular intervals (about once per year). Servicing, calibration, and parts replacement are carried out by Rion (at cost). Please contact your supplier.
INLET Cleaning

If the unit gives a count also when the filter is mounted, contamination such as lint or dust may be present in the sensor. Use the supplied brush and perform cleaning as described below.

1. Turn power to the unit on.
2. Start the measurement to pass air through the sensor.
3. Carefully insert the brush through the INLET and push it in until it stops.
4. Move the brush up and down while rotating it clockwise and counterclockwise a few times.
5. Pull the brush out of the INLET.
6. Stop the measurement. Be sure to stop the measurement only after removing the brush.
7. Mount the same filter as before and check whether the unit gives a count.
8. If the unit still gives a count, the sensor may be contaminated internally. Perform extended purging with the filter in place.

If this does not remove the problem, please contact your supplier.
Serial Interface

The KM-27 incorporates a serial interface corresponding to EIA RS-232-C specifications. Using an optional cable, this interface can be connected to a computer, allowing external control of the unit.

<table>
<thead>
<tr>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>The following explanation assumes some familiarity with computers and with the RS-232-C interface standard.</td>
</tr>
</tbody>
</table>

**Connection to the computer**

The connector pin assignment is shown below. Note that the pin assignment at some computers may be different. Make sure that you use the correct cable for your computer system.

<table>
<thead>
<tr>
<th>Connector on KM-27</th>
<th>Connector on computer (IBM PC compatible)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gnd</td>
<td>1</td>
</tr>
<tr>
<td>TxD</td>
<td>2</td>
</tr>
<tr>
<td>Rxd</td>
<td>3</td>
</tr>
<tr>
<td>Gnd</td>
<td>7</td>
</tr>
<tr>
<td>CTS</td>
<td>5</td>
</tr>
<tr>
<td>RTS</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The computer must be equipped with an RS-232-C serial interface. It must be connected using a proper serial cable, and the communication parameters must be set to the same values at both ends.

Two types of optional cables are available from Rion for interfacing to a computer. Choose the cable that fits the requirements of your system.

- CC-62: For connection to a computer with a 25-pin D-sub connector (female)
- CC-62A: For connection to a computer with a 9-pin D-sub connector (male)

**Connection procedure**

1. Set the communication parameters to the same values at both ends. The KM-27 settings are as follows.

   - Data word length: 8 bit
   - Stop bits: 1 bit
   - Parity: None
   - Baud rate: 300, 1200, 2400, 9600 bps
     (selectable from front panel)

2. Use the optional cable to connect the SERIAL I/O connector on the KM-27 to the serial port of the computer.

3. Select the desired measurement mode at the KM-27.

4. Send the universal select command (U) from the computer to the KM-27, to enable the select mode.
Commands

The following ASCII commands are supported by the KM-27.

"a" Auto
After this command has been used, the "d" command will start measurement in automatic mode.

"b" Manual
After this command has been used, the "d" command will start measurement in manual mode.

"c" Start measurement (under computer control)
Measurement starts immediately, with no startup lag (quick start) and continues until stopped by the computer. The number of measurement cycles is controlled by the computer.

"d" Start measurement (using KM-27 settings)
Measurement starts using the settings established with the front panel controls of the KM-27 (measurement period, hold time, measurement cycles).

"e" End measurement
 Stops the measurement immediately.

"g" Active mode
Enables the measurement preparation mode. The pump is activated and the flow system is purged.

"h" Standby mode
To reduce power consumption and wear, the air pump is turned off and the sensor is deactivated.

"l" Local mode (for factory testing)
The KM-27 goes off-line.
"A"  Send measurement data
    Causes the KM-27 to send the next data from the buffer. If the buffer is
    empty, "#" is sent. After sending, the data are cleared from the buffer. If a
    measurement cycle has not yet been completed after power-on, the unit
    also sends "#". Measurement data are only sent after the current
    measurement cycle is completed.

"C"  Clear buffer
    Clears the internal buffer of the KM-27.

"M"  Request mode
    Sends information on the current mode. "C" means measurement in
    progress. "H" means hold. "S" means measurement is completed.

"R"  Resend measurement data
    Sends the last data once more. Data preceding the last data are permanently
    erased.

"U"  Universal select
    When this command is received, the KM-27 responds to all commands,
    regardless of select codes programmed at the unit.
Data Format

The KM-27 can send measurement result data to the computer. The data are sent as ASCII strings with predetermined position assignments. The total length of the string depends on the amount of data. Each data set consists of a 3-character header which indicates the data type (such as particle size range), followed by a 6-character data string.

The data format is as shown below.

Special characters used as status prefix have the following meaning.

