The theory of light scattering
When particle size becomes smaller than the wavelength of light, the scattering of light energy by particles plays a more dominant role than reflection or refraction. The intensity of the scattered light has a constant relationship to particle size, the refractive index of particles and medium, light wavelength, etc., and it is possible to determine the size of the particle by measuring the intensity of scattered light.

Light obscuration method
Light scattering occurs when the sample introduced through the inlet nozzle is irradiated with light and then the particles pass through the light. The scattered light is detected by the photo detector and is converted to electrical signals. The size of the electrical signals represents the particle size and the frequency of scattered-light detection represents the particle count. A particle detection cell (flow cell) made of fused silica or sapphire is used if the sample is liquid.

Light-scattering method
Light scattering occurs when the sample introduced through the inlet nozzle is irradiated with light and then the particles pass through the light. The scattered light is detected by the photo detector and is converted to electrical signals. The size of the electrical signals represents the particle size and the frequency of scattered-light detection represents the particle count. A particle detection cell (flow cell) made of fused silica or sapphire is used if the sample is liquid.

Outline drawing of the light-scattering method sensor

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3 Overview of airborne particle counters
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11 Examples of liquid-borne particle counter systems
12 Liquid-borne particle counters
17 Overview of gas-borne particle counters / KS-93
18 Example of multi-point monitoring system installation (Sensors, Tubes)
19 Software / Multi-point monitoring software
20 Overview of pharmaceuticals / pharmaceutical standards / KL-8A4 / Injection fluid measurement systems
21 Validation
22 Options
23 Company outline
Major fields of use of airborne particle counters

Airborne particle counters are used for the purpose of counting the number of particles suspended in the air including airborne particle management and filter performance tests in cleanrooms, air showers, mini-environments (front opening unified pod (FOUP), etc.), and dust generation tests for hard disc drive (HHD) parts, etc. Cleanrooms consist of industrial clean rooms (ICR), used in semiconductor and flat panel display (FPD) production and in other industrial fields, and biological clean rooms (BCP) used in pharmaceutical and food production, hospitals and surgery rooms and managed particle size differs in each industrial field.

Cleanliness classes

Cleanliness class is determined by ISO 14644-1. Maximum concentration for each cleanliness class and its measured particle size is defined as shown in the Table 1. The expressions of “class 100” and “class 10 000,” which have been used for many years, originate from the U.S. standards Fed-Std-209E where cleanrooms with a maximum of 100 particles of 0.5 μm or larger per cubic foot (Approx. 28.3 L) were considered to be class 100. This standard, however, was eliminated in November 2001 promised by the formulation of the ISO standards. The Fed-Std-209E classes that correspond to the ISO cleanliness classes are indicated on the right-hand side of Table 1. Cleanrooms are also used and managed for the purpose of preventing foreign matter from mixing, contamination and infection in biotechnology, medical treatment, pharmaceutical production, and food product industries. If cleanliness management of maximum concentration based on particle count, controlling microorganisms has also become necessary in cleanroom management.

The concentration of suspended bacteria is regulated by PIC/S, GMP, JP, FDA and so forth while the maximum concentration of particles draws upon ISO 14644-1 and other standards.

Determining the maximum concentration for each particle size

Max. concentration Cm = k^2 / D

Where k is more than 1000 m^2, N_k > 27x 4/1000

Major change in ISO 14644-1: 2015

- Maximum concentration to determine the cleanliness level has been changed from “average from all measured points” to “individual points must not exceed upper limit”.
- Number of points to measure is selected based on Table 3.
- Concentration of 5μm at class 5 has been deleted.
- Determination standard of 0.5μm upper confidence limits for measurement points 2 to 9 has been deleted.
Air cleanliness in sterile pharmaceutical production areas

**JP (Japan Pharmacopoeia)**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Maximum permitted particle count N/m³</th>
<th>At rest 0.5 µm</th>
<th>At rest 5 µm</th>
<th>In operation 0.5 µm</th>
<th>In operation 5 µm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>3,520</td>
<td>20</td>
<td>3,520</td>
<td>20</td>
<td>1&lt;1</td>
</tr>
<tr>
<td>B</td>
<td>3,520</td>
<td>20</td>
<td>3,520</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>C</td>
<td>352,000</td>
<td>2,900</td>
<td>3,520,000</td>
<td>29,000</td>
<td>100</td>
</tr>
<tr>
<td>D</td>
<td>3,520,000</td>
<td>29,000</td>
<td></td>
<td></td>
<td>200</td>
</tr>
</tbody>
</table>

**EU-GMP (European Pharmacopoeia)**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Maximum permitted particle count N/m³</th>
<th>At rest 0.5 µm</th>
<th>At rest 5 µm</th>
<th>In operation 0.5 µm</th>
<th>In operation 5 µm</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>3,520</td>
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<td>3,520</td>
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<td>3,520</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>C</td>
<td>352,000</td>
<td>2,900</td>
<td>3,520,000</td>
<td>29,000</td>
<td>100</td>
</tr>
<tr>
<td>D</td>
<td>3,520,000</td>
<td>29,000</td>
<td></td>
<td></td>
<td>200</td>
</tr>
</tbody>
</table>

**ISO 21501-4**

**Counting efficiency**
The counting efficiency shall be (50 ± 20) % for calibration particles with a size close to the minimum detectable size, and it shall be (100 ± 10) % for calibration particles with a size of 1.5 times to 2 times larger than the minimum detectable particle size.

**False count rate**
The false count rate is determined by measuring the particle number concentration in the unit of counts per cubic meter at the minimum reported size range when sampling clean air.

**Sampling flow rate**
The standard uncertainty of volumetric flow rate shall be equal to or less than ± 5 %.

**Maximum particle number concentration**
The maximum measurable particle number concentration shall be specified by the manufacturer.

**NOTE**
When the particle number concentration is higher than the maximum particle number concentration, the number of uncounted particles increases because of an enhanced probability of multiple particles existing in the sensing volume (coincidence error) and/or saturation of the electronic system.

**Calibration interval**
It is recommended that the calibration interval of an LSAPC be one year or less.

---

### Standards for particle counters

[Light scattering airborne particle counter for clean spaces] (An extract)

### Examples of airborne particle measurement

**General measurement**
Cleanrooms, clean benches, surgery rooms, sterile rooms, etc.

**Filter performance testing**

**Dust source surveys**
Using the audio mode

---

**Examples of airborne particle measurement**

**Connected to printer**

**Connected to computer**

**Suction**

**Outlet (clean air)**

**Low**

**High**

**Long**

**Short**

**Beep! Beep! Beep!**
Particle Counter

**KC-22A** (Light-scattering method)

- **Light source**: Diode pumped solid state laser (wavelength: 1,064 nm)
- **Flow rate**: 2.83 L/min
- **Size range (5 channels)**: ≥ 0.1 μm, ≥ 0.15 μm, ≥ 0.2 μm, ≥ 0.3 μm, ≥ 0.5 μm
- **Maximum particle number concentration**: 10,000 particles/L (coincidence loss 5%)
- **Sampling tube diameter**: Outside diameter: 7 mm, Inside diameter: 5 mm
- **Power**: 100 V AC, 50/60 Hz, Approx. 80 VA
- **Dimensions and weight**: Approx. 185 (H) × 155 (W) × 330 (D) mm, Approx. 7.5 kg

This product is environment-friendly. It does not include toxic chemicals on our policy.

