INSTRUCTION MANUAL

TWO-CHANNEL CHARGE AMPLIFIER

UV-06A

RION CO., LTD.

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

Organization of this manual

This manual describes the features and operation of the Two-Channel Charge Amplifier UV-06A. For information regarding the operation of other equipment in the case of incorporating the UV-06A into a measurement system with other equipment, always make sure refer to the documentation of the other equipment. The following pages contain important information on safety. Be sure to read this part.

The manual contains the following sections.

Outline

Gives basic information on the unit, and contains a block diagram.

Controls and Features

Briefly identifies and explains all parts of the unit.

Power Supply Connection

Describes the power supply connection, and the steps for using several UV-06A units in a linked configuration.

Connection and Setup

Describes the sensitivity / measurement mode settings. Also describes the accelerometer selection.

Measurement

Describes the steps for measurement.

Frequency Characteristics

Describes the frequency characteristics of the high pass filter and the low pass filter of the unit. Also describes the frequency characteristics of the measurement mode velocity (VEL) and the measurement mode displacement (DISP) of the unit.

Specifications

Lists the technical specifications of the unit.

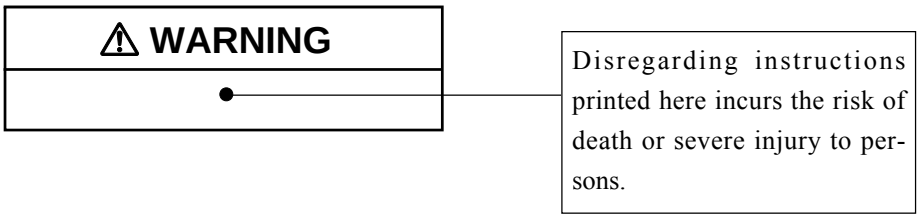
Technical Information

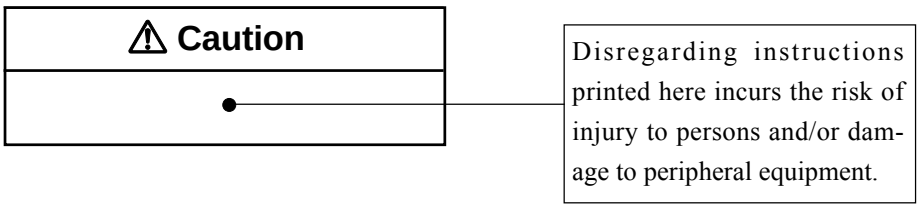
Provides additional information that is helpful for using the unit.

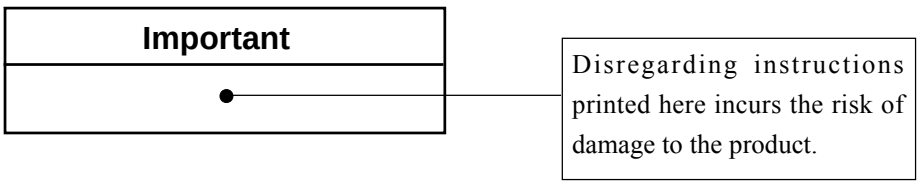
* All company names and product names mentioned in this manual are trademarks or registered trademarks of their respective owners.

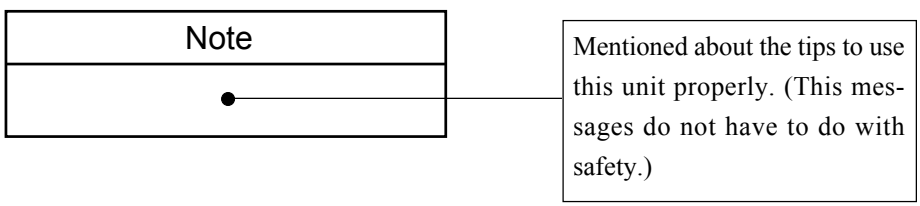
FOR SAFETY

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









Precautions

- Operate the unit as described in this manual.
- Do not disassemble the unit or attempt internal alterations.
- Observe the following precautions before using the unit:
  1) Make sure that all connections are properly established.
  2) Check the setting of all switches and controls, and make sure that the unit is operating normally.
- The permissible ambient temperature range for operation of the unit is -10 to +50°C. Relative humidity must be below 90%.
- Do not store or use the unit in locations which
  1) may be subject to strong magnetic fields or strong radiation, or
  2) may be subject to high levels of dust or splashes of water, or
  3) may be subject to gases or air with high salt or sulphur content, or are in the vicinity of stored chemicals, or
  4) may be subject to high temperature, humidity, or to direct sunlight, or
  5) may be subject to vibrations or shock.
- Always switch off the power after using the unit.
- When disconnecting cables, always hold the plug and do not pull the cable.
- Use the specified AC adapter.
- In case of malfunction, do not attempt any repairs. Note the condition of the unit clearly and contact the supplier.

