

**INSTRUCTION MANUAL**  
**LIQUID-BORNE PARTICLE COUNTER**  
**KL-20A**



3-20-41 Higashimotomachi, Kokubunji, Tokyo 185-8533, Japan



## ORGANIZATION OF THIS MANUAL

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This manual describes the functions, operations etc., of the Particle Counter (in liquid) KL-20A.

It also describes operations of other units in case connected to set up measuring system, but make sure to read these manuals for connecting units also for safety and accuracy.

This manual is organized into the following sections:

### **Outline**

Describes basic functions which are not mentioned in other sections.

### **Panel Explanation**

Describes briefly names and functions of switches, buttons, controls on panels.

### **Reading the Display**

Describes meaning of numbers appeared on the display, error signs, indicator lights.

### **Preparations**

Describes how to connect each part (especially sampling tube).

### **Settings**

Describes the settings of each part to basic mode for measurements.

### **Measurement**

Describes examples of basic measurement system with their connections and operations.

### **Maintenance**

Describes how to clean the piping and how to replace a fuse.

### **Control Connector Functions**

Reference for composing system which is to electrically control this unit by yourself.

### **RS-232-C Interface**

Describes settings and commands of RS-232-C Interface.

### **Specifications**

Describes specifications of this unit.

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## FOR SAFETY

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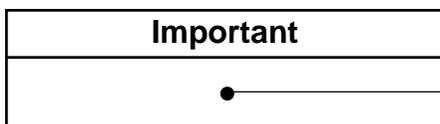
In this manual, important safety instructions are specially marked as shown below. To prevent the risk of death or injury to persons and severe damage to the unit or peripheral equipment, make sure that all instructions are fully understood and observed.



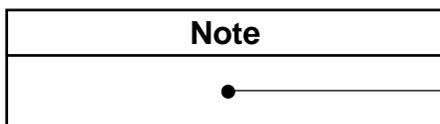
Disregarding instructions printed here incurs the risk of death or severe injury to persons.



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



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



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



# WARNING

## Sample Fluid Danger Prevention

When toxic sample fluid comes into contact with any part of the human body or when toxic gases generated by the sample fluid are breathed, there is a danger of severe injury or death.

Sample fluid also involves the risk of fire, explosion, corrosion, deformation and other effects.

Observe the following points closely to ensure safe use of sample fluid.

- Do not pass hydrofluoric acid or other sample fluids which can cause corrosion of fluid-contacting parts (PFA, synthetic quartz) through the system.
- Observe the following points when setting up or dismantling a measurement system.
  - Check the sample fluid for any risks due to toxicity or other harmful properties.
  - Make sure that sample fluid cannot be emitted by the system and come into contact with body parts, clothing etc.
  - When attaching or detaching tubes, connectors etc., always use appropriate protective tools and wear dual-layer gloves.
  - Double-check all connections before starting the sample fluid flow.
- This unit does not incorporate a leak sensor or other safety device. Before starting operation, perform a thorough leak check to verify safety.
- The pressure of sample fluid passed through the unit may not exceed 300 kPa (gauge pressure). Ensure that the supply system (sampler, sample fluid lines etc.) has sufficient pressure resistance.
- When using sample fluid which may produce harmful gases, provide adequate ventilation as prescribed by applicable laws and regulations.

- Before and after measurement, clean the entire sample fluid system thoroughly to remove any remnants. Otherwise unwanted effects such as thermal build-up, hardening, particle accumulation etc. can occur. This is especially important to prevent the possibility of serious accidents when using the unit to measure different types of sample fluids.
- Before starting to prepare the system for storage, complete the cleaning process with pure water and verify neutrality (pH7).
- Dispose of waste sample fluid only as prescribed by applicable laws and regulations.
- Never mix waste sample fluid with other substances unless absolute safety has been established.

# **WARNING**

## **The unit uses a laser source**

This unit is designated as a class 1 laser product according to IEC 60825-1 (2001). The internal particle detector mechanism uses a laser, but it is fully shielded so that the beam cannot exit from the enclosure. The identification label shown at right is affixed to the top of the unit.



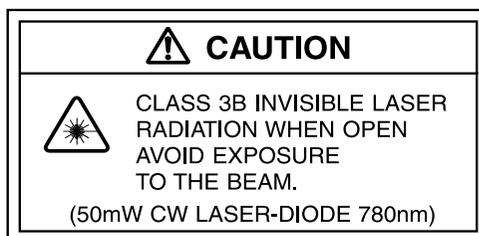
CLASS 1 LASER PRODUCT  
IEC 60825-1(2001)

## **Laser Precautions**

The particle detector mechanism in this unit uses a laser classified as a class 3B laser product according to IEC 60825-1 (2001). The laser source can cause blindness if viewed directly, and can cause skin injuries if the skin is exposed directly to the beam.

Never open the cover, because this involves the risk of exposure to the laser beam.

The warning label is affixed to the inside of the unit.



## **Caution**

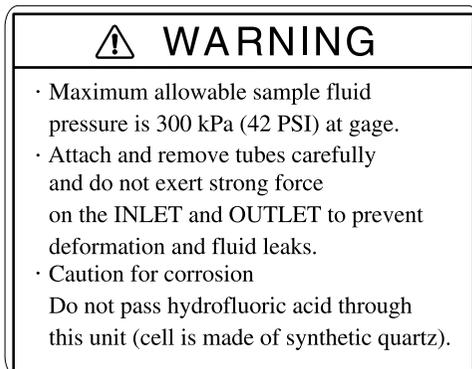
Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

# Warning Labels

The following types of warning labels are used with this unit.

- **Warning label for sample fluid and handling INLET and OUTLET**

The label states that the particle detector cell of this unit is made of synthetic quartz and warns that no hydrofluoric acid may be passed through the unit. It also specifies the maximum sample fluid pressure as 300 kPa (gauge pressure). The label is affixed to the top of the unit.



The label also states that a shock and/or an excessive force on the INLET and OUTLET may cause the deformation and/or fluid leaks.

- **Laser product description label (Class 1)**

Indicates that this unit is designated as a class 1 laser product according to IEC 60825-1 (2001). The label is affixed to the top of the unit.



- **Cleaning label**

Gives instructions for cleaning the unit with pure water and filling it with ethyl alcohol before returning it for servicing.

The label is affixed to the top and the INLET side of the unit.

***Important***

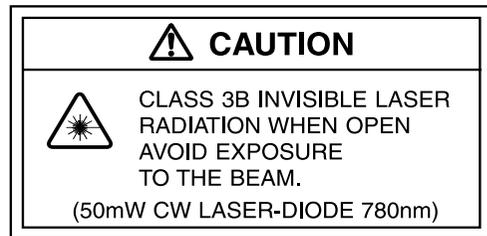
Before returning the unit for maintenance or servicing, purge the sample fluid system thoroughly with pure water to remove any sample fluid remnants.

Then fill the piping with alcohol (isopropyl alcohol, ethyl alcohol or methyl alcohol).

- **Laser product warning label (Class 3B)**

Indicates that the unit internally uses a laser classified as a class 3B laser product according to IEC 60825-1 (2001). The laser source can cause blindness if viewed directly, and can cause skin injuries if the skin is exposed directly to the beam.

The label is affixed to the inside of the unit.



# Precautions

- The unit is designed originally for 100 V AC as used in Japan. Before connecting the power cord, confirm that proper measures have been taken for adapting the unit to your power supply.
- Operate the unit only as described in this manual.
- Do not touch any parts of the unit other than necessary for operation.
- Before using the unit, make sure that all cable and PFA tube connections are correctly and safely established.
- In case of malfunction, do not attempt any repairs. Note the condition of the unit clearly and contact the supplier.
- The end plugs are required to seal the unit when returning it for maintenance or servicing. Store the plugs in a safe location for later use.
- Before returning the unit for maintenance or servicing, thoroughly purge the piping with pure water. Then fill the piping with ethyl alcohol and install the end plugs.
- Do not use or store the unit in locations which
  - may exceed the temperature range specified in specifications or may be subject to moisture condensation (If the temperature of the sample fluid is lower than the ambient temperature, condensation may occur. Take suitable countermeasures such as using purge gas.)
  - may be subject to splashes of water or to direct sunlight, or
  - may be subject to air with high salt or sulphur content or to gases, or
  - which do not provide correct power supply conditions, or
  - which do not provide a suitable means for grounding the unit, or
  - may be subject vibrations or shock.
- Do not store the unit in locations where condensation or freezing inside the piping may occur.
- Avoid sudden temperature changes which may cause moisture condensation on the optical assembly.
- Do not disassemble the unit or attempt internal alterations.

# Contents

FOR SAFETY .....	iii
Outline .....	1
Precaution for sample fluids .....	2
Block Diagram .....	2
Peripheral Equipment Connections .....	3
Panel Explanation .....	4
Front Panel .....	4
Rear Panel .....	6
Side Panel .....	8
Reading the Display .....	9
Preparations .....	11
Power Cord Connection .....	11
Use of a particle size plate .....	12
Connecting the Sampling Tubes .....	12
Disconnecting the Sampling Tubes .....	13
Connecting a Syringe Sampler .....	14
Purge Gas .....	16
Before Supplying the Sample Fluid .....	16
Settings .....	18
Measurements Mode Setting .....	18
Sample Fluid Flow Rate Adjustment .....	20
Particle Size Selection .....	21
Alarm Level Setting .....	21
Measurement .....	22
Power-On .....	22
On-Line Measurement .....	23
Off-Line Pressurization Measurement .....	27
Off-Line Suction Measurement .....	31
Measurement Termination .....	34

Maintenance .....	35
Steps after use .....	35
Cleaning the piping .....	35
When the fuse has blown .....	37
Control Connector Functions .....	38
Pin Layout and Functions .....	38
Interface .....	39
Output Signals .....	40
Input Signals .....	41
RS-232-C Interface .....	42
Outline .....	42
Data Transfer Protocol .....	42
Interface Functions .....	43
Cables .....	43
Transfer Parameters and Measurement Data Transfer Mode ...	46
Remote Mode / Local Mode .....	48
Commands .....	49
Format of Data from KL-20A .....	56
Specifications .....	59



# Outline

The liquid-borne particle counter KL-20A is designed to measure the concentration of particles in liquid, using the light-scattering method. Particles are displayed in five size ranges.

Using the built-in RS-232-C interface, automatic recording of measurement results and transfer of data to other equipment is possible.

As this unit does not incorporate a flow control circuit for the sample fluid, the flow rate of the sample fluid must be controlled by external means.

## Features

- Capability for on-line measurement with flow controller KZ-36U.
- Capability for off-line measurement with flow controller KZ-36U, sampler KZ-30U, and external pump KZ-28M.
- Capability for off-line measurement with syringe sampler KZ-30W1/W2.
- Particle count for five particle sizes (sizes over 0.2, 0.3, 0.5, 1 and 2  $\mu\text{m}$ ) in a single measurement.
- Battery backup retains measurement settings when unit is turned off or when power is interrupted.
- Alarm function can give audible warning when number of particles exceeds a certain level (selectable in 4 steps). A relay for control of external devices is also provided.

## Particle size detection

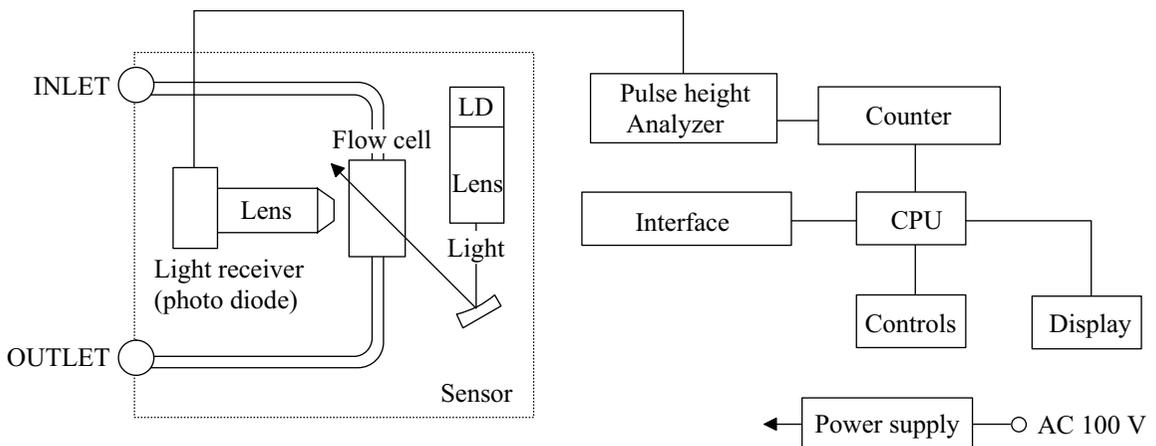
Sizing of particles is based on the amount of light scattered by the particles. The threshold for particle size discrimination is calibrated at the factory, using reference particles of known diameter and refractive index (polystyrene latex spheres with refractive index 1.6). Therefore, measured size is optically equivalent to the size of polystyrene latex particles.

## Precaution for sample fluids

This unit is designed to detect the size and concentration of particles floating in liquid. Never use the unit with the liquid types listed below, to prevent the possibility of accidents and damage to the unit.