**KC-22B** (Light-scattering method)

- **Light source**: Diode pumped solid state laser (wavelength: 1,064 nm)
- **Flow rate**: 2.83 L/min
- **Size range (5 channels)**: ≥ 0.1 μm, ≥ 0.15 μm, ≥ 0.2 μm, ≥ 0.3 μm, ≥ 0.5 μm
- **Maximum particle number concentration**: 10,000 particles/L (coincidence loss 5%)
- **Sampling tube diameter**: Outside diameter: 7 mm, Inside diameter: 5 mm
- **Power**: 100 V AC, 50/60 Hz, Approx. 80 VA
- **Dimensions and weight**: Approx. 185 (H) × 155 (W) × 330 (D) mm, Approx. 7.5 kg

This product is environment-friendly. It does not include toxic chemicals on our policy.

**KC-24** (Light-scattering method)

- **Light source**: Diode pumped solid state laser (wavelength: 1,064 nm)
- **Flow rate**: 28.3 L/min
- **Size range (5 channels)**: ≥ 0.1 μm, ≥ 0.15 μm, ≥ 0.2 μm, ≥ 0.3 μm, ≥ 0.5 μm
- **Maximum particle number concentration**: 2,000,000 particles/m³ (coincidence loss 10%)
- **Sampling tube diameter**: Outside diameter: 11 mm, Inside diameter: 7 mm
- **Power**: 100 V to 240 V AC, 50/60 Hz, Approx. 300 VA
- **Dimensions and weight**: Approx. 280 (H) × 320 (W) × 450 (D) mm, Approx. 19.4 kg

This product is environment-friendly. It does not include toxic chemicals on our policy.

Not available in EU.
Particle Counters Airborne

Particle Counter

**KC-31** (Light-scattering method)

- **Light source**: Laser diode (wavelength 780 nm, rated output 100 mW)
- **Flow rate**: 28.3 L/min
- **Size range (6 channels)**: ≥ 0.3 μm, ≥ 0.5 μm, ≥ 1.0 μm,
  ≥ 2.0 μm, ≥ 5.0 μm, ≥ 10.0 μm
- **Maximum particle number concentration**: 28 000 000 particles/m³ (coincidence loss 10 %)
- **Sampling tube diameter**: Outside diameter: Ø 16 mm, Inside diameter: Ø 12 mm
- **Power**: Lithium ion battery or AC adapter (100 V to 240 V AC, 50/60 Hz)
- **Dimensions and weight**: Approx. 203 (H) × 260 (W) × 266 (D) mm (excl. protruding parts),
  Approx. 5.5 kg (with 1 battery)

This product is environment-friendly. It does not include toxic chemicals on our policy.

Particle Counter

**KC-32** (Light-scattering method)

- **Light source**: Laser diode (wavelength 780 nm, rated output 100 mW)
- **Flow rate**: 50 L/min
- **Size range (6 channels)**: ≥ 0.3 μm, ≥ 0.5 μm, ≥ 1.0 μm,
  ≥ 2.0 μm, ≥ 5.0 μm, ≥ 10.0 μm
- **Maximum particle number concentration**: 16 000 000 particles/m³ (coincidence loss 10 %)
- **Sampling tube diameter**: Outside diameter: Ø 16 mm, Inside diameter: Ø 12 mm
- **Power**: Lithium ion battery or AC adapter (100 V to 240 V AC, 50/60 Hz)
- **Dimensions and weight**: Approx. 203 (H) × 260 (W) × 266 (D) mm (excl. protruding parts),
  Approx. 5.5 kg (with 1 battery)

This product is environment-friendly. It does not include toxic chemicals on our policy.

Particle Counter

**KC-20A** (Light-scattering method)

- **Light source**: Laser diode (wavelength 780 nm, rated output 3 mW)
- **Flow rate**: 30 L/min
- **Size range (5 channels)**: ≥ 10 μm, ≥ 20 μm, ≥ 30 μm, ≥ 50 μm, ≥ 100 μm
- **Maximum particle number concentration**: 2 000 particles/L (coincidence loss 5 %)
- **Sampling tube diameter**: Outside diameter: Ø 11 mm, Inside diameter: Ø 7 mm
- **Power**: 100 V to 240 V AC, 50/60 Hz, Approx. 160 VA
- **Dimensions and weight**: Approx. 135 (H) × 300 (W) × 401 (D) mm, Approx. 11.6 kg

This product is environment-friendly. It does not include toxic chemicals on our policy.
Hand-held Particle Counter

**KC-51 (Light-scattering method)**

- **Light source**: Laser diode (wavelength 780 nm, rated output 35 mW)
- **Flow rate**: 2.83 L/min
- **Size range**: 3 channels: 0.3 μm, 0.5 μm, 5 μm (Default setting)
- **Maximum particle number concentration**: 140,000,000 particles/m³ (coincidence loss 10 %)
- **Sampling tube diameter**: Outside diameter: Ø8 mm, Inside diameter: Ø6 mm
- **Power**: Built-in battery or AC adapter (100 V to 240 V AC, 50/60 Hz)
- **Dimensions and weight**: Approx. 304 (H) × 87 (W) × 55 (D) mm, Approx. 780 g

*This product is environment-friendly. It does not include toxic chemicals on our policy.*

---

Hand-held Particle Counter

**KC-52 (Light-scattering method)**

- **Light source**: Laser diode (wavelength 780 nm, rated output 40 mW)
- **Flow rate**: 0.5 L/min
- **Size range**: 5 channels: 0.3 μm, 0.5 μm, 1 μm, 2 μm, 5 μm
- **Maximum particle number concentration**: 100,000 particles/L (coincidence loss 5 %)
- **Sampling tube diameter**: Outside diameter: Ø7 mm, Inside diameter: Ø5 mm
- **Power**: 100 V to 240 V AC, 50/60 Hz, Approx. 50 VA
- **Dimensions and weight**: Approx. 135 (H) × 300 (W) × 300 (D) mm, Approx. 6.3 kg

*This product is environment-friendly. It does not include toxic chemicals on our policy.*