Contents

FOR SAFETY iii

Outline 1

Controls and Features 3

Front panel 3

Rear panel 5

Inner Panel 6

Power Supply Connection 8

Connection and Setup 11

Output Connections 13

Accelerometer Selection and Mounting Method 14

Measurement 16

Measurement Range 18

Frequency Characteristics 20

Specifications 22

Technical Information 27

Noise Level and Measurement range 27

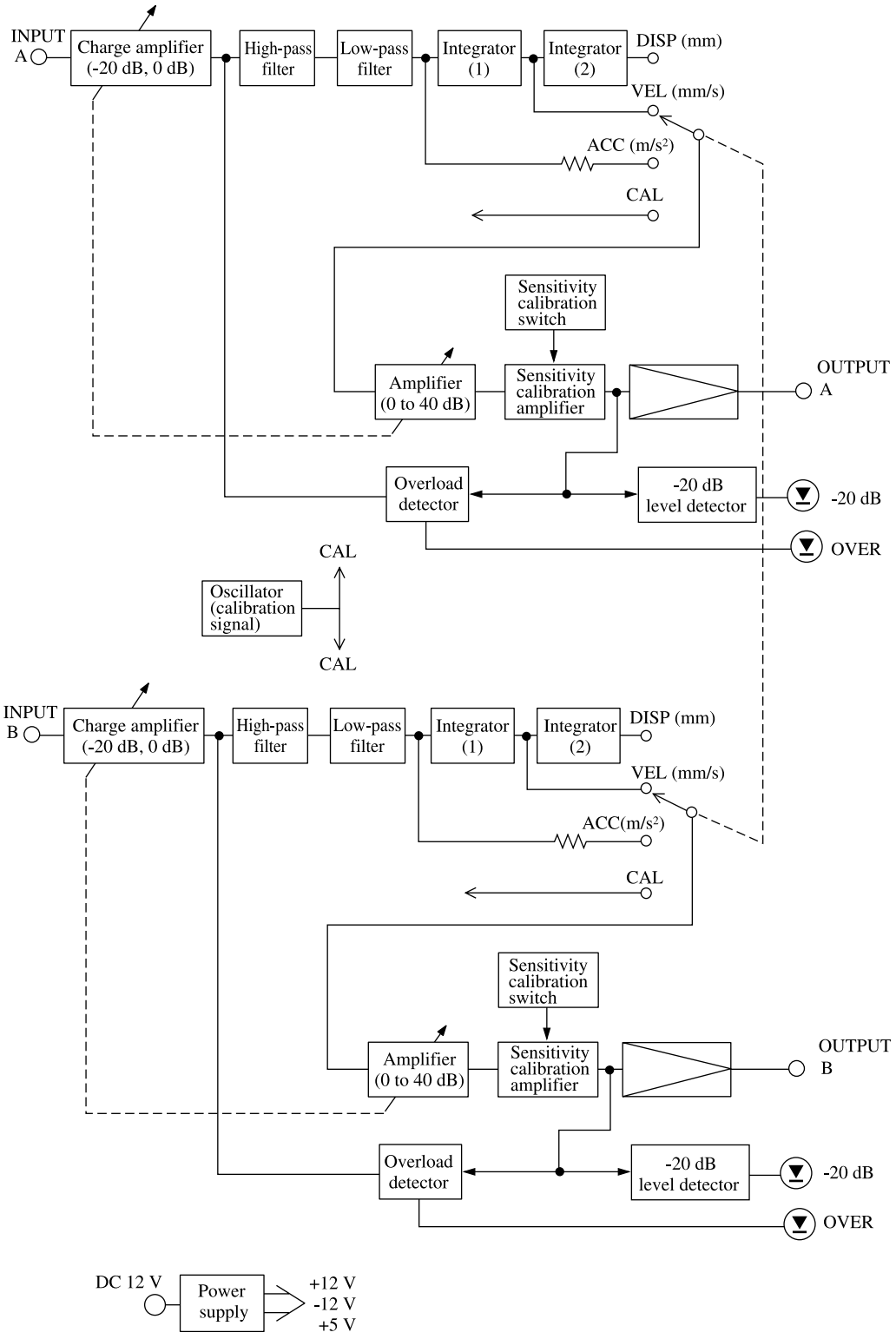
Outline

The UV-06A is a two-channel charge amplifier for piezoelectric accelerometers. It provides micro-dot input connectors for the accelerometers and BNC type AC output connectors. By combining several units in a linked installation, a multi-channel setup can be easily configured.

For each channel, the unit incorporates integrators for converting the acceleration signal into vibration velocity and displacement signals, a high-pass filter and a low-pass filter. A built-in oscillator for calibrating a level recorder or frequency analyzer is also provided.

Using the rack-mount base, the unit can be installed in a rack even if the channel configuration is less than the full rack width (24 channels).

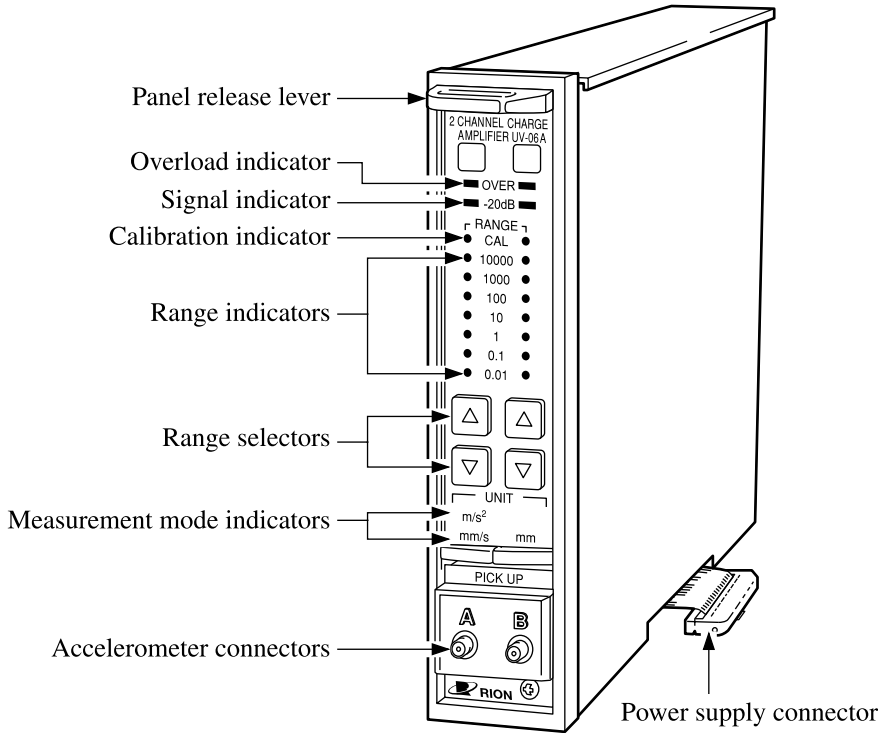
The unit can be powered from an AC adapter, or from the battery unit BP-07 in installations with only a few channels.



Block Diagram

Controls and Features

Front panel



Panel release lever

Push this lever down and pull it out to gain access to the inner panel for changing various measurement settings.

Overload indicator (OVER)

Lights up when amplifier saturation occurs.

Signal indicator (-20 dB)

Lights up when the signal level is -20 dB or higher, refered to the full-scale point.

Calibration indicator (Cal)

Lights up when the internal calibration oscillator is used (activated with the range selector).

Range indicators (0.01 to 10000)

Show the full-scale level of the selected range.

Range selectors (▲ ▼)

These buttons serve to switch the range up or down.

Measurement mode indicators

Show the unit of the selected measurement: m / s^2 for acceleration, mm / s for velocity, and mm for displacement.

