

Multi Channel Fiber



optomet.

LASER VIBROMETRY



3D-Single Point

Multi Channel Fiber

- Up to 4 x channels
- Differential measurements

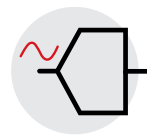


- SMART Laser Doppler Vibrometer for non-contact vibration measurements
- Optomet dual-fiber technology for optimal signal quality and maximum flexibility
- Up to four interferometers for simultaneous measurements at up to four points
- Synchronization with other SMART devices
- Versatile 7-inch touch display
- Improved connectivity: Wi-Fi, Bluetooth & USB

# SMART MULTI-FIBER

Modular Multi-Fiber system - flexible measurement solution: adaptable, precise, and ideal for diverse industrial applications allowing up to four simultaneous non-contact vibration measurements.

# General specifications

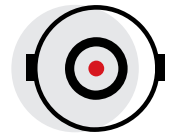


## Overview

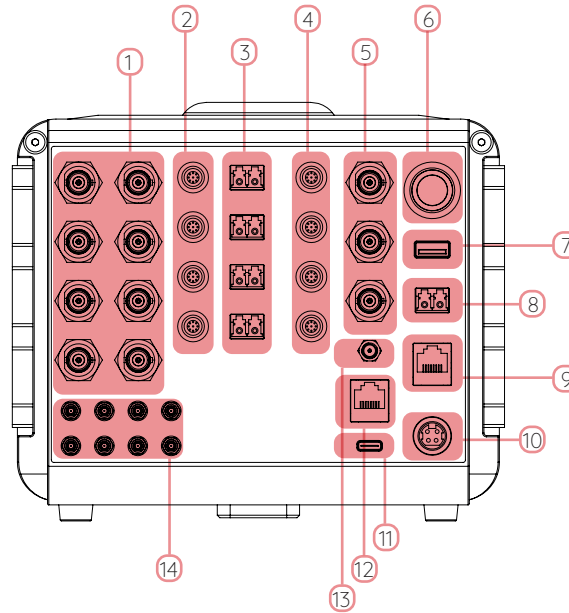
|                          |  |
|--------------------------|--|
| Measured quantities      | Velocity, displacement, acceleration   |
| Max. frequency bandwidth | DC to 50 MHz   |
| Frequency range          | Can be chosen individually using a freely configurable band-pass filter for velocity, displacement and acceleration signals  |
| Max. velocity            | 50 m/s   |
| Measurement ranges       | Measurement range limits can be freely adjusted between <ul style="list-style-type: none"><li>• 1 mm/s and 50 m/s for velocity</li><li>• 10 nm and 100 m for displacement</li><li>• 10 m/s<sup>2</sup> and 100 Mio. m/s<sup>2</sup> for acceleration</li></ul> |
| Signal processing        | Digital (FPGA based)   |
| Filter                   | Low-pass and high-pass filters are defined by the selected frequency range<br>Tracking filter: off / slow / fast   |
| User interface           | 7" Full HD+ touchscreen with 1000 nits peak brightness   |
| Operating temperature    | 0 °C to 40 °C  |
| Dimensions               | Length × width × height (excluding fiber head): 308 × 192 × 152 mm   |
| Weight                   | ~ 3.3 kg to 4.2 kg + fiber head  |
| Optical fiber cable      | 2 m by default, optionally available with fiber cables up to 50 m length   |
| Power supply             | 100 - 240 V AC (50-60 Hz) or 12 V DC   |
| Portability              | Convenient all-in-one design for seamless portability and simple setup   |
| Storage temperature      | -10 °C to 65 °C  |
| Relative humidity        | Max. 80 %, non-condensing  |
| Calibration interval     | Every 24 months (recommended)  |

The exact features depend on the configured options.

