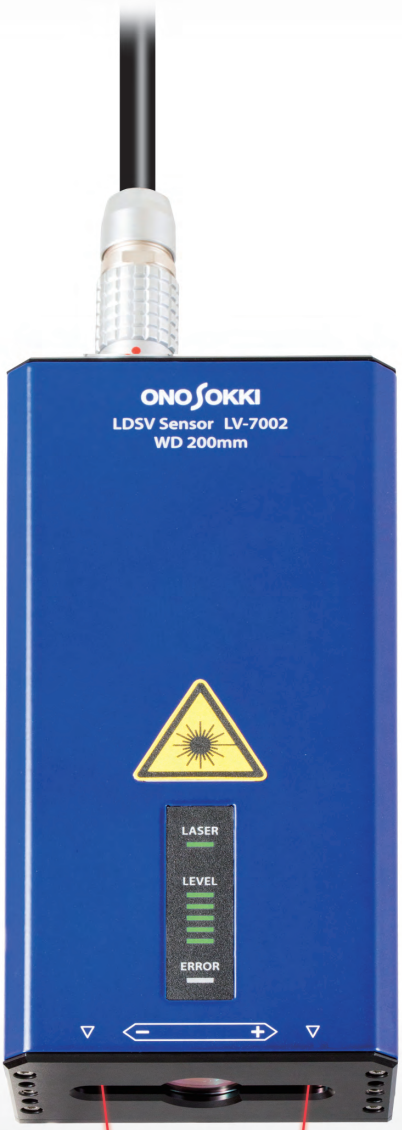
Laser Doppler Surface Velocity Meter

LV-7000 Series



Anytime anywhere, high sensitivity and high response detection

ONO SOKKI

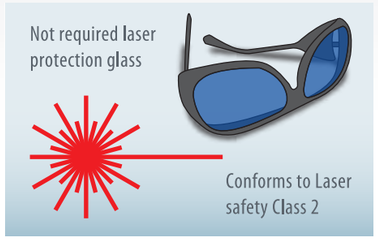
LV-7000 series

Laser Doppler Surface Velocity Meter

Anytime anywhere
Fast and easy non-contact detection
High sensitivity and high-speed response
Laser Doppler Surface Velocity Meter

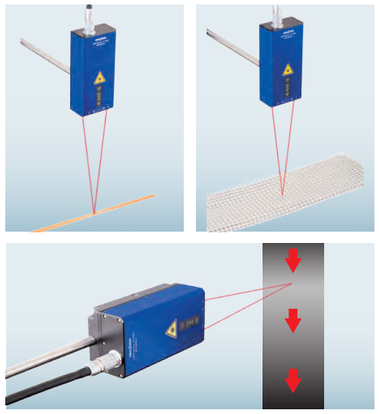
The LV-7000 series
Laser Doppler Surface Velocity Meter
offers non-contact detection of velocity,
velocity irregularity and displacement of rotating
objects and moving objects.

Feature



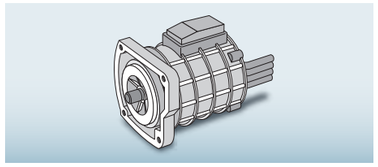
High sensitivity detection Class 2 Laser product

- Laser protection glass, laser controlled area and laser administrator are no longer required.
- Original optical system and demodulating circuit allow high sensitivity detection. Available to measure wide variety of targets.
- Red visible light allows easy, quick positioning and checking.



Non-contact detection, No-load measurement

- High spatial resolution with small laser-spot. Enables measurement of thin/tiny target including thread and narrow parts.
- Not necessary to worry about defects such as scratch, wrinkle, or transformation by laser detection.
- Hardly affected by flipping, shaking, or eccentricity. Slip or friction is not generated.
- Enables velocity measurement and length measurement in vertical movement, negative gradient movement, which are difficult to detect by contact-type detector.
- Extension speed/direction measurement of extensible materials including rubber, resin, and fabric.



Simple operation and high function

- By the indicator which is installed on a compact sensor, you can check the target and operating condition at the same time.
- Easy to see numerical values by large LED display and stand jigs. Current setting conditions are clear at a glance.
- Simple and speedy operation with large function button.
- Supports 0 to ±3,600 m/min of velocity, 1,600 m/s² of acceleration*1. Used for evaluation of various rotating objects.
  *When LV-0730 High-velocity module for sensor, LV-0731 High-velocity module for controller installed.
- Selectable output signal format from analog, phase difference, RS-232C according to the usage.
- Difference measurement between two points by setting two velocity meters.

LV-7002
Laser Doppler surface velocity sensor
+
LV-0730
High-velocity module for sensor

LV-7100 Laser Doppler surface velocity meter controller
+
LV-0731 High-velocity module for controller

NEW

Supports high velocity and high acceleration measurement

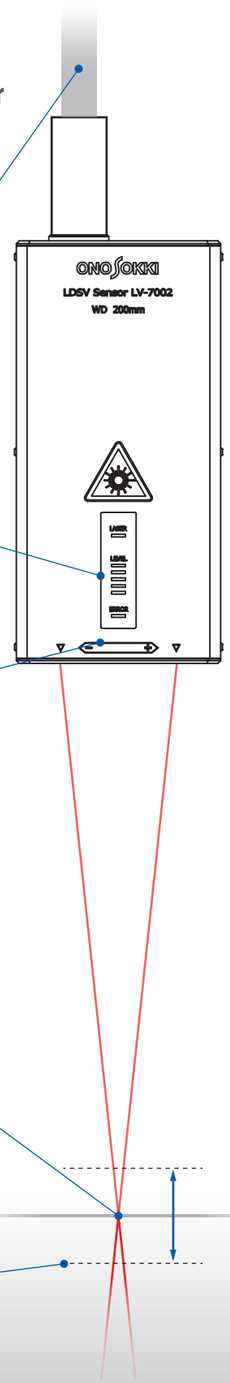
- Installing options enable to support twice the velocity and acceleration of the standard specification.
- Velocity range: 0 to ±3,600 m/min, max. tracking acceleration: 1,600 m/s².
- Rotating/moving objects with high speed or with sudden speed change are measured, those are not supported by standard LV-7000 series.

Function

Detection, measurement, and control all in one simple, compact unit

LV-7002

Laser Doppler Surface Velocity Sensor



Sensor cable

•LV-0703(3 m) •LV-0705(5 m)

Scale factor specific to a sensor is automatically calibrated. No worry of setting error anymore.

LASER / LEVEL / ERROR

All the indicators are equipped on a surface of the sensor. Detection conditions and sensor operating conditions are able to be checked at a glance.

"+" when moving from the left to the right with respect to the sensor.

"-" when moving from the right to the left with respect to the sensor.

• The polarity of the output/display can be inversed.

Conforms to Laser Safety Class 2

You can confirm the focus of the laser, and a detection position in vision by the naked eye.

Conforming Laser Safety Standards

- FDA 21CFR Part 1040.10 (CDRH)
- IEC60825-1:2007,2014
- JIS C 6802:2007,2014

Detectable range (Depth) ±10 mm/ ±15 mm*

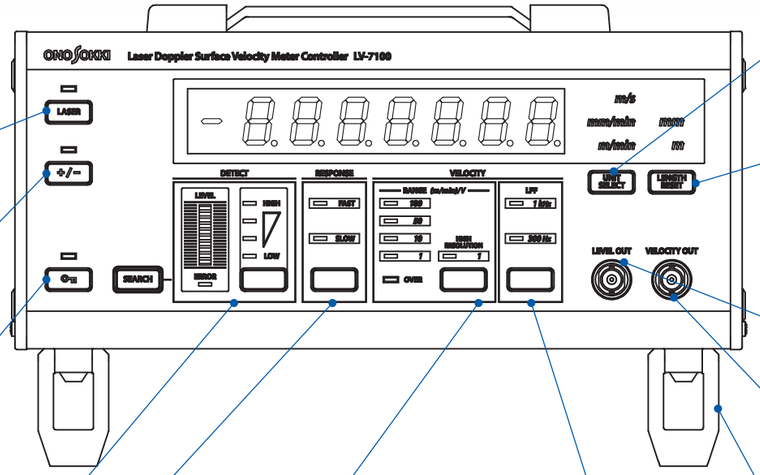
*When LV-0730 is installed.

Please refer to page 12 for details.

• Accuracy might be decreased or detection range might be changed according to an object.

LV-7100

Laser Doppler Surface Velocity Meter Controller



LASER

LASER ON/OFF switch

Allows you to switch the laser emission between ON (start) and OFF (stop). It starts in a switch OFF state at the time of power ON.

• Special mode to start with switch ON state at the time of power ON is available. (Modification is required for this mode before factory shipment.)

+ / –

POLARITY selection switch

Allows you to switch the polarity between negative and positive. You can apply the moving direction and polarity regardless of the suspending sensor direction.

KEY LOCK

Prevents unexpected setting change caused by accidental key press.

DETECT

Selectable from 4 levels of detection sensitivity. Wide variety of objects can be detected, such as transparent film, rubber, and metals.

CONNECT IN/OUT

Connects two units of LV-7100 with each other, which allows simultaneous execution of LENGTH RESET.