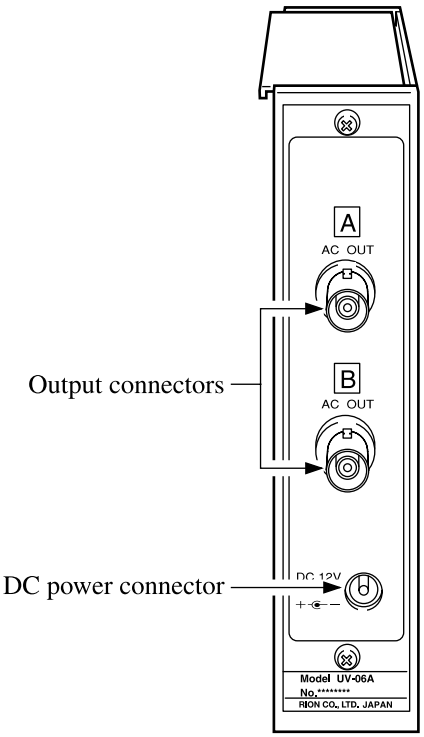
Accelerometer connectors

For connection of piezoelectric accelerometers.

Power supply connector

This connector is used when several units are used together in a multi-channel configuration.

Rear panel



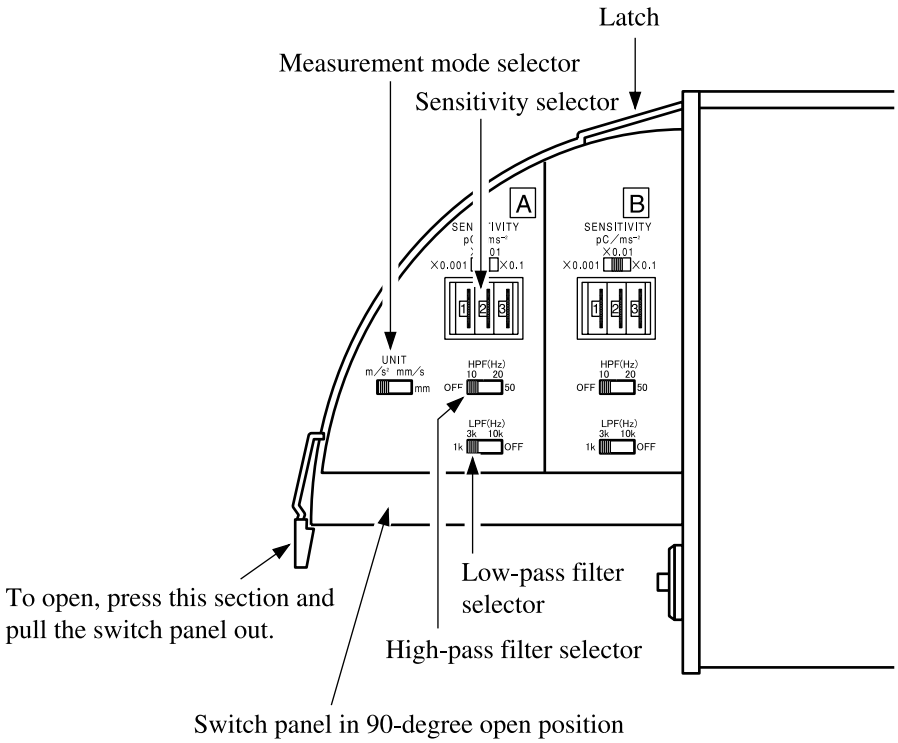
Output connectors

An AC signal corresponding to the accelerometer signal is supplied here.

DC power connector

The output from the AC adapter or the external DC power supply is connected here.

Inner Panel



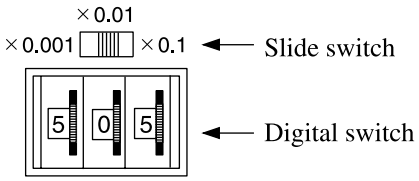
Measurement mode selector

Selects the measurement unit: m / s^2 for acceleration, mm / s for velocity, and mm for displacement.

Sensitivity selector

Set this selector to match the accelerometer sensitivity.

Example: If the charge sensitivity of the accelerometer is 5.05 pC / (m / s^2), set the digital switch to "505" and the slide switch to " × 0.01" as shown below.



Latch

This latch secures the inner panel when it is open. To close the inner panel, press the top section of the latch to release it, and push the panel in.

Low-pass filter selector

Provides the settings 1 kHz, 3 kHz, 10 kHz, and OFF.

High-pass filter selector

Provides the settings OFF, 10 Hz, 20 Hz, and 50 Hz.

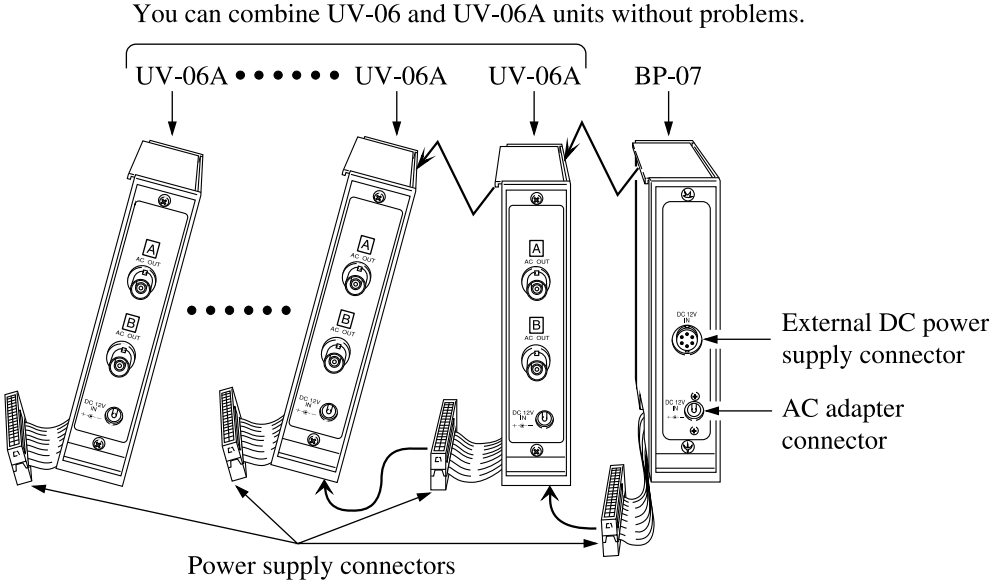
Power Supply Connection

The unit can be powered from the optional AC adapter NC-11, NC-79, NC-95 or NC-97 AC adapter, or from the battery unit BP-07.