# Connectivity



## Schematic



|   |                                     |    |  |
|---|-------------------------------------|----|--|
| 1 | Analog signal outputs (BNC)         | 8  | Optical communication port                   |
| 2 | Fiber head power output             | 9  | Ethernet port: for device communication/data |
| 3 | Optical fiber connector (LC-Duplex) | 10 | Power input                                  |
| 4 | LEMO signal inputs (12 Channels)    | 11 | USB port (Type-C)                            |
| 5 | BNC HF signal inputs (up to 50 MHz) | 12 | Ethernet port: for device communication/data |
| 6 | Power button                        | 13 | Antenna connector                            |
| 7 | USB port (Type-A)                   | 14 | Multi-purpose SMB ports                      |

## Inputs and outputs

|                      | Connector type  | Characteristics   | Description   |
|----------------------|---|---|---|
| Optical fiber        | Up to 4 x fiber quick connects (LC-Duplex)<br>Up to 4 x fiber head power (LEMO) | Connect up to 4 x fiber heads or 1 x 3D-Fiber head  | <ul style="list-style-type: none"> <li>Collect vibration data with all four fiber heads simultaneously</li> <li>Separate placement of fiber heads and device for maximum flexibility in your applications</li> <li>Choice of compact yet robust fiber heads for measurements in harsh environments</li> <li>Superior signal quality due to the unique Optomet dual-fiber technology with separate optical paths for incoming and outgoing signal</li> </ul> |
| Analog signal inputs | Up to 4 x LEMO<br>Up to 4 x 3 = 12 channels                                     | $\pm 1\text{ V} / \pm 10\text{ V}$ (switchable)<br>24-bit A/D converter per channel<br>1.5 MSPS sample rate | <ul style="list-style-type: none"> <li>Synchronous reference signal recording up to 750 kHz on 12 channels</li> <li>Support for IEPE (Integrated Electronic Piezoelectric), TEDS and DC/AC coupling</li> <li>Input impedance: 1 MOhm    20 pF (optional 1 GOhm    3 pF)</li> </ul>  |

|                         | Connector type                                | Characteristics   | Description  |
|-------------------------|---|---|--|
| Analog HF signal inputs | Up to 3 x BNC                                 | ± 2 V<br>14-bit A/D converter<br>312.5 MSPS sample rate | <ul style="list-style-type: none"> <li>Synchronous HF signal recording up to 50 MHz on 3 channels</li> <li>Input impedance: 50 Ohm</li> </ul>  |
| Analog signal outputs   | Up to 8 x BNC<br>Up to 8 independent channels | ± 2 V<br>16-bit D/A converter<br>312.5 MSPS sample rate | <ul style="list-style-type: none"> <li>Versatile signal outputs: Analog velocity, displacement, acceleration and arbitrary signal generator</li> <li>Generate various preset functions (sine, chirp, gaussian, ...) or load arbitrary signals</li> <li>Source impedance: 50 Ohm</li> </ul> |
| Trigger inputs          | 2 x SMB                                       |   | <ul style="list-style-type: none"> <li>Digital external trigger input for the device</li> <li>Input impedance: 50 Ohm</li> </ul>   |
| Trigger outputs         | 2 x SMB                                       |   | <ul style="list-style-type: none"> <li>Digital trigger output for external devices</li> <li>Source impedance: 50 Ohm</li> </ul>  |

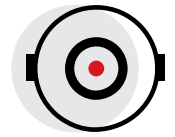
## Digital interface

|                          | Connector type      | Characteristics                             | Description  |
|--------------------------|---------------------|---|--|
| Ethernet (copper)        | Up to 2 x RJ45      | 1 Gbit/s data rate                          | <ul style="list-style-type: none"> <li>Stream the measurement data over Ethernet with up to 312.5 MSPS and 48-bit</li> <li>Digital remote control of device settings</li> <li>Interface with digital data acquisition and analysis software SMART Lab</li> <li>Use your device as control hub for your Ethernet-based equipment</li> </ul>                                       |
| Ethernet (fiber optical) | Up to 2 x LC-Duplex | 10 Gbit/s / 1 Gbit/s data rate (switchable) | <ul style="list-style-type: none"> <li>Stream the measurement data over Ethernet with up to 312.5 MSPS and 48-bit</li> <li>Digital remote control of device settings</li> <li>Interface with data acquisition and analysis software SMART Lab</li> <li>PTP-based synchronization with other SMART series devices</li> <li>Up to 20 km range (up to 160 km on request)</li> </ul> |