- Explosive liquid or mixtures containing explosive liquid.
- Liquid which may cause corrosion of fluid-contacting parts or mixtures containing such liquid.
- Liquid with a temperature of less than +10°C or more than +30°C.
- Liquid with a pressure of more than 300 kPa ( gauge pressure).
- Liquid which may have effects such as thermal build-up, hardening, and particle accumulation. Always clean the system thoroughly before using a different liquid.

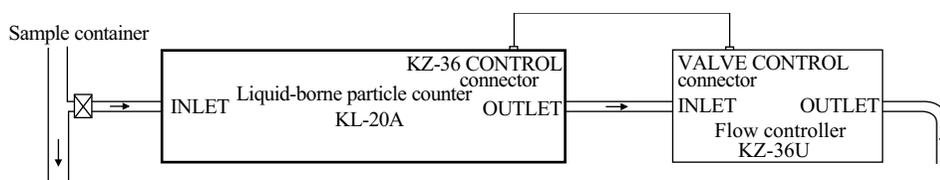
## Block Diagram



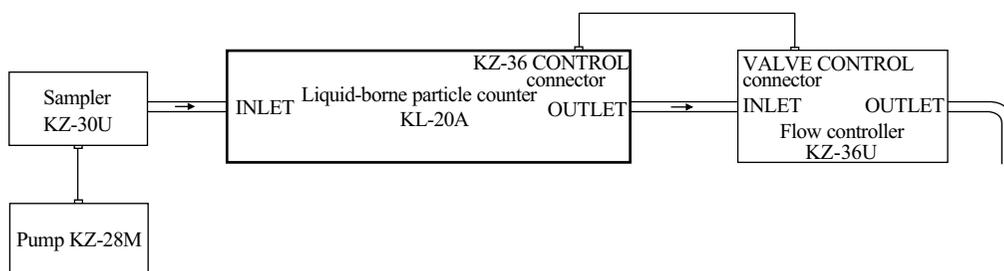
## Peripheral Equipment Connections

This section shows a few representative connection examples, but there are of course other possibilities, depending on the type of equipment in use. For sample fluids with high viscosity or low boiling point, pressurizing type equipment (such as the combination of pump KZ-28M, sampler KZ-30U, and flow controller KZ-36U) is suitable. For sample fluids with low viscosity or high boiling point, suction equipment (such as the syringe sampler KZ-30W1/W2) is suitable. For low-quantities of sample fluid and high-precision measurements, a syringe sampler should be used. Choose the type of equipment which is best suited to the purpose of the measurement.

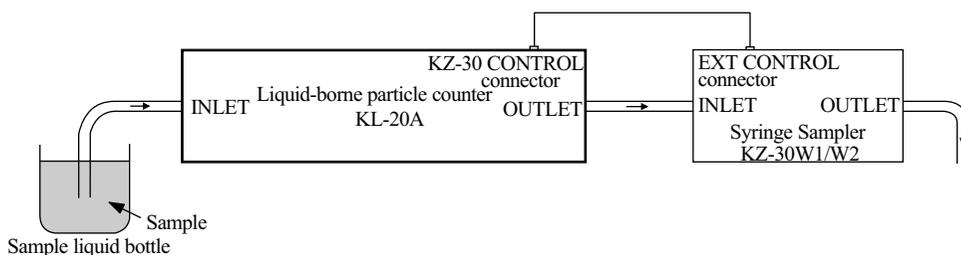
- On-line measurement



- Off-line measurement (Pressurizing measurement)

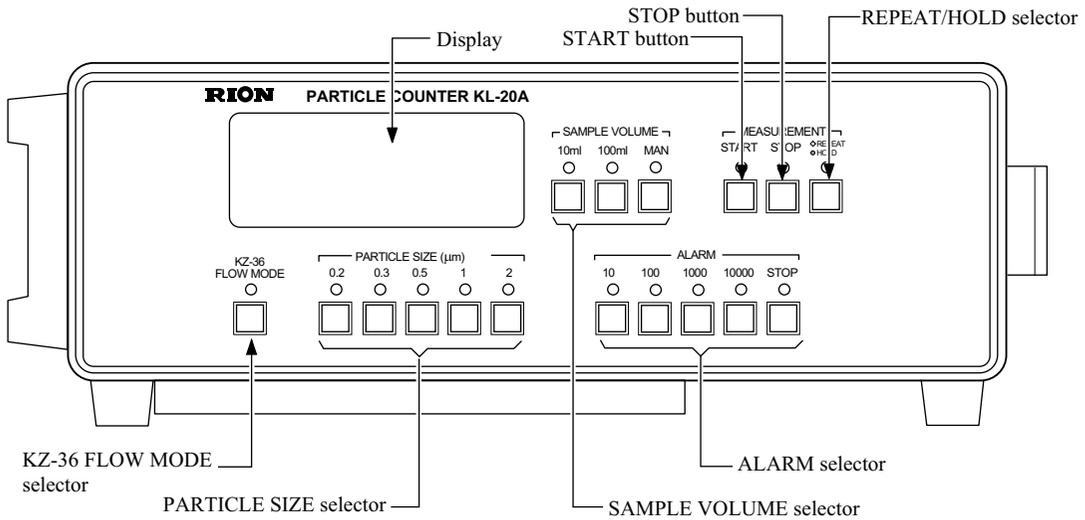


- Off-line measurement (suction measurement)



# Panel Explanation

## Front Panel



### Display

The particle count, laser level condition, detector condition etc. are shown on this display.

### START button

Press this button to start the measurement.

### STOP button

Pressing this button stops the measurement during manual operation.

### REPEAT/HOLD selector

During automatic measurement, this button switches the unit between repeated measurement (REPEAT, indicator lit) or single measurement (HOLD, indicator off).

**ALARM selector**

These buttons serve to select the threshold level for the alarm. The particle size is chosen with the PARTICLE SIZE selector.

**SAMPLE VOLUME selector**

These buttons serve to select the sample fluid volume for manual or automatic measurement.

**PARTICLE SIZE selector**

These buttons serve to select the particle size to be shown on the display and used for triggering the alarm.

**KZ-36 FLOW MODE selector**

This button determines whether the sample fluid is routed through the stabilizer in the flow controller KZ-36U or not during the measurement pause intervals.

Button indicator lit:

SAMPLE VOLUME not set to MAN

Sample fluid is routed through stabilizer (checked flow).

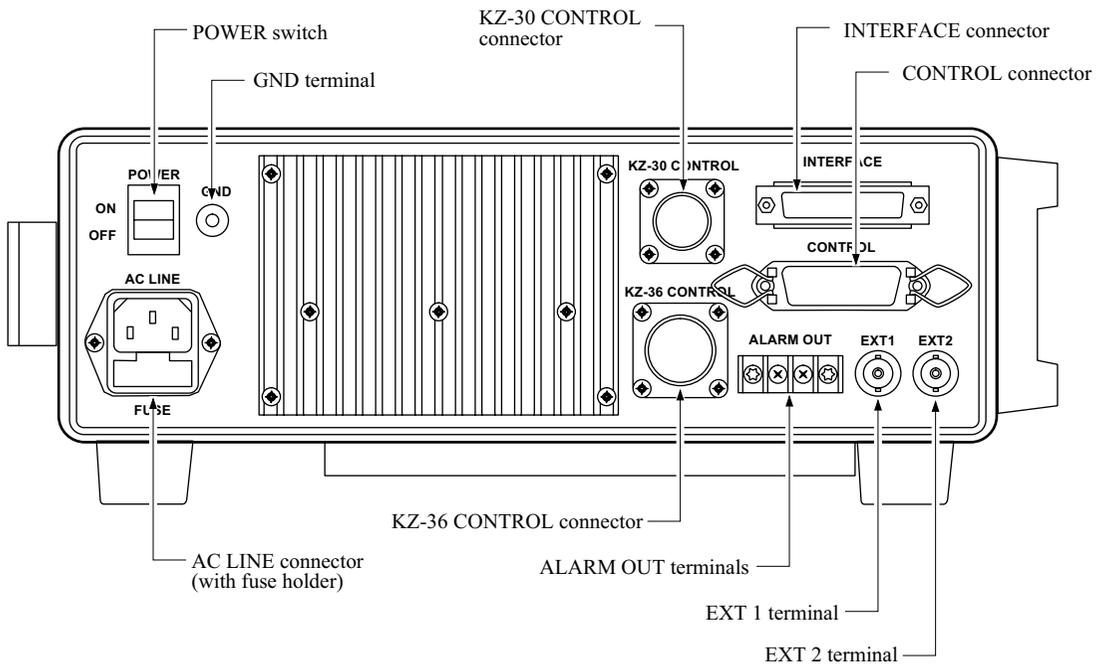
SAMPLE VOLUME set to MAN

Sample fluid flow stops.

Button indicator off:

Sample fluid is not routed through stabilizer (unchecked flow).

## Rear Panel



### POWER switch

Serves to turn the unit on and off.

### GND terminal

Serves to ground the unit.

### KZ-30 CONTROL connector

The syringe sampler KZ-30W1/W2 (option) is to be connected here.

### INTERFACE connector

Input/output connector for the standard built-in RS-232-C interface (Serves for connection of printer KP-06 (option)).

### CONTROL connector

The external control connector to be connected to other units (Serves for connection of printer KP-05L (option)).

**EXT 1 terminal (external output terminal 1)**

The sensor signal for particle sizes from 0.2 to 0.4  $\mu\text{m}$  is supplied at this terminal.

**EXT 2 terminal (external output terminal 2)**

The sensor signal for particle sizes from 0.5 to 2  $\mu\text{m}$  is supplied at this terminal.

**ALARM OUT terminals**

When the alarm level set with the PARTICLE SIZE selector and the ALARM selector is exceeded, these terminals are closed by a built-in relay for control of an external device.

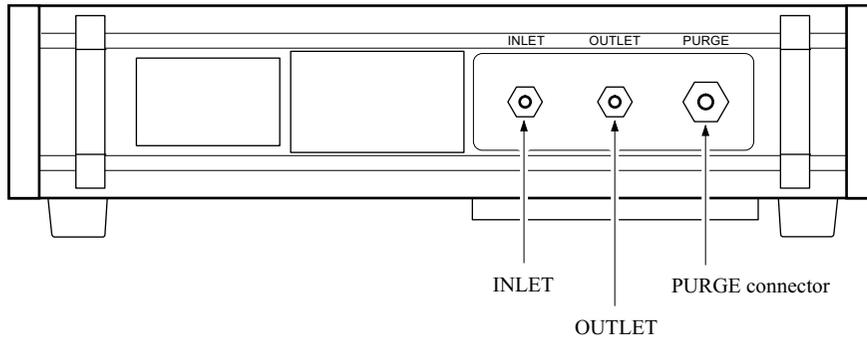
**KZ-36 CONTROL connector**

The flow controller KZ-36U (option) is to be connected here.

**AC LINE connector (with fuse holder)**

Accepts the AC power cord for connection to a power supply. The integrated fuse holder contains a power line fuse (T 0.6 A).

## Side Panel



### **INLET**

Sample liquid inlet

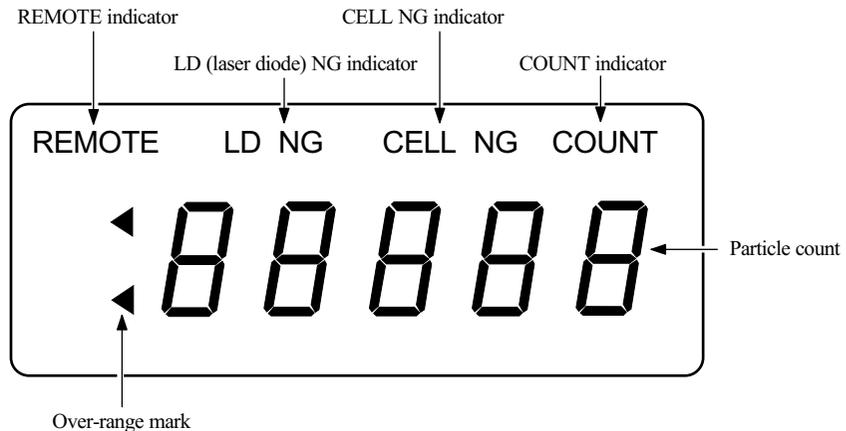
### **OUTLET**

Sample liquid outlet

### **PURGE connector**

Serves to purge the particle detector section with clean and dry air to prevent condensation.

# Reading the Display



- Particle count:** Shows the total number of particles with size selected by the PARTICLE SIZE selector or larger (range 0 to 99999).
- REMOTE indicator:** Lights up when the unit is remote controlled using the standard RS-232-C interface. Flashes when the unit is set to hold by external control.
- LD NG indicator:** Lights up when the output of the internal laser diode falls below the normal level.
- CELL NG indicator:** Lights up when normal measurement is not possible due to contamination or condensation in the detection cell.
- COUNT indicator:** Lights up while a measurement is being performed.
- Over-range mark:** Lights up when the particle count has exceeded 5 digits.

For information on error indication, see the next page.

## Error indication

If an error (not necessarily due to a defect of the unit) has occurred, the display shows the following information.

**P:** The temperature control of the light source has exceeded the normal range. This indication appears also after the unit was turned on, until the normal operating temperature range is reached.

While "P" is shown, measurement cannot be started.

**E:** A measurement error has occurred due to one of the following causes:

- Light source output level has fallen below the required minimum.
- "P" was displayed during measurement, but the unit has afterwards returned to normal.