SENSOR

Sensor input connector

RESPONSE

You can select the setting of tracking acceleration from FAST or SLOW.

VELOCITY

The detecting velocity range can be selected from 4 ranges. HIGH RESOLUTION range can be set for the target moving with very small velocity.

UNIT SELECT

Switches the indication unit to be displayed on the display panel among velocity, distance, and length.

LENGTH RESET

Resets (zero reset) the measured value currently displayed in the distance / length measurement.

LEVEL OUT

Outputs the DC voltage (0 to 14 VDC) corresponding to the level of received laser beam displayed in the LEVEL indicator. Used for monitoring and recording the detection status.

VELOCITY OUT

Outputs the voltage corresponding to the velocity (±10 V).

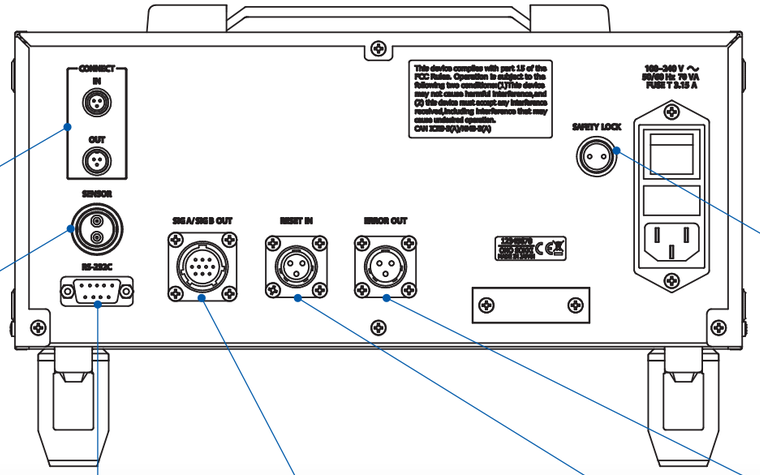
STAND JIG

Unfolding stand jig allows the display panel tilted to make the visual recognition and operation easier.

LPF

You can select the lowpass filter to be applied to the velocity output from 300 Hz, 1 kHz, or 5 kHz (OFF).

• Please refer to page 13 for details.



SAFETY LOCK

Normally used by short-circuiting the pins with connecting the supplied safety lock connector. Laser output is stopped when it is opened. Connect to area sensor or interlock as necessary.

ERROR OUT

It notifies undetectable situation (sensitivity error, acceleration over etc.) by the signal output.

RS-232C

Changes the settings and reads out the velocity / distance (length) by connecting with a PC or a PLC.

SIG A / SIG B OUT

Output connector for output of phase difference signal corresponding to the distance/length.

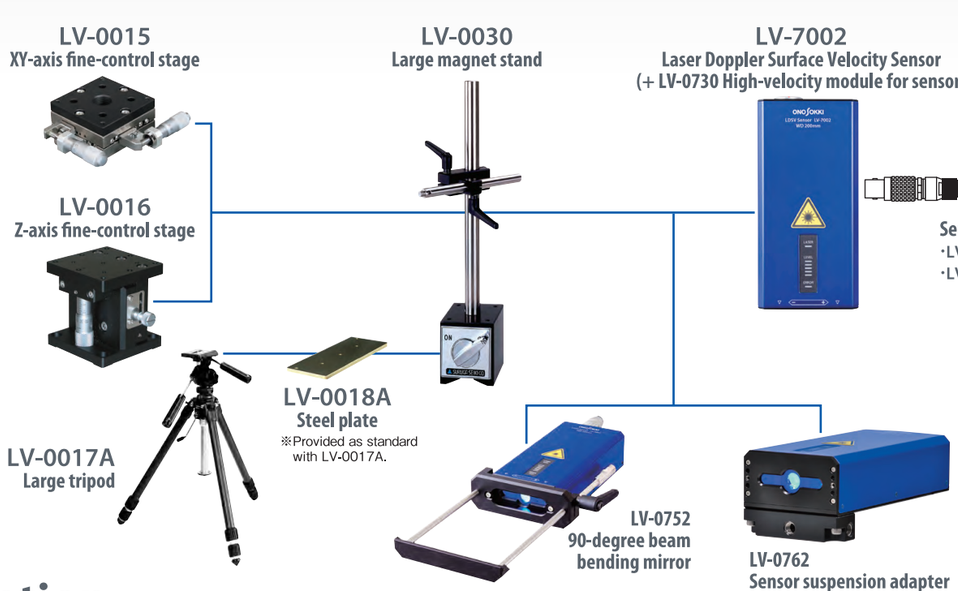
You can retrieve the signal to various counters and PLCs for controlling.

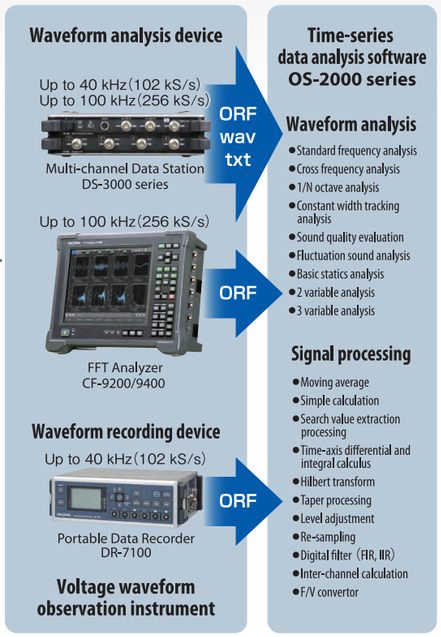
RESET IN

Input terminal to remotely reset and return the measured distance/length value displayed to zero.

System Configuration

Detection, data processing and analysis. Fully supported by Ono Sokki





※Please refer to exclusive brochures for more details of DS-3000 series, CF-9000 series, DR-7100, and OS-2000 series.

Option

LV-0730 High-velocity module for sensor NEW

The LV-0730 enlarges the detection velocity range and tracking acceleration by installing on the sensor end face.
Detection range : 0 to ± 3,600 m / min
Max. following acceleration : 1,600 m/s²

*LV-0731 High-velocity module for controller is required.
*Attachment/detachment of the LV-0730 from the sensor should be operated at factory of Ono Sokki. Please contact your nearest distributor or Ono Sokki sales office for more details.
*Image when options are installed

LV-0731 High-velocity module for controller NEW

LV-0731 enlarges the detection velocity range and tracking acceleration of the LV-7100 controller.
Detection range : 0 to ±3,600 m/min
Max. following acceleration : 1,600 m/s²

*LV-0730 High-velocity module for sensor is required.
*Image when options are installed

LV-0752 90-degree beam bending mirror NEW

This optical jig can deflect the laser beam at an angle of ±90 degrees at any given point. Assists laser light radiation onto targets in narrow spaces or gaps and enables measurement.

*Also available when LV-0730 is installed.

<Example>

LV-0762 Sensor suspension adapter NEW

LV-0762 enables four-way suspension when installed to the LV-7002 sensor to be overhung or overhung with upside down.

*Also available when LV-0730 is installed.

<Example>

LV-0030 Large magnet stand

The large magnet stand for sensor suspension. Laser light can be radiated from various directions by using two joints. You can make fine adjustment of detection position when used in combination with LV-0015/0016.

LV-0015 XY-axis fine-control stage

You can perform fine adjustment of detection position in X/Y directions when used in combination with LV-0030 Large magnet stand.

Stage surface : 60×60 mm
Moving distance : ±5 mm

LV-0016 Z-axis fine-control stage

This stage enables precise vertical movement in Z axis direction. You can perform focusing and make fine adjustment of the position in horizontal direction.

Stage surface : 60×60 mm
Moving distance : 0 to 10 mm

LV-0017A Large tripod

This tripod supports the sensor suspension of objects in where without surface plate or at high position. Magnetized fixing of large magnet stand (LV-0030) is available by using a steel plate.

Accessory included
LV-0018A : steel plate

LV-0772 Controller connection kit

It connects two units of LV-7100 Laser surface velocity meter controller for 2-channel detection. You can reset the distance / length displayed on both controllers at the same time.

*LV-7100 is not included.
*Also available when LV-0731 is installed.

LV-0791A Storage trunk

Item list accomodate
・LV-7002※ × 1
・LV-7100※ × 1
・LV-0703 or LV-0705 × 1
・LV-0030 × 1
・LV-0015 × 1
・LV-0016 × 1
・LV-0018A × 1
・LV-0752 × 1
・LV-0762 × 1
・LV-0772 × 1
・Instruction manual
・AC cable

Dedicated trunk that is capable of accommodating various accessories including cables and a large magnet stand, in addition to the LV-7000 system.

※*Also available when LV-0730/LV-0731 are installed.

Application

More correct understanding of phenomena, more precise evaluation, and quality improvement of materials or parts.