## Connectivity options

|                                 | Connection type                            | Description   |
|---------------------------------|--|---|
| Synchronization                 | 4 x SMB                                    | <ul style="list-style-type: none"> <li>2 x synchronization inputs (Input impedance: 50 Ohm, 3.3 V or 5 V)</li> <li>2 x synchronization outputs (Source impedance: 50 Ohm, 3.3 V)</li> <li>Frequency synchronization with external devices using 10 MHz signals</li> <li>Frequency &amp; phase synchronization with external devices via PPS (Pulse per second)</li> </ul> |
| USB                             | 1 x USB-C (USB 3.2)<br>1 x USB-A (USB 3.0) | <ul style="list-style-type: none"> <li>Connect USB devices such as cameras, keyboards or storage devices to the vibrometer for direct data recording</li> </ul>   |
| Wireless                        | Bluetooth 5.2<br>Wi-Fi 7                   | <ul style="list-style-type: none"> <li>Bluetooth: connect human interface devices such as keyboard, mouse or headphones to the vibrometer</li> <li>Wi-Fi: control your vibrometer wirelessly and stream measurement data over the air</li> </ul>  |
| GNSS-module                     | GPS, Galileo, GLONASS and BeiDou           | <ul style="list-style-type: none"> <li>Precise absolute time and position information using global navigation satellite systems (GNSS)</li> <li>External antenna connector</li> </ul>   |
| Inertial measurement unit (IMU) |  | <ul style="list-style-type: none"> <li>Synchronous recording of the vibrometer's acceleration and orientation</li> <li>Vibration monitoring of vibrometer enables detection of disturbances</li> <li>More accurate alignment with your test object</li> </ul>   |

# Configurable options



## Frequency options

|                      |   |   |
|----------------------|---|---|
| Frequency 250 kHz    | Measure frequencies up to 250 kHz, covering the entire acoustic range and beyond  | S |
| Frequency 5 MHz      | Measure frequencies up to 5 MHz   | O |
| Frequency 15 MHz     | Measure frequencies up to 15 MHz  | O |
| Frequency 25 MHz     | Measure frequencies up to 25 MHz  | O |
| Frequency 35 MHz     | Measure frequencies up to 35 MHz  | O |
| Frequency 50 MHz     | Measure frequencies up to 50 MHz to the limit of what is technologically feasible | O |
| Frequency upgrade M  | Upgrade the frequency limitation of any option by 500 kHz                         | O |
| Frequency upgrade L  | Upgrade the frequency limitation of any option by 1 MHz                           | O |
| Frequency upgrade XL | Upgrade the frequency limitation of any option by 5 MHz                           | O |

## Velocity options

|                         |  |   |
|-------------------------|--|---|
| Basis                   | Continuously adjust the velocity measurement range between 10 mm/s and 15 m/s  | S |
| High Speed              | Measure velocities up to 25 m/s  | O |
| Pro                     | Measure velocities up to 35 m/s  | O |
| Master                  | Measure velocities up to 50 m/s  | O |
| Ultra                   | Measure velocities up to 50 m/s and get access to the high resolution upgrade with the smallest velocity measurement range of 1 mm/s | O |
| High-resolution upgrade | Smallest velocity measurement range 1 mm/s   | O |
| Velocity upgrade M      | Increase the maximum velocity of any velocity option by 2.5 m/s  | O |

