LDV PRODUCTS

Vibrometers Using the Non-contact Laser Doppler Method

# LV Series

## The Non-contact Method Opens up the World of Vibration Measurement

**Old Model**
**(Reference only)**


ONO SOKKI

*Smart & Small*

# *A New Discovery with Each Use*
# *Non-contact Measurement Makes it Possible*

LDV PRODUCTS

# *LV-1700 series*

## Greatly increased detection ability

The new optics system used provides enhanced operability with sensitivity increased by 20 dB (compared to earlier models), and remarkably improved ease of use.

## Small size, lightweight sensor

The small-format, lightweight sensor weighs approximately 650 g*, including the lens, and can be freely mounted on a wide variety of devices.

*excluding the cable

## Safe Class 2 Laser Beam

The laser is a Class 2 visible red laser beam (approx. 633nm) with an output of only 1 mW or less. There are almost no restrictions with regard to operation or installation.

## Short positioning distance of only 100 mm*

The new-design lens enables it to be positioned up to only 100 mm away from the measurement object. The 100-mm distance is a standard feature. Moreover, as the distance scale is marked on the lens, the sensor settings are easy to make.


* from the lens tip


*The LV-0712 displacement output board is mounted in the unit shown in the above photograph.

Transparent · Rotational objects · High temperature · High frequency · Ultra-small structures · Through glass · · ·

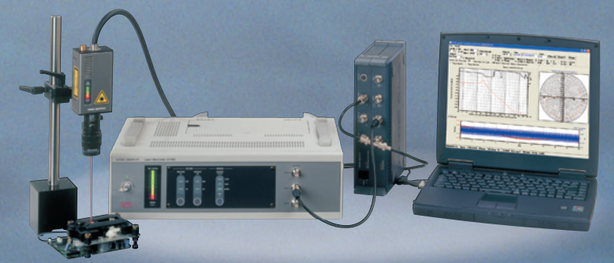
**Covers a broad range, from general mechanical vibrations to high-frequency, large-amplitude vibrations**

## *LV-1710*

**Wide-range, all-round model**

**Measurement frequency 1 Hz to 3 MHz, 0.3 μm/s to 10 m/s**

- General mechanical vibrations
- High-speed mechanical vibrations in internal-combustion engines
- Ultrasonic tool, etc.



Using the DS-2000 and the DS-0242 servo analysis software together with the LV-1700 Series enables optical pickup actuator analysis.

## Wide range of options

There is a wide range of peripheral devices available for the LV-1700 Series, from a fringe count displacement meter unit and a 20 MHz wideband unit through to a 90-degree reflecting mirror that bends laser light in small areas, to meet various application needs.

## On-line control

An RS-232C interface is provided to enable on-line control.



**Easily handles a wide spectrum of vibrations, from ultra-minute vibrations to general mechanical vibrations**

## *LV-1720*

**High-resolution, nano-range model**

**Measurement frequency 1 Hz to 300 kHz, 0.1μm/s to 0.5 m/s**

- Thin film vibrations
- Micromachine, microstructure vibrations
- General mechanical vibrations, etc.

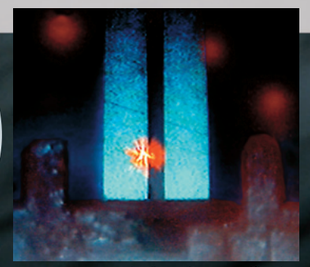

*The LV-0722 displacement output board is mounted in the unit shown in the above photograph.

## Essential information is displayed on the sensor.

Even when the sensor and the converter are at some distance from each other, the level meter and detection error display provided on the sensor enable quick confirmation of the detection status and easy setup.


## CCD camera for magnified monitoring of the measurement object

The easily installable optional video monitor unit (LV-0147) enables magnification up to 35 times* to enable confirmation of the laser beam position on the same axis, and ensure precision measurement of small components.



*14" monitor magnification

## All-in-one ultra-compact unit

The sensor fits right into the small-format converter unit for easy transportation and storage. The lightweight, all-in-one unit weighs only 12 kg, and can be easily carried around.

Storage trunk
***LV-0300***

# Options

## Option Boards for Displacement Output and Acceleration Output

If an option board is built into the LV-1710/1720, output of displacement or acceleration signals via the option connector is enabled.

