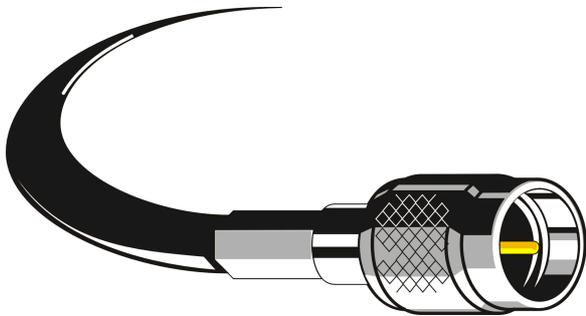


User Manual

Portable Digital Vibrometer

PDV 100



Warranty and Service

The warranty for this equipment complies with the regulations in our general terms and conditions in their respective valid version.

This is conditional on the equipment being used as it is intended and as described in this manual.

The warranty does not apply to damage caused by incorrect usage, external mechanical influences or by not keeping to the operating conditions. The warranty also is invalidated in the case of the equipment being tampered with or modified without authorization.

To return the equipment always use the original packaging. Otherwise we reserve the right to check the equipment for transport damage. Please mark the package as fragile and sensitive to frost. Include an explanation of the reason for returning it as well as an exact description of the fault. You can find advice on fault diagnosis in [chapter 6](#).

Trademarks

Brand and product names mentioned in this manual could be trademarks or registered trademarks of their respective companies or organizations.

Identification Labels

PDV 100



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1 Safety Information

1.1 Laser Safety

The light source of the PDV is a helium neon laser. It is important to understand that laser light has properties different from ordinary light sources. Laser light is generally extremely intense due to the beam's low divergence. Great care should be taken when handling lasers that the direct or reflected beam do not enter the eye. To ensure this, the following precautions have been taken:

- In general, Polytec equipment complies with the standards **IEC/EN 60825-1** and **US 21 CFR 1040.10** and **1040.11** except for deviations pursuant to Laser Notice no. 50, dated 26 July 2001.
- The optical output of the laser is less than 1 mW providing the equipment is used in the manner for which it was intended. This means that the PDV conforms with **laser class 2 (II)** and is generally very safe. Even when optimally focused, the laser light is not intense enough to harm the skin.
- The PDV is equipped with a **beam shutter** which can be used to block the laser beam during the warm-up phase or when the PDV is not in use, although switched on.
- The display on the laser vibrometer indicates whether the laser is active and thus whether there is potential danger from emitted laser beams.
- It is **not necessary to open the housing** when using the PDV as intended. Opening the housing will invalidate the warranty.

Please pay attention to the following **safety precautions** when using the PDV:

- Avoid looking directly into the laser beam with the naked eye or with the aid of mirrors or optical instruments!
- Only open the beam shutter when making measurements!
- To position the PDV, always switch the beam shutter off. Only when the PDV is roughly in place, open the beam shutter.
- Do not use any reflective tools, watches etc. when you are working in the beam path of the laser!

Caution!

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure!

1.2 Laser Warning Labels

Warning labels

The laser warning labels for the PDV are shown in [figure 1.1](#). In the countries of the European Union (EU), label 2 is affixed in the national language of the customer.

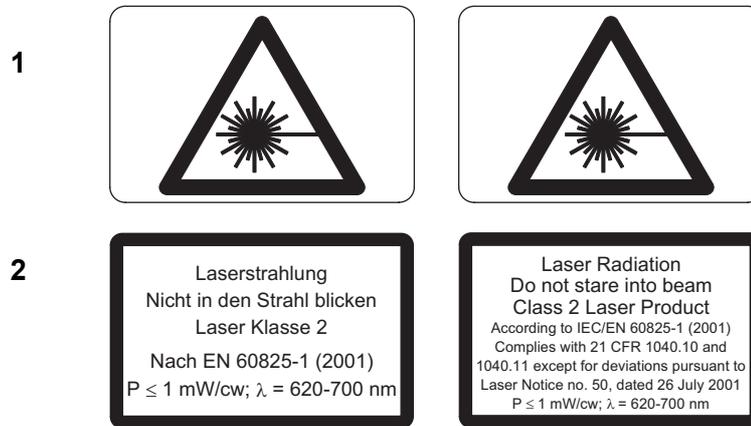


Figure 1.1: Laser warning labels for the PDV

Position

The position of the laser warning labels on the PDV is shown in [figure 1.2](#).