## Measurement quantities

|              |   |   |
|--------------|---|---|
| Velocity     | Measure vibrational velocities  | S |
| Displacement | Measure vibrational displacements with continuously adjustable ranges from 10 nm to 100 m                                   | O |
| Acceleration | Measure vibrational accelerations with continuously adjustable ranges from 10 m/s <sup>2</sup> to 100 Mio. m/s <sup>2</sup> | O |







## Warranty

|                    |   |   |
|--------------------|---|---|
| Waranty            | 12 months                                   | S |
| Warranty extension | Extension of standard warranty by 12 months | O |

## Maintenance

|                          |  |   |
|--------------------------|--|---|
| Extended maintenance     | Additional extension of hardware maintenance by 12+ months   | O |
| Recalibration & cleaning | Check, cleaning & realignment of optical parts, check of laser output power, and factory calibration | O |

## Accessories

|                           |  |   |   |
|---------------------------|--|---|---|
| Transport case            | <ul style="list-style-type: none"> <li>Stable and waterproof Peli case for safe storage and transport of the vibrometer</li> <li>External dimensions (L x W x H): 62 x 49 x 22 cm</li> </ul> | S |   |
| Fiber head transport case | Safely stow and transport your fiber head in a high-quality Peli case  | S |  |
| Transport bag             | Compact and light transport bag for outdoor measurements   | O |  |
| Tripod with fluid head    | Precisely align your vibrometer with high-quality tripods by Manfrotto   | O |  |
| Positioning stage         | Precisely align your Fiber measurement head with a precise positioning stage   | O |  |
| IR-detector card          | Transforming the invisible infrared light into a spot of visible light   | S |  |

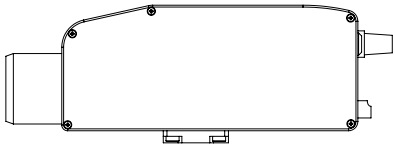
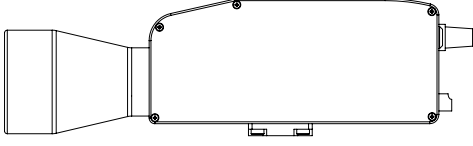
# Optical specifications



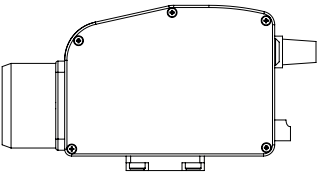
## Overview

|                    |  |
|--------------------|--|
| Working distances  | <ul style="list-style-type: none"> <li>• Variable working distance from 25 mm to 100 m</li> <li>• Choice of various fiber heads</li> </ul>                       |
| Laser wavelength   | Measurement laser: 1550 nm, Target laser: 510-530 nm   |
| Laser safety class | <ul style="list-style-type: none"> <li>• Measurement laser: output power: &lt;10 mW, class 1</li> <li>• Target laser: output power: &lt;1 mW, class 2</li> </ul> |
| Optics             | Auto-, and manual focusing   |

## Autofocus fiber heads

|  |   |  |
|--|---|--|
|  |  |  |
|  | Mid-Range Autofocus   | Long-Range Autofocus   |
|  | Dimensions (L x W x H): 159 mm x 43 mm x 68 mm (excluding lens)                     |  |
| Working distance                         | 135 mm to 10 m  | 450 mm to 100 m  |
| Min. stand-off distance (mm)             | 135   | 450  |
| Focal length (mm)                        | 50  | 100  |
| Spot size at min. stand-off distance (m) | 42  | 72   |