NC-11: For 120 V AC, output 12 V DC 300 mA
NC-79: For 100 to 250 V AC, output 12 V DC 2 A
NC-95: For 100 to 240 V AC, output 12 V DC 2.5 A
NC-97: For 100 to 240 V AC, output 12 V DC 3.3 A

When using several UV-06A units in a linked configuration, connect the AC adapter to the first unit, and use the bus connector located in the bottom panel for subsequent units.

To use the optional battery unit BP-07 (for eight IEC R14, size "C" batteries), connect the units as shown below.



When using several charge amplifiers, secure the units with the metal joints, as shown on the next page.

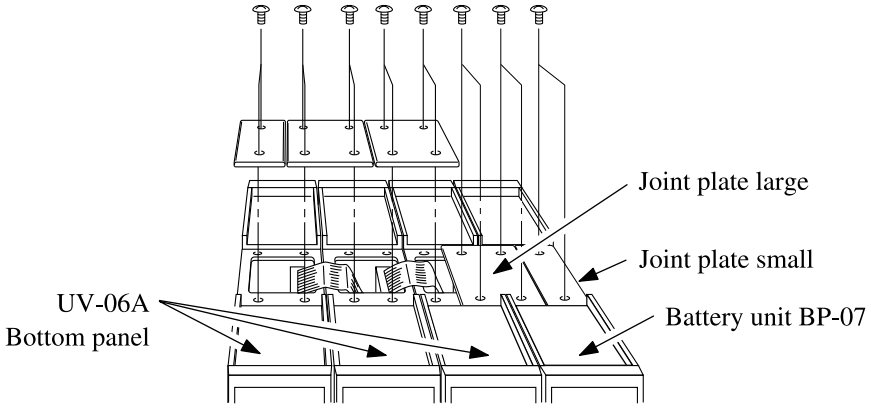
If the battery voltage meter of the battery unit BP-07 enters the red zone, immediately replace all eight batteries (IEC R14, size "C") with new ones.

It is also possible to connect the AC adapter NC-11, NC-79, NC-95 or NC-97 to the battery unit BP-07. In this case, power is normally provided by the adapter, but the measurement will not be interrupted also in case of a power failure, because the battery pack acts as a back-up power supply.

For powering 1 to 2 units, the AC adapter NC-11 is suitable. For 3 or more units, use the AC adapter NC-79, NC-95 or NC-97.

Important
Use only the specified AC adapter. Using a different adapter may cause malfunction or damage.

When using several amplifiers together, secure the units with the metal joints, as shown below.



Important

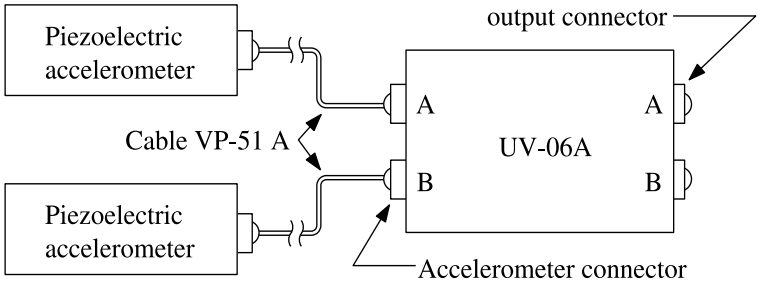
The UV-06A does not have a power switch. Consequently, you should plug the AC adapter into an AC outlet only after the accelerometer and all other equipment connections are completed. When using the battery unit, set the power switch on the battery unit to "Off" before making connections.

Note

When powering three UV-06A units from a single battery unit BP-07 (for eight IEC R14, size "C" batteries), operation time will be about 15 hours with one set of fresh alkaline batteries. (25°C)
Dispose of used batteries in accordance with local laws and regulations.

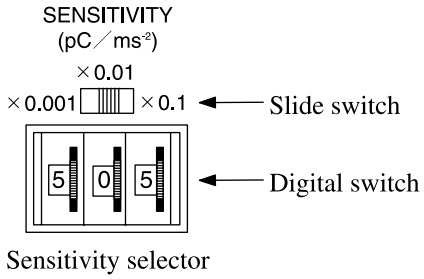
Connection and Setup

1. Connect the piezoelectric accelerometers to the UV-06A as shown in the illustration below, using the low-noise cable VP-51A.



2. Select the measurement mode.
   The measurement mode selector determines whether vibration acceleration, velocity, or displacement is measured.
   - m / s²: Acceleration (unit: m / s²)
   - mm / s: Velocity (unit: mm / s)
   - mm: Displacement (unit: mm)

3. Set the sensitivity of the unit to match the sensitivity of the accelerometer.
   This is done by setting the sensitivity selector switches to a gain setting that is suitable for the electrical charge sensitivity of the accelerometer. The digital switch has a setting range of 100 to 999. The actual gain value is set as follows: (Digital switch numeral) × (Factor set with slide switch)



Note
The 100 digit cannot be set to 0. (ex: 099)