---

Particle Counter

**KC-01E (Light-scattering method)**

- **Light source**: Laser diode (wavelength 780 nm, rated output 40 mW)
- **Flow rate**: 0.5 L/min
- **Size range**: 5 channels: 0.3 μm, 0.5 μm, 1 μm, 2 μm, 5 μm
- **Maximum particle number concentration**: 100,000 particles/L (coincidence loss 5 %)
- **Sampling tube diameter**: Outside diameter: Ø7 mm, Inside diameter: Ø5 mm
- **Power**: 100 V to 240 V AC, 50/60 Hz, Approx. 50 VA
- **Dimensions and weight**: Approx. 135 (H) × 300 (W) × 300 (D) mm, Approx. 6.3 kg

*This product is environment-friendly. It does not include toxic chemicals on our policy.*

---

Particle Counter

**KC-03B (Light-scattering method)**

- **Light source**: Laser diode (wavelength 780 nm, rated output 40 mW)
- **Flow rate**: 3 L/min
- **Size range**: 5 channels: 0.3 μm, 0.5 μm, 1 μm, 2 μm, 5 μm
- **Maximum particle number concentration**: 30,000 particles/L (coincidence loss 5 %)
- **Sampling tube diameter**: Outside diameter: Ø7 mm, Inside diameter: Ø5 mm
- **Power**: 100 V to 240 V AC, 50/60 Hz, Approx. 65 VA
- **Dimensions and weight**: Approx. 135 (H) × 300 (W) × 300 (D) mm, Approx. 7.3 kg

*This product is environment-friendly. It does not include toxic chemicals on our policy.*
PARTICLE COUNTERS AIR BORNE

### Particle Sensor

**KA-05** *(Light-scattering method)*

<table>
<thead>
<tr>
<th>Spec</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light source</td>
<td>Laser diode (wavelength 785 nm, rated output 70 mW)</td>
</tr>
<tr>
<td>Flow rate</td>
<td>28.3 L/min</td>
</tr>
<tr>
<td>Size range (2 channels)</td>
<td>≥ 0.5 μm, ≥ 5.0 μm</td>
</tr>
<tr>
<td>Maximum particle number concentration</td>
<td>28 000 000 particles/m³ (coincidence loss 10%)</td>
</tr>
<tr>
<td>Sampling tube diameter</td>
<td>Inside diameter: φ 6 mm</td>
</tr>
<tr>
<td>Power</td>
<td>9 to 28 V DC (supplied by external unit, option)</td>
</tr>
<tr>
<td>Dimensions and weight</td>
<td>90 (H) x 130 (W) x 58 (D) mm (excl. protruding parts), Approx. 2 kg</td>
</tr>
</tbody>
</table>

This product is environment-friendly; it does not include toxic chemicals on our policy.

### Particle Sensor

**KA-02** *(Light-scattering method)*

<table>
<thead>
<tr>
<th>Spec</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light source</td>
<td>Laser diode (wavelength 780 nm, rated output 35 mW)</td>
</tr>
<tr>
<td>Flow rate</td>
<td>2.83 L/min</td>
</tr>
<tr>
<td>Size range (2 channels)</td>
<td>≥ 0.3 μm, ≥ 0.5 μm</td>
</tr>
<tr>
<td>Maximum particle number concentration</td>
<td>140 000 000 particles/m³ (coincidence loss 10%)</td>
</tr>
<tr>
<td>Sampling tube diameter</td>
<td>Internal diameter: 1/8-inch, (approx. 3.2 mm)</td>
</tr>
<tr>
<td>Power</td>
<td>9 to 28 V DC (supplied by external unit, option)</td>
</tr>
<tr>
<td>Dimensions and weight</td>
<td>52 (H) x 107 (W) x 53 (D) mm (excl. protruding parts), Approx. 360 g</td>
</tr>
</tbody>
</table>

This product is environment-friendly; it does not include toxic chemicals on our policy.

### Particle Sensor

**KA-03** *(Light-scattering method)*

<table>
<thead>
<tr>
<th>Spec</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light source</td>
<td>Laser diode (wavelength 780 nm, rated output 35 mW)</td>
</tr>
<tr>
<td>Flow rate</td>
<td>2.83 L/min</td>
</tr>
<tr>
<td>Size range (5 channels)</td>
<td>≥ 0.3 μm, ≥ 0.5 μm, ≥ 1.0 μm, ≥ 2.0 μm, ≥ 5.0 μm</td>
</tr>
<tr>
<td>Maximum particle number concentration</td>
<td>140 000 000 particles/m³ (coincidence loss 10%)</td>
</tr>
<tr>
<td>Sampling tube diameter</td>
<td>Outside diameter: φ 7 mm, Inside diameter: φ 5 mm</td>
</tr>
<tr>
<td>Power</td>
<td>AC adapter (100 V to 240 V AC, 50/60 Hz)</td>
</tr>
<tr>
<td>Dimensions and weight</td>
<td>126 (H) x 87 (W) x 204 (D) mm (excl. protruding parts), Approx. 2 kg</td>
</tr>
</tbody>
</table>

This product is environment-friendly; it does not include toxic chemicals on our policy.

### Particle Sensor

**KA-82** *(Light-scattering method)*

<table>
<thead>
<tr>
<th>Spec</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light source</td>
<td>Diode pumped solid state laser (wavelength: 1.064 nm)</td>
</tr>
<tr>
<td>Flow rate</td>
<td>2.83 L/min</td>
</tr>
<tr>
<td>Size range (5 channels)</td>
<td>≥ 0.1 μm, ≥ 0.15 μm, ≥ 0.2 μm, ≥ 0.3 μm, ≥ 0.5 μm</td>
</tr>
<tr>
<td>Maximum particle number concentration</td>
<td>10 000 particles/L (coincidence loss 5%)</td>
</tr>
<tr>
<td>Sampling tube diameter</td>
<td>Outside diameter: φ 7 mm, Inside diameter: φ 5 mm</td>
</tr>
<tr>
<td>Power</td>
<td>100 V to 240 V AC, 50/60 Hz, Approx. 100 VA</td>
</tr>
<tr>
<td>Dimensions and weight</td>
<td>Approx. 185 (H) x 155 (W) x 330 (D) mm, Approx. 7.5 kg</td>
</tr>
</tbody>
</table>

Not available in EU.
Major fields of use of liquid-borne particle counters

Liquid-borne particle counters are used for the control of particles in chemical used for the semiconductor process specialized material such as SOG (spin on glass) and photoresist materials, ultrapure water and cleaning-use chemical agents (e.g., alkaline, organic solvents, hydrofluoric acid).

In addition, they are also used for the detection of coarse particles in chemical mechanical polishing (CMP) slurry, measurement methods include in-line and batch measurements.

Management of chemical fluids

Chemical fluids are used in the precision electronic industry for cleaning as well as the removal of oxidized film and photoresist. Pure water and chemical fluids are used in large quantities especially in the production of semiconductors, hard disk drives (HDD) and flat panel displays (FPD). The control of liquid-borne particles has become essential for the realization of improvements in quality and yield due to the miniaturization and larger scale integration of such electronic devices.