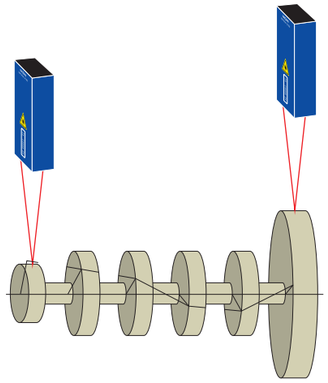
- Printing machine/Printer/ Office automation equipment
- Carrier machine/Convayor/Belt
- Building materials/Sheet
- Converting
- High function film
- Woven fabric/Nonwoven fabric/Textile
- Transmission machine/Pulley/ Transmission belt
- Take-off line/Cutting to standard length
- Tire/Roller
- Plastic/Rubber/Resin
- Wire/Copper wire/Thread
- Paper/Fiber

Promises a reduction in wasted material

Paper: feeding velocity/irregular velocity, meander amount, length	Roller: irregular velocity, irregular rotation, position
Belt: irregular velocity, meander amount, length	Hydraulic cylinder, actuator: extending and retracting velocity
Gear reducer: irregular rotation velocity, transmission error	Roll, film: slip, velocity difference
Belt: transmission, slip	Extruder, take-off machine: velocity, length
Torsion vibration	Wire, pipe: feeding length, return length

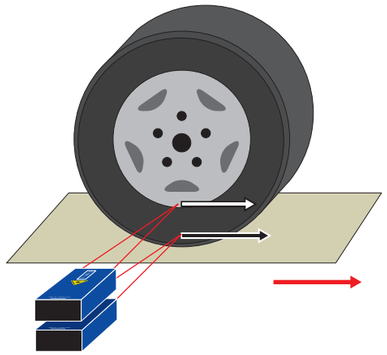
Torsion /torsional vibration measurement

Transmission machine, drive-train, rotating shaft, turbin, forged crankshaft



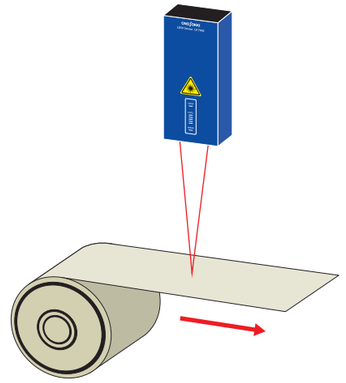
Measurement of velocity / behavior between a tire and grounding surface

Velocity difference, peripheral velocity change/difference,torsion, deformation, slip



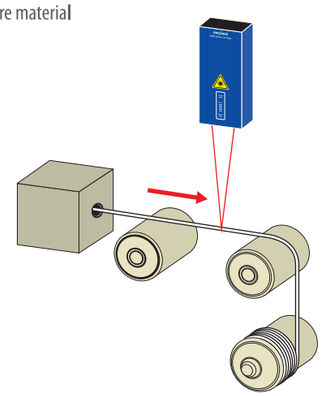
Velocity / Irregular velocity measurement

Paper, film, rubber, woven fabric, nonwoven fabric, textile, plastic, etc.



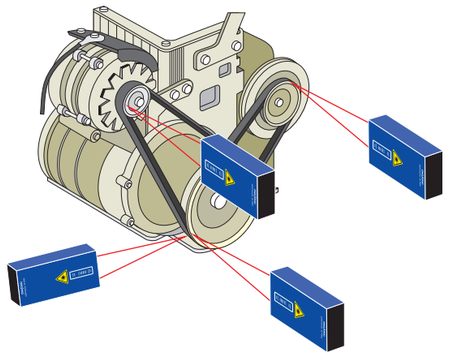
Length measurement when winding

Thread, wire for communication, copper wire for elevator, hose, harness, coated wire material



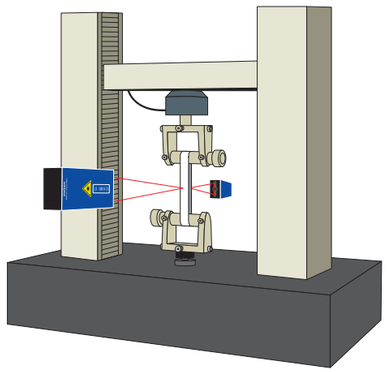
Behavior measurement of pulley/ belt

Velocity, slipping, expand or contract, and differential of a crank pulley, alternator, compressor, compression machine, and belt



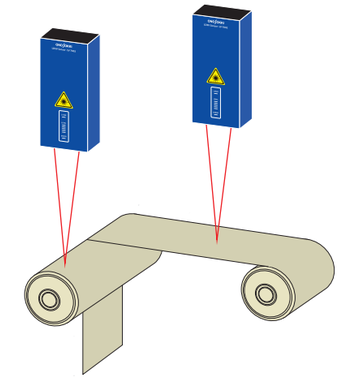
Measurement for material evaluation

Material stretching position, difference of stretching position and stretching velocity, behavior of compression / stretching



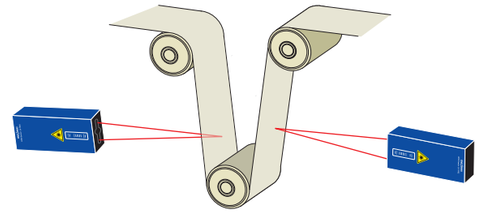
Slipping amount measurement at conveying

Printer, photo copying, scanner, paper, woven fabric, nonwoven fabric, textile, plastic, etc.



Vertical / negative gradient of conveyance

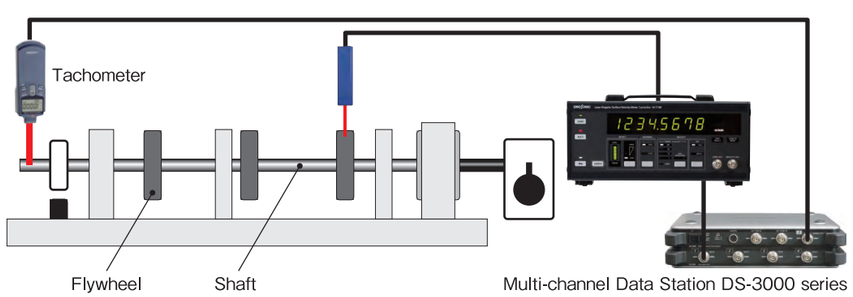
Velocity and velocity irregularity at vertical / negative gradient positions of transport direction for paper, film, rubber, woven fabric, nonwoven fabric, texile, plastic,etc.

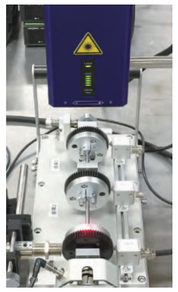


Measurement Example

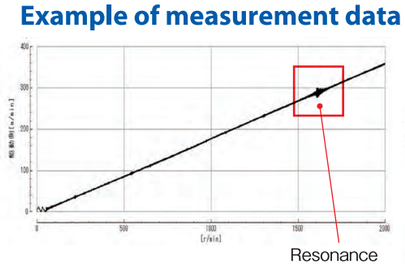
Evaluation of rotation resonance in rotating body

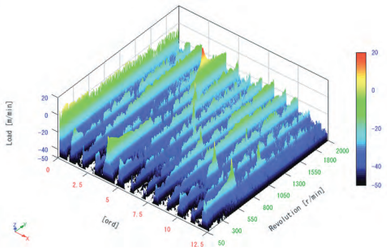
Overview of measurement





Example of measurement data



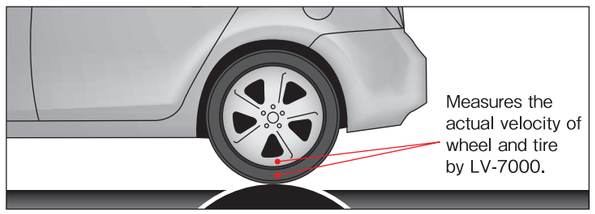


Measure the peripheral velocity of the flywheel attached to the shaft with LV-7000. By measuring together with the rotation speed, you can see at what rotation speed the rotation resonance is occurred.

In the case of this rotating body, rotation resonance is occured at around 1,600 r/min. By performing tracking analysis of measured data, evaluation including order can be performed.

Measurement of tire rotation speed on chassis dynamometer

Overview of measurement

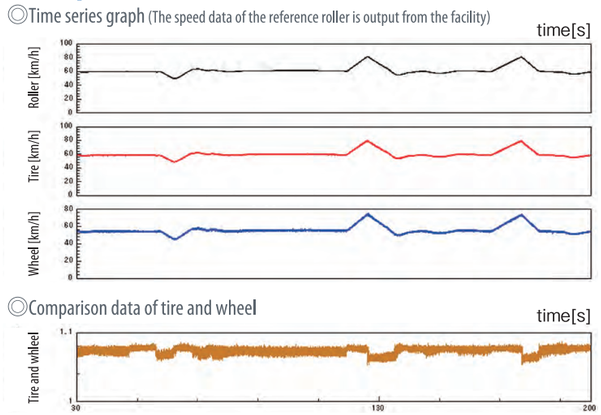


The speed of the tire and the wheel while the acceleration and the deceleration were repeated during operation at the steady-state speed was measured with LV-7000. The roller speed was measured beforehand in the facility. Not only velocity measurement at steady speed but also velocity change of acceleration and deceleration were detected.

