

Digital Laser Doppler Vibrometer

Nova-Series



SWIR Single-Point Laser Vibrometer

Vibrometry in the short-wave infrared range for maximum signal-to-noise ratio. Delivers best signal quality for dark or rough surfaces, biological tissue, as well as long working distances.



IDEAL FOR

- Dark / rough surfaces
- Very high-frequency vibrations
- Biological surfaces
- Moving or rotating objects
- High speed vibrations up to 25 m/s
- Long distance measurements

HIGH-END AND BEST-PERFORMANCE

The „Nova-Series“ Laser Vibrometer operates with an invisible SWIR Laser (1550 nm). At a wavelength of 1,550 nm, ten times the laser power of a HeNe system is available for measurements without compromising the eye safety.

The NOVA Series comes in when maximum dynamic range is required or every decibel of signal level counts. Typical use cases are surfaces that poorly reflect visible light, for example dark and rough surfaces or biological tissue. A high signal strength is also of vital importance for measurements over long distances, e.g. in civil engineering or aerospace.

Technical Data

Measured Quantities – Performance Parameters

| Max. ² Frequency | Max. ² Velocity | Best Vel. ¹ Resolution | Max. ^{2,3} Displacement | Best Disp. ^{1a} Resolution | Max. ^{2,3} Acceleration | Best Accel. ¹ Resolution |
|--------------------------------|-------------------------------|--------------------------------------|-------------------------------------|--|-------------------------------------|--|
| 24 MHz | 25 m/s | 1.7 nm s ⁻¹ /√Hz | ±1.225 m | 0.05 pm /√Hz | 78.4 Mg | 1.8μg /√Hz |

¹ The Res. is defined as the signal amp. (rms) that produces 0 dB signal-to-noise ratio (SNR) with 1 Hz spectral res. at 50 % f_{max}.

^{1a} The Res. is defined as the signal amp. (rms) that produces 0 dB SNR with 1 Hz spectral res..

² Actual specifications depend on the configured decoder.

³ Optional available

Measurement Specifications

| | |
|--|---|
| Measured quantities | Velocity, displacement, acceleration |
| Frequency bandwidth ² | 0 Hz - 24 MHz |
| Max. velocity ² | 25 m/s |
| Velocity measurement ranges ² | 14 |
| Signal processing | Digital (FPGA based) |
| Source impedance | 50 Ohm |
| Analog signal output | 3 × BNC, ±2 V - Velocity, displacement ³ , acceleration ³ , signal generator ³ - Data rate: 160 MSamples/s @ 16-bit |
| Digital Signal Output & PC-Interface | 1 Gbit RJ45 Ethernet: - Data rate: 1 GBit (53.3 MSamples/s @ 16-bit) - Digital data acquisition- and analysis software <i>OptoGUI</i> - Digital remote control of device settings |
| External Trigger | Digital external trigger in/out via SMB |
| Filter | High-pass filter: off / 10 / 20 / 40 / 80 / 160 / 320 / 640 Hz 1.28 / 2.56 / 5 / 10 / 20 / 40 / 80 / 160 kHz (0.16 / 7 / 50 Hz) ⁴ Low-pass filter: off / 2.5 / 5 / 10 / 20 / 50 / 100 kHz Tracking filter: off / slow / fast |

⁴ For Sense Remote decoder

Optical Specifications

| | |
|--------------------|--|
| Working distances | Variable working distance from 0 mm to >300 m |
| Laser wavelength | Measurement laser: 1550 nm, Target laser: 510-530 nm |
| Laser safety class | Measurement laser: output power: <10 mW, class 1 Target laser: output power: <1 mW, class 2 |
| Optics | Auto-, remote-, and manual focusing |

General Device Specifications

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|--|--|
| User interface output | Color screen 3.5" + 20 segment LED bargraph |
| User interface input | Touch screen, knobs with push-button, key switch (power) |
| Operating temperature | 0 to 40°C |
| Dimensions | Length×width×height (excluding handle and lens): 380×180×148 mm |
| Weight | 8 kg + objective lens |
| Power supply | 110 - 240 V AC (50-60Hz) or 12 V DC |
| Portable Operation | Possible |
| Portable power supply | 12 V DC portable charger ³ |
| Integrated signal generator ³ | - Produce various preset functions (sin, chirp, gaussian, ...) - Import of arbitrary functions and audio wave-files |

³ Optional available

Model Options - Decoders^{5,6}

⁵For details see decoder data-sheets. ⁶Variations from displayed models available on request.