In semiconductor production lines and spaces have now been reduced to less than 0.1μm, while the head-to-media clearance in the production of HDD has dropped below 0.01μm. In FPD production, there are demands for larger screens and higher quality for TVs and monitors, accordingly pixel defects on large glass substrate measuring 1 to 2 square meters cannot be permitted. It is thus important to control peripheral particles in order to ensure improvements in microfabrication technology and the production of high performance electronic devices. Liquid-borne particle counters play an important role as qualitative devices for measuring them.

Cleaning process assessment and management

In semiconductor production, particles adhering to wafers are removed through a cleaning process. In addition, the generation of dust in the component parts themselves of products that require the suppression of dust, has a considerable impact on product quality and performance. It is therefore necessary to clean each of them individually and gauge the effect. In order to ensure highly effective and reliable cleaning, it is necessary to implement the management of various elements including the confirmation of particle count in the cleaning agent prior to use, volume of overflow in the cleaning agent tank, optimal supply volume of cleaning agent, optimal cleaning time and cleanliness of recycled cleaning agent.

Particle measurement can be carried out effectively using liquid-borne particle counters as a means for clarifying the relationship between these various elements and throughput, yield, etc., and for resolving problem areas. Directly connecting a particle counter to supply-lines for cleaning tanks and recirculation lines as well as implementing constant monitoring makes it possible to identify particle fluctuations in cleaning tanks and recirculation lines and scientifically improve production lines.

**PARTICLE COUNTERS**

**LIQUID-BORNE**

Compatible with a wide variety of fluids from pure water to hydrofluoric acid

Liquid-borne particles contamination have a significant effect on product quality.

In addition, fluids that are consumed by the human body are also thought to have an effect on human life depending on the properties of suspended particles.

The control of liquid-borne particles has become essential in all fields.

**Pulse Height Analysis Software**

**KF-50A**

- Displays results of pulse height analysis as performed in particle counter
- Automatically calculates particle sizes from voltage values for display
- Suitable for noise check of samples with noise rise such as photoresist
- Ideal for maintenance purposes and for assuring particle counter classification accuracy
- Particle distribution data can be used to test particle generator stability

Pulse height analysis example
Example of application

<table>
<thead>
<tr>
<th>Application</th>
<th>Target sample</th>
<th>Compatible models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wet process</td>
<td>Acid (including Hf), alkali, organic solvents, pure water, etc.</td>
<td>KS-28B, etc.</td>
</tr>
<tr>
<td>Film formation</td>
<td>Pure water</td>
<td>KS-18F, KS-18B, KS-16F/16BF, KS-17B</td>
</tr>
<tr>
<td>Plating</td>
<td>Copper sulfate</td>
<td>KS-42B, KS-42C, KS-42D</td>
</tr>
<tr>
<td>Lithography</td>
<td>Resist, developing fluid, antireflection agents, etc.</td>
<td>KS-42B, KS-42C, KS-42D</td>
</tr>
<tr>
<td>Part dust generation test</td>
<td>Pure water, IPA</td>
<td>KS-42C</td>
</tr>
<tr>
<td>Injection fluid, cleanliness</td>
<td>Injection fluid, injection-use water, infusion solutions, rubber stoppers, etc.</td>
<td>KS-31W</td>
</tr>
</tbody>
</table>

Example of measurement with liquid-borne particle counters

Example 1
Measurement particles at the wet cleaning process

Example 2
Measurement particles removed from the parts surface
Examples of liquid-borne particle counter systems

In-line measurement systems

In-line measurement system 1 (using flow controller)

Batch measurement systems

Batch measurement system 1 (for submicron particles, Max. 10ch)

Batch measurement system 2 (pressure suction)

Batch measurement system 3 (for micron particles, 10ch selectable sizes)
**PARTICLE COUNTERS LIQUID-BORNE**

---

**Controller**

**KE-40B1**

- **Size range**: 10 channels
- **Numerical display**: Count (max. 8 digits)
- **Measurement time**: 10 seconds to 2 hours, manual
- **Power**: 100 V to 240 V AC, 50/60 Hz, Approx. 130 VA
- **Dimensions and weight**: Approx. 140 (H) × 240 (W) × 146 (D) mm, Approx. 3 kg

*This product is environment-friendly. It does not include toxic chemicals on our policy.*

---

**Particle Sensor**

**KS-41A** *(Light-scattering method)*

- **Light source**: Laser diode (wavelength 830 nm, rated output 200 mW)
- **Materials of parts exposed to sample**: Synthetic quartz, PFA
- **Flow rate**: 10 mL/min
- **Setting range**: 0.15 μm to 0.5 μm
- **Factory default (4 channels)**: ≥ 0.15 μm, ≥ 0.2 μm, ≥ 0.3 μm, ≥ 0.5 μm
- **Maximum particle number concentration**: 1 200 particles/mL (coincidence loss 5 %)
- **Power**: DC12 V (Supplied by KE-40B1)
- **Dimensions and weight**: 160 (H) × 300 (W) × 251 (D) mm, Approx. 7.5 kg

*This product is environment-friendly. It does not include toxic chemicals on our policy.*

---

**Particle Sensor**

**KS-41B** *(Light-scattering method)*

- **Light source**: Diode pumped solid state laser (wavelength 532 nm, rated output 500 mW)
- **Materials of parts exposed to sample**: Synthetic quartz, PFA
- **Flow rate**: 5 mL/min
- **Setting range**: 0.1 μm to 0.5 μm
- **Factory default (5 channels)**: ≥ 0.1 μm, ≥ 0.15 μm, ≥ 0.2 μm, ≥ 0.3 μm, ≥ 0.5 μm
- **Maximum particle number concentration**: 9 600 particles/mL (coincidence loss 10 %)
- **Power**: DC12 V (supplied by KE-40B1)
- **Dimensions and weight**: 164 (H) × 464 (W) × 305 (D) mm (excluding protruding parts), Approx. 12.5 kg

*(Use of 10 mL glass syringe is necessary)*

*This product is environment-friendly. It does not include toxic chemicals on our policy.*
**Particle Sensor**

**KS-19F (Light-scattering method)**

- **Light source**: Diode pumped solid state laser (wavelength 532 nm, rated output 800 mW)
- **Materials of parts exposed to sample**: Sapphire, PFA
- **Flow rate**: 10 mL/min
- **Setting range**: 0.03 μm to 0.13 μm
- **Factory default (4 channels)**: ≥ 0.03 μm, ≥ 0.06 μm, ≥ 0.1 μm, ≥ 0.13 μm
- **Maximum particle number concentration**: 40 000 particles/mL, (coincidence loss 10 %)
- **Power**: DC12 V (Supplied by KE-40B1)
- **Dimensions and weight**: Approx. 147 (H) × 272 (W) × 442 (D) mm, Approx. 12 kg