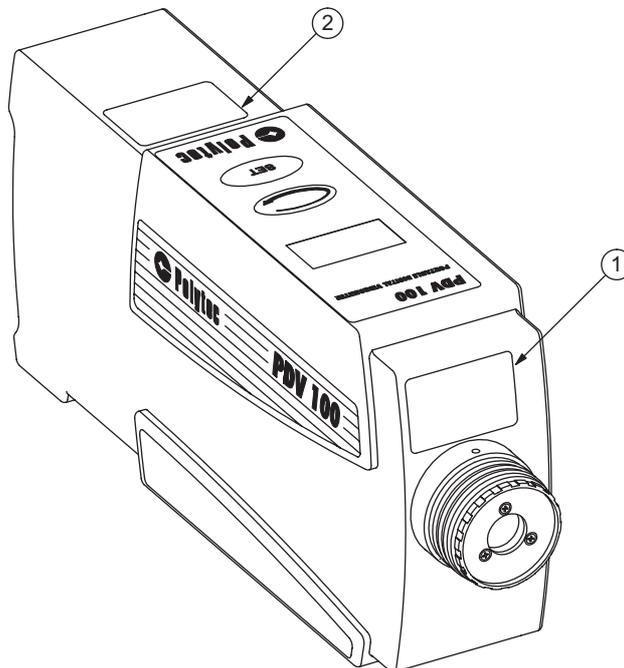


Figure 1.2: Position of the laser warning labels on the PDV

1.3 Electrical Safety

PDV The PDV is designed to be used powered by a low voltage (nominally 12VDC) provided externally, which is accessible for constructional reasons.

Due to the insulation used and the encased construction, the high-voltage of the laser created internally can not be accessed, even in the case of malfunction. Protective grounding of the completely closed metal housing is therefore not necessary.

Power supply To reduce the risk of an electric shock or malfunction, only use the plug-in power supply PDV-AC provided by the manufacturer. Do not expose the plug-in power supply to rain or moisture.

It is not necessary to open the housing when using the power supply as intended. Always use the correct plug adapter.

Battery charger (optional) Lithium ion batteries require a very strict compliance with the charging parameters. For this reason only use the battery charger PSV-CH provided by Polytec. Using any other battery chargers may result in fire or explosion of the battery.

Note!

When loading the batteries it is **recommended** to open the cover of the carrier bag to ensure unimpeded air circulation.

1.4 safety when using lithium ion batteries

Warning!

Incorrect use of the battery may result in an excessive rise in temperature (heat accumulation), fire or explosion leading to serious personal injury!

Please pay attention to the following **safety precautions** when using lithium ion batteries:

- Do not throw the battery into fire or expose it to extreme heat!
- Do not leave the battery in the direct sun, near a radiator, or in a closed car on a warm day!
- Do not reconstruct, disassemble, deform, or short-circuit the battery!
- Do not touch the terminals of the battery with metal objects such as necklaces, keys, coins and hairpins! Replace the protective cap on the battery cable connector if the battery is being stored.
- Do not allow the battery to come into contact with sea water or water of any kind!
- Do not drop the battery or subject it to great shocks!
- Do not use any batteries which are emitting a fluid or which show external damage.

1.5 Safety when Charging the Lithium Ion Battery

Warning!

Incorrect behavior when charging the battery may result in an excessive rise in temperature (heat accumulation), fire or explosion leading to serious personal injury!