Output impedance: 50 Ω
Voltage output: ±10 V

### *For LV-1710*

**LV-0712 Displacement output board**

| LV-1710 measurement ranges | Displacement measurement ranges | | |
|---|---|---|---|
| | (1Hz to 20kHz) | (10Hz to 50kHz) | (1kHz to 200kHz) |
| 1.0 (m/s) /V | 100 (mm/V) | 1 (mm/V) | 10 (μm/V) |
| 0.1 (m/s) /V | 10 (mm/V) | 100 (μm/V) | 1 (μm/V) |
| 0.01 (m/s) /V | 1 (mm/V) | 10 (μm/V) | 100 (nm/V) |

**LV-0711 Acceleration output board**

| LV-1710 measurement ranges | Acceleration measurement ranges | | |
|---|---|---|---|
| | (1Hz to 2kHz) | (1Hz to 20kHz) | (100Hz to 400kHz) |
| 1.0 (m/s) /V | $10^3$ (m/s²) /V | $10^5$ (m/s²) /V | $10^7$ (m/s²) /V |
| 0.1 (m/s) /V | $10^2$ (m/s²) /V | $10^4$ (m/s²) /V | $10^6$ (m/s²) /V |
| 0.01 (m/s) /V | $10^1$ (m/s²) /V | $10^3$ (m/s²) /V | $10^5$ (m/s²) /V |

### *For LV-1720*

**LV-0722 Displacement output board**

| LV-1720 measurement ranges | Displacement measurement ranges | | |
|---|---|---|---|
| | (1Hz to 20kHz) | (10Hz to 50kHz) | (1kHz to 200kHz) |
| 0.05 (m/s) /V | 5 (mm/V) | 50 (μm/V) | 500 (nm/V) |
| 0.01 (m/s) /V | 1 (mm/V) | 10 (μm/V) | 100 (nm/V) |
| 0.002 (m/s) /V | 0.2 (mm/V) | 2 (μm/V) | 20 (nm/V) |

**LV-0721 Acceleration output board**

| LV-1720 measurement ranges | Acceleration measurement ranges | | |
|---|---|---|---|
| | (1Hz to 2kHz) | (1Hz to 20kHz) | (100Hz to 300kHz) |
| 0.05 (m/s) /V | 5 x $10^1$ (m/s²) /V | 5 x $10^3$ (m/s²) /V | 5 x $10^5$ (m/s²) /V |
| 0.01 (m/s) /V | $10^1$ (m/s²) /V | $10^3$ (m/s²) /V | $10^5$ (m/s²) /V |
| 0.002 (m/s) /V | 2 (m/s²) /V | 2 x $10^2$ (m/s²) /V | 2 x $10^4$ (m/s²) /V |

Both displacement output board (LV-0712/LV-0722) and acceleration output board (LV-0711/LV-0721) can not be built in (LV-1710/LV-1720) simultaneously.

## *LV-0120* Fringe Count Displacement Meter Unit

Designed for use with the LV Series Laser Doppler Vibrometers, the LV-0120 is a displacement meter that uses the fringe count method. DC displacement measurement is also possible.

Maximum resolution: 5 nm
Output signal resolution: 13-bit
Measurement frequency range: DC to 100 kHz
Output signal: Analog signal ±10 V
Power supply: 100 VAC ±10% 1A (120/220/240 VAC on request.)
Operating temperature range: 0 to 40°C
Outer dimensions: 420 (W) x 100 (H) x 500 (D) mm
Weight: 6.5 kg

| Range | Measurement range | Output voltage sensitivity | Maximum response speed |
|---|---|---|---|
| 1 | ±20μm | ±2μm/V | 0.079m/s |
| 2 | ±160μm | ±16μm/V | 0.74m/s |
| 3 | ±1.25mm | ±125μm/V | 1m/s |
| 4 | ±10mm | ±1mm/V | 10m/s |
| 5 | ±80mm | ±8mm/V | 10m/s |

### Applications

- Measurement of minute displacements and deformations in components and structures.
- Measurement of low-frequency vibrations.

## *LV-0160* 20 MHz Wideband Unit

Enables measurement up to a frequency of 20 MHz* when connected to the LV-1710/1720 Laser Doppler Vibrometers.