Overview Model Options and Characteristics of the default Velocity Decoder⁷

| Model (Decoder) | Description | Measuring Ranges ⁵ | Max. Velocity | Frequency Bandwidth |
|--------------------------|--|-------------------------------|---------------|-----------------------------|
| Start (D-VD-0N) | Entry Model. | 7 | 2.5 m/s | 0 Hz – 100 kHz |
| Basis (D-VD-1N) | Versatile model with high resolution ⁸ | 8 | 5 m/s | 0 Hz – 500 kHz |
| Sense (D-VD-2N) | Smallest measurement range ± 2.45 mm/s and highest resolution ⁹ | 11 | 5 m/s | 0 Hz – 1 MHz |
| Sense Remote (D-VD-2N-R) | Sense features + extra low disp.-HPF 0.16 / 7 / 50 Hz (measure building vibrations, etc.). | 11 | 5 m/s | 0 Hz – 25 kHz |
| Sense Speed (D-VD-2N-12) | Sense features + additional measurement range at ± 12 m/s. | 12 | 12 m/s | 0 Hz – 1 MHz |
| High Speed (D-VD-3N) | Supports measurements up to highest velocities. | 11 | 25 m/s | 0 Hz – 2.5 MHz |
| High Frequency (D-VD-4N) | Supports measurements up to highest frequencies. | 9 | 12 m/s | 0 Hz – 10 MHz |
| Master (D-VD-5N) | The all-rounder: Includes all Sense, High Speed, and High Frequency features. | 14 | 25 m/s | 0 Hz – 10 MHz |
| Master+ (D-VD-5N-24) | Includes all Master features and has an additional super-high frequency upgrade | 14 | 25 m/s | 0 Hz – 24 MHz ¹⁰ |

⁷ All models feature by default a velocity decoder and optionally displacement and acceleration decoders

⁸ Best velocity res.: $12 \text{ nm s}^{-1}/\sqrt{\text{Hz}}$.

⁹ Best velocity res.: $1.7 \text{ nm s}^{-1}/\sqrt{\text{Hz}}$.

¹⁰ Velocity limited to 1 m/s at frequencies above 10 MHz.

Characteristics of the optional Displacement Decoder⁷

| Decoder | Required Vel.-Decoder | Number Measuring Ranges ⁵ | Smallest Range ¹¹ | Largest Range | Frequency Bandwidth |
|------------|-----------------------|--------------------------------------|------------------------------|---------------|-----------------------------|
| D-DD-0N | D-VD-0N | 19 | ±122.5 nm | ±122.5 mm | 0 Hz – 100 kHz |
| D-DD-1N | D-VD-1N | 19 | ±122.5 nm | ±122.5 mm | 0 Hz – 500 kHz |
| D-DD-2N | D-VD-2N | 19 | ±122.5 nm | ±122.5 mm | 0 Hz – 1 MHz |
| D-DD-2N-R | D-VD-2N-R | 19 | ±122.5 nm | ±1.225 m | 0 Hz – 25 kHz |
| D-DD-2N-12 | D-VD-2N-12 | 19 | ±122.5 nm | ±122.5 mm | 0 Hz – 1 MHz |
| D-DD-3N | D-VD-3N | 19 | ±122.5 nm | ±122.5 mm | 0 Hz – 2.5 MHz |
| D-DD-4N | D-VD-4N | 19 | ±122.5 nm | ±122.5 mm | 0 Hz – 10 MHz |
| D-DD-5N | D-VD-5N | 19 | ±122.5 nm | ±122.5 mm | 0 Hz – 10 MHz |
| D-DD-5N-24 | D-VD-5N-24 | 19 | ±122.5 nm | ±122.5 mm | 0 Hz – 24 MHz ¹⁰ |

¹¹ Best displacement resolution: 0.05 pm.