Please pay attention to the following **safety precautions** when charging the lithium ion battery:

- To charge the battery, only use the battery charger provided by the manufacturer!
- Never connect the battery directly to a mains supply or an on-board plug socket!
- While charging, do not place the battery in direct sunlight. If the battery gets too hot, a built-in safety device is activated, preventing the battery from charging further. Heating the battery can destroy this safety device and can cause an explosion or ignition of the battery.
- If the given charge time for the battery is significantly exceeded without the battery reaching full capacity, please abort the charging process. Doing so may cause the battery to overheat, explode, or ignite.

2 Introduction

2.1 Area of Application

Polytec's **Portable Digital Vibrometer PDV** is used for non-contact measurement of surface vibrational velocities. The PDV is a compact, portable laser vibrometer with state-of-the-art design of optics and signal processing. The PDV is shown in [figure 2.1](#).

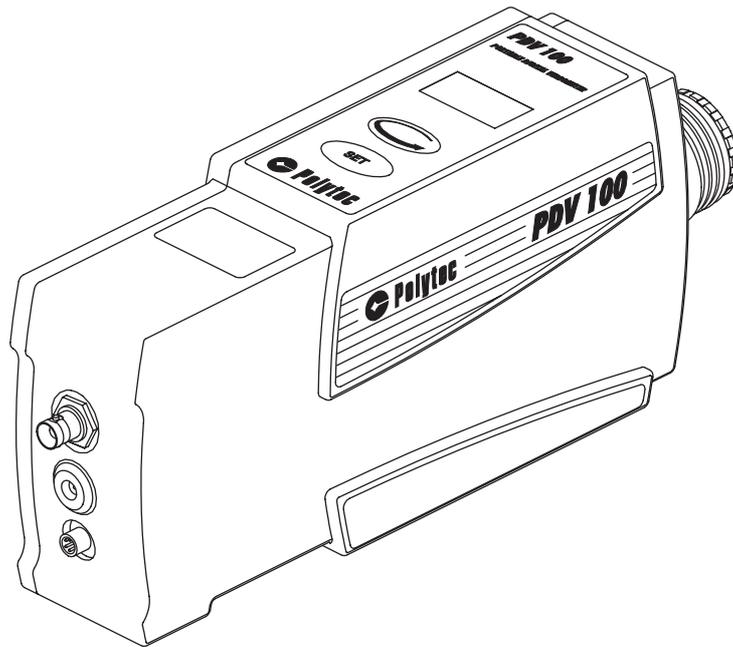


Figure 2.1: View of the PDV 100

In the frequency range from 0.05Hz to 22kHz the handy PDV allows you to realize measurement accuracy which you previously needed a stationary measurement device in a calibration laboratory to achieve. With the three measurement ranges which cover a velocity range of 0.05 μ m/s to 0.5m/s and with precise digital filters, you can optimally adapt the PDV to nearly all applications in the acoustic frequency range.

2.2 Measurement Principle

The PDV measures vibrational velocity according to the heterodyne interferometer principle, which generates a high-frequency carrier signal at the photo detector with the aid of a Bragg cell. The beam of a helium neon laser is pointed at the vibrating object and scattered back from it. Velocity and amplitude of a vibrating object generate a frequency or phase modulation due to the Doppler effect. The object beam is thereby subjected to a small frequency shift which is described as the Doppler frequency f_D . The Doppler frequency is a function of the velocity component v in the direction of the object beam according to

$$f_D = 2 \cdot \frac{v}{\lambda}, \quad \text{Equation 2.1}$$

whereby λ is the laser wavelength. The Bragg cell also generates an optical frequency shift f_B in the reference beam (70 MHz). After superimposing the measurement and the reference beam, an electrical signal is generated at the photo detector with the instantaneous frequency

$$f_C(t) = f_B + f_D(t) = f_B + 2 \cdot \frac{v(t)}{\lambda}. \quad \text{Equation 2.2}$$

This is a carrier frequency signal with the center frequency f_B , which is frequency modulated with the signed Doppler frequency $f_D(t)$. Through frequency demodulation the velocity signal can be decoded. In the PDV the demodulation of the Doppler signal is purely based on a digital process. In contrast to the conventional vibrometers which use analog, this then means that the measurement accuracy is virtually independent of aging and environmental influences. State-of-the-art DSP technology makes it possible to realize excellent measurement system characteristics, despite the compact design and minimal energy consumption.