Measurement speed range: 2 mm/s to 2 m/s
Velocity measurement range: 2 (m/s) V
Measurement frequency range: 1 Hz to 20 MHz
Velocity output signal: Analog voltage ±2.5 V
Output impedance: 75 Ω
Power supply: 100 VAC ±10% 1A (120/220/240 VAC on request.)
Operating temperature range: 0 to +40°C
Outer dimensions: 420 (W) x 100 (H) x 500 (D) mm
Weight: Approx. 6.5 kg

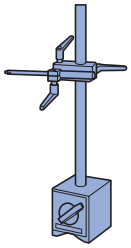
* Modification to enable connection is required.

### Applications

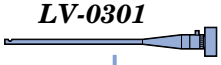
- High-frequency measurement of crystal oscillators and piezoelectric elements.

# *Freely configure your own system from our wide range of options that provide complete support from detection through to analysis.*

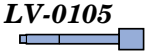
Large-format magnetic stand
***LV-0030***



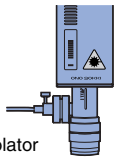
90-degree reflecting mirror
***LV-0301***

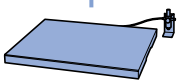


Ultra-thin reflecting mirror
***LV-0105***



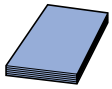
Video monitor unit
***LV-0147***





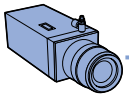
Benchtop vibration isolator
***LV-0200***

Objective lens
***LV-0155***

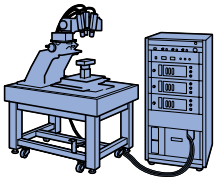


Reflective marks
***LV-0012***
A4 size, 10 sheets/pack

Air purge case
***LV-0020***



3D-type Laser Doppler Vibrometer*
***LV-3300***



Acceleration output board for the LV-1710
***LV-0711***

Displacement output board for the LV-1710
***LV-0712***

***LV-1710***

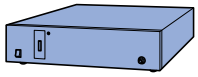
***LV-1720***

Acceleration output board for the LV-1720
***LV-0721***

Displacement output board for the LV-1720
***LV-0722***

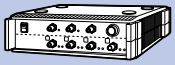
Fringe count displacement meter unit
***LV-0120***

20 MHz wideband unit
***LV-0160***



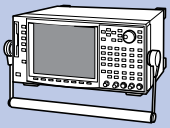
**Waveform analysis equipment***
(FFT analyzer)

Up to 40/100 kHz



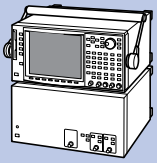
Multi-channel
**DS-2000** Series

Up to 100 kHz



**CF-5220Z**

Up to 2 MHz



**CF-5220Z**
+
2 M data sampling unit
**CF-0515**

* Please contact us or nearest distributor for detailed information.

*Combining the LV-1700 Series with the LV-0155 objective lens and the LV-0147 video monitor unit enables vibration detection of ultra-small objects.*

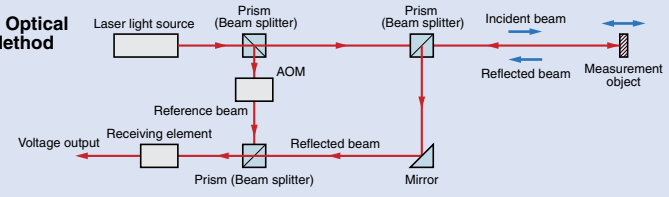
## ***Laser Doppler Vibrometer*** *A Brief Explanation*

If a light wave (wavelength) of a specific frequency is beamed at a moving object, the frequency of the wave reflected from the moving object changes in proportion to the velocity of the object.

This phenomenon is known as the Doppler shift. A proportional relationship between the moving velocity of the object and the Doppler shift is established. This means that if the amount of change caused by the Doppler shift is known, the moving velocity of the object can then be calculated. However, since with a laser Doppler vibrometer, the object under measurement is a vibration phenomenon that has plus and minus velocity vectors, if the laser beam emitted from the laser source is used as is, a problem occurs with the point of judgment with respect to the plus/minus sign. For this reason, the optical heterodyne method utilizing an element called an acousto-optical modulator (AOM) is used.