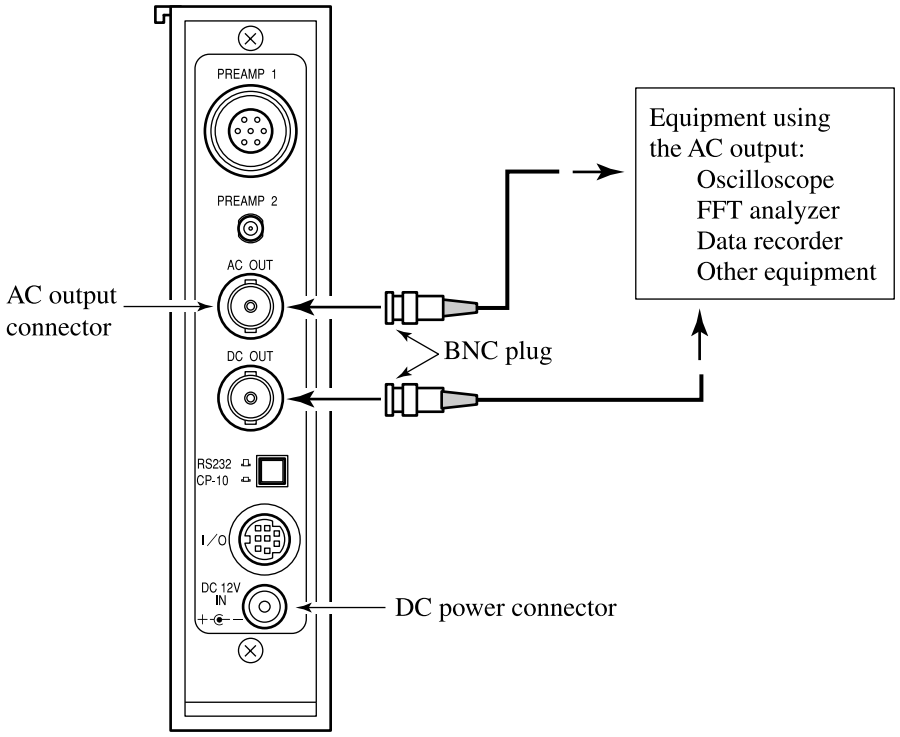
The setting should match the electrical charge sensitivity [pC / (m / s^2)] shown on the "calibration chart of the accelerometer". If the electrical charge sensitivity is given in pC / G, convert it into pC / (m / s^2) by dividing the value by 9.8.

For example, if the electrical charge sensitivity of the accelerometer is 5.05 pC / (m / s^2), set the digital switch to "505" and the slide switch to "× 0.01". The setting range is 0.1 to 99.9, but by setting the Sensitivity selector to a value that is 10 times the electrical charge sensitivity and multiplying the measurement result by 10, accelerometers with a sensitivity between 0.01 and 0.0999 pC / (m / s^2) can be used.

Output Connections

AC Output

The AC output connectors A, B provide a signal corresponding to the measured vibration. This signal can be supplied for example to an oscilloscope for waveform observation, or to a data recorder or FFT analyzer.



	AC output
Connector type	BNC
Output impedance	Approx. 50 Ω
Output voltage	1 V rms ± 2% (RMS mode) 1 V peak ± 2% (EQ PEAK mode) 1 V p-p ± 2% (EQ P-P mode)
Maximum output voltage	± 10 V peak (no overload)
Load impedance	10 kΩ or more

Accelerometer Selection and Mounting Method

The UV-06A is a vibration meter designed for use with piezoelectric accelerometers. Dynamic type or other types of accelerometers cannot be used with this unit. Choose a piezoelectric accelerometer suited for the type of measurement that is to be carried out, taking into account factors such as vibration range, frequency range, environmental conditions, etc.

Typical piezoelectric accelerometers made by Rion (representative values)

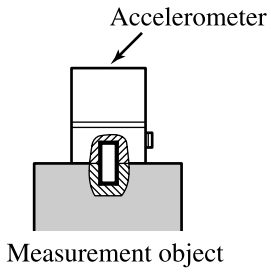
	General	High-output	Lightweight	Heat-resistant	3-axis
Model	PV-85	PV-87	PV-90B	PV-65	PV-93
Charge sensitivity [pC/(m/s^2)]	6	40	0.15	7	0.7
Mounting resonance frequency (kHz) *1	24	9	70	25	30*2
Frequency range (Hz)	1 to 7000	1 to 3000	1 to 25000	1 to 9000	1 to 8000*2
Temperature range (˚C)	-50 to +160	-50 to +160	-50 to +160	-50 to +260	-50 to +160
Mass (g)	23	115	1.2	26	28
Construction principle	Shear type	Shear type	Shear type	Shear type	Shear type

*1: When mounted with specified screws at specified torque
*2: Vertical direction value

Proper selection and mounting of the accelerometer is vital to obtain reliable measurement results. The accelerometer mounting method greatly affects the contact resonance frequency. The advantages and disadvantages of various methods are outlined below, to assist you in choosing the proper method.

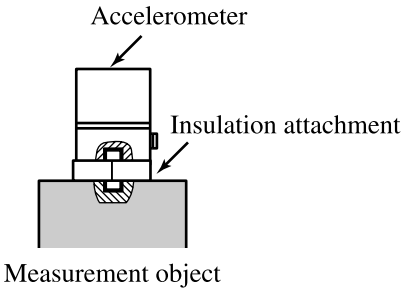
Rigid screw mounting

This mounting principle assures optimum frequency response characteristics. The mounting surface should be perfectly smooth, and the screw holes must be drilled in such a way as to assure perfect perpendicularity of the accelerometer.



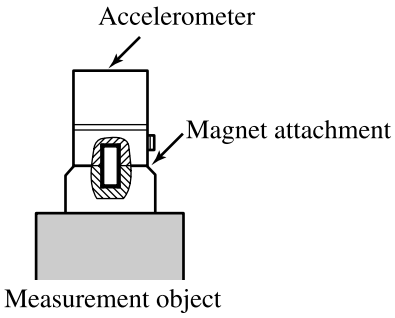
Insulation attachment mounting

This mounting principle is used when electrical insulation between accelerometer and measurement object is required. The contact resonance frequency will be lower than with rigid screw mounting. Regarding the screw holes, the same precautions as for rigid screw mounting apply.



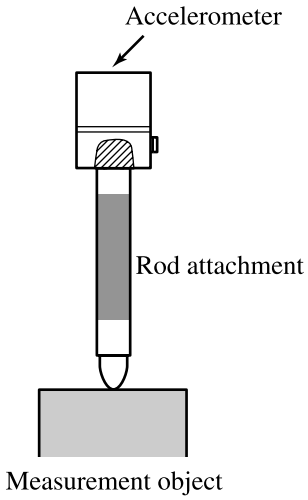
Magnet attachment mounting

Because the contact resonance frequency will be quite low, this principle is mainly suited for vibration measurements in the medium to low frequency range. The maximum acceleration that can be measured depends on the accelerometer mass.



Rod attachment mounting

Pressing the accelerometer against the measurement object with a rod is the simplest method, but it is only suitable for measurements below 500 Hz, because contact resonance frequency will be very low. This method should only be used if none of the other three mounting methods are feasible.