By using a serial Interface proven in digital audio technology, the output signal can be fed into the digital inputs of modern recording devices or signal analyzers without any loss of accuracy. For the conventional type of signal processing, an analog signal output with 24 bit amplitude resolution is also available.

3 First Steps

3.1 Unpacking and Inspection

Unpacking The scope of supply consists of the following components:

- laser vibrometer PDV 100
- plug-in power supply PDV-AC
- carrier bag
- digital audio cable (Triax/RCA)
- 1 Allen key size 1.5mm
- 1 sheet reflective film 3M Scotchlite Tape® (enclosed in the manual)

optional

- carrier bag PDV-BS with integrated lithium ion battery PDV-LI (rechargeable) and battery charger PDV-CH
- motor vehicle supply cable PDV-DC for the PDV being operated at a 12V on-board plug socket or a motor vehicle cigarette lighter
- tripod with 3-axes head VIB-A-T01
- tripod with fluid stage VIB-A-T02

Caution!

Handle the front optics with care. Dirt may only be removed using a soft, dry cloth, an optics brush and bellows!

Inspection Please pay attention to the following steps when unpacking:

1. After unpacking, check all components for external damage (scratches, loose screws etc.).
2. Check the packaging for signs of unsuitable handling during transport.
3. In the case of a wrong delivery, damage or missing parts, inform your local Polytec representative immediately and give them the serial number of the instrument. The identification label can be found on the underside of the instrument and also on the inside cover of this manual.
4. Carefully retain the original packaging in case you have to return the instrument.

After unpacking, carry out a first functional test as described in [section 3.4](#).

3.2 Operating and Maintenance Requirements

Ambient conditions	The PDV can be used in normal climatic conditions (refer to chapter 7). Avoid condensation on the optical components caused by a rapid change in temperature. Avoid exposure to direct sunlight to prevent the instrument from overheating.
Mains connection	The plug-in power supply provided for the PDV has a wide range input and can be connected to all mains voltages with nominal values between 100V and 240V.
Cooling	It is essential to ensure unimpeded air circulation around the PDV and protect it from radiant heat. With high ambient temperatures, mount it on cooling metal surfaces if possible to minimize heat build-up.
Connecting cable	Make sure that all jacks are connected properly and firmly. Protect all connecting cables from mechanical damage and from high temperatures.
Warming-up	The optical components in the PDV require a warm-up period of approximately 20 minutes until the optimal operating temperature has been reached.
Front optics	Handle the front optics with care. Dirt may only be removed using a soft, dry cloth, an optics brush and bellows.
Cleaning	The housing surfaces of the instrument can be cleaned with mild detergent solutions or ethanol.
Opening up the equipment	It is not necessary to open the housing when using the equipment as intended and will invalidate the warranty.
Battery and battery charger (optional)	The lithium ion battery for the PDV can be used at temperatures of between 0°C and +40°C (32°F and 104°F). Ensure a temperature of between +10°C and +30°C (50°F and 86°F) when charging the batteries.

3.3 Control Elements

View from above

The view from above of the laser vibrometer is shown with the control elements in [figure 3.1](#).