You can see the difference of velocity when accelerated and decelerated based on the steady-state speed as a reference. In this measurement, it shows the phenomenon that the tire rotating speed becomes faster when accelerated, and the wheel rotating speed becomes faster when decelerated.

Example of measurement data

◎Time series graph (The speed data of the reference roller is output from the facility)



◎Comparison data of tire and wheel

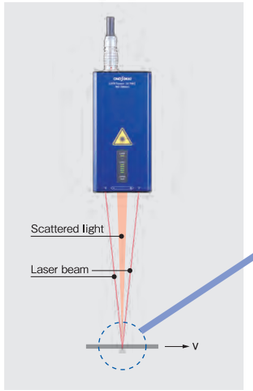
Measurement Principle

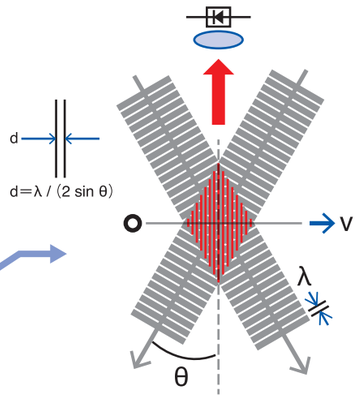
Measurement principle 1
～Detection of moving object velocity～

1) Interference fringe is generated in the intersection of 2 laser beams in angle at 2θ.
2) Particle passes through in the range of interference fringe. (Particle=target object)
3) When the particle passes through the interference fringe, the laser beam is lighted in alternate shifts as light > dark > light > dark….

The frequency of the scattering bright and dark fringes caused by the particle can be expressed using the equation f = v/d where v is the velocity of the particle and d is an interval of the fringes.

4) Based on the scattered light (back scattering) received by the light detecting part of the sensor, the frequency f is calculated.
5) The interval d of interference fringe is fixed, so the velocity v is able to be obtained.



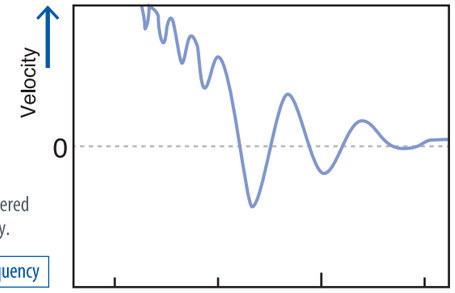


Measurement principle 2
～Detection of variation direction / polarity～

Unless the direction and polarity of the moving target are known, its velocity fluctuation and other irregularities cannot be detected. To solve this issue, the frequency of one of the two laser beams is shifted using acousto-optic modulators (AOMs) so that the interference fringes move at a velocity corresponding to the frequency shift ⊿f to make it possible to detect the direction and polarity of velocity v.

The direction and polarity are determined by whether the frequency strength f ′of the scattered light which has been detected at receiver is higher or lower compared to the shift frequency.

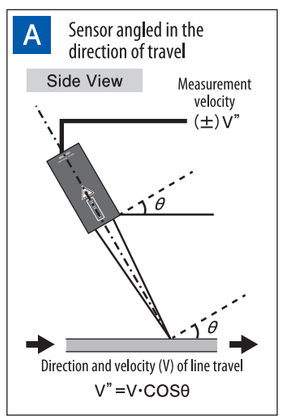
f ′ < ⊿f : Frequency lower than shift frequency　f ′ > ⊿f : Frequency higher than shift frequency

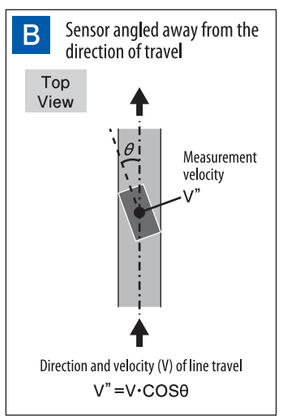


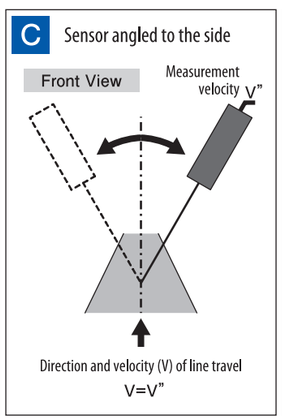
Positioning and Associated Error Related to Location between Sensor and Target

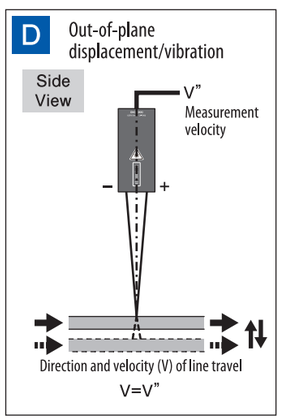
Measurements can have errors depending on the location of the sensor relative to the target. By knowing the relationships between the locations of sensor, measurement target, and measurement results, even better results can be obtained.

Sensor location relative to the target	Impact on measurement accuracy	Note
A Sensor angled in the direction of travel	Smaller than actual velocity	Velocity smaller by the magnitude of the angle (cosθ)
B Sensor angled away from the direction of travel	Smaller than actual velocity	Velocity smaller by the magnitude of the angle (cosθ)
C Sensor angled to the side	None	Signal-to-noise ratio needs to be monitored for a possible drop.
D Out-of-plane displacement / vibration	The greater the vertical displacement, the lower the accuracy.	Please refer to the specification for the LV-7002.









Specification

LV-7002 Laser Doppler Surface Velocity Sensor

Detection method	Laser Doppler system, back-scattering differential type		
Detection polarity	"+" when moving from the left to the right with respect to the sensor		
Distance accuracy	±0.2 % or less	Length evaluation by Ono Sokki standard plane at 25C°.	
Laser beam	Laser safety class	Class 2	
	Measuring laser beam	λ=1550 nm	
		less than 10 mW	CW oscillation
	Aiming laser beam	λ= 635 nm	
		less than 1 mW	CW oscillation
	Laser beam spot diameter	2 mm × 1 mm , ellipse	Long diameter: parallel to the moving direction of the object
	LD light source life	Aiming light source:10,000 hours or more (25℃) * Theoretical calculated value	When the output of aiming beam is less than the specified range, the LASER LED at controller side is flashed and the measurement beam is turned off.
		Measurement light source：10,000 hours or more *Theoretical calculated value	
Detection length	Center of detection length	200 mm *from the bottom surface of the sensor	
	Detection range (depth)	±4 mm distance accuracy:±0.2 (of reading) % or less	*Length evaluation by Ono Sokki standard plane at 25℃.
		±10 mm distance accuracy:±5.0 (of reading) % or less	
Detection velocity	Scale factor	Automatically read out to the controller from the sensor.	approx. 7.5 µm
	Detection velocity range	0 to ±1,800 m/min	
	Maximum tracking acceleration	800 m/s² or more	
Sensor suspension	Screw hole for LV-0030 Large magnet stand	Thread nominal diameter: M8	Appropriate tightening torque requirement (6 N･m)
		Number of holes: 1	
		Position： Sensor reference surface part, detection center axis	
		Depth： 8 mm or more	
	Screw hole for sensor suspension (for LV-0762 sensor suspension adapter)	Thread nominal diameter： M4	Appropriate tightening torque requirement (1.5 N･m) Increased strength by helical insert processing
		Number of holes: 4	
		Position： Sensor reference surface part, four corners	
		Depth： 4 mm or more	
Option	Screw hole for LV-0752 90-degree beam bending mirror	Thread nominal diameter： M3	Appropriate tightening torque requirement (0.6 N･m) Increased strength by helical insert processing
		Number of holes: 2	
		Position: Sensor front surface part	
		Depth: 3 mm or more	
Light receive sensitivity monitor	Light receive signal level (SIG LEVEL)	Displays the light reception level in 5-segment LED (green)	
	Light receive signal error (ERROR)	LED (red) lights up when demodulation error is occured.	
Laser radiation monitor (LASER)	LED (green) lights up when laser for measurement is radiated.		
Outer dimensions	W 75 mm x H 40 mm x D 155 mm		
Weight of the main unit	Approx. 750 g	Not including option/ cable	
Conforming standard	Laser safety	FDA 21CFR Part 1040.10（CDRH）	
		IEC60825-1:2007:2014	
		JIS C 6802:2007:2014	
	EMC standard	FCC（Part15B）:2015	
		CANADA EMI standard (ICES-003):2016	
		EN61326-1:2013 class A Table2	
	Safety	EN61010-1:2010	
Operating environment	Temperature range	0 to 40 ℃	
	Humidity range	20 to 80 % (with no condensation)	
Storage environment	Temperature range	-10 ℃ to 50 ℃	
	Humidity range	20 to 80 % (with no condensation)	

LV-7002 Laser Doppler Surface Velocity Sensor + LV-0730 High-velocity module for sensor