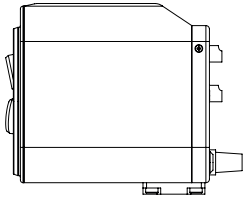
## Fixed focus fiber head

|  |                |                   |                       |
|---|----------------|-------------------|-----------------------|
| Compact fiber head with fixed working distance                                    |                |                   |                       |
| Dimensions (L x W x H): 94 mm x 43 mm x 68 mm (excluding lens)                    |                |                   |                       |
| Lens options  | Spot size ( m) | Focal length (mm) | Working distance (mm) |
| 25 mm   | 25             | 40                | 25                    |
| 37 mm   | 29             | 50                | 37                    |
| 64 mm   | 43             | 75                | 64                    |
| 89 mm   | 61             | 100               | 89                    |
| 139 mm  | 90             | 150               | 139                   |
| 189 mm  | 118            | 200               | 189                   |

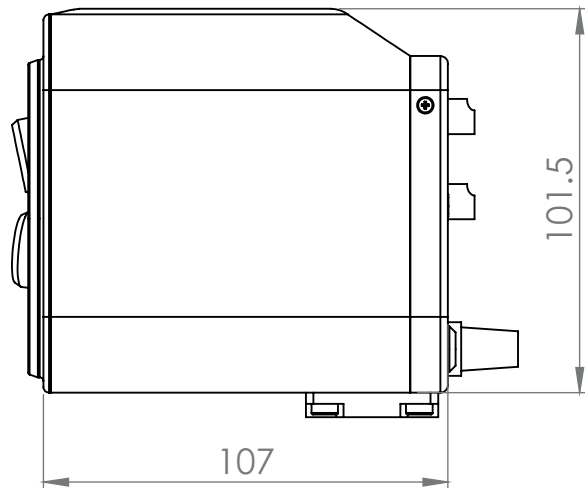
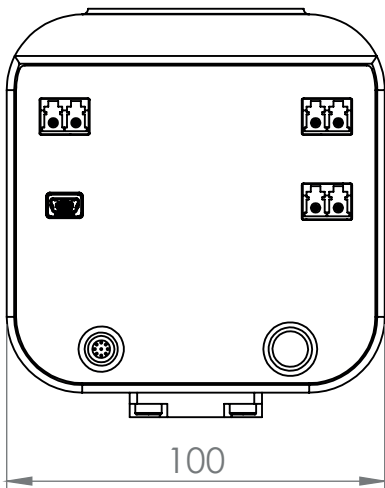
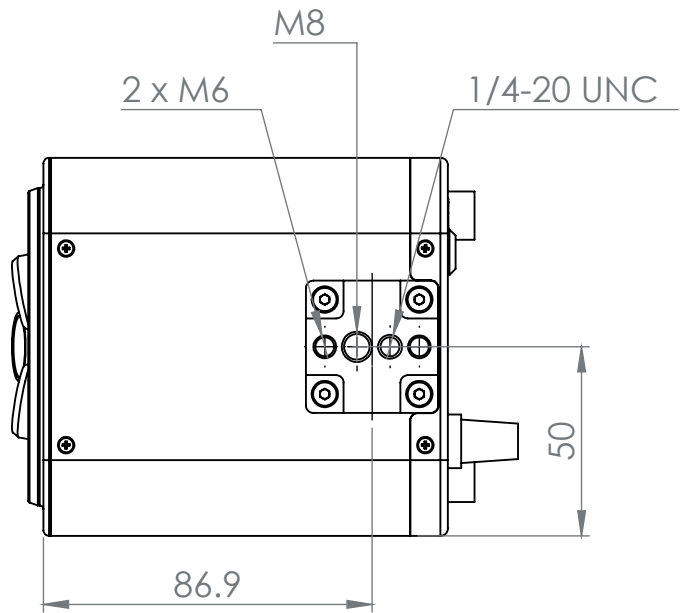


DO NOT STARE INTO BEAM Class 2 Laser Product  
 Laser CLASS 1: invisible,  $\lambda = 1550$  nm, output power: < 10 mW  
 Laser CLASS 2: visible, green laser beam,  $\lambda = 510-530$  nm, output power: < 1 mW