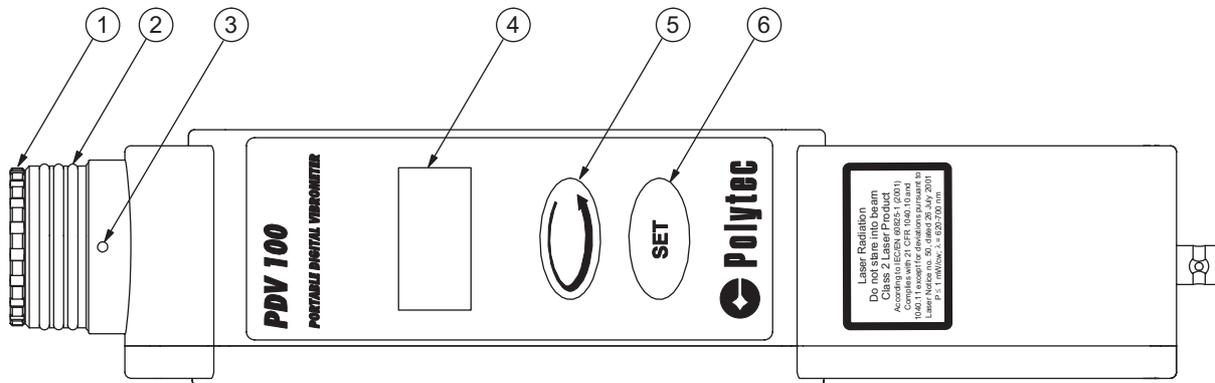


Figure 3.1: View from above of the laser vibrometer

1 Beam shutter

Beam shutter to block the laser beam (refer to [section 5.2](#))

Warning!

Only open the beam shutter when you are making measurements!

2 Focusing ring

Ring to focus the laser beam (refer to [section 5.3](#))

3 Clamping screw for the focusing ring

Allen screw to fix the focusing ring after focusing the laser beam (refer to [section 5.3](#))

4 Liquid Crystal Display (LCD) with background lighting

The display shows the settings of the vibrometer. The organization of the display and how to use it to operate the vibrometer is described in detail in [section 5.6](#).

5 Selection key

Using this key the cursor  is moved in a circle on the display from one parameter to the next. The cursor is used to select the parameter which should be changed (refer to [section 5.6](#)).

6 SET key

Using this key the setting of the selected parameter is changed (refer to [section 5.6](#)).

Rear view

The rear view of the laser vibrometer is shown with the control elements in [figure 3.2](#).

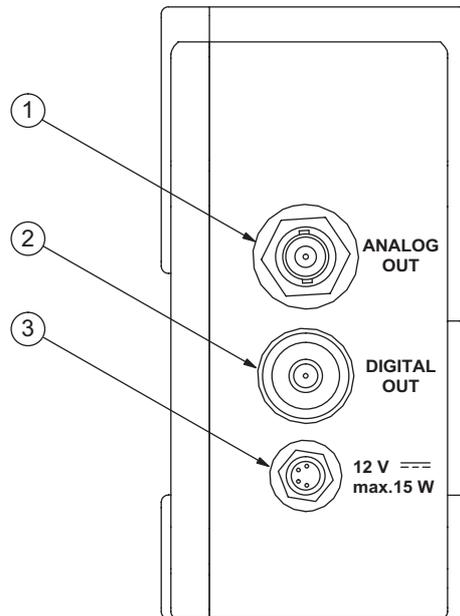


Figure 3.2: Rear view of the laser vibrometer

- 1 Analog voltage output **ANALOG OUT** (BNC jack)
The voltage at this output is proportional to the instantaneous vibrational velocity of the object. The voltage is positive when the object is moving towards the vibrometer optics.
- 2 Digital signal output **DIGITAL OUT** (Triax jack)
At this output the velocity information is available in S/P-DIF format (**S**ony/**P**hilips **D**igital **A**udio **I**nter**F**ace), e.g. to display the output signal on a PC monitor using a sound card.
- 3 Connector for **12V** DC voltage (4-pin circular connector)
Socket for the connecting cable of the power supply or for the battery cable

View from the bottom The view from the bottom of the laser vibrometer is shown with the control elements in [figure 3.3](#).