With this method, the laser beam that has been subjected to a specific frequency shift by the AOM is used as the reference beam, and then made to interfere with the beam reflected from the object in the receiving element. At this time, since the reflected beam is experiencing a Doppler shift from the vibrations of the object under measurement, the beat frequency of the interfered beams becomes an FM-converted wave centered at the shifted frequency from the AOM. This wave is then converted to an electrical signal in the receiving element. After it undergoes FM demodulation, a voltage signal proportional to the vibratory velocity of the object under measurement is obtained, and then output from the converter as a velocity signal with a plus or minus (+/-) sign.

**Outline of the Optical Heterodyne Method**



# Accessories

## *LV-0030* Large size magnetic stand

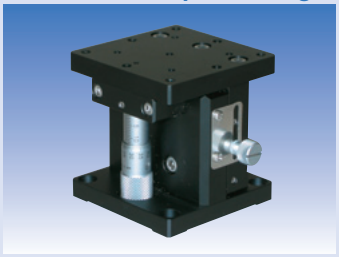
The magnetic stand is used for positioning the sensor. Using it together with the LV-0015 or LV-0016 fine-positioning stage enables fine adjustment of the detection position.

## *LV-0015* Fine-positioning XY stage

The XY stage enables precise alignment of the sensor position.

Stage surface: 60 x 60 mm
Movable range: ±5 mm

## *LV-0016* Fine-positioning Z stage



The Z stage enables precise alignment of the sensor up/down position.

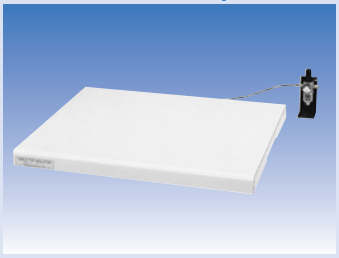
Stage surface: 60 x 60 mm
Movable range: 0 to 10 mm

## *LV-0017* Large size tripod

Used for positioning the sensor in locations where there is no bed plate.

* A conversion adapter is required for direct mounting of the sensor.

## *LV-0200* Benchtop vibration isolator



Isolates the sensor from vibrations transmitted through areas such as the floor.
Auto-leveling type.

Size: 500 x 600 x 57 mm
Weight: Approx. 29 kg
Auto-leveling mechanism: Operated using 0.3 to 0.7 MPa pressurized air or nitrogen gas

## *LV-0300* Storage trunk

The storage trunk can hold the LV-1710/1720 main unit together with options such as the large-format magnetic stand.

Weight: Approx. 9 kg

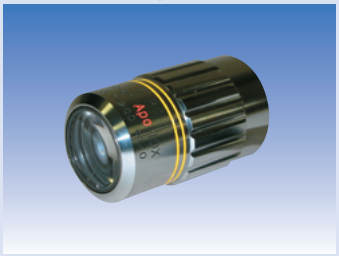
## *LV-0147* Video Monitor Unit

Attaching the video monitor unit to the LV-1710/1720 lens enables easy checking of the laser spot position at a high magnification ratio. Measurement of ultra-small components can be easily performed.

Monitor magnification ratio: Approx. 35 times*

*When a 14" monitor is used

## *LV-0155* Objective Lens



Attaching the objective lens to the end of the LV-1710/1720 lens enables the laser spot to be focused to approximately 3 μm.

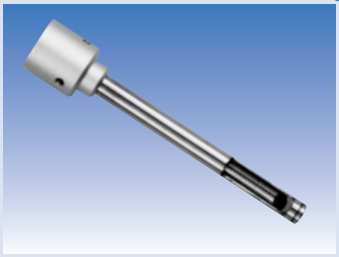
Measurement distance: Approx. 40 mm

* A conversion adapter to enable attachment is provided.

## *LV-0301* 90-degree reflecting mirror

Attaching the mirror to the LV-1710/1720 lens enables the laser beam to be bent 90 degrees and rotated 360 degrees, so that it can be aimed at areas such as small crevices.

## *LV-0105* Ultra-thin reflecting mirror



This is a 90-degree reflecting mirror for use in areas that are narrower than the tip of the LV-0301 mirror. It is used to replace the mirror on the tip of the LV-0301.