If the "LD NG" indicator is not lit, measurement can be started.

# Preparations

## Power Cord Connection

### Important

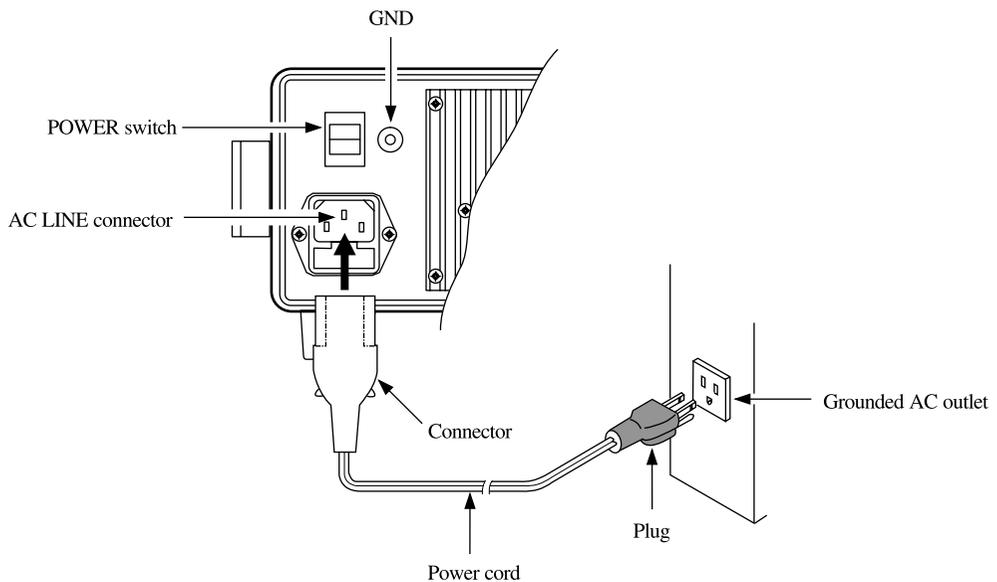
The unit is designed originally for 100 V AC as used in Japan.

Before connecting the power cord, confirm that proper measures have been taken for adapting the unit to your power supply.

1. Set the POWER switch to OFF.
2. Insert the supplied power cord into the AC LINE connector and plug the other end into a grounded AC outlet.
3. For safety, connect the GND terminal on the rear of the unit to a good ground.

### Important

Connect the power cords of other equipment in the same way as described above. Be sure to turn off the power switch of every unit before making power cord connections.



## Use of a particle size plate

When the printer KP-05L is used to record the particle count, remove the particle size indicator panel from the top side of the printer and insert the particle size plate supplied with the KL-20A into the same slot.

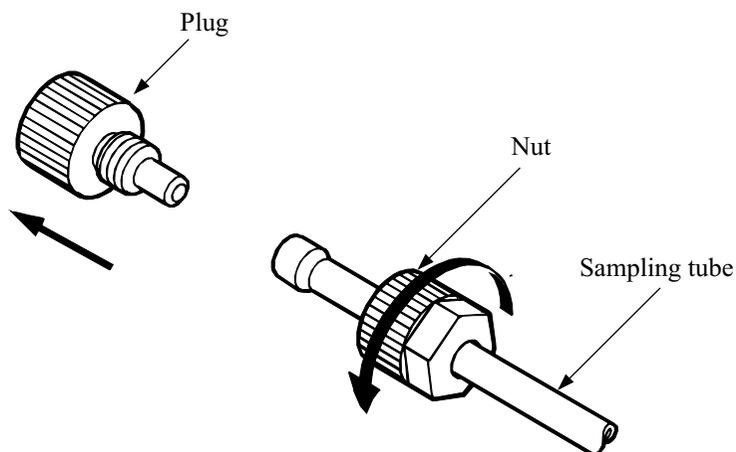
## Connecting the Sampling Tubes

1. Remove the end plugs from the INLET and OUTLET connectors of the KL-20A by turning the plugs counterclockwise.
2. Loosen the nut of the sampling tube by turning it counterclockwise, and remove the plug from the sampling tube.

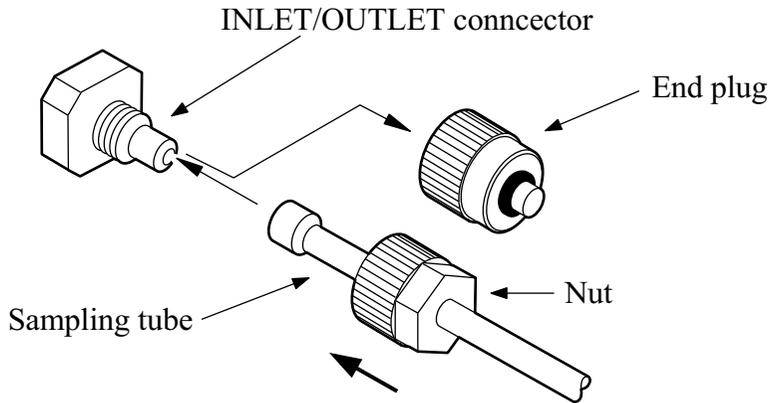
### Important

Store the end plugs in a safe place, since they will be needed when the unit is sent to the supplier for servicing and maintenance.

Store the plugs in a safe place, since they will be needed for storing the sampling tubes.

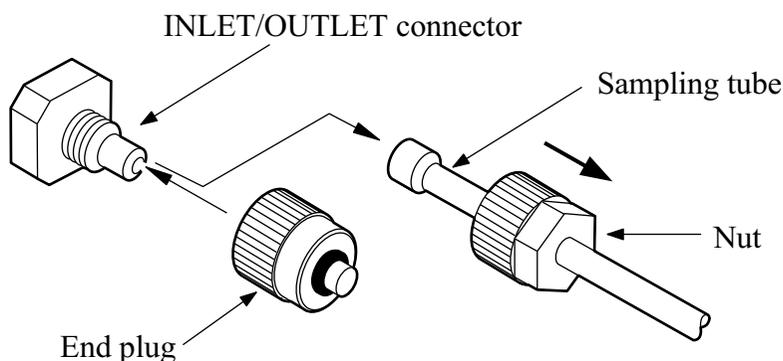


- Slide the tip of the sampling tube onto the INLET connector and turn the nut clockwise to fasten the tube.  
Connect the OUTLET side in the same way.



## Disconnecting the Sampling Tubes

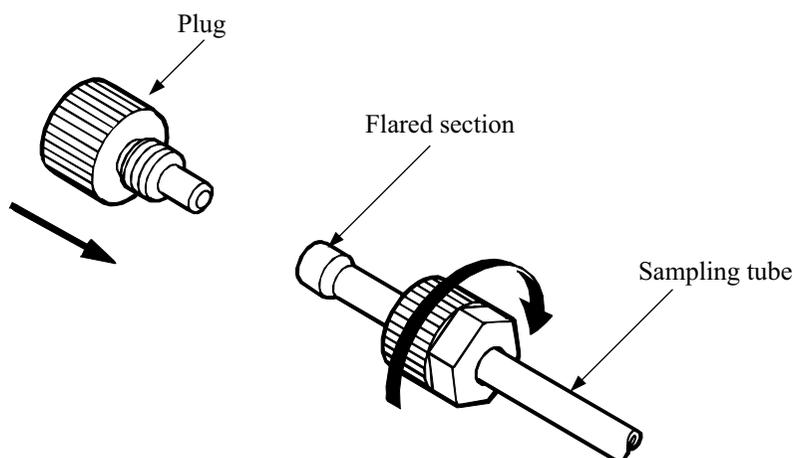
- Thoroughly purge the unit with pure water to remove any sample fluid remnants from the piping.  
If the use of pure water poses the risk of sample fluid reaction and thermal build-up, hardening, or particle accumulation, use a different cleaning agent that is suitable for the sample fluid.
- Turn the nut on the INLET connector counterclockwise and pull the sampling tube off.  
Disconnect the OUTLET side in the same way.
- Place the end plugs on the INLET and OUTLET connectors and secure the plugs by turning them clockwise.



4. Insert the plug of the sampling tube into the flared section at the tip of the sampling tube and turn the nut clockwise to secure it.

**Important**

The flared section will contract slightly over time. Always store the sampling tube with the plug in place.



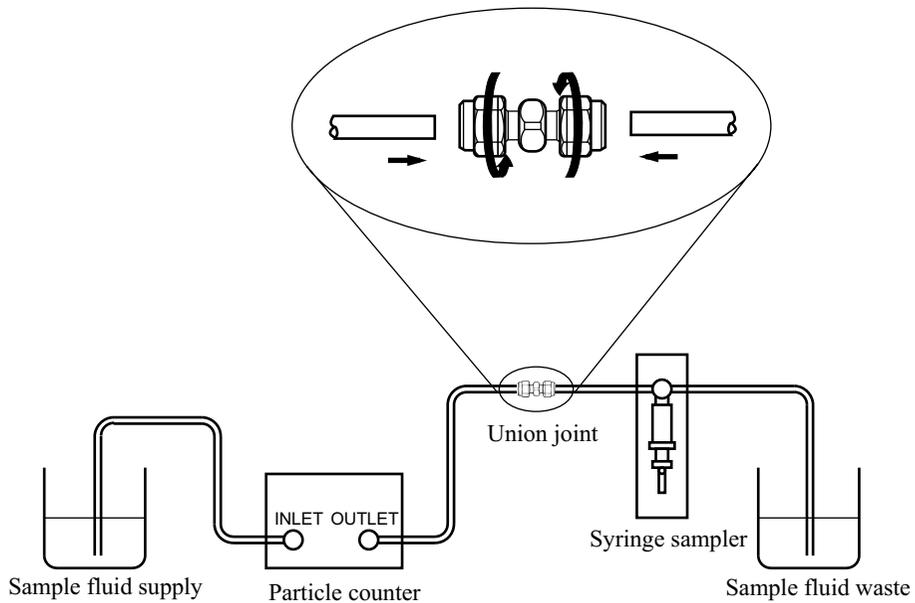
## Connecting a Syringe Sampler

The syringe sampler KZ-30W1/W2 can be used with the KL-20A.

Connect the sampling tube leading to the OUTLET connector of the KL-20A to the sampling tube leading to the INLET connector on the syringe sampler, using the union joint supplied with the KL-20A. Insert the tube ends into the joint and turn the nuts clockwise to secure the connection.

**Important**

Fasten the joint tightly, to prevent air bubbles from being sucked in by the syringe sampler.

**⚠ WARNING**

**The union joint connection can be separated easily if subject to stress. Take care that the tubes are not caught anywhere and do not pull them apart by hand.**

**When installing the system, take suitable measures to prevent accidents.**

For critical installations, you may wish to purchase a sampling tube from Rion which does not require a joint. The standard sampling tube length is 80 cm, but customized lengths are also possible. Please contact the supplier.

## Purge Gas

In the cases listed below, the interior of the unit should be cleaned with purge gas supplied to the PURGE connector, to prevent problems such as moisture condensation or adverse effects on the electrical circuitry.

- If the temperature of the sample fluid is lower than the ambient temperature, so that moisture condensation may occur in the particle detector.
- If there is the possibility that corrosive gases in the vicinity may affect the unit.
- If there is the possibility that corrosive gases which permeate the PFA tubes may leak from the PFA tubes and/or internal joints.

The purge gas requirements are as follows.

- Dry clean air or nitrogen gas
- Temperature 15 to 30°C
- Flow rate 3 to 10 L/min

The PURGE connector uses an Rc 1/8 type (PT 1/8 female).

## Before Supplying the Sample Fluid

Since the KL-20A does not have a flow rate adjustment facility, additional equipment is required to adjust the sample fluid flow. Refer to the examples shown on page 3 and configure a system which can supply sample fluid at a rate of 10 mL per minute.

 <b>WARNING</b>
<b>Observe the pressure limits for the sample fluid system.</b>

The cell of the KL-20A is made of synthetic quartz, and the INLET and OUTLET parts use PFA. Never use sample fluids which can cause corrosion of fluid-contacting parts. Otherwise leaks or seepage may occur. The fluid system of the KL-20A is designed to withstand sample fluid with a pressure range of 300 kPa (gauge pressure). If this range is exceeded, leaks or seepage may occur.

** WARNING**

**Always perform a leak test before supplying sample fluid.**

Fill the system with pure water and leave it exposed to a pressure of 300 kPa (gauge pressure) for a while to verify that there are no leaks.

** WARNING**

**When using different types of sample fluid, verify that there is no danger of a chemical reaction.**

Before changing to a different type of sample fluid, always clean the entire sample fluid system first to remove any remnants. Otherwise unwanted effects such as thermal build-up, hardening, particle accumulation etc. can occur. Use the system only after verifying that the cleaning process was successful. Otherwise there is a danger of serious accidents.

Some sample fluids may react with water, leading to emulsification or thermal build-up.