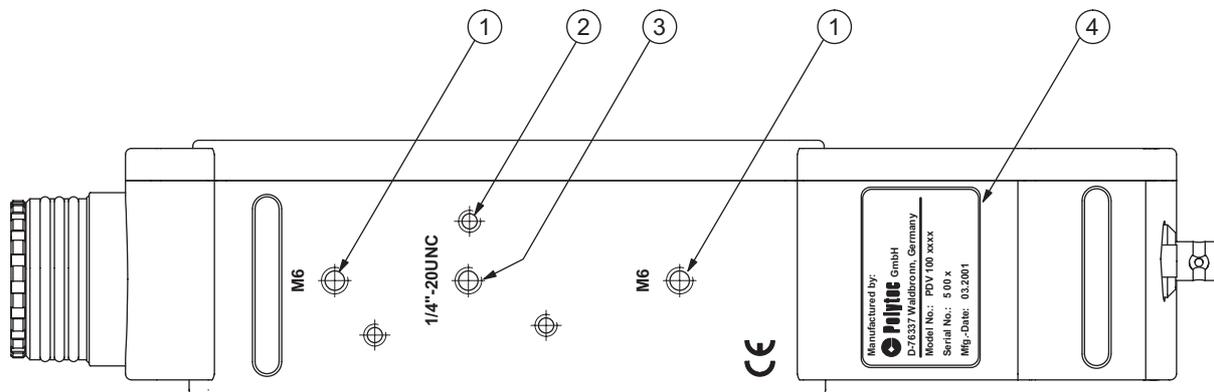


Figure 3.3: View from the bottom of the laser vibrometer

- 1 Mounting holes M6**
Using these two mounting holes, the PDV can be mounted on cooling metal surfaces.
- 2 Three mounting holes M5 for optional tripod VIB-A-T02**
Here the quick release plate of the optional tripod will be fixed (refer to [section 3.5.1](#)).
- 3 Mounting hole 1/4"-20UNC**
Using this mounting hole, the PDV can be mounted on camera tripods with an inch thread, e.g. the optional tripod with 3-axes head VIB-A-T01.
- 4 Identification label**
On the identification label you will find, among other things, the serial number of the instrument.

3.4 Functional Test

For the first functional test of the PDV, proceed as follows:

- Preparing** 1. Make sure that the beam shutter on the laser vibrometer is closed.
- Cabling** 2. Plug the connecting cable of the power supply into the socket 12V on the back of the laser vibrometer.
The connection must be easy to plug in. If not, check the plug for bent contact pins to avoid serious damage being incurred.
- Switching on** 3. Plug the power supply to a wall socket.
On the top of the laser vibrometer the display lights up. Laser light is not yet emitted as the beam shutter is still closed.
4. Before now opening the beam shutter, remember the information on laser safety in [section 1.1!](#)
5. Open the beam shutter. To do so, turn the corrugated ring on the front lens to the left when looking in the direction of the emitted laser beam.
The laser beam is now emitted from the laser vibrometer.
- Test** 6. Point the aperture of the PDV onto a matt white test surface, e.g. a piece of paper.
7. Position the PDV approximately 23cm away from the test surface (measured from the retaining ring for the front lens, refer to [section 7.2.4](#)) and focus the laser beam on the test surface using the focusing ring.
If the signal level display on the display lights up, the optics and the input section of the electronics are working correctly.
8. Set the measurement range (Velo) 20mm/s on the PDV.
9. Connect an oscilloscope to the BNC jack ANALOG OUT on the back of the laser vibrometer, set the oscilloscope to 1V/DIV and move the test surface.

Note!

Pay attention to the high pass filter being switched off (HP=N). Otherwise you have to move the test surface rapidly.

If the voltage shown on the oscilloscope reacts to the movement of the test surface, the decoder and output section are working correctly.