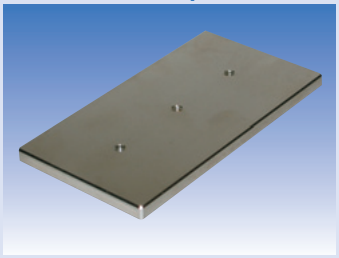
ø=4 mm

## *LV-0020* Air purge case

Protects the sensor from on-site oil mist and dust.

* A separate air unit is required.

## *LV-0018* Steel plate

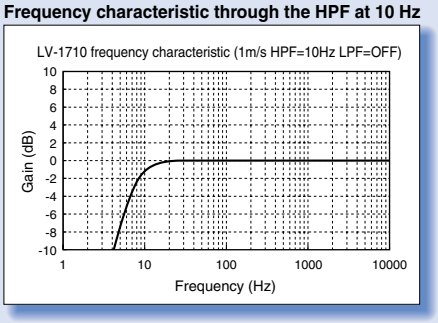


Attaching the steel plate to the tripod enables the magnetic stand to be used on top of the tripod (used horizontally).

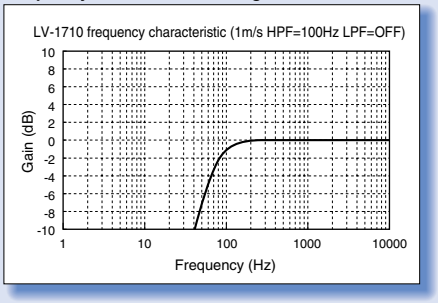
# *LV-1710/1720* Frequency Characteristic Graphs

## *LV-1710*

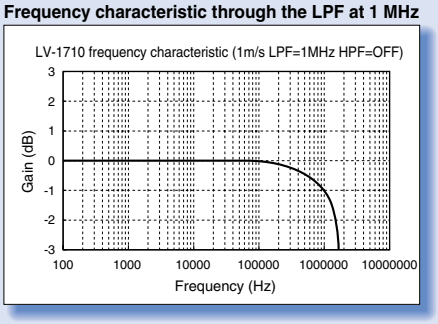
**Frequency characteristic through the HPF at 10 Hz**



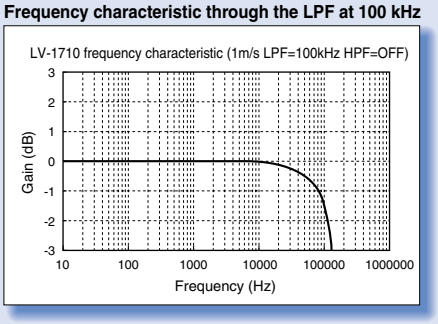

**Frequency characteristic through the HPF at 100 Hz**



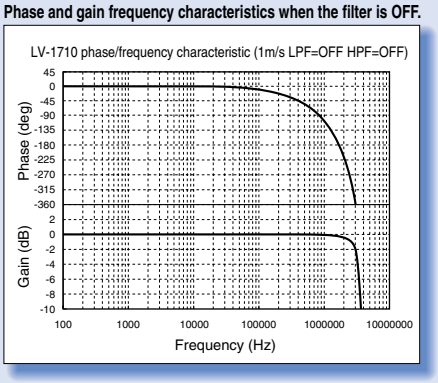

**Frequency characteristic through the LPF at 1 MHz**




**Frequency characteristic through the LPF at 100 kHz**

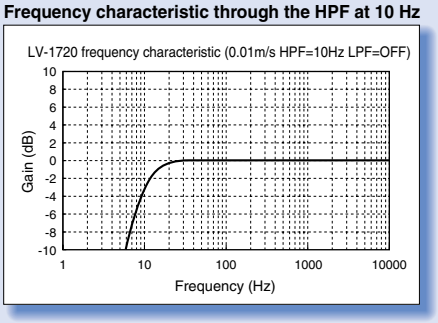



**Phase and gain frequency characteristics when the filter is OFF.**

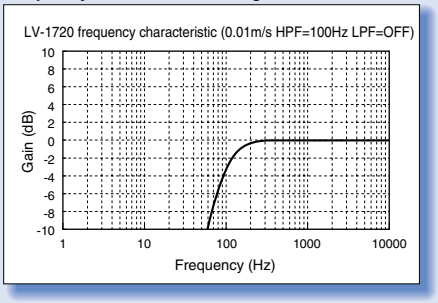



## *LV-1720*

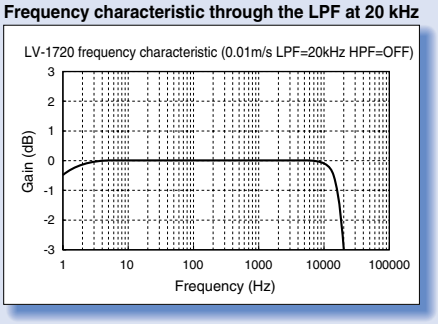
**Frequency characteristic through the HPF at 10 Hz**