**KS-18FX (Light-scattering method)**

- **Light source**: Diode pumped solid state laser (wavelength 532 nm,rated output 500 mW)
- **Materials of parts exposed to sample**: Sapphire, PFA
- **Flow rate**: 10 mL/min
- **Setting range**: 0.04 μm to 0.15 μm
- **Factory default (4 channels)**: ≥ 0.04 μm, ≥ 0.06 μm, ≥ 0.1 μm, ≥ 0.15 μm
- **Maximum particle number concentration**: 30 000 particles/mL, (coincidence loss 10 %)
- **Power**: DC12 V (Supplied by KE-40B1)
- **Dimensions and weight**: Approx. 147 (H) × 272 (W) × 442 (D) mm, Approx. 12 kg

**KS-18F (Light-scattering method)**

- **Light source**: Diode pumped solid state laser (wavelength 532 nm, rated output 500 mW)
- **Materials of parts exposed to sample**: Sapphire, PFA
- **Flow rate**: 10 mL/min
- **Setting range**: 0.05 μm to 0.2 μm
- **Factory default (4 channels)**: ≥ 0.05 μm, ≥ 0.1 μm, ≥ 0.15 μm, ≥ 0.2 μm
- **Maximum particle number concentration**: 30 000 particles/mL, (coincidence loss 10 %)
- **Power**: DC12 V (Supplied by KE-40B1)
- **Dimensions and weight**: Approx. 147 (H) × 272 (W) × 442 (D) mm, Approx. 12 kg

**KS-42A/42AF (Light-scattering method)**

- **Light source**: Laser diode (wavelength 830 nm, rated output 200 mW)
- **Materials of parts exposed to sample**: KS-42A: Synthetic quartz, PFA
- **Flow rate**: 10 mL/min
- **Setting range**: 0.1 μm and 0.13 μm to 0.5 μm
- **Factory default (6 channels)**: ≥ 0.1 μm, ≥ 0.15 μm, ≥ 0.2 μm, ≥ 0.3 μm, ≥ 0.5 μm
- **Maximum particle number concentration**: 1 200 particles/mL, (coincidence loss 5 %)
- **Power**: DC12 V (Supplied by KE-40B1)
- **Dimensions and weight**: Approx. 125 (H) × 240 (W) × 151 (D) mm, Approx. 4 kg

This product is environment-friendly. It does not include toxic chemicals on our policy.

KS-42AF: Compatible with hydrofluoric acid
PARTICLE COUNTERS LIQUID-BORNE

Particle Sensor

KS-42D (Light obscuration method)

- **Light source**: Laser diode (wavelength 780 nm, rated output 5 mW)
- **Materials of parts exposed to sample**: Synthetic quartz, PFA, Perfluoro
- **Flow rate**: 25 mL/min
- **Setting range**: 2 μm to 100 μm
- **Factory default**: (8 channels) ≥ 2 μm, ≥ 5 μm, ≥ 7 μm, ≥ 10 μm, ≥ 25 μm, ≥ 50 μm, ≥ 100 μm (≥ 150 μm support available as option)
- **Maximum particle number concentration**: 10,000 particles/mL (coincidence loss 10 %)
- **Power**: DC12 V (Supplied by KE-40B1)
- **Dimensions and weight**: Approx. 125 (H) × 140 (W) × 150 (D) mm, Approx. 2.2 kg

This product is environment-friendly. It does not include toxic chemicals on our policy.

Particle Sensor

KS-42B/42BF (Light-scattering method)

- **Light source**: Laser diode (wavelength 780 nm, rated output 40 mW)
- **Materials of parts exposed to sample**:
  - KS-42B: Synthetic quartz, PFA, PTFE
  - KS-42BF: Sapphire, PFA, PTFE
- **Flow rate**: 10 mL/min
- **Setting range**: 0.2 μm to 2 μm
- **Factory default**: (5 channels) ≥ 0.2 μm, ≥ 0.3 μm, ≥ 0.5 μm, ≥ 1 μm, ≥ 2 μm
- **Maximum particle number concentration**: 1,200 particles/mL (coincidence loss 5 %)
- **Power**: DC12 V (Supplied by KE-40B1)
- **Dimensions and weight**: Approx. 125 (H) × 240 (W) × 151 (D) mm, Approx. 3.2 kg

This product is environment-friendly. It does not include toxic chemicals on our policy.

Particle Sensor

KS-42C (Light-scattering method)

- **Light source**: Laser diode (wavelength 780 nm, rated output 5 mW)
- **Materials of parts exposed to sample**: Synthetic quartz, PFA, PTFE
- **Flow rate**: 10 mL/min
- **Setting range**: 0.5 μm to 20 μm
- **Factory default**: (7 channels) ≥ 0.5 μm, ≥ 1 μm, ≥ 2 μm, ≥ 3 μm, ≥ 5 μm, ≥ 10 μm, ≥ 20 μm
- **Maximum particle number concentration**: 1,200 particles/mL (coincidence loss 5 %)
- **Power**: DC12 V (Supplied by KE-40B1)
- **Dimensions and weight**: Approx. 125 (H) × 240 (W) × 151 (D) mm, Approx. 3 kg

This product is environment-friendly. It does not include toxic chemicals on our policy.
PARTICLE COUNTERS

AIRBORNE PARTICLE COUNTERS
LIQUID-BORNE PARTICLE COUNTERS
GAS-BORNE PARTICLE COUNTERS
PHARMACEUTICAL PRODUCTS
MONITORING SYSTEM
VALIDATION

COMPANY OUTLINE

PARTICLE COUNTERS

KL-30AX (Light-scattering method)
Light source: Diode pumped solid state laser (wavelength 532 nm, rated output 500 mW)
Materials of parts: Synthetic quartz, fluorocarbon rubber, fluoroplastic, PVC,
exposed to sample: SUS304/316, Pyrex glass, POM
Sampling flow rate: Flow rate 20 mL/min and purge flow rate 0.1 to 1 L/min combined
(Purge flow rate will differ depending on sample fluid pressure)
Setting range: 0.04 µm to 0.2 µm
Factory default: (4 channels)  ≥ 0.04 µm, ≥ 0.08 µm, ≥ 0.1 µm, ≥ 0.15 µm
Maximum particle number concentration: 15,000 particles/mL (coincidence loss 10 %)
Power: 100 V to 240 V AC, 50/60 Hz, 130 VA
Dimensions and weight: Approx. 230 (H) x 385 (W) x 570 (D) mm, Approx. 24.8 kg
For pure water

Particle Counter
KL-30B (Light-scattering method)
Light source: Laser diode (wavelength 830 nm, rated output 200 mW)
Materials of parts: Synthetic quartz, fluorocarbon rubber, fluoroplastic, PVC,
exposed to sample: SUS304/316, Pyrex glass, POM
Sampling flow rate: Flow rate 10 mL/min and purge flow rate 0.1 to 1 L/min combined
(Purge flow rate will differ depending on sample fluid pressure)
Setting range: 0.05 µm to 0.2 µm
Factory default: (4 channels)  ≥ 0.05 µm, ≥ 0.1 µm, ≥ 0.15 µm, ≥ 0.2 µm
Maximum particle number concentration: 15,000 particles/mL (coincidence loss 10 %)
Power: 100 V to 240 V AC, 50/60 Hz, Approx. 80 VA
Dimensions and weight: Approx. 230 (H) x 330 (W) x 569 (D) mm, Approx. 19.8 kg
This product is environment-friendly. It does not include toxic chemicals on our policy.