Laser beam	Laser safety class	Class 2	
	Measuring laser beam	λ= 1.550 nm	
		10 mW or less	CW oscillation
	Aiming laser beam	λ= 635 nm	
		1 mW or less	CW oscillation
	Laser beam spot diameter	2 mm x 1 mm, ellipse	Long diameter: parallel to the moving direction of the object
General velocity detection	Center of detection distance	172 mm *From the end face at the lower end of the module.	
	Detection range（depth）	±4 mm distance accuracy：±0.2 (of reading) % or less	Length evaluation by Ono Sokki standard plane at 25C°.
		±15mm distance accuracy：±5.0 (of reading) % or less	
Sensor in general	Scale factor	Automatic reading from sensor to controller	approx. 15 µm
	Detection velocity range	0 to ±3,600 or more	
	Max. tracking acceleration	1,600 m/s² or more	
Outer dimensions	W : 76 mm / H : 40 mm / D : 183 mm		
Weight of main unit	approx. 900g	Not including cables or other options	

LV-7100 Laser Doppler Surface Velocity Meter Controller

Sensor input	1	Rear panel side		
General velocity detection	Detection velocity range	0 to ±1800 m/min		
	Tracking acceleration	800 m/s²	When【FAST】is selected at RESPONSE.	
		400 m/s²	When【SLOW】is selected at RESPONSE.	
		When exceeding the upper limit	RESPONSE LED : blink, ERROR OUT : output	* Response frequency: up to 800 Hz
Velocity output (VELOCITY OUT)	Output voltage	±10 V（20 V p-p）	When input side impedance is 100 k Ω or more. *Short circuit protection	
		Polarity	"+ voltage" when moving from the left to the right with respect to the sensor "- voltage" when moving from the right to the left with respect to the sensor *Reversible available	
	Output impedance	50 Ω or less	Should be received at 100 kΩ or more of impedance (input side).	
	Output terminal format	BNC (receptacle)	Front panel side	
	Cutoff frequency	5 kHz	LPF GAIN fc=-3 dB	
	Velocity range (VELOCITY-RANGE (m/min)/V)	Selectable from buttons in [RANGE] on a front panel	180 (m/min)/V	
			50 (m/min)/V	
			10 (m/min)/V	
			1(m/min)/V	
			1 (m/min)/V (HIGH RESOLUTION)	cutoff frequency 10 Hz *GAIN fc = -3 dB
	Measurement lower limit, resolution	180（m/min）/V	Measurement lower limit: 0.54 m/min or less*	
		50（m/min）/V	Measurement lower limit: 0.50 m/min or less *	
		10（m/min）/V	Measurement lower limit: 0.03 m/min or less*	
		1（m/min）/V	Measurement lower limit: 0.003 m/min or less*	
		1（m/min）/V（HIGH-RESOLUTION）, fc=10 Hz	Resolution: 0.01 m/min or less*	
	Linearity ※ Excluding DC offset	180（m/min）/V	±1 % (F.S.) or less	
		50（m/min）/V	±1 % (F.S.) or less	
		10（m/min）/V	±2 % (F.S.) or less	
		1（m/min）/V	±5 % (F.S.) or less	
		1（m/min）/V（HIGH-RESOLUTION）, fc=10 Hz	±5 % (F.S.) or less	
	DC offset	180（m/min）/V	±90 m/min or less	※Within the operating temperature range (0 to 40℃)
		50（m/min）/V	±25 m/min or less	
		10（m/min）/V	±5 m/min or less	
		1（m/min）/V	±0.5 m/min or less	
		1（m/min）/V（HIGH-RESOLUTION）, fc=10 Hz	±0.05 m/min or less	
	Low-pass filter (VELOCITY-LPF)	Select with the button in the [LPF] on the front panel		
		1 kHz	GAIN fc=-3 dB (allowance ±2.0 dB)	
		300 Hz		
		OFF	GAIN fc=5 kHz（-3 dB）	
Phase difference output (SIG A / SIG B OUT)	Output waveform	2-phase square wave output		
	Output format	Line driver output	Hi: 2.5 V or more	
			Lo: 0.5 V or less	
			Response time: up to 1 MHz	
		Totem-pole output	Hi: 10.5 V or more	
			Lo: 0.5 V or less	
			Response time: up to 100 kHz	
	Phase difference	90 °±60 °	T: cycle T/4±T/6	
	Duty ratio	50 %±20 %	T: cycle T/2±T/5	
	Shape of output terminal	NJC-2010-RF (receptacle)	Rear panel side	made by Nanaboshi Electric Mfg Co., Ltd.
	Pulse width (A,B Phase)	Dividing ratio 1	approx. 7.5 µm	Scale factor (automatically read out from a sensor to a controller) / After multiplication by 4
		Dividing ratio 2	approx. 15 µm	
		Dividing ratio 4	approx. 30 µm	
		Dividing ratio 8	approx. 60 µm	
		Dividing ratio 16	approx. 120 µm	
		Dividing ratio 32	approx. 240 µm	
		Dividing ratio 64	approx. 480 µm	
		Dividing ratio 128	approx. 960 µm	
		Dividing ratio 256	approx. 1,920 µm	
	Pulse width selection	Dip-switch setting	Rear panel side	
Display section	Display unit	7-segment LED (green)		
		7-digit + polarity (1-digit)		
		Decimal point	Fixed in the unit or velocity range	
		Display update interval	0.1 s	
		Max. display length	9999.999 m	
		Distance reset	0 reset the distance in the front panel side【LENGTH RESET】 0 reset the distance in the rear panel side【RESET IN】short circuit.	
	Unit selection	Selectable with【UNIT SELECT】button on the front panel		
		Speed	m/s, mm/min, m/min	
		Distance	m, mm	

*Condition: Noise PEAK value in FFT power spectrum (effective value, up to 5 kHz) by reference measurement target

Specification

LV-7100 Laser Doppler Surface Velocity Meter Controller

Display section	Display of signal level reception error	Flashing display		
	Display while searching	[-] display		
	Display of scale factor error	Displayed "8.8.8.8.8.8.8.8." by 7-segment LED		
	Display of max. distance	Flashing display		
Light receive monitor	Light receive signal level display (DETECT-LEVEL)	10-segment LED (green) array display		
	Light receive signal level output (LEVEL OUT)	Output terminal format	BNC (receptacle)	Front panel side
		Output signal	0 to 14V	
			Proportional to light receive signal level	
		Frequency response	GAIN fc=5 kHz (-3 dB)	
	Light receive signal level error display (DETECT-ERROR)	LED (red) lights up when the light receive level is decreased.		
	Light receive signal level error output (ERROR OUT)	Output terminal format	NJC-163-RF (Receptacle)	
		Output method	Open collector (negative logic)	
		Output withstand voltage	30 V or less	
		Sync current	50 mA or less	
	Search (DETECT-SEARCH)	Search operation with [SEARCH] button on the front panel		
Serial interface (RS-232C)	Standard	RS-232C		
	Connector	D-sub 9-pin	Rear panel side	
	Communication specification	Communication method	Asynchronous full-duplex	
		Data signal speed (bit/ second)	19,200	
		Character length	8 bits	
		Parity bit	None	
		Start bit	1 bit	
		Stop bit	1 bit	
		Terminator	CR+LF	
		Flow resistance	None	
Polarity switch (+ / -)	Polarity inversion with the [+/-] button on the front panel	Polarity inversion of digital display		
		Polarity inversion of velocity output voltage		
	LED (red) lights up while polarity inversion period			
Distance reset input (RESET IN)	Terminal format	NJC-163-RM (Receptacle)	Rear panel side	
	Input method	Non-voltage a contact		
Safety lock connection (SAFETY LOCK)	Input terminal format	RM12BRD-2S (Receptacle)	*Short-circuit processing part is supplied as standard.	
	Input method	Non-voltage a contact input		
		Laser is radiated when device is short circuited.		
Laser radiation ON/OFF (LASER)	ON/OFF with the [LASER] button on the front panel		LED (green) lights on when it is ON	
	Warning display	Aiming laser's lifetime warning	Flashing approx. 1s interval	
		Laser light failure	Flashing approx. 0.1s interval	
	Fail safe function	Always start with LASER OFF when the power is ON. *Can be modified to the operation board type which starts laser emission when the power is turned ON.		
Laser receiving level setting (DETECT-LOW to HIGH)	Laser receiving level setting	4 ranges	*LOW is selected at the time of shipment.	
	Select with the button in the [LOW to HIGH] of the front panel.			
Key lock (O-n)	Select by pressing [KEY LOCK] in the front panel.			
	Select	Press and hold the button for approx. 2 seconds.	* LED (white) flashes while selecting.	
	Cancel	Press and hold the button for approx. 2 seconds.		
	Key locked range	Lock all key operation except [LASER] ON/OFF		
Controller connection (CONNECT IN / OUT)	Signal connection	Number of connection units	Max. 2 with electrical connection	
		Function when connected with a cable	Resets the distance of LV-7100 (2 units) at the same time.	
	Unit connection	Connecting two units of LV-7100 vertically (stacking) are available.	*LV-0772 Controller connection kit is required.	
Operating environment	Temperature range	0 to 40 ℃		
	Humidity range	20 to 80 %	With no condensation	
Storage environment	Temperature range	-10 to 50 ℃		
	Humidity range	20 to 80 %	With no condensation	
Power requirement	Input voltage	100 to 240 VAC		
		50/60 Hz		
	Power consumption	Less than 70 VA		
Power switch	ON/OFF by locker switch	Rear panel side		
Cooling of main unit	Forced-air cooling			
Outer dimensions	W 310 X H 135 X D 176 mm	Excluding handle/ protruded section		
Weight	Approx. 3 kg	Controller only		
Accessory	AC power cable ×1	YC-1 2M GY	For Japan use (for AC100 V)	
	SAFETY LOCK connector ×1	RM12BPE-2PH (processed short circuit)	HIROSE ELECTRIC CO., LTD.	
	RESET IN connector ×1	NJC-163-PF	Nanaboshi Electric Mfg.Co,Ltd.	
	ERROR OUT connector ×1	NJC-163-PM	Nanaboshi Electric Mfg.Co,Ltd.	
	SIG A/SIG B OUT ×1	NJC-2010-PM	Nanaboshi Electric Mfg.Co,Ltd.	
	Signal cable (1.5m) ×2	MX-101		
	Backup fuse ×1	T3.15A AC250 V	Stored in a fuse holder of main unit.	
	Instruction manual ×1			