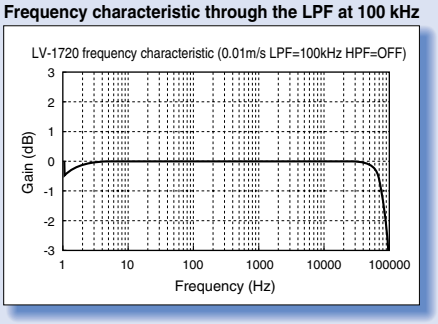

**Frequency characteristic through the HPF at 100 Hz**



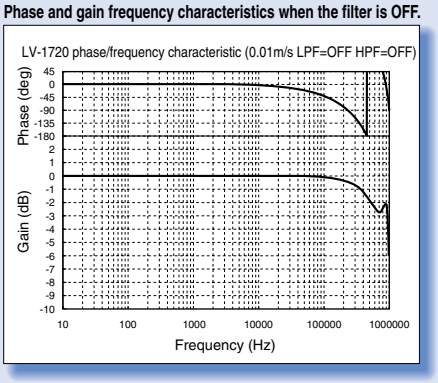

**Frequency characteristic through the LPF at 20 kHz**




**Frequency characteristic through the LPF at 100 kHz**




**Phase and gain frequency characteristics when the filter is OFF.**




Note: The above frequency characteristics are the standard values for each model.

# *LV-1710/1720* Specifications

## • Sensor Unit

| | *LV-1710* | *LV-1720* |
|---|---|---|
| Detection demodulation system | Velocity demodulation using optical heterodyne detection | |
| Light source | He-Ne laser (632.8 nm wavelength) | |
| Reflected light output | Within 1 mW (conforming to Class 2 JIS C6802 standard) | |
| Measurement distance | 100 mm to 5 m | |
| Laser spot | 20μm or less (at the shortest measurement distance) | |
| Signal cable length | 3 m (can be extended to a maximum of 15 m by modification on request.) | |
| Display unit | Level display, 10-segment LED bar display | |
| | Output error display (red LED display) | |

## • Converter Unit

| | | |
|---|---|---|
| Measurement frequency range | 1 Hz to 3 MHz | 1 Hz to 300 kHz |
| Velocity range | 1 m/s/V (max. 10 m/s) | 0.05 m/s/V (max. 0.5 m/s) |
| | 0.1 m/s/V (max. 1 m/s) | 0.01 m/s/V (max. 0.1 m/s) |
| | 0.01 m/s/V (max. 0.1 m/s) | 0.002 m/s/V (max. 0.02 m/s) |
| Velocity output | Analogue voltage: ±10 V (DC offset within ±20 mV) | |
| Minimum velocity resolution | 0.3 μm/s (when the range is 0.01 m/s/V and the LPF 1 MHz or 1 kHz) | 0.1 μm/s (when the range is 0.002 m/s/V and 1 kHz Filter OFF) |
| Output impedance | 50 Ω (the lowest input impedance is 100 kΩ or higher) | |
| Low-pass filter | 100 kHz, 1 MHz, OFF | 20 kHz, 100 kHz, OFF |
| High-pass filter | 10 Hz, 100 Hz, OFF | 10 Hz, 100 Hz, OFF |
| Monitor output | Analogue voltage: 0 to 10V (output impedance 50 Ω) | |
| Velocity range display | LED display | |
| Display unit | Level display, 20-segment LED bar display | |
| | Laser emission (green LED) | |
| | Velocity overrange (red LED) | |
| | Sensor error display (red LED) | |
| Storage | The sensor unit fits into the conversion unit, and the cable is wound up on the rear panel. | |

## • External Remote

| | |
|---|---|
| Safety lock | Intercepts the laser beam path (laser emission when the beam path is short.) Non-voltage 1a contact input |
| Mechanical shutter | Intercepts the laser beam path when the main unit's key switch or the safety lock is activated. |
| Interface | RS-232C |