KL-30A (Light-scattering method)
Light source: Diode pumped solid state laser (wavelength 532 nm, rated output 500 mW)
Materials of parts: Synthetic quartz, fluorocarbon rubber, fluoroplastic, PVC,
exposed to sample: SUS304/316, Pyrex glass, POM
Sampling flow rate: Flow rate 10 mL/min and purge flow rate 0.1 to 1 L/min combined
(Purge flow rate will differ depending on sample fluid pressure)
Setting range: 0.05 µm to 0.15 µm
Factory default: (4 channels)  ≥ 0.05 µm, ≥ 0.1 µm, ≥ 0.15 µm, ≥ 0.2 µm
Maximum particle number concentration: 15,000 particles/mL (coincidence loss 10 %)
Power: 100 V to 240 V AC, 50/60 Hz, 130 VA
Dimensions and weight: Approx. 230 (H) x 385 (W) x 570 (D) mm, Approx. 24.8 kg
This product is environment-friendly. It does not include toxic chemicals on our policy.
PARTICLE COUNTERS LIQUID-BORNE

### Particle Sensor

**KS-17B** (Light-scattering method)
- **Light source:** Laser diode (wavelength 830 nm, rated output 200 mW)
- **Materials of parts exposed to sample:** Synthetic quartz, PFA, Fluorocarbon rubber
- **Flow rate:** 10 mL/min
- **Size range (2 channels):** ≥ 0.05 μm, ≥ 0.1 μm (4 channels optional)
- **Maximum particle number concentration:** 100,000 particles/mL (coincidence loss 5 %)
- **Power:** 100 V to 240 V AC, 40 VA (Including external power requirement KZ-50 (accessory))
- **Dimensions and weight:** Approx. 110 (H) × 240 (W) × 150 (D) mm, Approx. 3.5 kg

**KS-16/16F** (Light-scattering method)
- **Light source:** Laser diode (wavelength 830 nm, rated output 200 mW)
- **Materials of parts exposed to sample:** KS-16: Synthetic quartz, PFA, Fluorocarbon rubber
- **Flow rate:** 10 mL/min
- **Size range (5 channels):** ≥ 0.05 μm, ≥ 0.1 μm, ≥ 0.2 μm, ≥ 0.3 μm, ≥ 0.5 μm
- **Maximum particle number concentration:** 1,200,000 particles/mL (coincidence loss 5 %)
- **Power:** 100 V to 240 V AC, 40 VA (Including external power requirement KZ-50 (accessory))
- **Dimensions and weight:** Approx. 110 (H) × 240 (W) × 150 (D) mm, Approx. 3.5 kg

### Particle Counter

**KL-28B/28BF** (Light-scattering method)
- **Light source:** Laser diode (wavelength 830 nm, rated output 40 mW)
- **Materials of parts exposed to sample:** KS-28B: Synthetic quartz, PFA, PTFE
- **Flow rate:** 10 mL/min
- **Size range (2 channels):** ≥ 0.2 μm, ≥ 0.5 μm
- **Maximum particle number concentration:** 12,000 particles/mL (coincidence loss 5 %)
- **Power:** Supplied by KE-28B, 100 V to 240 V AC, 23 VA
- **Dimensions and weight:** Approx. 70 (H) × 85 (W) × 118 (D) mm, Approx. 0.6 kg
- **Controller:** KE-28B (exclusively for use with KS-28B/28BF)

**KS-16F:** Compatible with hydrofluoric acid

**KS-17B:** For pure water
Direct measurement of material gases for semiconductor production

Many material gases that are toxic, flammable, corrosive or reactive are used in production processes for semiconductors, FPDs, solar cells and other products. Such gases may react, for example, with moisture and readily produce particulate matter. It is necessary to conduct measurements safely with no leakage while controlling such reactions in order to inhibit particle contamination in the material gases.

The KS-93 gas-borne particle counter incorporates a flow path unit using a flow cell in the particle detection unit, realizing leakage of less than $1\times10^{-10}\text{Pa.m}^3/\text{s}$ (vacuum hood method) and the case also has a hermetically sealed structure of less than $1\times10^{-6}\text{Pa.m}^3/\text{s}$ (sniffer method) as a safeguard against accidents. The flow path consists of SUS316 tubing and a quartz flow cell and is readily capable of purging by straight tube connection with no dead space.

Example of dust generation measurement in the material gas supply system

Example of particle dust generation measurement in gas cylinders

Particle Sensor

KS-93 (Light-scattering method)

- **Light source**: Laser diode (wavelength 830 nm, rated output 200 mW)
- **Materials of parts exposed to sample gas**: Synthetic quartz, SUS316 L, Fluorocarbon rubber
- **Flow rate**: 100 mL/min
- **Size range (5 channels)**: $\geq 0.1\ \mu\text{m}$, $\geq 0.15\ \mu\text{m}$, $\geq 0.2\ \mu\text{m}$, $\geq 0.3\ \mu\text{m}$, $\geq 0.5\ \mu\text{m}$
- **Maximum particle number concentration**: 30 000 particles/min (coincidence loss 5 %)
- **Power**: 100 V to 240 V AC, 40 VA (including external power requirement KZ-50 (accessory))
- **Dimensions and weight**: Approx. 135 (H) x 280 (W) x 150 (D) mm, Approx. 6.5 kg (built to order)
PARTICLE COUNTERS

**Monitoring system**

**Multi-point Monitoring Systems**

Example of clean room environment management

Example in process management

1. Application to chemical fluid supply systems with centralized management of multiple types of chemical fluids
2. Air control of the filling module in the PET bottle beverage filling process and air control in the cap mounting module; environment and water management
3. Constant monitoring of mini-environment water handling area (FIMS) and a broad range of other uses

Sensor multi-point monitoring systems

Installation of sensors at the various measurement points; simultaneous measurement at all measurement points

- Measurement is possible on the same cycle even if measurement points are increased.
- General particle concentration changes can be ascertained through continuous measurement.