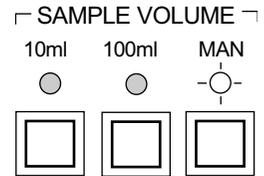
# Settings

## Measurements Mode Setting

### ● Manual measurement

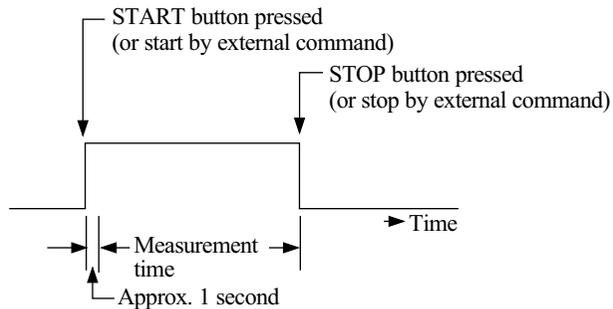
Press the MAN button of the SAMPLE VOLUME selector. (The indicator of the button lights up.)

The sample liquid volume can be calculated as follows:



Set to MAN

$$\text{Sample liquid volume (mL)} = 10 \text{ (mL/min)} \times \text{measurement time (min)}$$



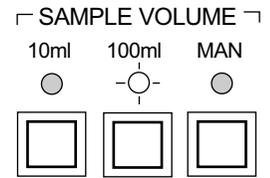
The measurement time is the time from the point at which the indication "COUNT" appeared on the display (approx. 1 second after the START button was pressed) until the STOP button was pressed. This applies also for the following sections.

### ● Automatic measurement

Press the "10mL" or "100mL" button of the SAMPLE VOLUME selector to select the desired sample liquid volume.

The time required for the measurement with each setting is as follows.

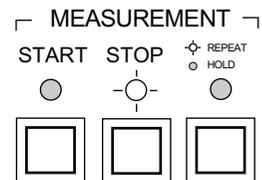
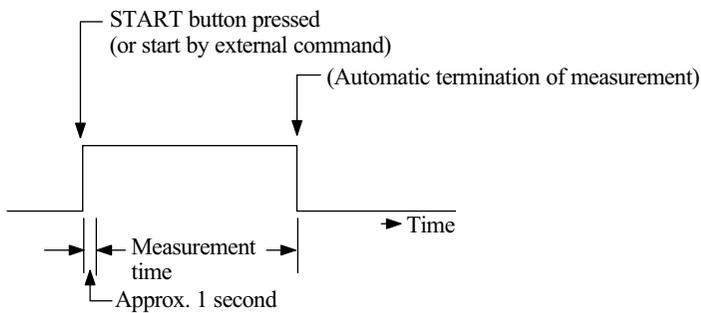
Setting	Measurement time
10 mL	Approx. 1 minute
100 mL	Approx. 10 minutes



Set to 100 mL

### ● One-time automatic measurement

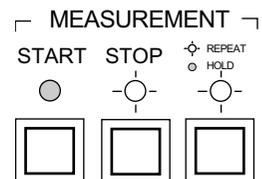
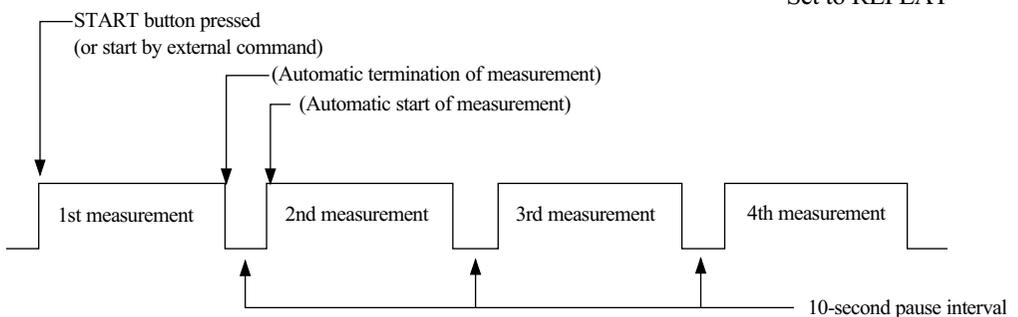
Set the REPEAT/HOLD selector to "HOLD".



Set to HOLD

### ● Repeated automatic measurement

Set the REPEAT/HOLD selector to "REPEAT".



Set to REPEAT

## Sample Fluid Flow Rate Adjustment

The KL-20A does not incorporate a means to adjust the flow rate of the sample fluid, which must therefore be controlled by external equipment. The flow rate should be adjusted to 10 mL/min, since the KL-20A is designed for measurements with this flow rate.

- **For pressurized sample fluid systems**

The sample fluid is sent to the KL-20A and a flow controller (KZ-36U) using the pressure of the system. For details on adjusting the flow rate, please refer to the instruction manual of the KZ-36U.

When the KZ-36U is connected, refer to the chapters "On-Line Measurement" (page 23) and "Off-Line Pressurization Measurement" (page 27).

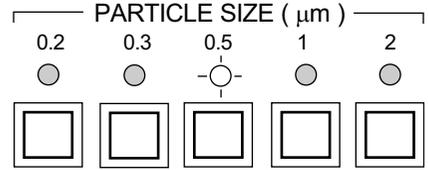
- **For non-pressurized sample fluid systems**

When the sample fluid is taken for example from a sample fluid bottle, use the syringe sampler KZ-30W1/W2 to send the sample fluid to the KL-20A. For details on adjusting the flow rate, please refer to the instruction manual of the KZ-30W1/W2.

When the KZ-30W1/W2 is connected, refer to the chapter "Off-Line Suction Measurement" (page 31).

## Particle Size Selection

Use the PARTICLE SIZE selector buttons to choose the particle size you want to display. The indicator of the selected button lights up.

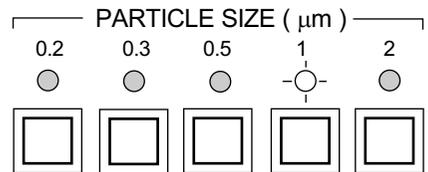


Set to 0.5  $\mu\text{m}$

Setting	Display
0.2	Number of particles with size 0.2 $\mu\text{m}$ or larger
0.3	Number of particles with size 0.3 $\mu\text{m}$ or larger
0.5	Number of particles with size 0.5 $\mu\text{m}$ or larger
1	Number of particles with size 1 $\mu\text{m}$ or larger
2	Number of particles with size 2 $\mu\text{m}$ or larger

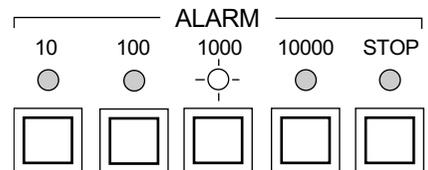
## Alarm Level Setting

The alarm function activates a beeper when the number of particles of the size set with the PARTICLE SIZE selector or larger exceeds a certain level. The ALARM OUT terminals on the rear panel are shorted, which can be used to control external equipment.



Set to 1  $\mu\text{m}$

1. Press a button of the PARTICLE SIZE selector to choose the particle size. (The respective indicator lights.)
2. Press a button of the ALARM selector to choose the number of particles above which the alarm is to be triggered. (The respective indicator lights.)



Set to 1000

If the alarm function is not to be used or to release the alarm, press the STOP button of the ALARM selector.

# Measurement

## Power-On

### Important

Before turning on the power, fill the piping in the particle detector with fluid. If the unit is switched on while the particle detector cell is dry, the laser beam may burn contamination into the cell lining, causing an increase in noise.

Set the POWER switch to ON.

The panel controls will be set to the same positions that were active when the unit was last turned off. (When used for the first time, the factory defaults will be active.) The indicators of the selected settings light up.

Until the light source reaches the required temperature, the indication "P" is shown on the display. When the unit is ready for operation, "0" appears on the counter.

### Important

After switching on the unit, wait at least 10 minutes before starting a measurement, to allow the light source output to stabilize.

When the unit has been switched off, wait at least 1 minute before turning it on again. Otherwise the light source may be damaged.

## On-Line Measurement

The KZ-36 FLOW MODE selector on the KL-20A allows the choice between two modes:

- Stop/purge mode

In this mode, the sample fluid flows at a high rate (unchecked) during measurement pause.

- Constant flow mode

In this mode, the sample fluid always flows at a constant rate (10 mL/min), during measurement and during measurement pause.

### Required external equipment

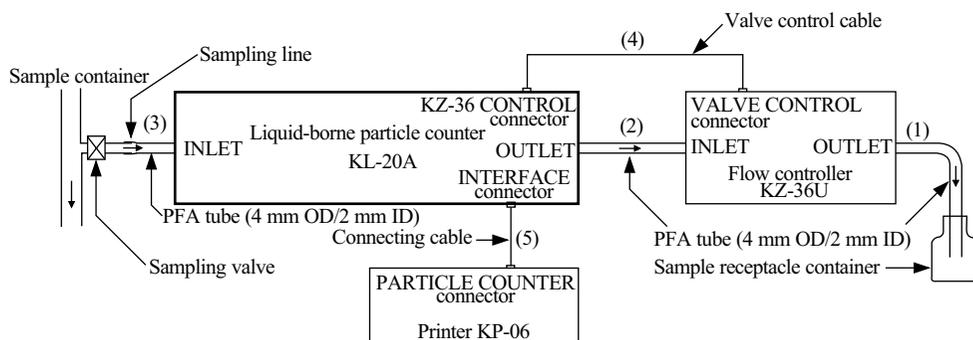
Flow controller KZ-36U

Printer KP-06

### 1. Tube and signal cable connections

Make the following connections.

- (1) KZ-36U OUTLET to sample receptacle container: PFA tube (4 mm OD/ 2 mm ID, supplied with KZ-36U)
- (2) KL-20A OUTLET to KZ-36U INLET: PFA tube (4 mm OD/2 mm ID)
- (3) Sample container outlet to KL-20A INLET: PFA tube (4 mm OD/2 mm ID)
- (4) KZ-36 CONTROL connector of KL-20A to VALVE CONTROL connector of KZ-36U: Valve control cable (supplied with KZ-36U)
- (5) INTERFACE connector of KL-20A to PARTICLE COUNTER connector of KP-06: Connecting cable (supplied with KP-06)



## 2. Setup

Set switches and controls to the settings in the following order.

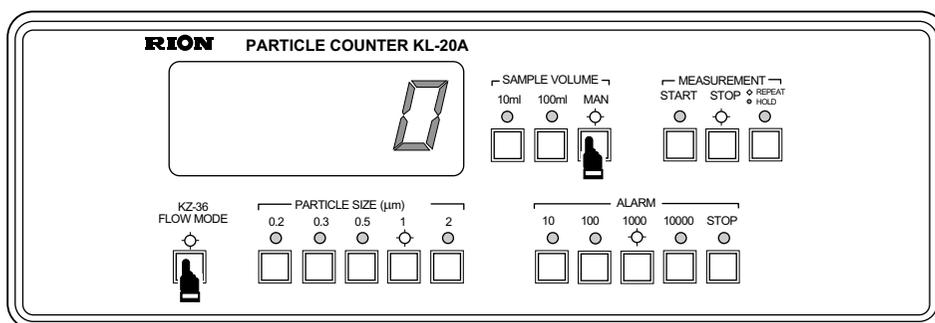
1. POWER switch: ON (see "Power-On" on page 22)

Also switch the power of connected equipment on.

2. SAMPLE VOLUME selector: MAN (indicator lit)
3. KZ-36 FLOW MODE selector: ON (indicator lit)



Make sure REMOTE indicator is off if no operation. Unworkable when LAMP REST switch is ON with KP-06 connected.



## 3. KP-06 setup

Set switches and controls to the settings in the following order.

1. Measurement period (PERIOD): 1440
2. Averaging runs (AVG): 1
3. ALL DATA button: OFF (indicator off)
4. SINGLE button: OFF (indicator off)

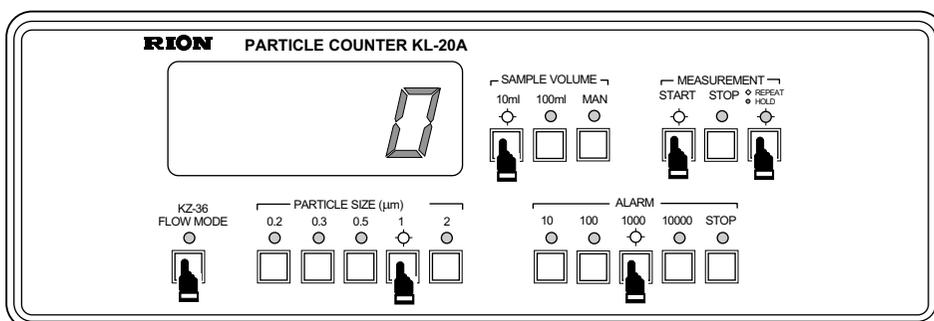
## 4. Sample fluid flow rate adjustment

1. Open the sampling valve.
2. Press the START button to start the sample fluid flow.
3. Adjust the FLOW ADJUST knob on the KZ-36U to obtain a flow rate of 10 mL per minute.
4. Press the STOP button to stop the sample fluid flow.

## 5. Measurement

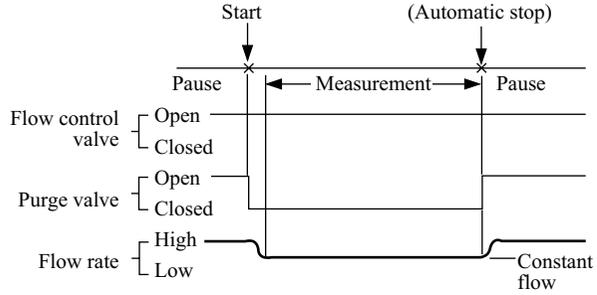
For details on the measurement method, please refer to "JIS K 0554-1989 Measurement of Particles in Ultra-Pure Water". When using the printer KP-06, refer also to its instruction manual.