## • General Specifications

| | |
|---|---|
| Operating power supply | 100 to 240 VAC, 50/60 Hz |
| Operating temperature range | 0 to 40°C |
| Operating humidity range | 30 to +80% RH (non-condensing) |
| Storage temperature range | -10 to +50°C |
| Sensor weight | Approx. 650 g (excluding the cable) |
| Main unit weight | Approx. 12 kg (including the sensor) |
| Power consumption | 65 VA or less (at 100 VAC, 50 Hz) |

## • Certifications

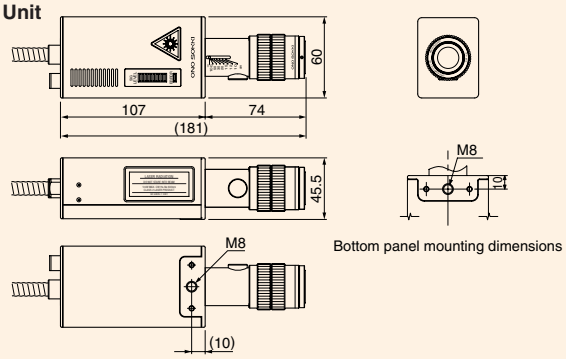
The LV-1710/1720 models have been designed and tested in accordance with the following standards.

[JIS C6082 (Laser Product Emission Safety Standards)] [IEC60825-1:2001] [FDA(CDRH)] [CE Marking (Low Voltage Directive: EN61010-1) (EMC directive: EN61326)] [FCC(Part 15B)] [CANADA EMI Standard(ICES-003)]

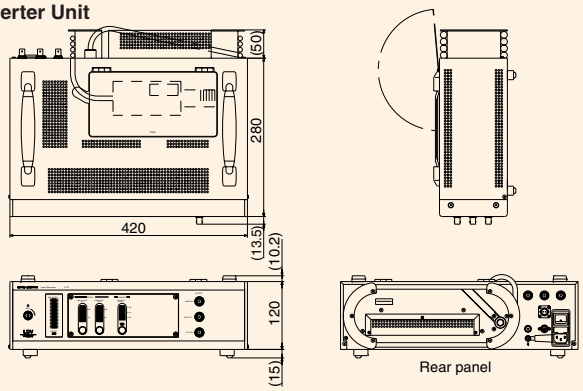

## • Outer Dimensions (common to both *LV-1710/1720*)

Unit: mm

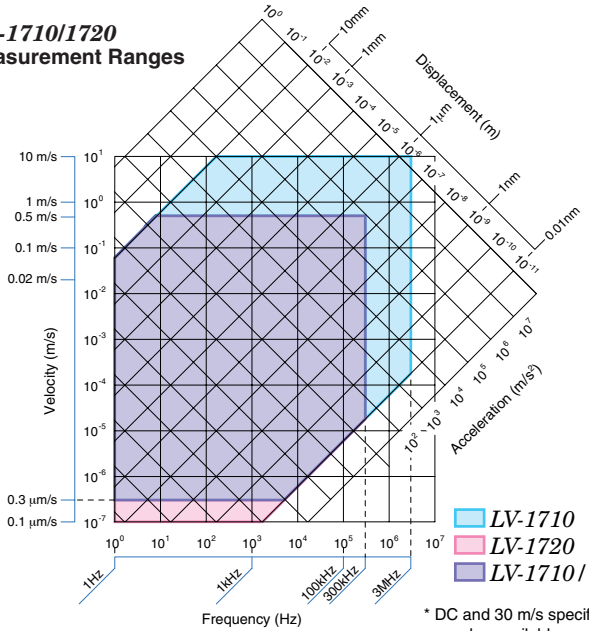
### Sensor Unit




### Converter Unit




## • *LV-1710/1720* Measurement Ranges




The measurement ranges are within the frames shown above.

* DC and 30 m/s specifications are also available. Please contact us for further details.

* Outer appearance and specifications are subject to change without prior notice.

**URL: http://www.onosokki.co.jp/English/english.htm**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PRINTED WITH SOY INK Recycled Paper

CAT. NO. 040903-01 Printed in Japan 049 (SK) 3K