LV-7100 Laser Doppler Surface Velocity Controller + LV-0731 High-velocity module for controller

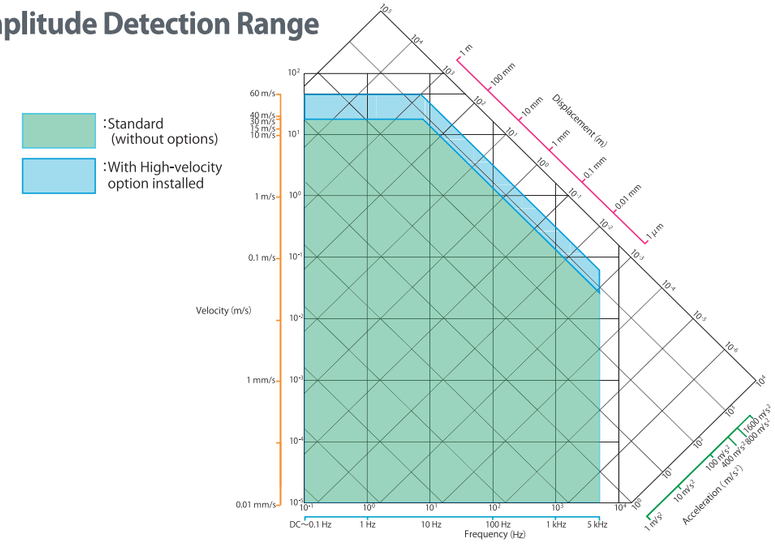
Detection velocity	Detection velocity range	0 to ±3,600 m/min		
	Tracking acceleration	1,600 m/s²	when [FAST] is selected at RESPONSE	
		800 m/s²	when [SLOW] is selected at RESPONSE	
		When exceeding the upper limit	RESPONSE LED: blink, ERROR OUT: output * Response frequency: up to 800 Hz	
VELOCITY OUT	Velocity range (m/min)/V	Select by the button in (RANGE) on the front panel	360 (m/min) /V	
			100 (m/min) /V	
			20 (m/min) /V	
			2 (m/min) /V	
			2 (m/min) /V (HIGH RESOLUTION)	Cutoff frequency 10 Hz (GAIN fc=-3 dB)
		Velocity range over	LEDs illuminate (in red) when any of the velocity ranges exceeds its upper limit by 1%.	
	Measurable lower limit, resolution	360 (m/min) /V	Measurement lower limit 1.08m/min or less*	
		100 (m/min) /V	Measurement lower limit 1.00m/min or less*	
		20 (m/min) /V	Measurement lower limit 0.06m/min or less*	
		2 (m/min) /V	Measurement lower limit 0.006m/min or less*	
		2 (m/min) /V (HIGH RESOLUTION)	Resolution 0.02m/min or less*	
	Linearity *excluding DC offset	360 (m/min) /V	±1% (F.S.) or less	
		100 (m/min) /V	±1% (F.S.) or less	
		20 (m/min) /V	±2% (F.S.) or less	
		2 (m/min) /V	±5% (F.S.) or less	
		2 (m/min) /V (HIGH RESOLUTION) * fc = 10 Hz	±5% (F.S.) or less	
	DC offset	360 (m/min) /V	±180m/min or less	In the range of operating temperature range (0 to 40℃)
		100 (m/min) /V	±50m/min or less	
		20 (m/min) /V	±10m/min or less	
		2 (m/min) /V	±1.0m/min or less	
		2 (m/min) /V (HIGH RESOLUTION) * fc = 10 Hz	±0.1m/min or less	
Phase difference pulse output (SIG A / SIG B OUT)	Pulse duration (A,B Phase)	Frequency divided by 1	approx. 15 µm	Scale factor (automatically read from sensor to controller) / After 4 multiplying
		Frequency divided by 2	approx. 30 µm	
		Frequency divided by 4	approx. 60 µm	
		Frequency divided by 8	approx. 120 µm	
		Frequency divided by 16	approx. 240 µm	
		Frequency divided by 32	approx. 480 µm	
		Frequency divided by 64	approx. 960 µm	
		Frequency divided by 128	approx. 1920 µm	
		Frequency divided by 256	approx. 3840 µm	

*Condition: Noise PEAK value in FFT power spectrum (effective value, up to 5 kHz.) by reference measurement target

LV-0752 90-degree Beam Bending Mirror

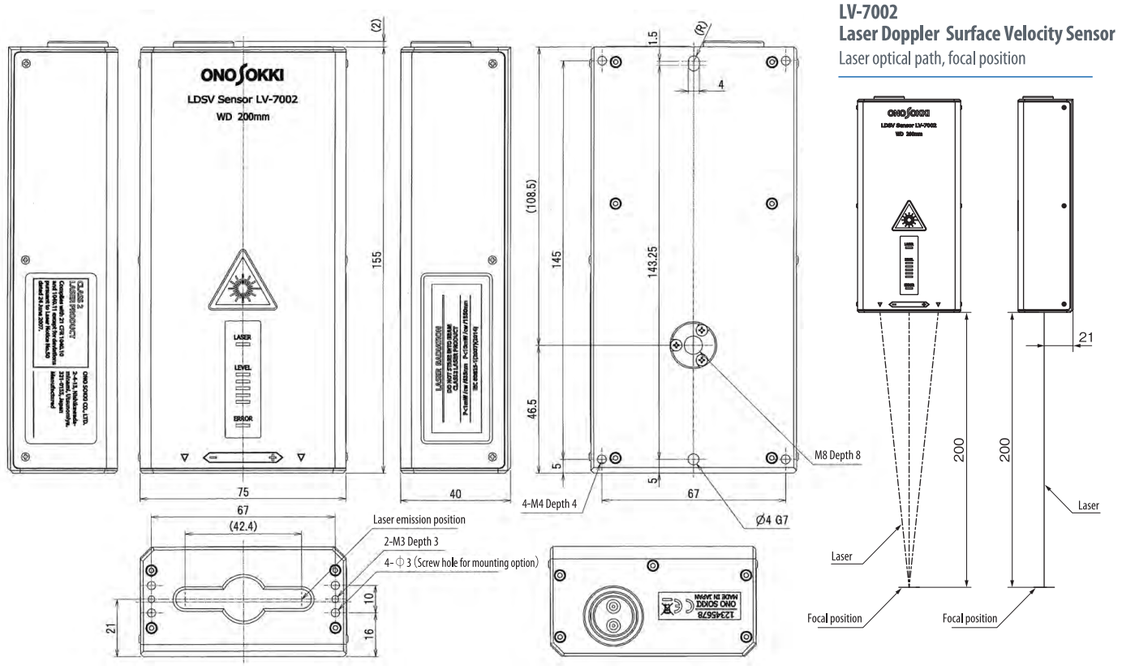
		when installed to LV-7002	when installed to LV-7002 + LV-0730
Detection distance	Detection distance (center)	30 to 180 mm	30 to 150 mm
	Detection range (depth)	±8 mm	±8mm
Detection accuracy (Length evaluation by Ono Sokki standard plane at 25℃)		±0.2 mm (of reading) % or less (depth: ±4 mm)	
		±5.0 mm (of reading) % or less (depth: ±8 mm)	
Outer dimensions		approx. 108 (W) x 38 (H) x 234.5 (D) mm (not including protruded section)	
Weight		approx. 300g	
Operating environment	Temperature range	0 to 40℃	
	Humidity range	20 to 80% (with no condensation)	
Storage environment	Temperature range	-10 to 50℃	
	Humidity range	20 to 80% (with no condensation)	
Accessory		Hex socket head cap screw x 1 (must be used with the slide prevention lever removed.) Hexagonal bar wrench x 1	