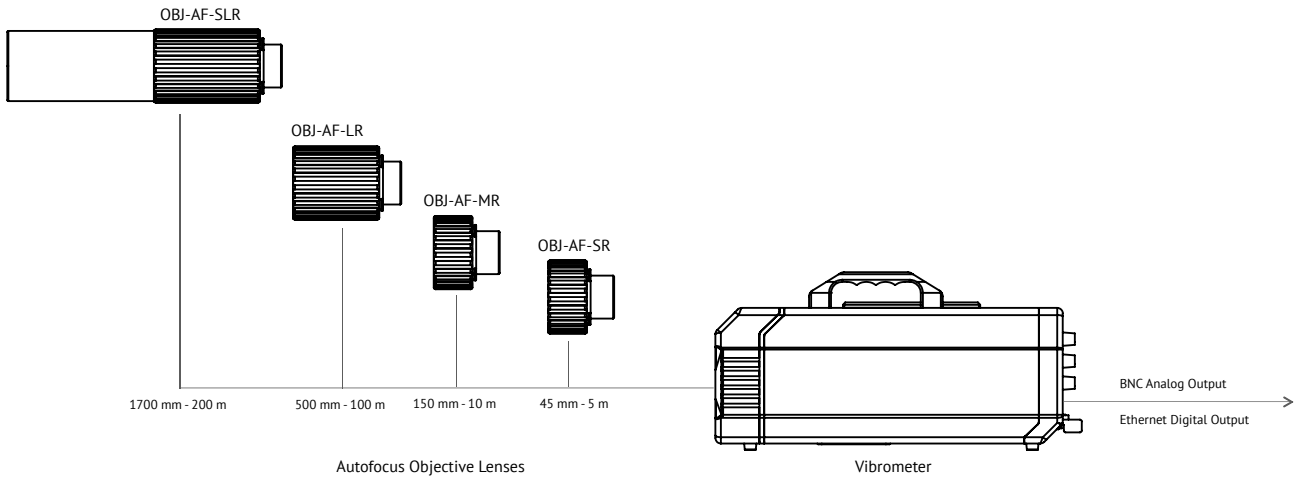
Characteristics of the optional Acceleration Decoder⁷

| Decoder | Required Vel.-Decoder | Number Measuring Ranges ⁵ | Smallest Range ¹² | Largest Range | Frequency Bandwidth |
|------------|-----------------------|--------------------------------------|------------------------------|---------------|-----------------------------|
| D-AD-0N | D-VD-0N | 7 | ±392 g | ±1.6 Mg | 0 Hz – 100 kHz |
| D-AD-1N | D-VD-1N | 8 | ±392 g | ±1.6 Mg | 0 Hz – 500 kHz |
| D-AD-2N | D-VD-2N | 11 | ±3.9 g | ±3.2 Mg | 0 Hz – 1 MHz |
| D-AD-2N-R | D-VD-2N-R | 11 | ±3.9 g | ±80 kg | 0 Hz – 25 kHz |
| D-AD-2N-12 | D-VD-2N-12 | 12 | ±3.9 g | ±7.6 Mg | 0 Hz – 1 MHz |
| D-AD-3N | D-VD-3N | 11 | ±392 g | ±39.2 Mg | 0 Hz – 2.5 MHz |
| D-AD-4N | D-VD-4N | 9 | ±392 g | ±76.8 Mg | 0 Hz – 10 MHz |
| D-AD-5N | D-VD-5N | 14 | ±3.9 g | ±78.4 Mg | 0 Hz – 10 MHz |
| D-AD-5N-24 | D-VD-5N-24 | 14 | ±3.9 g | ±78.4 Mg | 0 Hz – 24 MHz ¹³ |

¹² Best acceleration resolution: $1.8\mu\text{g}/\sqrt{\text{Hz}}$.