## 3D fiber head

|  |        |
|--|--------|
|  |        |
| Compact 3D fiber head with fixed working distance                                    |        |
| Dimensions (L x W x H): 107 mm x 100 mm x 102 mm (excluding lens)                    |        |
| Working distance   | 83 mm  |
| Focal length   | 100 mm |





# Software SMART Lab



## Highlights

- Lifetime license with no recurring costs
- Installation on any capable computer with Windows 10 / Windows 11
- 1 x license key included (via dongle or online license key)
- Analysis of measurement files for up to 3 users with a single software license
- Connection and control of multiple vibrometers simultaneously for reference, multipoint, and 3D vibration measurements
- Selection of measurement point on loaded 3D-model
- Convenient access to all data in a single software - from vibrometers to multiple reference sensors
- Seamless switching between time and frequency domain representation
- Multichannel arbitrary signal generator for generating predefined signals (sine, sine sweep, square, random, etc.) or custom signals from imported .csv or .wav files
- Real-time signal analysis and enhancement based on speckle tracking and intelligent averaging
- Calculation of various frequency functions: FRF, FFT, auto-spectrum, cross-spectrum, coherence
- Multithreading export of time data, all frequency functions, and reference channel data into the Universal File Format (.uff), Hierarchical Data Format (.hdf5), and MATLAB® file format (.mat)
- Save and load all settings and measurement data in Optomet File Format

## SMART Lab - Features

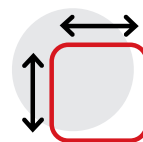
|                    |  |
|--------------------|--|
| Remote control     | <ul style="list-style-type: none"> <li>• All vibrometer settings via a single ethernet connection</li> <li>• Measurement and pilot laser: autofocus, pilot laser brightness</li> <li>• Multiple vibrometers at once for reference, multipoint and 3D vibration measurements</li> </ul>   |
| Acquisition module | <ul style="list-style-type: none"> <li>• Phase correct acquisition of vibrometer signal and reference channels</li> <li>• Convenient access to all your data in a single software - from vibrometers to multiple reference sensors</li> <li>• Live view of measured time and frequency data</li> <li>• Multi-channel arbitrary signal generator to generate predefined signals (sine, sine sweep, rectangle, random, etc.) or custom signals from imported .csv or .wav files</li> <li>• Triggering on measured signals or external triggers</li> <li>• Trace history to record and recall multiple traces of the velocity/displacement/acceleration data</li> </ul> |
| Analysis module    | <ul style="list-style-type: none"> <li>• Real-time Fast Fourier Transform (FFT) for responsive data analysis</li> <li>• Frequency domain representation with up to 536 Mio FFT lines</li> <li>• Fourier boundaries to limit FFT calculations to certain time ranges of the time data</li> <li>• Several window functions for FFT calculations, including rectangular, hanning, hamming, exponential</li> <li>• Phase correct calculation of the frequency response function (FRF)</li> <li>• Live Spectrogram of the ongoing measurements FFT's</li> </ul>   |
| Data export        | <ul style="list-style-type: none"> <li>• Export time and frequency data to .csv, .h5, or .mat files</li> <li>• Export time data as .wav audio file</li> <li>• Take screenshots from within our software and export with up to 4K resolution</li> <li>• Save projects to and load projects from the native file format</li> </ul>   |

SMART Lab runs on any modern computer with Microsoft Windows.