- Choose suitable settings for the purpose of the measurement.  
For information on settings, refer to the section "Settings" on pages 18 to 21. (The illustration below shows the unit when the underlined settings have been chosen.)
  - REPEAT/HOLD selector: REPEAT, HOLD (when KP-06 is connected, only HOLD can be set)
  - SAMPLE VOLUME selector: 10mL, 100mL  
(When either of these buttons is pressed, the sample fluid starts to flow at a rate of 10 mL/min, as set at the KZ-36U.)
  - PARTICLE SIZE selector: 0.2, 0.3, 0.5, 1, 2
  - ALARM selector: 10, 100, 1000, 10000, STOP
- Set the KZ-36 FLOW MODE selector.  
To choose the stop/purge mode:  
Set button to OFF (indicator out).  
The sample fluid flows at a high rate.  
To choose the constant flow mode:  
Set button to ON (indicator lit).  
The sample fluid flows at 10 mL per minute.
- Press the START button on the KP-06 to start the measurement. The sample fluid flows at a rate of 10 mL/min.

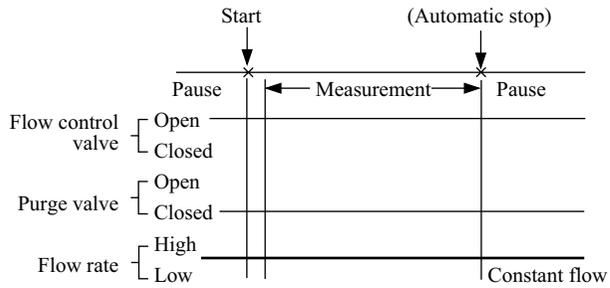


The relationship between the valves of the KZ-36U and the sample fluid flow is as shown below.

Stop/purge mode



Constant flow mode



## Off-Line Pressurization Measurement

### Required external equipment

Flow controller KZ-36U

Sampler KZ-30U

Pump KZ-28M

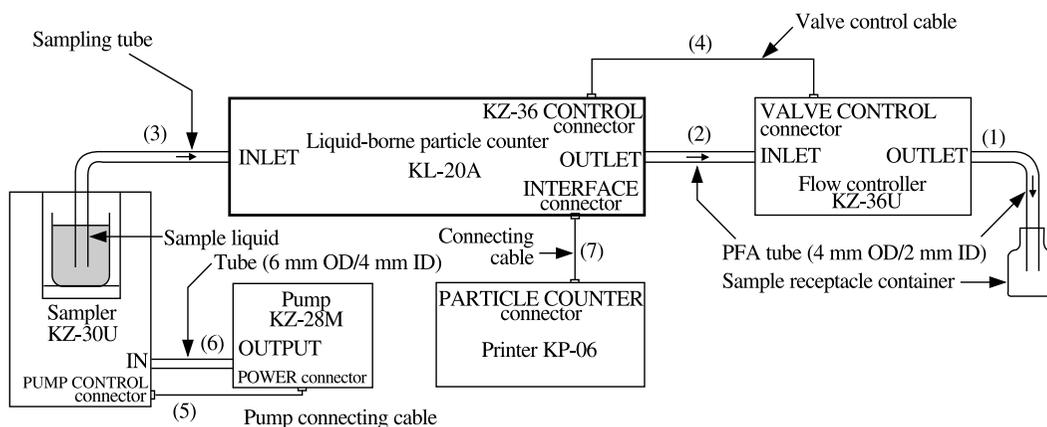
Printer KP-06

For details, please refer to the instruction manuals of the respective units.

### 1. Tube and signal cable connections

Make the following connections.

- (1) KZ-36U OUTLET to sample receptacle container: PFA tube (4 mm OD/2 mm ID, supplied with KZ-36U)
- (2) KL-20A OUTLET to KZ-36U INLET: PFA tube (4 mm OD/2 mm ID)
- (3) KL-20A INLET: Sampling tube supplied with KZ-30U
- (4) KZ-36 CONTROL connector of KL-20A to VALVE CONTROL connector of KZ-36U: Valve control cable (supplied with KZ-36U)
- (5) PUMP CONTROL connector of KZ-30U to POWER connector of KZ-28M: Pump connecting cable (supplied with KZ-30U)
- (6) Air inlet (IN) of KZ-30U and OUTPUT of KZ-28M: Tube (6 mm OD/4 mm ID, supplied with KZ-28M)
- (7) INTERFACE connector of KL-20A to PARTICLE COUNTER connector of KP-06: Connecting cable (supplied with KP-06)



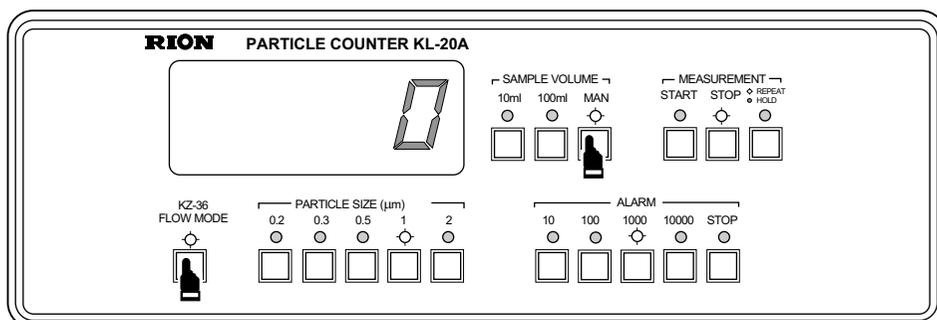
## 2. Setup

Set switches and controls to the settings in the following order.

1. POWER switch:ON

Also switch the power of connected equipment on.

2. SAMPLE VOLUME selector:MAN (indicator lit)
3. KZ-36 FLOW MODE selector:ON (indicator lit)



## 3. KP-06 setup

Set switches and controls to the settings in the following order.

1. Measurement period (PERIOD): 1440
2. Averaging runs (AVG): 1
3. ALL DATA button: OFF (indicator out)
4. SINGLE button: OFF (indicator out)

## 4. KZ-30U setup

Set switches and controls to the settings in the following order.

1. POWER switch: ON
2. PUMP switch: ON (KZ-28M is turned on, and the chamber in KZ-30U is pressurized.)
3. Adjust the pressure in the chamber with the regulator (70 to 200 kPa).

## 5. Sample fluid flow rate adjustment

1. Press the START button to start the sample fluid flow.
2. Adjust the flow rate to 10 mL/min with the FLOW ADJUST knob of the KZ-36U.
3. Press the STOP button to stop the sample fluid flow.
4. Set the PUMP switch of the KZ-30U to OFF.
5. Lift the release lever on the KZ-30U to discharge the pressure in the chamber.

## 6. KP-06 setup (actual)

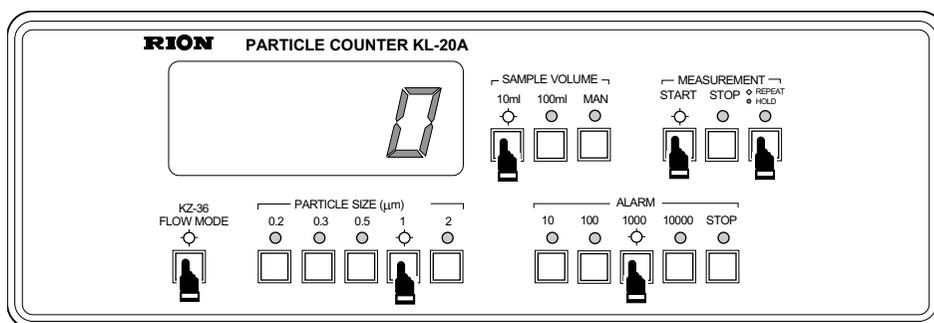
Set switches and controls to the settings in the following order.

- |                       |                                   |
|-----------------------|-----------------------------------|
| 1. Averaging runs:    | Any setting                       |
| 2. CH1 to CH6 button: | Recording channel (particle size) |
| 3. ALL DATA button:   | ON (indicator lit)                |
| 4. SINGLE button:     | ON (indicator lit)                |

## 7. Blank test

For details on the measurement method, please refer to "JIS B 9930-1977 Measurement of Particles in Hydraulic Oil".

1. Set the bottle containing filtered sample fluid in the KZ-30U.
2. Set the PUMP switch of the KZ-30U to ON and pressurize the chamber.
3. Choose suitable settings for the various items. (The condition of the underlined choices is shown in the illustration below.)
  - REPEAT/HOLD selector: HOLD (indicator off)
  - KZ-36 FLOW MODE selector: ON (indicator lit)
  - SAMPLE VOLUME selector: 10mL, 100mL (The sample liquid flows at a rate of 10 mL/min at this point.)



4. Press the START button on the KP-06 to start the measurement.
5. If the measurement value is below the prospective particle count, set the PUMP switch of the KZ-30U to OFF and start the actual measurement.  
If the measurement value is above the prospective particle count, purge the sample liquid piping with the filtered liquid and revert to step 1.

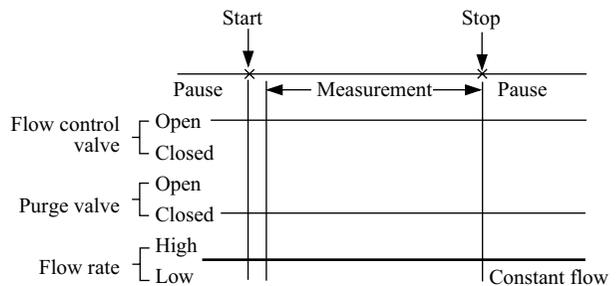
### 8. Actual measurement (sample count)

1. Set the bottle containing measurement fluid in the KZ-30U.
2. Set the SAMPLE VOLUME selector to "MAN" (to prevent the sample fluid from starting to flow immediately when step 3 is carried out).
3. Set the KZ-36 FLOW MODE selector on the KL-20A to ON.
4. Set the pump switch of the KZ-30U to ON and pressurize the chamber.
5. Set the SAMPLE VOLUME selector to "10 mL" or "100 mL", depending on the purpose of the measurement.

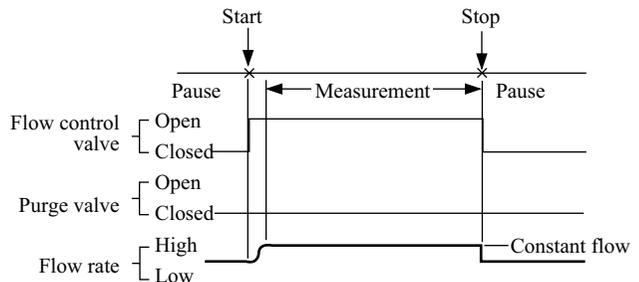
(When either of these buttons is pressed, the sample fluid starts to flow at a rate of 10 mL/min, as set at the KZ-36U.)

6. Press the START button on the KP-06 to start the measurement.

The relationship between the valves of the KZ-36U and the sample fluid flow is as shown at right.



When the SAMPLE VOLUME selector is set to "MAN", the relationship between the valves of the KZ-36U and the sample fluid flow is as shown at right.



## Off-Line Suction Measurement

### Required external equipment

Syringe Sampler KZ-30W1/W2

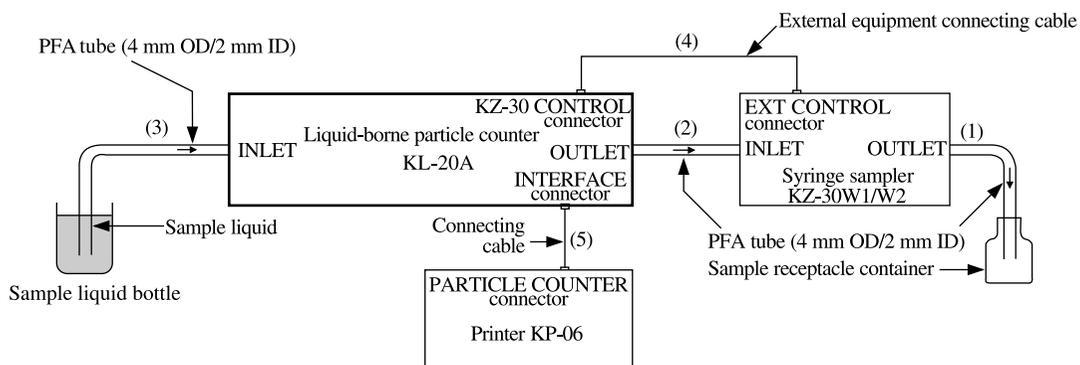
Printer KP-06

For details, please refer to the instruction manuals of the respective units.

### 1. Tube and signal cable connections

Make the following connections.