¹³ Acceleration limited to 15.3 Mg at frequencies above 10 MHz.

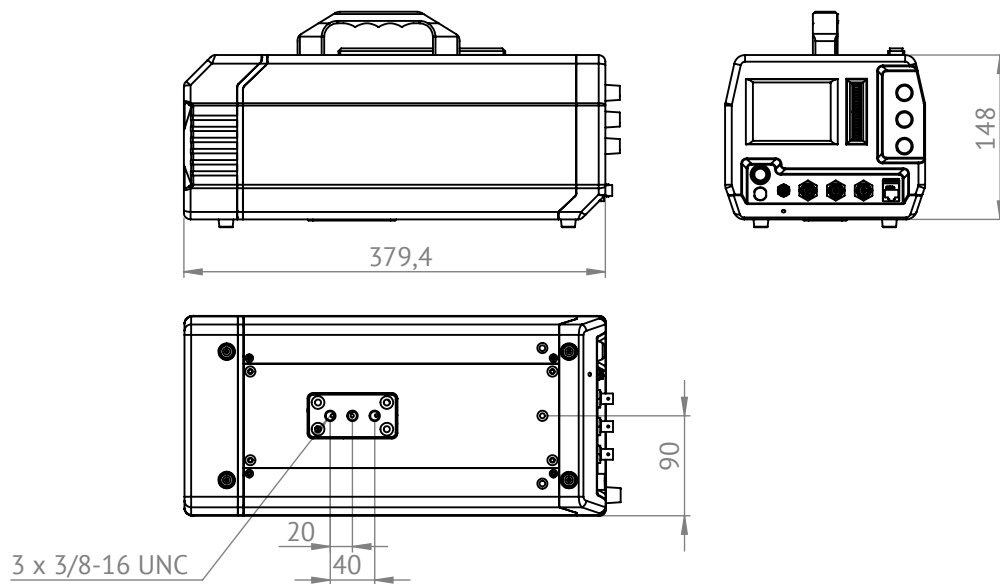
Set-up



Objective lens








| Specification | Short-Range Autofocus | Mid-Range Autofocus | Long-Range Autofocus | Super-Long Range Autofocus |
|---------------------------------|-----------------------|---------------------|----------------------|----------------------------|
| Focal length (mm) | 25 | 50 | 100 | 200 |
| Min. stand-off distance (mm) | 45 | 150 | 500 | 1700 |
| Min. Spot size in μm | 20 | 25 | 53 | 69 |
| Working distance | 45 mm ... 5 m | 150 mm ... 10 m | 500 mm ... 100 m | 1.7 m ... 200 m |

Dimension of the Vibrometer




Accessories

^S Standard included, ^O Optional available

| | | |
|---|--|---|
|  | <p>Transport Case for Single Point Vibrometer Stable and waterproof <i>Peli</i> case for safe keeping and transport of vibrometer. External dimension (L x B x H): 61.9 x 49.2 x 22.3 cm</p> | S |
|  | <p>Transport Bag Compact und light transport bag for outdoor measurements or transport as carry-on baggage in an plane.</p> | O |
|  | <p>Telescope For measurements from a greater distance, a telescope makes it easier to find the measuring point. The telescope can be easily mounted on the gauge rail at the top of the vibrometer.</p> | O |
|  | <p>IR-Camera For digital visualizing of the laser point. The camera can be easily mounted on the gauge rail at the top of the vibrometer.</p> | O |
|  | <p>IR-Detector Card Transforming the not-visible infrared light into a spot of visible light.</p> | S |
|  | <p>Mobile Battery Portable battery charger, external battery power bank. For powering the vibrometer when performing outdoor measurements.</p> | O |
|  | <p>Tripod with Fluid Head Precisely align your vibrometer with high quality tripods by <i>Manfrotto</i>.</p> | O |