## SMART Lab - Software updates

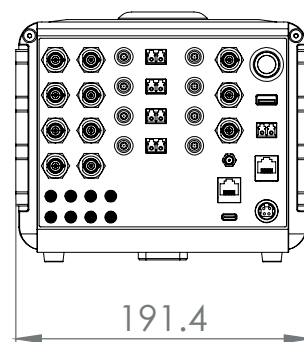
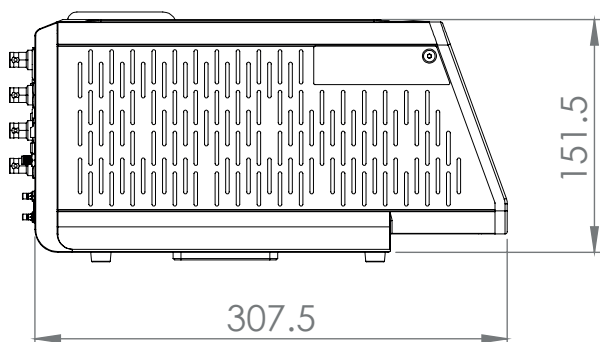
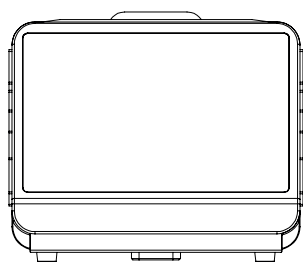
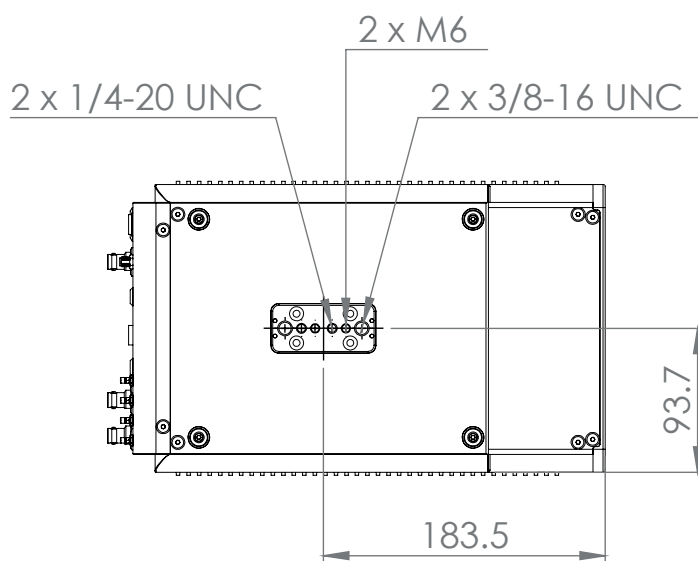
|  |   |
|--|---|
| 2 years of included software updates     | S |
| Extension of software updates by 2 years | O |