Amplitude Detection Range



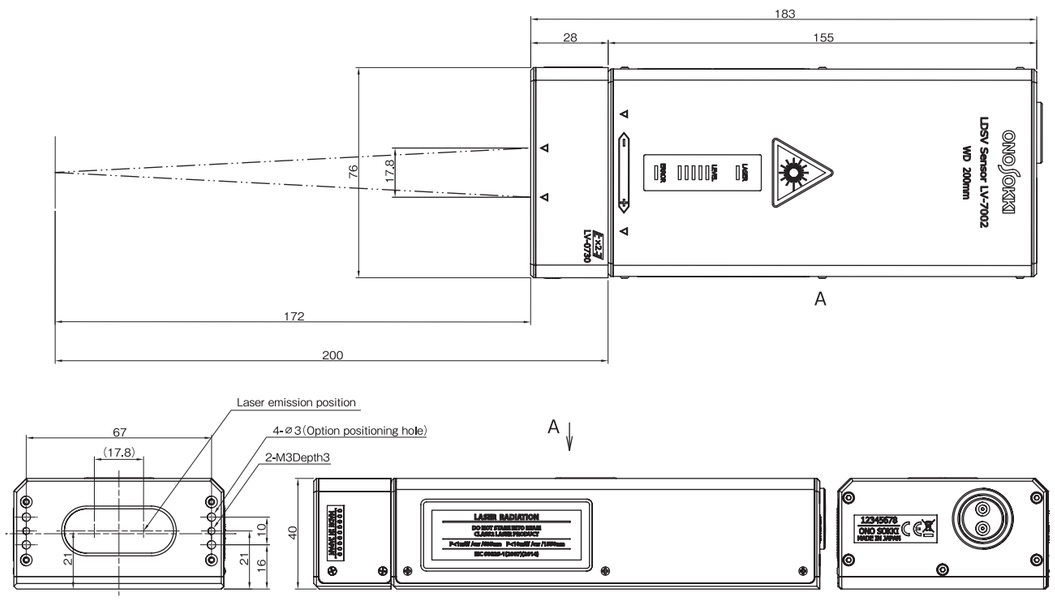
Outer Dimensions (Unit : mm)

LV-7002 Laser Doppler Surface Velocity Sensor

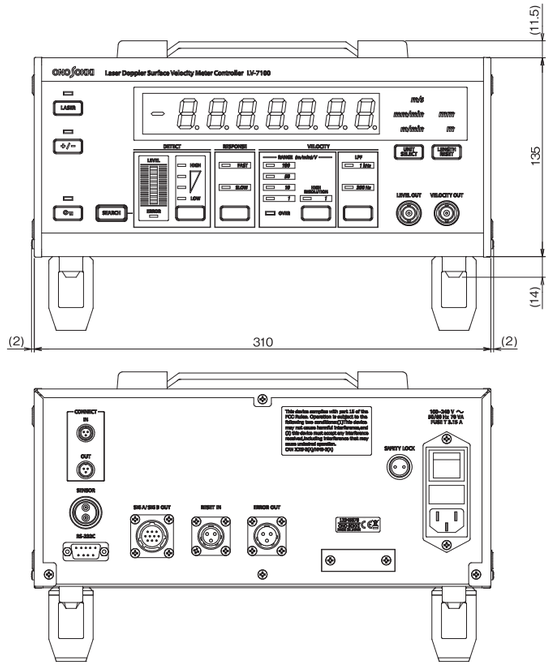


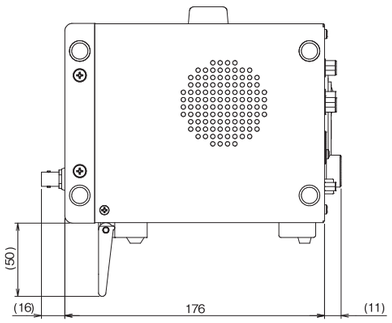
LV-7002
Laser Doppler Surface Velocity Sensor
Laser optical path, focal position

LV-7002 Laser Doppler Surface Velocity Sensor + LV-0730 High-velocity module for sensor

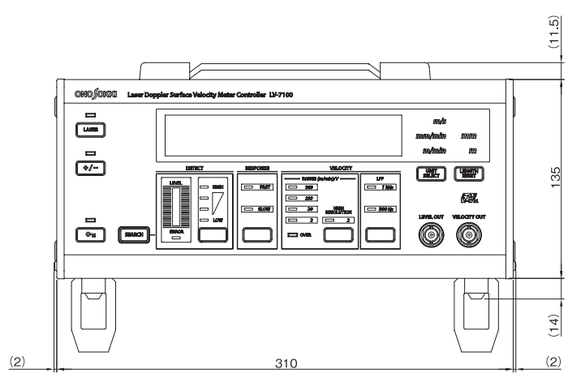


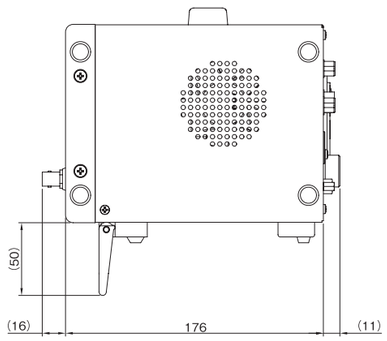
LV-7100 Laser Doppler Surface Velocity Meter Controller





LV-7100 Laser Doppler Surface Velocity Meter Controller + LV-0731 High-velocity module for controller





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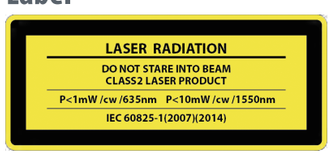
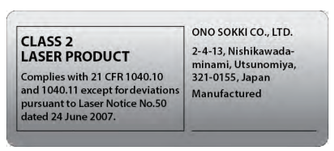
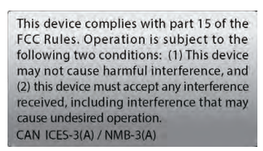
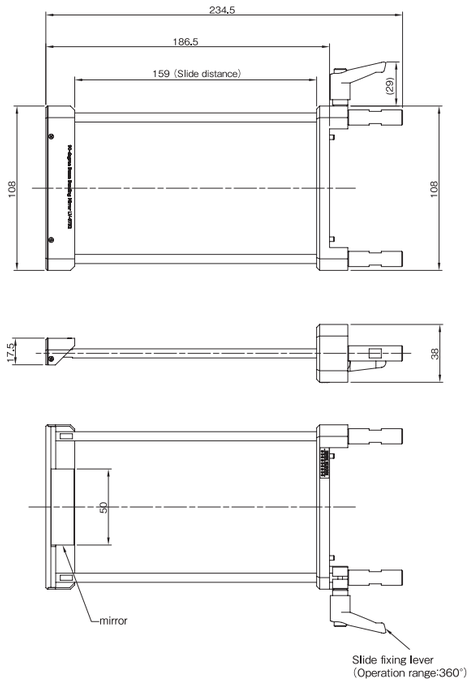




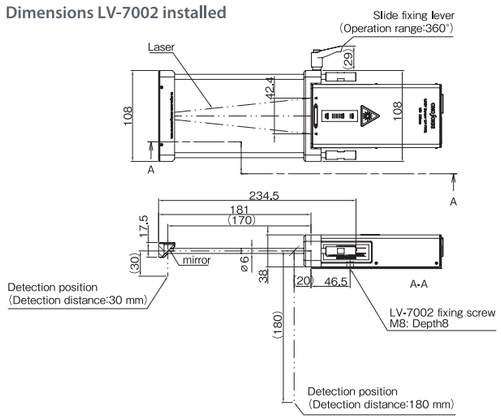


Outer Dimensions (Unit : mm)