⚠ WARNING

When making measurements on exposed rotating parts or power train parts of machinery, proceed with utmost care to prevent accidents due to getting caught in the machinery.

Measurement

1. Mount the accelerometer on the measurement object.
2. Select the measurement mode.
3. Press the range selector until the CAL indicator lights up.
   A voltage of 1 Vpeak (80 Hz) is now supplied at the output connectors. Use this signal to calibrate connected equipment. The signal corresponds to the full-scale level that will be supplied during measurement for the selected range.
4. Select the range for measurement so that the OVER indicator does not light.

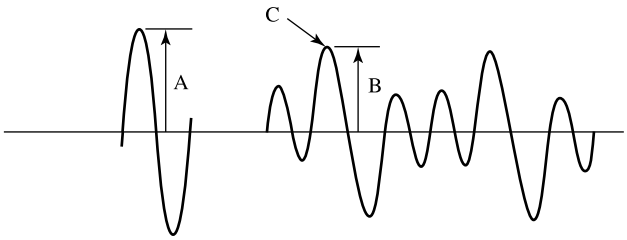
If the input signal is too high, causing amplifier saturation, the overload indicator lights up. In such a case, the measurement results will not be reliable.
The selectable range settings depend on the sensitivity setting (accelerometer sensitivity) and the measurement mode setting, as shown in the table below.

Correlation between available range and sensitivity/measurement mode settings

Sensitivity (pC/ms^{-2})	Measurement mode	Available range
0.100 to 0.999	Acceleration (m/s^2)	10 to 10000
	Velocity (mm/s)	10 to 10000
	Displacement (mm)	1 to 1000
1.00 to 9.99	Acceleration (m/s^2)	1 to 1000
	Velocity (mm/s)	1 to 1000
	Displacement (mm)	0.1 to 100
10.0 to 99.9	Acceleration (m/s^2)	0.1 to 100
	Velocity (mm/s)	0.1 to 100
	Displacement (mm)	0.01 to 10

When the range is selected, signals corresponding to the measured vibration are supplied at the AC output.

AC output: Depending on the measurement mode setting, an acceleration (m / s^2), velocity (mm / s) or displacement (mm) signal is supplied. The amplitude of the signal waveform can be refered to the calibration signal waveform (full-scale value).



Calibration signal waveform Measurement signal waveform

Amplitude at point C = (Full-scale value) × B / A

Measurement Range

The frequency range and measurement limits are determined by the accelerometer in use and the selected measurement mode.
The overload indicator lights up when the input signal has exceeded the measurement maximum.

Vibration Frequency Range

The frequency range depends on the measurement mode, as shown below.

Measurement mode setting and vibration frequency range

Acceleration (m/s^2)	1 Hz to 15 kHz (±5%)
	0.5 Hz to 30 kHz (±10%)
Velocity (mm/s)	3 Hz to 3 kHz (±5%)
Displacement (mm)	3 Hz to 500 Hz (±10%)

Upper Measurement Limit

The upper measurement limit for acceleration measurements (maximum input acceleration) depends on the input sensitivity setting.
Measurement is possible up to a value ten times the maximum range setting.

Sensitivity setting and upper measurement limit for acceleration

Sensitivity setting	Upper acceleration measurement limit
0.1 to 0.999 pC/(m/s^{-2})	100000 m/s^2 peak
1 to 9.99 pC/(m/s^{-2})	10000 m/s^2 peak
10 to 99.9 pC/(m/s^{-2})	1000 m/s^2 peak

- Velocity and displacement upper measurement limit
  Because the velocity and displacement values are obtained by integration of the measured acceleration, the upper measurement limit is determined by the upper measurement limit for acceleration and by the vibration frequency.

Lower Measurement Limit

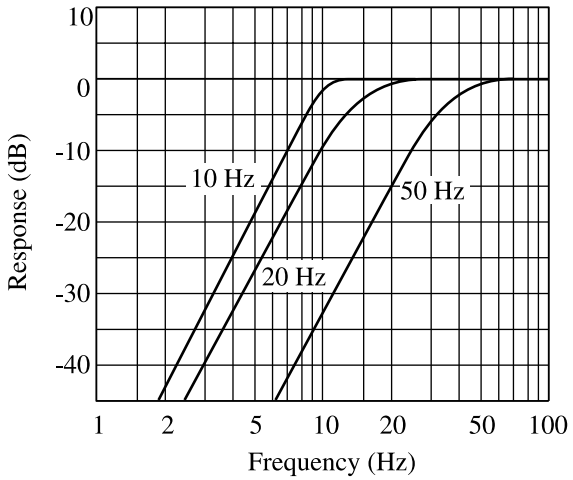
The lower measurement limit is determined by the residual noise level. Noise levels when a dummy load of 1000 pF is connected to the accelerometer connector and a sensitivity setting of 5.00 pC / (m / s^2) is selected are shown in the table below. To keep the influence on the measurement results within 1 dB (approx. 10%), the lower measurement limit should be twice as high as the noise level.

Measurement mode and noise level

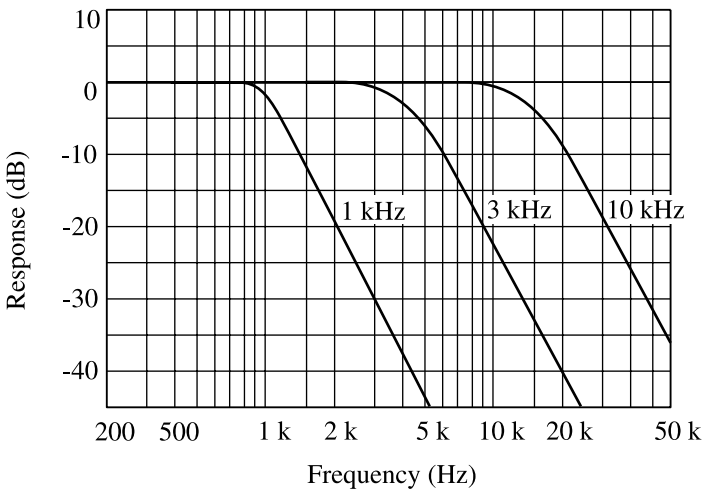
Measurement mode	Noise level
Acceleration (m/s^2)	0.01 m/s^2 rms
Velocity (mm/s)	0.1 mm/s rms
Displacement (mm)	0.0015 mm rms