Software

| | | |
|---|---|---|
|  | <p>OptoGUI Analysis Software Software for data acquisition, analysis and remote control. Live animation of measured time and frequency data.</p> | O |
|---|---|---|



OptoGUI software includes

| | | |
|----------------------------|--|----------|
| Remote control | Remotely control all vibrometer settings via ethernet. | S |
| Read-out | Read out data via ethernet with up to 80 MS/s | S |
| Time data | Live animation of measured vel./disp./accel. data | S |
| Export data | Export time data as .csv, .h5, or .mat files | S |
| Fourier-Transformation | -Perform the Fast-Fourier-Transformation of the data while measuring -Display the measured time data in the frequency-domain (spectrum) -FFT can be calculated with up to 8 Mio. FFT lines | S |
| Peak identification | Automatically identify signal peaks in the frequency spectrum | S |
| Waterfall Chart FFT | Show a live waterfall chart of the FFTs of the ongoing measurements | S |
| Fourier boundaries | Limit live FFT-calculation to certain time ranges of the time data | S |
| Signal trigger | Trigger your measurement with the vel., disp., or accel. signal | S |
| External trigger | Trigger your measurement with an external TTL signal (3.3 V) | S |
| Multiple traces | Record and recall multiple traces of the vel./disp./accel. time data | S |
| Arbitrary signal generator | Import file formats: .csv ASCII- or .wav audio files Pre-defined signals: sin, rectangle, chirp, random, ... | S |

Maintenance Specials

Warranty

| | | |
|--------------------|--|----------|
| Warranty | 12 month warranty for all not self-inflicted defects | S |
| Warranty extension | Extension of standard warranty to 24 months | 0 |

Software Updates

| | | |
|----------------------|--|----------|
| Software maintenance | Free software updates within warranty period | S |
| Extended maintenance | Additional extension of software updates by 12+ months | 0 |

Hardware Maintenance

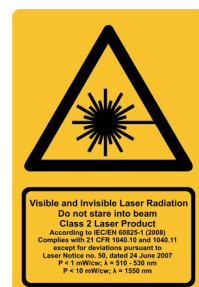
| | | |
|--------------------------|--|----------|
| Hardware Maintenance | Free hardware maintenance within warranty period | S |
| Extended maintenance | Additional extension of hardware maintenance by 12+ months | 0 |
| Recalibration & cleaning | Cleaning & realignment of optical parts, check of laser output power, check integrity of fiber, redo factory calibration | 0 |

Laser product label

DO NOT STARE INTO BEAM Class 2 Laser Product

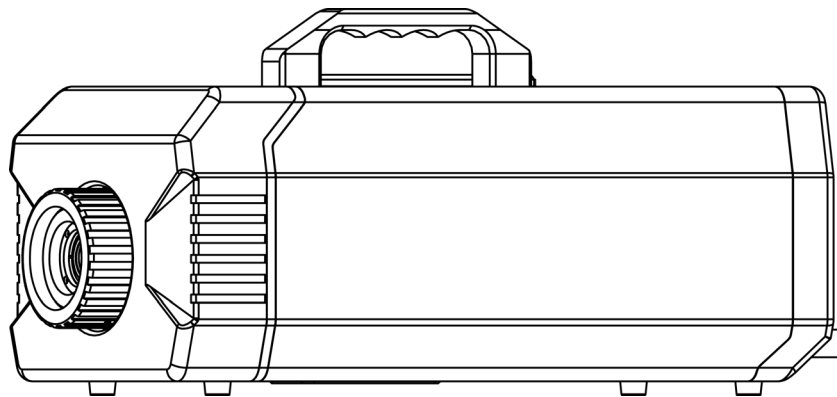
Laser CLASS 1: invisible, $\lambda=1550$ nm, output power: <10 mW

Laser CLASS 2: visible, green laser beam, $\lambda=510-530$ nm,
output power: <1 mW



DIGITAL LASER DOPPLER VIBROMETER

optomet.
LASER VIBROMETRY



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