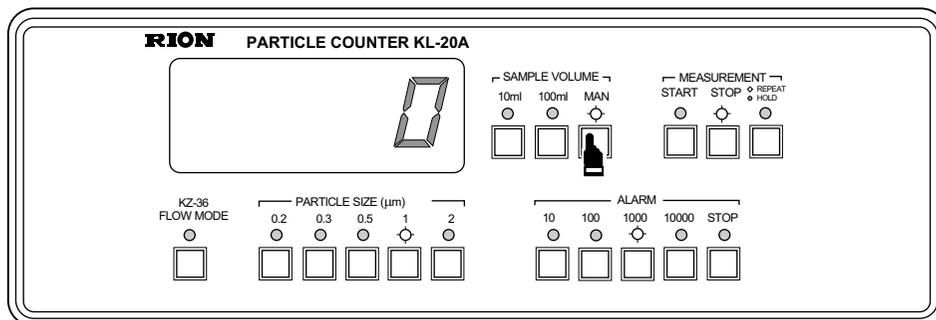
- (1) KZ-30W1/W2 outlet to sample receptacle container: PFA tube (4 mm OD/ 2 mm ID, supplied with KZ-30W1/W2)
- (2) KL-20A OUTLET to KZ-30W1/W2 inlet: PFA tube (4 mm OD/2 mm ID)  
Use union joint supplied with KL-20A to connect supplied sampling tubes.
- (3) Sample fluid bottle and KL-20A INLET: PFA tube (4 mm OD/2 mm ID)
- (4) KZ-30 CONTROL connector of KL-20A to EXT CONTROL connector of KZ-30W1/W2: Optional AB cable
- (5) INTERFACE connector of KL-20A to PARTICLE COUNTER connector of KP-06: Connecting cable (supplied with KP-06)



## 2. Setup of KL-20A

Set switches and controls to the settings in the following order.

1. POWER switch: ON (see "Power-On" on page 22)  
Also switch the power of connected equipment on.
2. SAMPLE VOLUME selector: MAN (indicator lit)



## 3. Setup of KP-06

Set switches and controls to the settings in the following order.

1. PERIOD (measurement block interval):  
1440
2. AVG (averaging count):  
Any setting
3. CH1 to CH6 button:  
Recording channel (particle size)
4. ALL DATA button:  
ON (indicator lit)
5. SINGLE button:  
ON (indicator lit)

## 4. Setup of syringe sampler (KZ-30W1/W2)

Measurement mode example

1. Suction rate: 10 mL/min
2. Blank volume: 1 to 5 mL
3. Measurement volume: 10 mL

For details, please refer to the instruction manuals of KZ-30W1/W2.

## 5. Blank check

For details on the measurement method, please refer to "JIS B 9930-1977 Measurement of Particles in Hydraulic Oil (Numeric Measurement)".

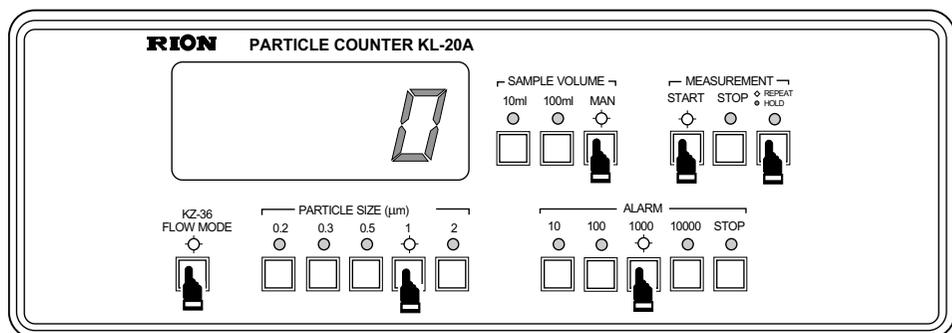
1. Set the bottle containing filtered blank fluid.
2. Choose the following settings.
  - REPEAT/HOLD selector: HOLD (indicator off)
  - SAMPLE VOLUME selector: MAN
3. Press the START button on the KP-06 to start the measurement.

The sample fluid starts flowing at a rate of 10 mL/min.

When the sample volume set with the KZ-30W1/W2 is reached, the operation stops automatically and the plunger returns to the home position. The sample fluid is ejected.

4. If the blank measurement value is below the prospective particle count, start the actual measurement.

If the blank measurement value is above the prospective particle count, purge the sample fluid piping with the blank fluid and revert to step 1.



## 6. Actual measurement

1. Set the bottle containing measurement fluid.
2. Press the START button on the KP-06 to start the measurement.

When the sample volume set with the KZ-30W1/W2 is reached, the operation stops automatically and the plunger returns to the home position. The sample fluid is ejected.

The measurement is repeated for the number of times set at the KP-06.

## Measurement Termination

1. When all measurements have been completed, purge the unit with pure water, as described in the section on "Maintenance" on page 35 and 36.
2. If the unit is not to be used for an extended period, fill the internal piping with ethyl alcohol to prevent bacteria contamination.
3. Remove the PFA tubes from the INLET and OUTLET connectors and mount end plugs on the connectors.
4. Set the POWER switch to OFF. Remove the power cord from the AC outlet and protect the unit with the plastic cover.

# Maintenance

## Steps after use

When removing the KL-20A from the measurement system, observe the following points.

1. Clean the piping with pure water. For more information, please refer to the section "System configuration example for cleaning" on page 36.
2. Set the POWER switch to OFF and disconnect the power cord from the AC outlet.
3. Fill the piping with alcohol to prevent bacteria growth.
4. Disconnect the INLET and OUTLET tubes and attach the end plugs.

### Important

The sample fluid system should be filled with liquid at all times (during measurement, storage, and transport). If the system dries up, an error (CELL NG) may occur.

## Cleaning the piping

When the CELL NG indicator is lit, clean the piping of the unit as follows.

1. Removal of chemicals and pure water cleaning  
Pass an ample amount of pure water through the system to remove any contamination and remnants of chemical substances. If the use of pure water poses the risk of sample fluid reaction and thermal build-up, hardening, or particle accumulation, use a different cleaning agent that is suitable for the sample fluid, and finally purge with clean water.
2. Check the CELL NG indicator.  
If the CELL NG indicator has disappeared, cleaning was successful.  
If the CELL NG indicator is still on, perform the following steps (cleaning with cleaning fluid).

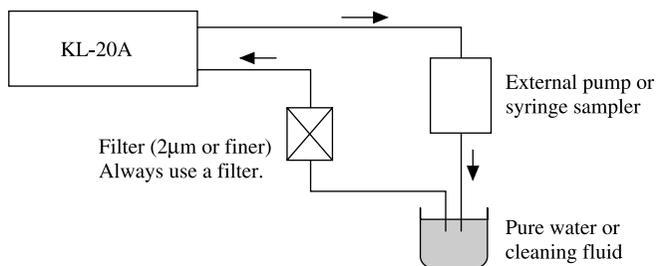
### 3. Cleaning with cleaning fluid

Use pressurization or suction within the prescribed range to pass cleaning fluid through the system. Flow rate control is not necessary. After an ample amount of cleaning fluid has been passed through the system, check the CELL indicator.

Suitable cleaning fluid: Optical cleaning fluid, acetone, alcohol or similar

Required equipment: External pump or syringe sampler, filter (2  $\mu\text{m}$  or finer)

#### System configuration example for cleaning



#### Important

If the CELL NG indicator is still on even after thorough cleaning with cleaning fluid, contact the supplier. For continued safety, do not perform any other cleaning measures except those described here.

## When the fuse has blown

<b>Important</b>
If the fuse has blown, an internal defect of the unit is the most likely cause. Contact the supplier as soon as possible to have the unit checked.

If you need to use the unit immediately for a measurement, replace the blown fuse and make the measurement, but have the unit checked as early as possible by the supplier. If the second fuse blows again, do not use the unit any further.

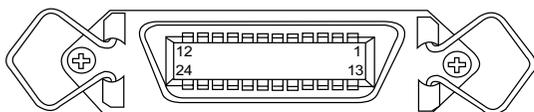
<b>Important</b>
Replace the fuse only with the supplied spare fuse. If there are no more spare fuses, be sure to contact the supplier. Correct operation with other fuses is not assured.

To replace the fuse, proceed as follows.

1. Disconnect the power code from the AC connector on the rear of the unit.
2. Push the clamps on both sides of the fuse holder inward and pull out the fuse holder.
3. Remove the blown fuse.
4. Set the new fuse in place (left side of the fuse holder as seen from the top).
5. Push the fuse holder back in.

# Control Connector Functions

## Pin Layout and Functions



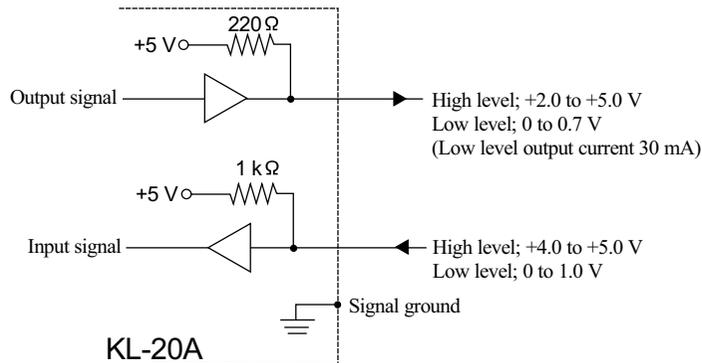
Connector type: Dai-ichi Denshi Kogyo 57-40240

Pin No.	Input/output designation	Signal name	Function
1	Out	0.2 $\mu\text{m}$ SIG	Particle signal for size 0.2 $\mu\text{m}$ and above, Hi for about 10 $\mu\text{s}$
2	Out	Ready	If KZ-30W1/W2 is connected, signal is Hi when KZ-30W1/W2 is ready
3	Out	0.3 $\mu\text{m}$ SIG	Particle signal for size 0.3 $\mu\text{m}$ and above, Hi for about 10 $\mu\text{s}$
4	Out	LOWER SAMPLE	Lo when "10 mL" sample liquid volume was selected
5	Out	0.5 $\mu\text{m}$ SIG	Particle signal for size 0.5 $\mu\text{m}$ and above, Hi for about 10 $\mu\text{s}$
6	Out	AUTO	Lo when "10 mL" or "100 mL" sample liquid volume was selected
7	Out	1 $\mu\text{m}$ SIG	Particle signal for size 1 $\mu\text{m}$ and above, Hi for about 10 $\mu\text{s}$
8	—	NC	
9	Out	2 $\mu\text{m}$ SIG	Particle signal for size 2 $\mu\text{m}$ and above, Hi for about 10 $\mu\text{s}$
10	Out	CLEAR	Lo to reset counter
11	Out	SIG GATE	Hi when count is being performed
12	—	GND	Signal ground
13	—	NC	
14	—	NC	
15	Out	LD STATUS	Lo when LD NG indication is lit

Pin No.	Input/output designation	Signal name	Function
16	In	EXT STOP	Active: Stop when Lo pulse is applied
17	Out	START SIG	Lo pulse is output when START button is pressed
18	In	EXT START	Active: Start when Lo pulse is applied
19	In	EXT HOLD	Lo to set to HOLD condition
20	Out	CELL STATUS	Lo when CELL NG indication is lit
21	Out	MODEL A	Hi
22	Out	MODEL B	Lo
23	Out	MODEL C	Lo
24	Out	MODEL D	Hi

Nc: Not Connected, Lo: low level, Hi: high level

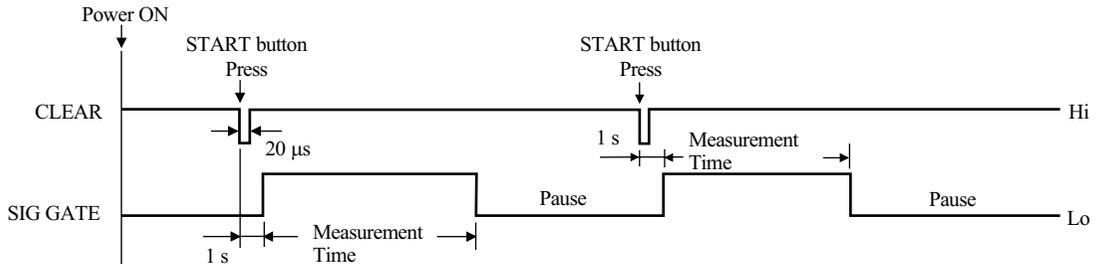
## Interface



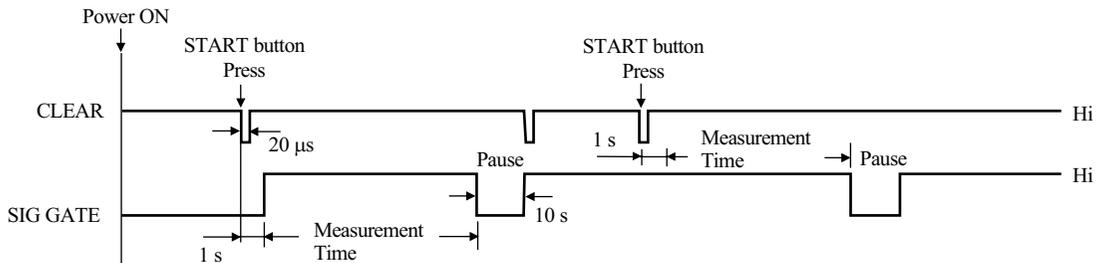
## Output Signals

### Control Signal Output

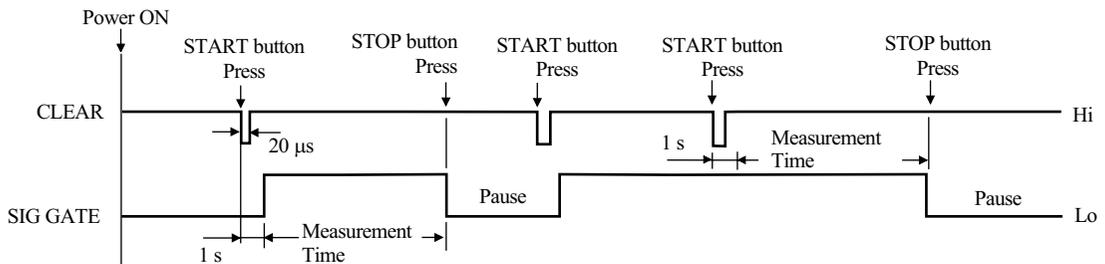
- One-time automatic measurement (REPEAT/HOLD selector set to "HOLD")