Frequency Characteristics

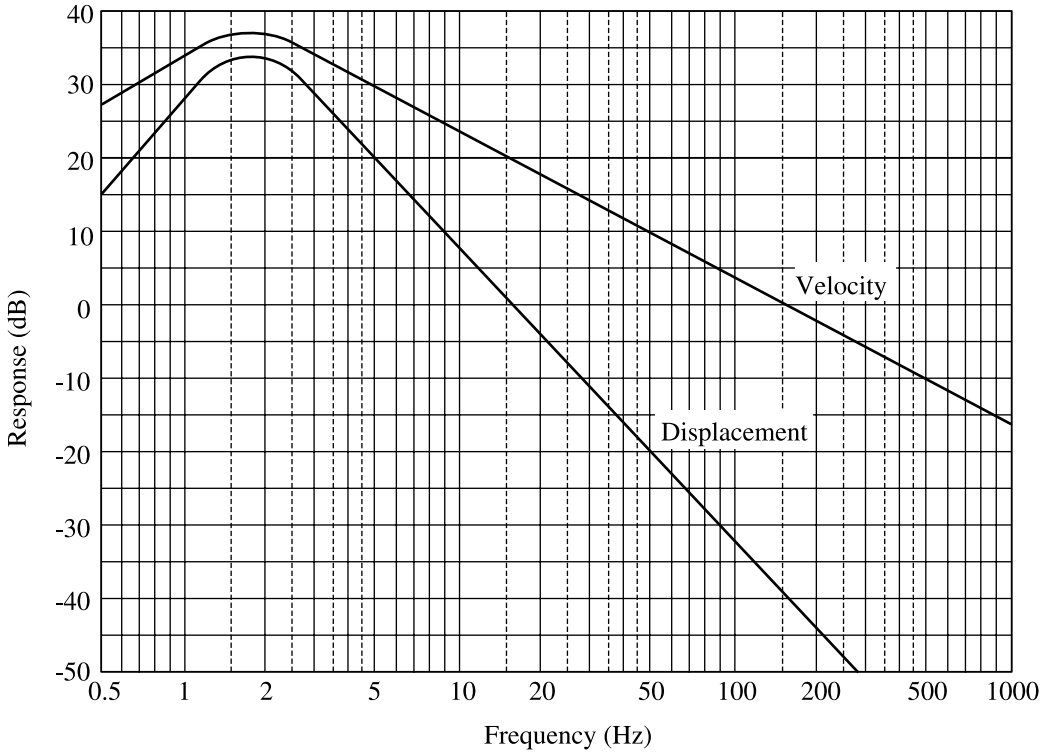
With the 10 Hz high-pass filter and 1 kHz low-pass filter engaged, this unit fulfills the frequency response requirements of ISO 2954 (Vibration Severity Meter) and JIS B0907-1989 (Requirements For Vibration Severity Measuring Instruments).



UV-06A high-pass filter frequency response



UV-06A low-pass filter frequency response



UV-06A velocity and displacement frequency response

Specifications

Number of channels	2
Signal input	For piezoelectric accelerometers
Max. input charge	100000 pC
Connector type	Micro-dot
Measurement mode	Acceleration (m / s^2), velocity (mm / s), displacement (mm) (selectable)

Full-scale range

For accelerometers with 0.100 to 0.999 pC / (m / s^2) sensitivity

Acceleration	10, 100, 1000, 10000 m / s^2
Velocity	10, 100, 1000, 10000 mm / s
Displacement	1, 10, 100, 1000 mm

For accelerometers with 1.00 to 9.99 pC / (m / s^2) sensitivity

Acceleration	1, 10, 100, 1000 m / s^2
Velocity	1, 10, 100, 1000 mm / s
Displacement	0.1, 1, 10, 100 mm

For accelerometers with 10.0 to 99.9 pC / (m / s^2) sensitivity

Acceleration	0.1, 1, 10, 100 m / s^2
Velocity	0.1, 1, 10, 100 mm / s
Displacement	0.01, 0.1, 1, 10 mm

Frequency range and deviation

Acceleration	1 Hz to 15 kHz (±5%), 0.5 Hz to 30 kHz (±10%)
Velocity	3 Hz to 3 kHz (±5%)
Displacement	3 Hz to 500 Hz (±10%)

Filters

High-pass filter	10, 20, 50 Hz
Low-pass filter	1, 3, 10 kHz
Attenuation	-18 dB / oct

Signal indication LED (at level higher than -20 dB below full-scale)

Calibration

Gain calibration Allowable accelerometer sensitivity ranges:
0.100 to 0.999 pC / (m / s^2)
1.00 to 9.99 pC / (m / s^2)
10.0 to 99.9 pC / (m / s^2)
For other ranges, conversion is required

Calibration signal output
Internal signal oscillator for calibration of connected equipment
Frequency: 80 Hz±5%, sine wave
Output voltage: 1 Vpeak±2% (full-scale)

Overload indication LED indicator flashes when waveform saturation occurs

AC signal output

Connector type BNC (rear panel)

Output impedance Approx. 50 Ω

Output voltage (80 Hz, at full-scale)

Acceleration	1 V±2%
Velocity	1 V±3%
Displacement	1 V±5%

Max. output voltage ±10 Vpeak (under no overload indication)

Load impedance 10 kΩ or more

Channel cross talk -80 dB or less
(Measurement conditions: range 100 m / s^2 for channels A and B, sensitivity setting 5.00 pC / (m / s^2), input signal 10 kHz)

Noise level (input capacitance 1000 pF, sensitivity 5.00 pC / (m / s^2)) HPF: OFF, LPF: OFF

Acceleration	0.01 m / s^2 rms
Velocity	0.1 mm / s rms
Displacement	0.0015 mm rms

Power supply

Voltage	9 to 15 V DC
Power consumption	Approx. 70 mA (12 V DC, full-scale point)

AC adapter (option)

NC-11 (12 V 300 mA)
NC-79 (12 V 2 A)
NC-95 (12 V 2.5 A)
NC-97 (12 V 3.3 A)

Battery unit (option)

BP-07

Ambient conditions for operation

-10 to +50°C, less than 90%RH (no condensation)

Dimensions 33 (W) × 149 (H) × 210 (D) mm
(without protruding parts)