# Mechanical parameters

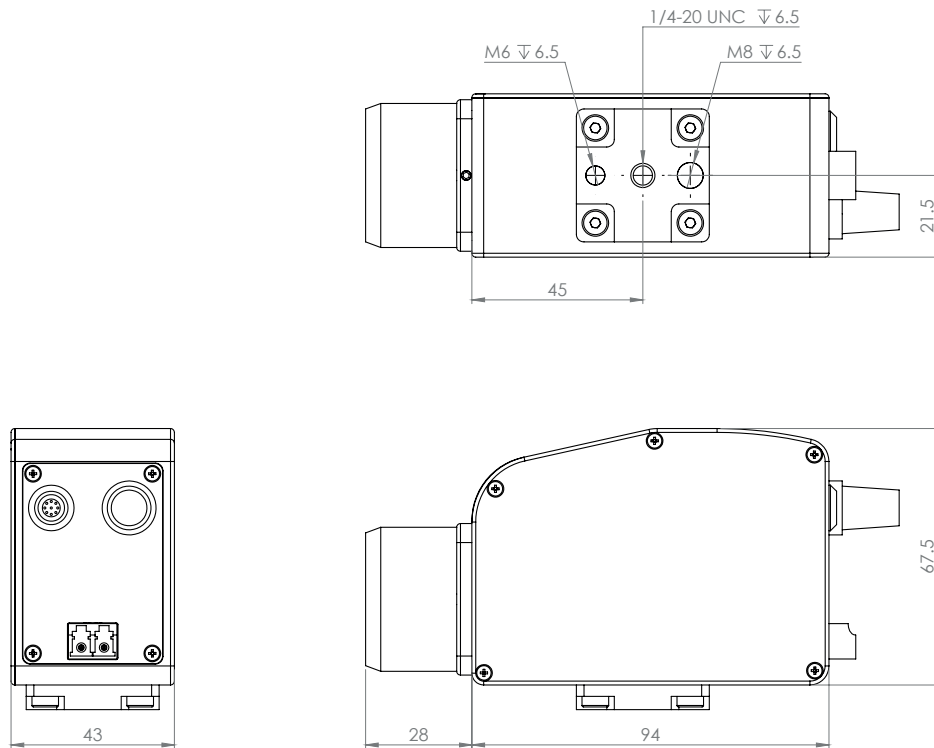


## SMART Multi-Fiber

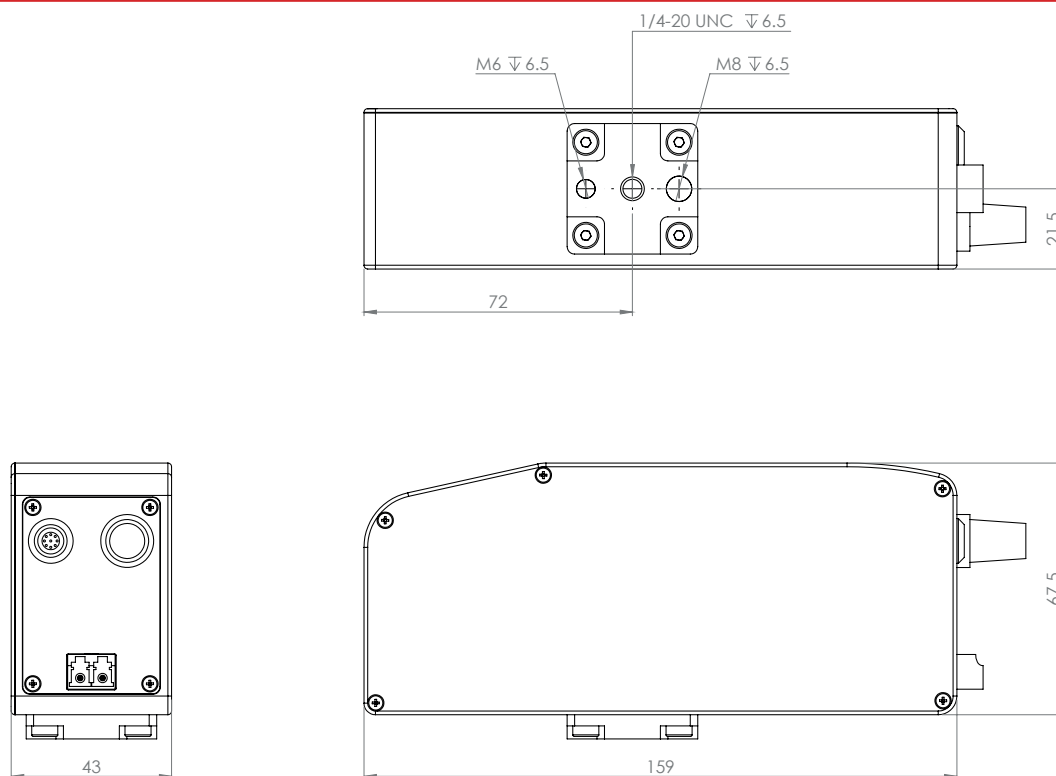
|                       |  |
|-----------------------|--|
| Dimensions            | Length x width x height (excluding fiber head): 308 x 192 x 152 mm |
| Weight                | ~ 3.3 kg to 4.2 kg + fiber head                                    |
| Operating Temperature | 0 °C to 40 °C  |
| Storage Temperature   | -10 °C to 65 °C  |
| Relative Humidity     | max. 80 %, non-condensing  |



## Fixed focus fiber head



## Autofocus fiber head



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LASER VIBROMETRY