- Repeated automatic measurement (REPEAT/HOLD selector set to "REPEAT")

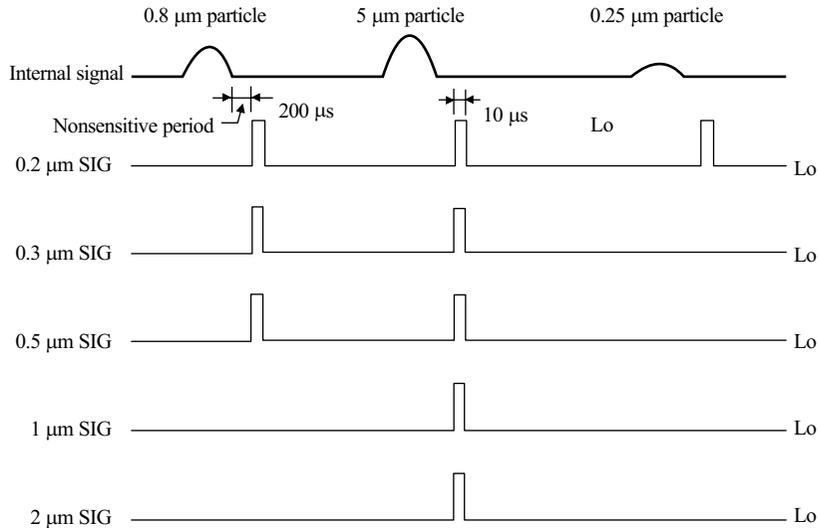


- Manual measurement (SAMPLE VOLUME selector set to "MAN")



## Particle Signal Output

When particles pass through the sensor area of the detection cell, output signals corresponding to the respective particle size group and all smaller groups are generated. If for example a  $0.8\ \mu\text{m}$  particle passes the sensor,  $0.2\ \mu\text{m}$ ,  $0.3\ \mu\text{m}$ , and  $0.5\ \mu\text{m}$  signals are produced.



## Input Signals

**EXT HOLD:** When this signal is at Lo level, measurement mode is set to one-time automatic and "REMOTE" is flashing. When the signal returns to Hi level, the setting that was active before entering Lo level is restored.

**EXT START:** Measurement starts at the rising edge from Lo level to Hi level.

**EXT STOP:** In the manual measurement mode, the measurement is terminated at the falling edge from Hi level to Lo level.

# RS-232-C Interface

## Outline

The built-in RS-232-C interface can be used to send measurement data from the KL-20A to a computer and to control operation of the KL-20A from the computer by setting measurement parameters and other items. This allows automatic measurement of particle concentration in liquids, monitoring of particle size distribution, etc.

## Data Transfer Protocol

Transmission configuration	Full-duplex, asynchronous	
Flow control	No	
Parity check	Even, odd, none (selectable)	[even]
Number of stop bits	1, 2 (selectable)	[2]
Character bits	7 bits, 8 bits (selectable)	[7 bits]
Transmission rate	75, 150, 300, 600, 1200, 2400, 4800, 9600 bps (selectable)	[4800 bps]
Line terminator	<CR>, <CR><LF> (selectable)	[<CR><LF>]
Character code	ASCII	
Standards	JIS-X-5101, EIA RS-232-C, CCITT V.24, V.28	

Values in rectangular brackets [ ] indicate defaults.

In order to enable correct data transfer, identical settings (transmission rate, parity, stop bit, data word length) must be used at both ends. To make changes from the default settings shown above, please refer to "Altering transfer parameters or measurement data transfer mode settings" on page 47.

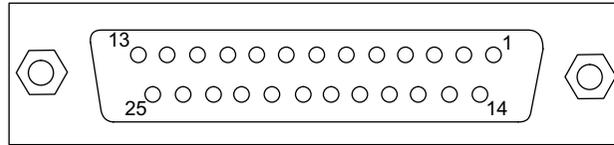
The terminator is used to indicate the end of a data or command string.

<CR>: Carriage return (0DH)

<LF>: Line feed (0AH)

## Interface Functions

Connector type: DTE, 25-pin, female



Pin no.	Signal type	Designation	Signal flow direction
1	Protective ground	FG	Not specific
2	Transmit data	SD	KL-20A →
3	Receive data	RD	KL-20A ←
4	Request to send	RS	KL-20A →
5	Clear to send	CS	KL-20A ←
6	Data set ready	DR	KL-20A ←
7	Signal ground	SG	Not specific
8	Carrier detect	CD	Not used in KL-20A
20	Data terminal ready	ER	KL-20A →

## Cables

The following four types of shielded cables are available from Rion as optional equipment. Cable length is 2 m.

CC-60: For interfaces with DTE type female connectors

CC-60R: For interfaces with DTE type male connectors

CC-60S: For interfaces with DCE type female connectors

CC-61: For interfaces with DTE type male connectors

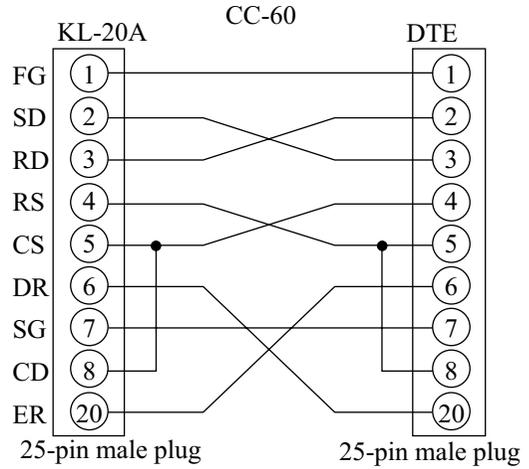
DTE: Data Terminal Equipment

DCE: Data Communication Equipment

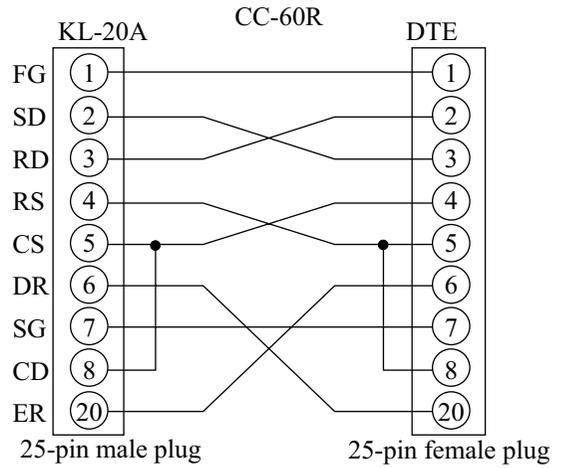
### Important

Before connecting or disconnecting any cables, make sure that power to the KL-20A and the other equipment is turned off.

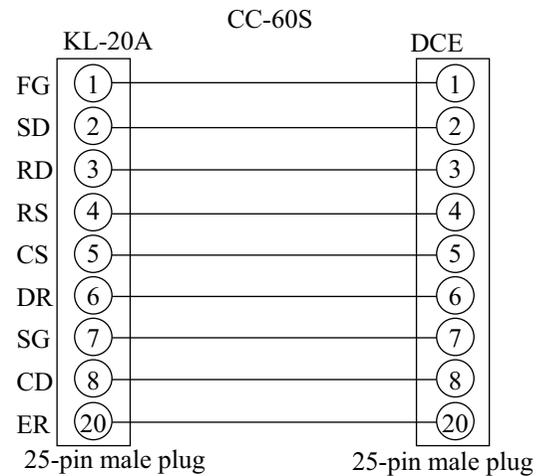
### Wiring of CC-60 cable

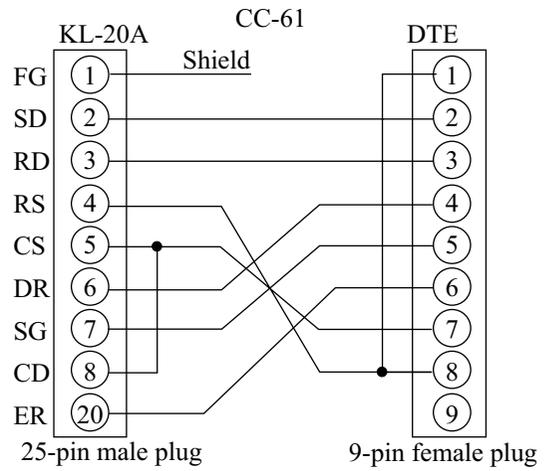


### Wiring of CC-60R cable



### Wiring of CC-60S cable



**Wiring of CC-61 cable**

## Transfer Parameters and Measurement Data Transfer Mode

### Transfer parameters

At the factory, the following parameters are preset. These settings can be changed with the rotary and DIP switches (SW1, SW2) on the RS-232-C interface board inside the KL-20A.

Parity check:	Even
Number of stop bits:	2
Data word length:	7 bits
Transmission rate:	4800 bps
Terminator:	<CR><LF>

### Measurement data transfer mode

There are two modes available for sending measurement data from the KL-20A: S0 and S1. These modes differ in the timing that is used to send the data. Which mode is selected after turning on the KL-20A depends on the setting of the SEL1 jumper on the RS-232-C interface board inside the KL-20A, but the setting can be easily changed later (using the S command). At the factory, SEL1 is set to the S0 mode.

**S0 mode:** After each measurement is terminated, data are sent out automatically. There is no need to use the B command to request measurement data.

**S1 mode:** After a measurement is terminated, the data are stored in the data buffer of the KL-20A. When the B command (request measurement data) is received, the data are sent from the buffer, and the buffer is cleared.

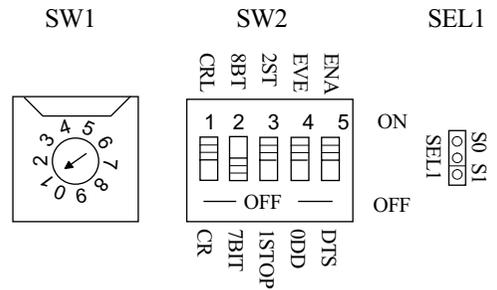
Data are stored in the buffer until the next measurement is completed. Then the data are overwritten with data from the new measurement. To retrieve the data from each measurement, the B command must be sent before the next measurement is completed.

## Altering transfer parameters or measurement data transfer mode settings

Set the power switch of the KL-20A to OFF. Then remove the top cover of the unit.

Switches SW1 and SW2 serve to set transfer parameters, and jumper SEL1 sets the measurement data transfer mode.

After making the desired adjustments, replace the top cover.



### **⚠ WARNING**

**Do not turn power to the unit on while the top cover is removed!**

#### Transmission rate (SW1)

SW1 setting	Transmission rate (bps)	SW1 setting	Transmission rate (bps)
0	9600	4	600
1	4800	5	300
2	2400	6	150
3	1200	7	75

### **Important**

**Do not set the switch to 8 or 9, as this will disable operation.**

#### Parity check (ENA-DIS and EVE-ODD of SW2)

Parity	ENA-DIS switch	EVE-ODD switch
None	OFF	—
Odd	ON	OFF
Even	ON	ON

Number of stop bits (2ST-1STOP switch of SW2)

ON: 2 stop bits

OFF: 1 stop bit

Data word length (8BT-7BIT switch of SW2)

ON: 8 bits

OFF: 7 bits

Terminator (CRL-CR switch of SW2)

ON: <CR><LF>

OFF: <CR>

Measurement data transfer mode (jumper position on SEL1)

Jumper on S0 side: S0 mode

Jumper on S1 side: S1 mode

## Remote Mode / Local Mode

In remote mode, control of the KL-20A is possible only via the RS-232-C interface. The buttons on the unit's front panel and the control connector on the rear panel are inactive. When the remote mode is activated, the indication REMOTE appears on the display of the KL-20A.

In the local mode, control of the KL-20A is possible via the RS-232-C interface and with the buttons on the unit's front panel. The control connector on the rear panel (EXT. START/STOP, EXT. HOLD) can also be used.

Switching between the local and remote mode is performed with the R command. The default mode when the KL-20A is turned on is the local mode.