<table>
<thead>
<tr>
<th>Character</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Space)</td>
<td>No alarm</td>
</tr>
<tr>
<td>!</td>
<td>Calibration problem</td>
</tr>
<tr>
<td>&quot;</td>
<td>Backup battery voltage low</td>
</tr>
<tr>
<td>#</td>
<td>Calibration problem, Backup battery voltage low</td>
</tr>
<tr>
<td>$</td>
<td>Alarm</td>
</tr>
<tr>
<td>%</td>
<td>Calibration problem, alarm</td>
</tr>
<tr>
<td>&amp;</td>
<td>Backup battery voltage low, alarm</td>
</tr>
<tr>
<td>'</td>
<td>Calibration problem, Backup battery voltage low, alarm</td>
</tr>
</tbody>
</table>

$b$: blank
The display on the KM-27 has 7 digits, but the data sent via the serial interface are 6 digits only. If the count has exceeded 6 digits, overflow occurs and the output is "999999".
## Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Optical system</strong></td>
<td>70° sideways light-scattering method</td>
</tr>
<tr>
<td><strong>Light source</strong></td>
<td>Laser diode</td>
</tr>
<tr>
<td><strong>Laser product classification</strong></td>
<td>Class 1, IEC 60825-1 (1993-11)</td>
</tr>
<tr>
<td></td>
<td>Internal particle detection mechanism uses Class 3B laser</td>
</tr>
<tr>
<td><strong>Light detector</strong></td>
<td>Pin type photodiode</td>
</tr>
<tr>
<td><strong>Calibration</strong></td>
<td>Polystyrene latex (PSL) spheres (refractive index 1.6)</td>
</tr>
<tr>
<td><strong>Minimum particle size</strong></td>
<td>0.3 µm</td>
</tr>
<tr>
<td><strong>Particle size ranges</strong></td>
<td>Six channels</td>
</tr>
<tr>
<td></td>
<td>(≥0.3 µm, ≥0.5 µm, ≥1 µm, ≥3 µm, ≥5 µm, ≥10 µm)</td>
</tr>
<tr>
<td><strong>Sample flow rate</strong></td>
<td>28.3 L/min</td>
</tr>
<tr>
<td><strong>Maximum particle number concentration</strong></td>
<td>14,000 particles/L</td>
</tr>
<tr>
<td></td>
<td>(coincidence loss 5% for 0.3 µm particles)</td>
</tr>
<tr>
<td><strong>Display</strong></td>
<td>7-digit LED display</td>
</tr>
<tr>
<td><strong>Measurement modes</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Manual</strong></td>
<td>Unit performs one measurement for preset measurement period and then stops.</td>
</tr>
<tr>
<td><strong>Automatic</strong></td>
<td>Unit performs a preset number of measurement cycles consisting of measurement period and hold time.</td>
</tr>
<tr>
<td><strong>Concen. (Concentration)</strong></td>
<td>Unit performs a preset number of measurement cycles and converts particle count into volumetric count using 1 CF or 1000 L. The counter runs until measurement is terminated.</td>
</tr>
<tr>
<td><strong>Beep</strong></td>
<td>A beep is emitted whenever particle count exceeds preset alarm level or an integer multiple of alarm level. The counter runs until measurement is terminated.</td>
</tr>
</tbody>
</table>
Specifications

Counting modes
- **Cumulative**: Cumulative count for all particles of specified size and above is shown.
- **Differential**: Count for particles with size between selected channel and next higher channel is shown.

Measurement parameters
- Measurement location number
  - Setting range: 0 to 999
- Measurement period
  - Setting range: 1 second to 23 hours 59 minutes 59 seconds (or continuous)
- Hold time
  - Setting range: 1 second to 23 hours 59 minutes 59 seconds
- Measurement cycles
  - Setting range: 1 to 999 (or continuous)

External connectors
- **SERIAL I/O**: For serial connection to a computer with RS-232-C interface
- **MANIFOLD**: For connection of optional manifold system
- **RETURN AIR**: For connection to sample manifold when optional manifold system is used

Printer
- **Built-in thermal printer**

Data printing
- On internal printer, after each measurement or by operator command

Printout contents
- Measurement location number, measurement date/time, measurement cycles, measurement period, cumulative and differential count for each particle size range

Ambient conditions for operation
- 12 to 29°C, 20 to 85% RH (no condensation)

Warm-up time
- 10 minutes

Power requirements
- 100 V AC (±10%), 50/60 Hz, 150 VA

Dimensions
- 156 (H) × 285 (W) × 448 (D) mm (without protruding parts)
- 165 (H) × 335 (W) × 479 (D) mm (maximum)

Weight
- Approx. 11 kg
Specifications

Supplied accessories

Filter 1
Power cord 1
Sampling tube 1
  (Tigon tube R-3400, OD3/8 inch × ID1/4 inch, 1 m)
Fuse (4 A) 2
Brush 1
Inlet cap 1
Printer paper (TF50KS-R) 2 rolls
Instruction manual 1
Inspection certificate 1
Specifications

Dimensional Drawings

Unit: mm