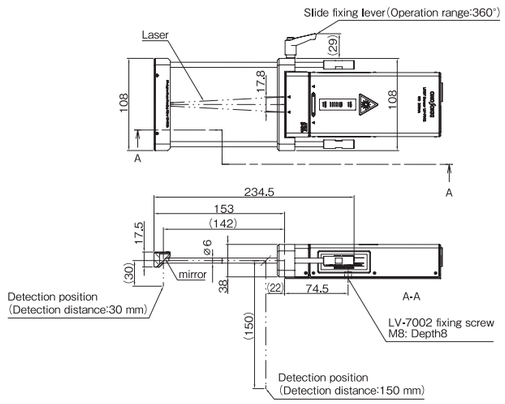
LV-0752 90-degree Beam Bending Mirror



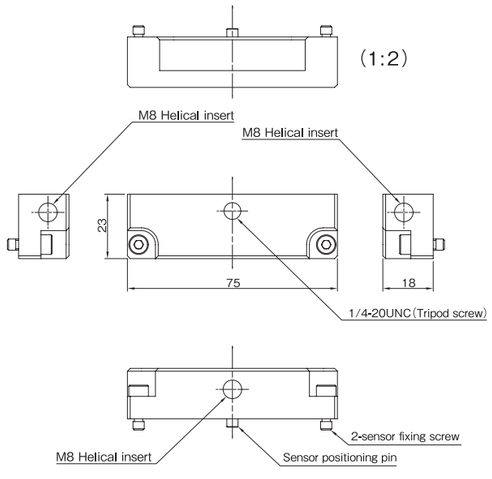
Dimensions LV-7002 installed



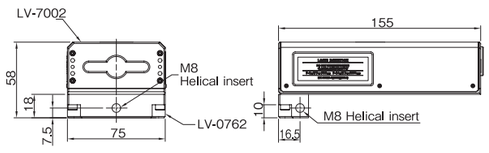
Dimensions LV-7002 + LV-0730 installed



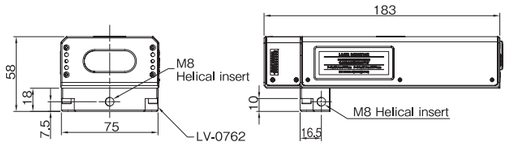
LV-0762 Sensor Suspension Adapter



Dimensions LV-7002 installed

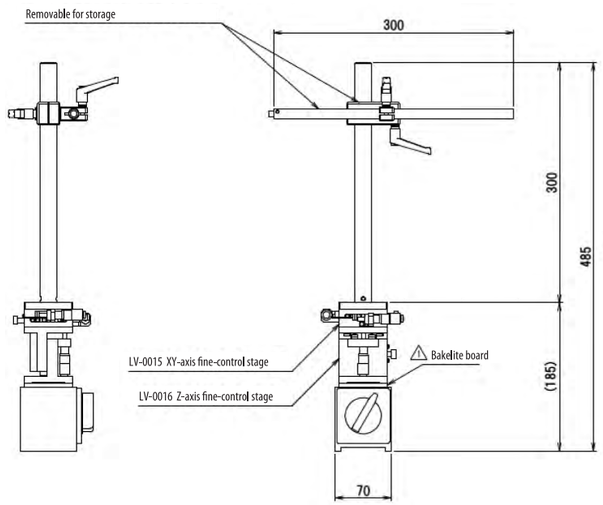


Dimensions LV-7002 + LV-0730 installed

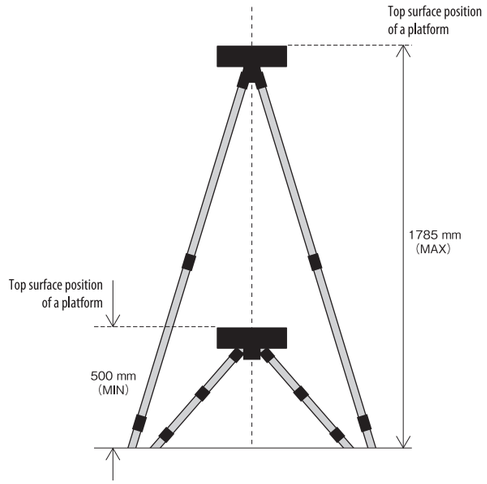


LV-0030 Large Magnet Stand

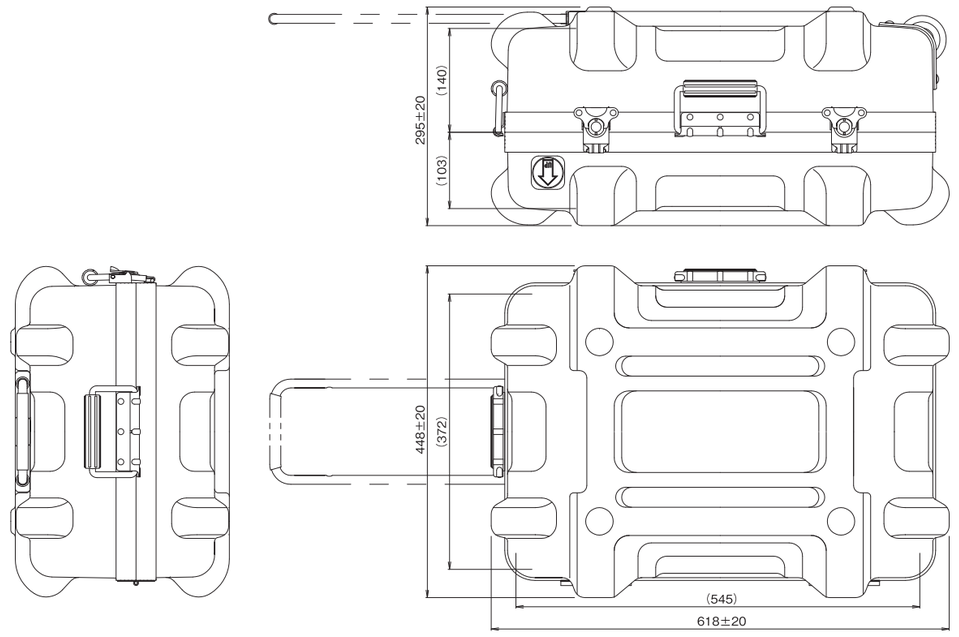
LV-0015 XY-axis fine-control stage
LV-0016 Z-axis fine-control stage



LV-0017A Large Tripod



LV-0791A Storage Trunk



LV-7000 series Laser Doppler Surface Velocity Meter

Model name	Product name	Description
LV-7002	Laser Doppler Surface Velocity Sensor	WD=200 mm
LV-7100	Laser Doppler Surface Velocity Meter Controller	———
LV-0703	Sensor cable	3 m
LV-0705	Sensor cable	5 m*
LV-0730	High-velocity module for sensor	Detection velocity range 0 to ±3,600 or more
LV-0731	High-velocity module for controller	Detection velocity range 0 to ±3,600 or more
LV-0752	90-degree beam bending mirror	———
LV-0762	Sensor suspension adapter	———
LV-0772	Controller connection kit	For connecting two units of LV-7100
LV-0791A	Storage trunk	Storage for 1 set

* Please consult us about cable extension.

Peripherals

RP-7400 series Roller Encoder

120·200 P/R
1200 P/R

■Feature

- Number of pulses:
  Selectable from
  120, 200 or 1200 P/R
- Output method (4 types)
  - ·Totem-pole output (standard)
  - ·Emitter output (option)
  - ·Collector output (option)
  - ·Open collector output (option)

■Specification

Roller circumference	: 200 mm (tolerance :0 to -0.2 at 20°C)
Output pulse	: for velocity : 120 P/R,1200 P/R for length : 200 P/R
Velocity range	: 0 to 600 m/min
Measurement unit	: 1200 P/R; 0.01 m/min 120 P/R; 0.1 m/min 200 P/R; 1 mm
Output waveform	: 2-phase square wave
Output voltage	: Hi; 10 V or more, Lo; 0.5 V or less
Output method	: Totem-pole output (standard) Emitter output (option) Collector output (option) Open collector output (option)
Applicable detector	: RV-3150, TM series
Operating temperature range	: 0 to 50°C
Vibration resisntance	: 19.6 m/s² (2 hours for each 3 directions) 10 to 150 Hz sweep, 20 cycles
Power requirement	: 12 VDC±5 % (100 mA or less)
Weight	: Approx. 400 g

RV-3150 Multi-functional Reversible Counter

■Feature

- Multiple ratio selection,
  ratio compensation, offset,
  decimal point selection,
  counting direction selection
- External output: comparator
  (Setting for comparator: 4 types
  are able to be saved as conditions.),
  Analog, BCD, RS-232C communication

■Specification

Sensor input signal	: Single phase or 90-degree phase difference square waveform Voltage signal (Hi; 4 to 30 V, Lo; 0 to 1 V) Line receiver (conforms to RS-422A)
Input frequency range	: DC to 100 kHz
Power supply for sensor	: 5±0.25 VDC,12 ±0.6 VDC (select either of them)
External control signal	
Input signal type	: Reset, gate, offset, key protect
Input signal format	: Voltage input (Hi; 4 to 5.25 V, Lo; 0 to 1 V) Non-voltage contact input
Function	: Number of multiplyings (1/2/4) Ratio (0.000001 to 0.999999), offset (0 to ±999999), comparator (setting range:0 to ±999999, 2-stage)
Outer dimensions	: 144 (W) x 72 (H) x 180 (D) mm (not including protruded section)
Power requirement	: 100 to 240 VAC, 50/60 Hz
Weight	: Approx.1.3 kg

ONO SOKKI

WORLDWIDE ONO SOKKI CO., LTD.
1-16-1 Hakusan, Midori-ku, Yokohama, 226-8507, Japan
Phone : +81-45-935-3918 Fax : +81-45-930-1808
E-mail : overseas@onosokki.co.jp

*Outer appearance and specifications are subject to change without prior notice.
URL: https://www.onosokki.co.jp/English/english.htm

U.S.A.
Ono Sokki Technology Inc.
2171 Executive Drive, Suite 400,
Addison, IL. 60101, U.S.A.
Phone : +1-630-627-9700
Fax : +1-630-627-0004
E-mail : info@onosokki.net
http://www.onosokki.net

THAILAND
Ono Sokki (Thailand) Co., Ltd.
1/293-4 Moo.9 T.Bangphud
A.Pakkred,
Nonthaburi 11120, Thailand
Phone : +66-2-584-6735
Fax : +66-2-584-6740
E-mail : sales@onosokki.co.th

INDIA
Ono Sokki India Private Ltd.
Plot No.20, Ground Floor, Sector-3,
IMT Manesar Gurgaon-122050,
Haryana, INDIA
Phone : +91-124-421-1807
Fax : +91-124-421-1809
E-mail : osid@onosokki.co.in

P.R.CHINA
Ono Sokki Shanghai Technology Co., Ltd.
Room 506, No.47 Zhengyi Road, Yangpu
District, Shanghai, 200433, P.R.C.
Phone : +86-21-6503-2656
Fax : +86-21-6506-0327
E-mail : admin@shonosokki.com

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