# Commands

## Command list

Command	Function	Remarks
C	Reset KL-20A	Single
R	Select local mode/remote mode	
R0	Select local mode	
R1	Select remote mode	
S	Select measurement data transfer mode	
S0	Select S0 mode (data sent after each measurement)	
S1	Select S1 mode (data sent after B command)	
A	Set alarm level	
A1	10	
A2	100	
A3	1000	
A4	10000	
A5	STOP	
V	Set sample fluid volume	
V1	MAN	
V2	10 mL	
V3	100 mL	
D	Set particle size for displaying particle count	
D1	0.2 $\mu\text{m}$	
D2	0.3 $\mu\text{m}$	
D3	0.5 $\mu\text{m}$	
D4	1 $\mu\text{m}$	
D5	2 $\mu\text{m}$	
H	Set REPEAT/HOLD selector	
H0	Select REPEAT (repeated automatic measurement)	
H1	Select HOLD (one-time automatic measurement)	
L	Set KZ-36 FLOW MODE selector	
L0	Set to OFF (indicator off)	
L1	Set to ON (indicator lit)	
G	Start/stop measurement	
G0	Stop measurement (only in manual mode)	Single
G1	Start measurement	
B	Get measurement data (valid in S1 mode)	Single
F	Get current measurement parameters	Single

- All characters are ASCII.
- "Single" means that the command must be sent as a single command to the KL-20A. If it is combined with other commands, all commands are disregarded.

### Command format

Commands used to control the KL-20A consist of a single alphabet character and a parameter formed by a single-digit numeral. Some commands do not require any parameter.

Either `<CR><LF>` or `<CR>` can be used as terminator (selected with CRL-CR switch of SW2, see page 47). In the following description, the terminator is indicated by `<EOL>` (end of line).

Commands C, G, B, and F are single commands which must be sent to the KL-20A by themselves. If these are combined with other commands, all commands are disregarded.

Commands other than C, G, B, and F can be combined and sent to the KL-20A as a multiple command string.

Example for single command      Example for multiple command string

A2 <code>&lt;EOL&gt;</code>
-----------------------------

A2V2D1H0R1 <code>&lt;EOL&gt;</code>
-------------------------------------

A2: Alarm level 100

V2: Sample liquid volume 10 mL

D1: Particle size 0.2 μm

H0: REPEAT mode (repeated automatic measurement)

R1: Remote mode

When sending a multiple command string which contains an undefined command, that command and all commands following it are disregarded. If for example the string `A2V2D0H0R1<EOL>` is sent (where `D0` is an undefined command), the alarm level of the KL-20A is set to 100 and the sample liquid volume to 10 mL, but the other commands (`H0` and `R1`) are disregarded, although they are valid commands. When an undefined command is sent, the KL-20A returns `ER2<EOL>`.

The commands for controlling the KL-20A have the same effect as corresponding buttons on the unit. The commands should therefore be sent in the same order as would be used to operate the unit with the buttons.

Power on/off switching cannot be performed with commands.

### **Response to commands**

When the KL-20A receives a command, it returns one of the following strings.

*ACK<EOL>*: Command received without error

*ER1<EOL>*: An error was detected during transfer

*ER2<EOL>*: Undefined command

*ER3<EOL>*: Command cannot be executed

The "ACK" etc. is a character string, and *<EOL>* is the terminator (*<CR><LF>* or *<CR>* as determined by the CRL-CR switch of SW2).

*ER3<EOL>* (command cannot be executed) is returned in the following cases.

- G1 command was received, but KL-20A is not in a condition to start measurement.
- Command G0 was received while automatic measurement is being carried out (COUNT indication lit).
- Command G0 was received within one second after command G1 was received.
- L command was received during measurement.

When the F command is received, *ACK<EOL>* is not returned. For the B command, *ACK<EOL>* is only returned when no measurement data to be sent are present.

## Commands to control operation of KL-20A

C command (no parameter): Reset KL-20A.

- Data buffer is cleared.
- Data prepared for transfer are cleared.
- Any currently running measurement is cancelled.

Note
When the C command is received while the KL-20A is ready to send data or sending data (data request command has been received or after measurement has been completed), the data transfer is cancelled and the data are cleared. In such a case, the <EOL> will not be received by the computer.

R command (R + parameter): Select local mode/remote mode.

R0: Set to local mode.

R1: Set to remote mode.

S command (S + parameter): Select measurement data transfer mode.

S0: Select S0 mode (data sent after each measurement).

S1: Select S1 mode (data sent after B command).

Which default setting is established when the power to the KL-20A is turned on depends on the setting of the SEL1 jumper.

## Commands determining measurement parameters of KL-20A

A command (A + parameter): Set alarm level.

A1: 10  
A2: 100  
A3: 1000  
A4: 10000  
A5: Stop

V command (V + parameter): Set sample liquid volume.

V1: MAN (manual)  
V2: 10 mL  
V3: 100 mL

D command (D + parameter): Set particle size for displaying particle count.

D1: 0.2  $\mu\text{m}$   
D2: 0.3  $\mu\text{m}$   
D3: 0.5  $\mu\text{m}$   
D4: 1  $\mu\text{m}$   
D5: 2  $\mu\text{m}$

H command (H + parameter): Set REPEAT/HOLD selector.

H0: REPEAT (repeated automatic measurement)  
H1: HOLD (one-time automatic measurement)

L command (L + parameter): Set KZ-36 FLOW MODE selector.

L0: Off (indicator off)  
L1: On (indicator lit)

This command is valid when no measurement is being carried out by the KL-20A (stop button indicator is lit). While a measurement is being carried out, the command is not accepted (an ER3<EOL> string is returned).

## Commands for controlling measurement start/stop

G command (G + parameter): Start/stop measurement.

- G0: Stop measurement (only valid during measurement in manual mode)
- G1: Start measurement.

Response of KL-20A to command G0

- During measurement in manual mode (depending on measurement data transfer mode)

Measurement data transfer mode	Response of KL-20A
S0 mode	Measurement is terminated, ACK<EOL> and measurement data are sent.
S1 mode	Measurement is terminated, ACK<EOL> is returned, and measurement data are entered into data buffer. Any previous data in data buffer are overwritten. Data can be retrieved from data buffer with B command.

- During measurement in automatic mode  
KL-20A returns ER3<EOL>, indicating that command cannot be executed. (Measurement is automatically terminated when preset sample liquid volume is reached.)
- During stop (no measurement being carried out)  
Only ACK<EOL> is returned.

Response of KL-20A to command G1

- During stop (no measurement being carried out)  
ACK<EOL> is returned, and measurement starts. However, if measurement cannot be carried out in current condition of KL-20A, ER3<EOL> is returned and measurement is not started.
- During measurement  
ACK<EOL> is returned, and a new measurement is started. Data stored up to that point are cleared.

## Commands requesting data from KL-20A

F command (F, no parameter): Get current measurement parameters.

When the F command is received, the KL-20A returns the current measurement parameters. It does not return an `ACK<EOL>`. For details on the format of the returned information, please refer to "Measurement parameters" (see page 57) in the section "Format of Data from KL-20A".

B command (B, no parameter): Get measurement data.

The response of the KL-20A to the B command depends on the measurement data transfer mode. For details on the format of the returned data, please refer to "Measurement data" in the section "Format of Data from KL-20A" (see page 58).

In S1 mode: If data are present in the data buffer, these data are sent and the buffer is cleared (no `ACK<EOL>` is sent).

If no data are present in the data buffer, only `ACK<EOL>` is sent.

In S0 mode: `ACK<EOL>` is sent, and the B command is disregarded. In this mode, measurement data are sent automatically after measurement is completed. The B command is not required.

## Format of Data from KL-20A

Character strings sent from the KL-20A are preceded by "F/" for measurement parameter settings and by "KL20A" for measurement data. Acknowledgment of received commands takes the form "ACK" or "ERn" (n = 1 to 3). By examining the first two or three characters in a string sent from the KL-20A, the type of data can be identified.

<b>Note</b>
Measurement parameters and measurement data are normally sent in the order they were requested. However, in the S0 mode, when the F command was received approximately at the same time as the measurement end, the order of the data depends on the timing of the F command and is not predictable. This must be considered when programming.

## Measurement parameters

Data returned by KL-20A in response to F command (get current measurement parameters)

F/VnDnAnHnLnRnSn<EOL>  
 (1)                      (2)

n: Numeral

<EOL>: Terminator (<CR><LF> or <CR>, depending on CRL-CR switch of SW2)

(1) Header indicating that the following string contains information on measurement parameters.

(2) Measurement parameter settings

<u>Vn: Sample liquid volume</u>	<u>Dn: Particle size</u>	<u>An: Alarm level</u>
V1: MAN	D1: 0.2 μm	A1: 10
V2: 10 mL	D2: 0.3 μm	A2: 100
V3: 100 mL	D3: 0.5 μm	A3: 1000
	D4: 1 μm	A4: 10000
	D5: 2 μm	A5: STOP

Hn: Setting of REPEAT/HOLD selector

H0: REPEAT (repeated automatic measurement)

H1: HOLD (one-time automatic measurement)

Ln: Setting of KZ-36 FLOW MODE selector

L1: On

L0: Off

Rn: Remote/local setting

R0: Local mode

R1: Remote mode

Sn: Measurement data transfer mode

S0: S0 mode (data sent after each measurement)

S1: S1 mode (data sent on request, after B command)



# Specifications

Optical system	45° sideways light-scattering method
Light source	Laser diode (maximum output 50 mW; wave length 780 nm)
Laser product classification	Class 1, IEC 60825-1 (2001) Internal particle detection mechanism uses class 3B laser
Light detector	PIN type photodiodes
Materials of component parts exposed to sample fluid	Synthetic quartz, PFA
Allowable sample fluid types	Fluids which do not corrode the fluid contact materials
Calibration	Polystyrene latex (PSL) spheres with refractive index 1.6 in pure water
Measurable particle size	0.2 to 2 $\mu\text{m}$ (with PSL particles of refractive index 1.6 in pure water)
Measurement size range	Five channels ( $\geq 0.2 \mu\text{m}$ , $\geq 0.3 \mu\text{m}$ , $\geq 0.5 \mu\text{m}$ , $\geq 1.0 \mu\text{m}$ , $\geq 2.0 \mu\text{m}$ )
Sample flow rate	10 mL / min
Maximum particle concentration	1,200 particles / mL (coincidence loss 5% for 0.2 $\mu\text{m}$ particles)
Sample fluid temperature range	+10 to +30°C (no moisture condensation on cell)
Allowable sample fluid pressure	300 kPa or less (gauge pressure)
Warm-up time	30 minutes

**Sample fluid connectors**

INLET:	Sample fluid inlet, 2×4 dia. flared tube joint
OUTLET:	Sample fluid outlet, 2×4 dia. flared tube joint
PURGE:	Purge gas inlet, Rc 1/8 (PT 1/8 female)

**Sample fluid volume****Automatic measurement**

10 mL (1 minutes), 100 mL (10 minutes)

**Manual measurement**

Arbitrary

**Measurement modes**

HOLD	Measurement value is retained until next measurement is started.
REPEAT	Measurement is restarted automatically with 10-seconds pause interval.

**Display**

Particle count	Particle count (max. 5 digits)
COUNT	Lights up while a measurement is being performed.
REMOTE	Lights up when the unit is remote controlled using the interface.
Over-range mark	Lights up when the particle count has exceeded 100,000.
CELL NG	Lights up when normal measurement is not possible due to contamination or condensation in the detection cell.
LD NG	Lights up when the output of the internal laser diode falls below the normal level.

**Alarm** Beeper and relay are activated when particle count exceeds a preset level.

**Alarm level settings**

10, 100, 1,000, 10,000 particles or STOP

## Input / Output connectors

## CONTROL connector

External control connector

(Serves for connection of printer KP-05L)

EXT1, EXT2 Test output

## KZ-36 CONTROL

Serves for connection of flow controller KZ-36U

## KZ-30 CONTROL

Serves for connection of sampler KZ-30W1 or KZ-30W2

## Interface

RS-232-C Interface connector

(Also serves for connection of printer KP-06)

ALARM OUT ALARM OUT terminals

with resistive load

30 V DC, 5 A or less,

250 V AC, 5 A or less

 $(\cos\phi = 1)$ 

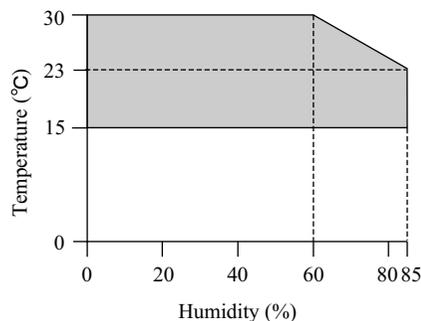
with inductive load

30 V DC, 3 A or less,

250 V AC, 2 A or less

 $(\cos\phi = 0.4, L/R = 7 \text{ ms})$ Power requirements 100 V AC  $\pm 10\%$ , 50 / 60 Hz, approx. 45 VA

## Ambient conditions for operation

Shaded section  in the following graph

(no condensation and no freezing in internal piping)

## Ambient conditions for storage

-10 to +50°C, less than 85% RH

(no condensation and no freezing in internal piping)

Dimensions 323 (W) × 118 (H) × 413 (D) mm (maximum)  
289 (W) × 99 (H) × 405 (D) mm (excluding joints and other protruding parts)

Weight Approx. 10 kg

Supplied accessories

Slow-blow fuse (T 0.6 A)	1
Tube A vacuum pack	1
Power cable (for use in Japan with 100 V, 2.5 m)	1
Plastic cover	1
Instruction manual	1
Liquid-borne particle counter usage precautions	1
Inspection certificate	1