Weight Approx. 700 g

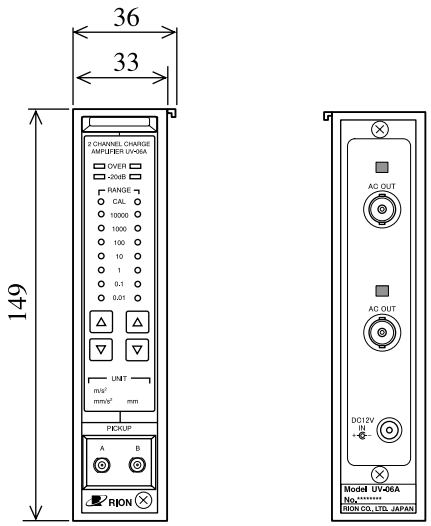
Supplied Accessories

Instruction manual	1
Inspection certificate	1

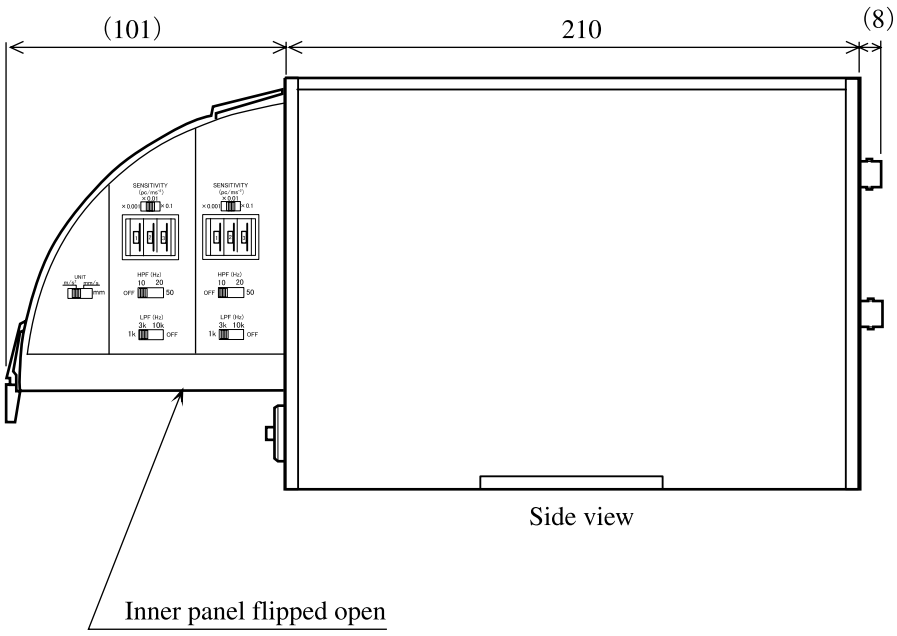
Optional Accessories

AC adapter	NC-11, NC-79, NC-95, NC-97
Battery unit	BP-07
Rack-mount base (for standard rack mounting)	UV-05-091

Joint plate and rubber feet (for linking several UV-06A units)
Piezoelectric accelerometer



Front view Rear view

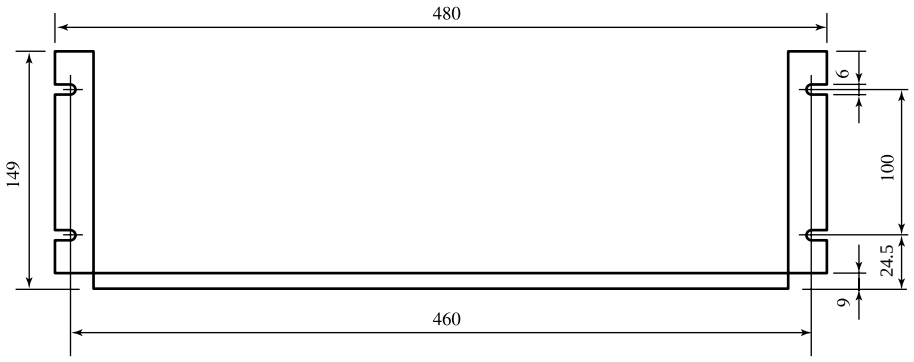


Side view

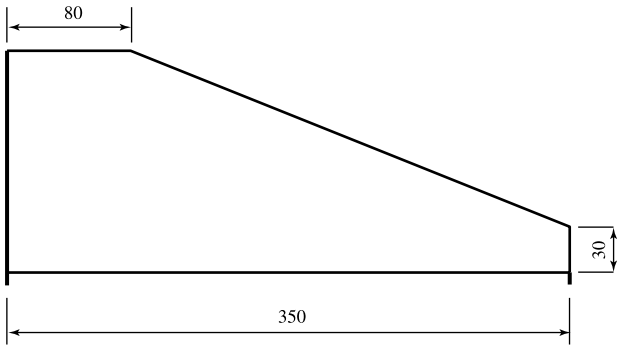
Unit:mm

Dimensional drawing

Rack-mount base UV-05-091



Front View



Side view

Plate thickness: 1.6

Unit:mm

Dimensional Drawing

Technical Information

Noise Level and Measurement range

Noise level using accelerometer input and sensitivity 5.00 pC/(m/s^2)

Measurement mode	Measurement range	HPF	LPF	Noise level
Acceleration	1	OFF	OFF	0.01 m/s^2 rms
Velocity	1	OFF	OFF	0.1 mm/s rms
Displacement	0.1	OFF	OFF	0.0015 mm rms

Noise level examples using piezoelectric accelerometer input

Accelerometer type	Measurement mode	Measurement range	HPF	LPF	Noise level
PV-85	Acceleration	1	OFF	OFF	0.008 m/s^2 rms
	Velocity	1	OFF	OFF	0.08 mm/s rms
	Displacement	0.1	OFF	OFF	0.0013 mm rms
PV-87	Acceleration	0.1	OFF	OFF	0.0013 m/s^2 rms
	Velocity	0.1	OFF	OFF	0.013 mm/s rms
	Displacement	0.01	OFF	OFF	0.00025 mm rms
PV-90B	Acceleration	10	OFF	OFF	0.25 m/s^2 rms
	Velocity	10	OFF	OFF	2.5 mm/s rms
	Displacement	1	OFF	OFF	0.05 mm rms

Measurement conditions: BP-07 battery operation (25˚C)

No. 33790 03-11