**Examples of multi-point monitoring installation**

- **Airborne particle counter** (AP)
- **Liquid-borne particle counter** (LP)
- **Thermo-hygrometer** (D)
- **Differential pressure gauge** (P)

**Class 5 (production equipment)**

- **Class 6**
- **Ordinary environment**

**Semiconductor**

- Etching
- Photo, lithograph
- Diffusion/ CVD
- PVD, CVD
- Wet station

**Bio-clean room**

- Safety rack
- Genetic engineering room
- Cell processing room
- Delivery room
- Passageway

**Vehicle production plant**

- Chassis plant
- Assembly plant

**Tube multi-point monitoring systems**

- Tubing is distributed from a single counter and measurements are made while switching from one measurement point to the next in succession.
- The system can be set up at lower cost than sensor multi-point systems.
- Easy installation in pasteurization zones.

Example of the tube multi-point monitoring system configuration
Software

RP Monitor Evo10 K1701 Ver. 2 / Evo10 K1701P Ver. 2 (Conforms to 21CFR Part11)

Compatible models
  - Allows control of particle counter measurement start/stop, and light source/internal pump on/off
  - Available setting parameters include measurement time, period, number of measurements, alarm, conversion etc.
  - Comments can be entered (at the beginning of a measurement or in a history graph)
  - Display mode selection allows real-time numeric indication on another computer, separate from the control computer

Allows control of up to 8 particle counters in serial mode, using 8 ports

Supported OS:
- Microsoft Windows 10 Pro 64 bit (English, Japanese)

Data storage format:
- Binary file format (Conversion to text file (CSV) is also possible)

RP Monitor Evo10 K1701 Ver. 3 / Evo10 K1701P Ver. 3 (Conforms to 21CFR Part11)

Compatible models
  - Allows control of particle counter measurement start/stop, and light source/internal pump on/off
  - Available setting parameters include measurement time, period, number of measurements, alarm, conversion etc.
  - Comments can be entered (at the beginning of a measurement)
  - Display mode selection allows real-time numeric indication on another computer, separate from the control computer

Allows simultaneous control of up to 31 particle counters in serial mode and multi mode R (expanded connection up to 160 units)

Peripheral device models
- Automatic alarm mail delivery system K0410, particle count and alarm status indicator K0205A/B, digital temperature/humidity converter TH-EV6A, signal tower

Supported OS:
- Microsoft Windows 10 Pro 64 bit (English, Japanese)

Data storage format:
- Binary file format (Conversion to text file (CSV) is also possible)
Injection Management

Since injections are injected directly into human bodies, the number and size of the insoluble particles are stipulated in pharmacopoeia. Due in part to the fact that, unlike the electronic industry, it is not possible in the pharmaceutical industry to confirm the occurrence of defects in the plant and, in the worst case, the outcome could affect patient’s life. Therefore it is necessary to be able to scientifically prove that there are only target ingredients and no insoluble particles, microorganisms and other impurities with production and inspection of the injection.

The Japanese pharmacopoeia strictly specifies the specification of the light obscuration automatic particle counters to be used to measure insoluble particles. Some specifications are measuring method, standard particles to be used, particle size accuracy, particle resolution, sample volume and counting efficiency.

As an option, light obscuration particle counter KL-05 can be customized to conform to Japanese Pharmacopoeia, United States Pharmacopoeia, European Pharmacopoeia, Korean Pharmacopoeia and Chinese Pharmacopoeia. Sensor, controller, sampler and display are made in to one unit to save the space and mobility. Measurement data is recorded automatically to the unit and it also has function to decide “pass” or “fail” against required quality. This data can also be sent to LIMS (Laboratory Information Management System) or converted to PDF file.

It has a digital signature, audit trail functions which complies to the guide line “21 CFR Part 11” of the FDA (Food and Drug Administration)

If there is a need to have sensor, controller and syringe sampler as separate apparatus, it is possible by using KS-42D (Sensor), KE-40B1 (Controller) and KZ-31W (Syringe sampler). One pharmacopoeia can be supported as an option.

<table>
<thead>
<tr>
<th>Criteria for JP, USP, EP, KP and ChP Insoluble Particulate Matter Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Large volume</td>
</tr>
<tr>
<td>10 µm or more</td>
</tr>
<tr>
<td>25 µm or more</td>
</tr>
<tr>
<td>Small volume</td>
</tr>
<tr>
<td>10 µm or more</td>
</tr>
<tr>
<td>25 µm or more</td>
</tr>
</tbody>
</table>

JCC-54 added to the KL-05 enables you to measure samples during pressurization.

Compressing chamber

JCC-54

Supported types of sample fluid
Fluids where the fluid or its gases will not corrode the materials of the unit

Chamber pressure (inside) 50 kPa
Materials of parts exposed to sample PTFE, PA6, PP, FKM (Fluoro rubber)
Dimension, weight 340 (H) x 245 (W) x 245 (D) mm, Approx. 12 kg (Excluding pump) (Custom-made product)

Light obscuration Particle Counter
KL-05

(Light obscuration method)

<table>
<thead>
<tr>
<th>Light source</th>
<th>Laser diode (rated output: 4.5 mW, wavelength: 790 nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluid-contacting materials</td>
<td>Flow cell: Synthetic quartz</td>
</tr>
<tr>
<td></td>
<td>Syringe: Borosilicate glass, PTFE</td>
</tr>
<tr>
<td></td>
<td>Syringe pump: Kel-F-PTFE, PTFE</td>
</tr>
<tr>
<td></td>
<td>Tube, packing, joint: PFA, PTFE, PCTFE, Perfluoro (special fluorine rubber)</td>
</tr>
<tr>
<td></td>
<td>Sample container plate: Polyacetal</td>
</tr>
<tr>
<td>Measurable particle size range</td>
<td>1 to 20 ranges from 1.3 µm to 100 µm (in 0.1 µm steps)</td>
</tr>
<tr>
<td>Flow rate</td>
<td>25 mL/min</td>
</tr>
<tr>
<td>Maximum particle number concentration</td>
<td>10 000 particles/mL (coincidence loss 10 %)</td>
</tr>
<tr>
<td>Power</td>
<td>100 V to 240 V AC, 50/60 Hz, approx. 80 VA</td>
</tr>
<tr>
<td>Dimensions and weight</td>
<td>Approx. 366 (H) x 360 (W) x 236 (D) mm (excluding protruding parts), Approx. 10 kg</td>
</tr>
</tbody>
</table>
In order to obtain the quality that is expected of a product, it is necessary to scientifically verify that the inspection and analysis methods, operational processes, etc., are appropriate and to document and file that in the form of a record. In GMP (Good Manufacturing Practice), validation is defined as the “development of a system capable of constantly verifying product safety and effectiveness based on scientific grounds” with the objective of “ensuring quality in the production of pharmaceuticals, etc.” We support validation operations (IQ, OQ, PQ) of the particle counters or multi-point monitoring systems that you use.