If the functional test has been successful, you can now install the PDV in the measurement location as described in [section 3.5](#).

If your PDV does not perform as described above, read through the information on fault diagnosis in [chapter 6](#) and if necessary, contact your local Polytec representative.

3.5 Installation

3.5.1 Assembly

The PDV has several threaded holes on the underside to mount the laser vibrometer:

- Two mounting holes M6 to mount the PDV on cooling surfaces if necessary
- One mounting hole 1/4" to mount the PDV on a camera tripod, for example the optional tripod with 3-axes head VIB-A-T01
- Three mounting holes M5 to mount the PDV onto the optional tripod with fluid stage VIB-A-T02

Assembly onto tripod VIB-A-T01

Before attempting to mount the laser vibrometer, all locking mechanisms of the tripod, particularly screws, should be checked to make sure they are tight. Loose screws may cause the tripod to be unstable and possibly collapse. Proceed with the assembly as follows:

1. Assemble the tripod as described in the assembly instructions provided by the manufacturer MANFROTTO.
2. Then mount the 3-axes head onto the tripod as described in the assembly instructions provided by the manufacturer MANFROTTO.
3. Set the laser vibrometer onto the 3-axes head and fix it using the central 1/4" screw.
4. Whenever you want to remove the laser vibrometer from the 3-axes head, you should hold the PDV while undoing the 1/4" screw.
5. Keep the assembly instructions for the tripod and the 3-axes head in a safe place.

Assembly onto tripod VIB-A-T02

Before attempting to mount the laser vibrometer, all locking mechanisms of the tripod, particularly screws, should be checked to make sure they are tight. Loose screws may cause the tripod to be unstable and possibly collapse. Proceed with the assembly as follows:

1. Assemble the tripod as described in the assembly instructions provided by the manufacturer MANFROTTO.
2. Then mount the fluid stage onto the tripod as described in the assembly instructions provided by the manufacturer MANFROTTO.
3. Open the locking mechanism on the fluid stage by simultaneously pressing the safety latch and opening the safety lever.
4. Mount the quick release hexagonal plate provided on the underside of the laser vibrometer using the three screws M5.

5. Use this plate to position the laser vibrometer on the fluid stage.
The safety lever clicks automatically into place.
6. Ensure that the quick release plate is attached all the way round. This needs to be done before the PDV is ready to use.
7. Whenever you want to remove the laser vibrometer from the fluid stage, you should hold the PDV while opening the safety lever.
8. Keep the assembly instructions for the tripod and the fluid stage in a safe place.

3.5.2 Electrical Connection

Mains operation

Only use the power supply PDV-AC provided by Polytec. The power supply has a wide range input and can be connected to all mains voltages with nominal values between 100V and 240V.

1. Plug the connecting cable into the socket 12V on the back of the laser vibrometer.
The connection must be easy to plug in. If not, check the plug for bent contact pins to avoid serious damage being incurred.
2. Plug the power supply to a wall socket.
The display on the laser vibrometer lights up and indicates that the PDV is ready to operate.

Battery operation (optional)

As an option you will get the carrier bag PDV-BS with battery and battery charger. Using the plug-in power supply PDV-AC supplied with the laser vibrometer PDV, the battery charger can be connected up to all mains voltages with a nominal value of 100V to 240V. You will find detailed information on this in [section A.1.2](#).

Before operating the laser vibrometer with a battery, you have to charge the battery. Refer also to [section A.1.2](#) on this. There you will also find further information on battery operation.