RION validation service operations

**Installation Qualification (IQ): Evaluation of qualifications at the time of installation**
- Confirmation of delivered items
- Check of external appearance of delivered products
- Confirmation of initial conditions
- Preparation of a record of confirmation items

**Operation Qualification (OQ): Evaluation of qualifications at the time of operation**
- Confirmation of operating conditions
- Confirmation that the action and function of the delivered products conform with specifications, etc.
- Preparation of a record of confirmation items

**Performance Qualification (PQ): Performance qualification evaluation**
- Performance confirmation tests at the time of actual operation
- Preparation of a record of confirmation items

Operational flow

1. Discussion with customers (Confirmation of IQ, OQ and PQ)
2. Preparation and approval of IQ, OQ and PQ implementation plans
3. Implementation of IQ, OQ and PQ operations
   - Required documents
     - Traceability system diagrams
     - Test results reports
     - Instruction manuals
     - Calibration certificates
     - Specification sheets
4. Preparation of IQ, OQ and PQ implementation records
**PARTICLE COUNTERS OPTION**

**Printer**

**KP-06A**
- **Printer**: Maximum 6 ranges (depending on particle counter)
- **Measuring results**: Date, time, Count for each size range (total only, or single and total values)
- **Repeated measurement**: 1 time to 99 times
- **Ozone paper type**: TP-08 Thermosemisonic paper
- **Power**: 100 V to 240 V AC, 50/60 Hz, Approx. 20 VA
- **Dimensions and weight**: Approx. 66 (H) x 170 (W) x 242 (D) mm, Approx. 2.5 kg
- **This product is environment-friendly. It does not include toxic chemicals on our policy.**

**Syringe Sampler**

**KZ-31W**
- **Suitable syringe sizes**: 25 mL
- **Maximum discharge volume**: 15 mL/stroke
- **External pressure**: 300 kPa
- **Fluid viscosity**: 30 mPa×s (with 10 mL/min)
- **Power**: 100 V to 240 V AC, Approx. 20 VA
- **Dimensions and weight**: Approx. 105 (H) x 230 (W) x 150 (D) mm, Approx. 2 kg
- **This product is environment-friendly. It does not include toxic chemicals on our policy.**

**Mass Flow Controller**

**CVR-1/4-FM (Viton)**
- **CVR-1/4-P-FM (Perfluor)**
- **Allowable sample type**: Pure water, chemical fluids
- **Flow**: 10 to 31.2 mL/min
- **Pressure used**: 100 kPa to 400 kPa
- **Dimensions and weight**: Approx. 125 (H) x 185 (W) x 110 (D) mm, Approx. 2.4 kg

**Sampler**

**KZ-30U** (with pressure control unit)
- **Supported types of sample fluid**: Fluids where the fluid or its gases will not corrode the materials of the unit
- **Pressure adjustment range**: 0.02 to 0.2 Mpa (gauge pressure)
- **Materials of parts exposed to sample**: PFA, PTFE, CTFE
- **Dimensions and weight**: 660 (H) x 250 (W) x 400 (D) mm, Approx. 19 kg
- **This product is environment-friendly. It does not include toxic chemicals on our policy.**

**Thermal Printer**

**DPU-S245** (For KC-51/52)
- **Printing method**: Thermal line dot printing
- **Print digit count**: 32 digits
- **Printer paper**: TP-34, TP-33 (clean printer paper)
- **Power**: AC adaptor, Li-Ion Rechargeable battery
- **Dimensions and weight**: Approx. 45 (H) x 83 (W) x 180 (D) mm, Approx. 280 g
- **This product is environment-friendly. It does not include toxic chemicals on our policy.**

**Bellows Sampler**

**K9904A**
- **Maximum discharge volume**: 15 mL/stroke
- **External pressure**: 300 kPa
- **Fluid viscosity**: 30 mPa×s (with 10 mL/min)
- **Power**: 100 V to 240 V AC, Approx. 20 VA
- **Dimensions and weight**: Approx. 105 (H) x 230 (W) x 150 (D) mm, Approx. 2 kg
- **This product is environment-friendly. It does not include toxic chemicals on our policy.**

**Aerosol Dilution System**

**XP-M8A / M8B**
- **Connectable particle counters**: KC-22B, M8A, KC-G1L, M8B
- **Dilution ratio**: 20, 40, 60, 80, 100 times
- **Dilution accuracy**: ±30 % (Dilution ratio 100 times at particle size 0.5 μm or less)
- **Power**: 100 V to 240 V AC ±10 %, 50/60 Hz
- **Dimensions and weight**: Main unit: Approx. 215 (H) x 200 (W) x 280 (D) mm (excluding projections), XP-M8A: Approx. 5.4 kg / XP-M8B: Approx. 6.9 kg
- **This product is environment-friendly. It does not include toxic chemicals on our policy.**

**Particles with outstanding diameter precision and distribution**

**Particle size precision is ±3 % of the displayed value**

**CLINTEX** (standard particle concentration)

<table>
<thead>
<tr>
<th>Type</th>
<th>Particle size</th>
<th>Guaranteed particle concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTX022020</td>
<td>0.23 μm</td>
<td>1000 particles/mL±15 %</td>
</tr>
<tr>
<td>CTX032020</td>
<td>0.34 μm</td>
<td>1000 particles/mL±10 %</td>
</tr>
<tr>
<td>CTX06020</td>
<td>0.60 μm</td>
<td>1000 particles/mL±10 %</td>
</tr>
<tr>
<td>CTX21120</td>
<td>2.08 μm</td>
<td>1000 particles/mL±10 %</td>
</tr>
<tr>
<td>CTX10410</td>
<td>10.14 μm</td>
<td>1000 particles/mL±10 %</td>
</tr>
</tbody>
</table>

([Build to order])
RION was founded in 1944 with the aim of developing commercial products based on scientific work carried out at the Kobayasi Institute of Physical Research, which has been pursuing research in the field of physics and acoustics. Rion's business activities are organized in two divisions: the medical equipment division and the environmental equipment division. The former comprises hearing aids and other auditory equipment for hearing impaired persons. A central product category is medical devices in the field of otorhinolaryngology. The environmental equipment division handles sound and vibration level meters, seismometers and other acoustic/vibration measurement devices, as well as particle counters primarily used for measurement of air-borne and liquid-borne particles. RION products are tailored to the requirements and expectations of its customers, which has helped the company maintain its leading position in the industry. We are committed to promoting health and welfare and creating a safe livelihood and comfortable environment reflecting our company philosophy of “contributing to people, society and the world through all of our activities” with the entire world in our sights.
All products that have particle detection modules use lasers. The laser product class is: class 1, IEC 60825-1