4 Making Measurements

4.1 Start-up

To make a measurement with the PDV, proceed as follows:

- Preparing**
1. Make sure that the beam shutter on the laser vibrometer is closed.
 2. Position the laser vibrometer roughly so that its laser beam aperture points in the direction of the object under investigation. If possible, position the laser vibrometer at an optimal stand-off distance to the object. You will find information on optimal stand-off distances in [section 4.2.4](#).
- Cabling**
3. Plug the connecting cable of the power supply into the socket 12V on the back of the laser vibrometer.
The connection must be easy to plug in. If not, check the plug for bent contact pins to avoid serious damage being incurred.
- Switching on**
4. Plug the power supply to a wall socket.
On the top of the laser vibrometer the display lights up. Laser light is not yet emitted as the beam shutter is still closed.
 5. From now on, the laser needs a warm-up period of approximately 20 minutes until it reaches the optimal operating temperature.
 6. Before now opening the beam shutter, remember the information on laser safety provided in [section 1.1](#)!
- Measuring**
7. Open the beam shutter. To do so, turn the corrugated ring on the front lens to the left when looking in the direction of the emitted laser beam.
The laser beam is now emitted from the laser vibrometer.
 8. Focus the laser beam on the surface of the object using the focusing ring.
The signal-to-noise ratio is maximum if the signal level display fully lights up. You can often still make measurements even if none of the bar graph is displayed. The output signal in this case, however, contains more noise.

You can now select suitable settings as described in [section 4.2](#) and operate the PDV as described in [chapter 5](#).

4.2 Selecting Suitable Settings

The settings necessary for a measurement are limited to selecting the velocity measurement range (VELO) and the low pass filter (LP), as well as setting the high pass filter (HP). Depending on the type of external signal acquisition, the measurement signal can be acquired from the analog voltage output ANALOG OUT or the digital output DIGITAL OUT.

4.2.1 Measurement Range

The PDV offers three velocity measurement ranges, whose full scale values are shown in mm/s in the **Velo** display line (20 mm/s, 100 mm/s and 500 mm/s). When using the digital output, the full scale value is needed as a reference for the numerical value transmitted. If you divide the full scale values by four, corresponding to the output voltage swing of $\pm 4V$, you get the respective scaling factors in $\frac{\text{mm}}{\text{s}}/V$ ($5 \frac{\text{mm}}{\text{s}}/V$, $25 \frac{\text{mm}}{\text{s}}/V$ and $125 \frac{\text{mm}}{\text{s}}/V$).

To optimize the signal-to-noise ratio, as a general rule the smallest possible measurement range should be used which is not exceeded under the given measurement conditions. Coming close to exceeding a measurement range (94% of the full scale) is shown by a circular symbol on the right next to the measurement range display. A brief appearance of the overrange indicator does not necessarily mean the measurement signal is causing overrange as noise peaks caused by brief disruptions of the optical signal level can trigger the display. However when using the filters, it is also possible that an internal overload outside the frequency pass band has occurred. In this case the overrange indicator would appear without overrange being apparent in the output signal. Despite this, the next highest measurement range would have to be selected to avoid waveform distortions.

4.2.2 Low Pass Filter

The PDV is equipped with a switchable, digital low pass filter. Unlike usual with analog filters, the three selectable cutoff frequencies 1 kHz, 5 kHz and 22 kHz mark the upper frequency limit for precise amplitude measurements (flatness $\pm 0,1$ dB) but not the -3 dB point. The changeover to the stop band has a steep frequency roll-off of -120 dB/dec, resulting in an effective suppression of noise at higher frequencies. The cutoff frequency of the low pass filter is set on the display in the line **LP**. On the technical specifications as for example the frequency response of the low pass filter please refer to [section 7.2.2](#).

4.2.3 High Pass Filter

To suppress low-frequency background vibrations, the PDV has got a switchable high pass filter type 3rd order Butterworth with a cutoff frequency of 100Hz (-3dB). The high pass filter is switched on (Y) and off (N) on the display at **HP**.

For technical reasons this filter has been realized in conventional analog technology and therefore only has an effect on the analog voltage output. The high pass filter can always be used beneficially for analog signal acquisition if you are working with high-level background interference e.g. caused by machine vibrations when a relatively small signal is to be measured at high frequencies. Under these conditions please take care of the internal saturation of the selected measurement range (refer also to [section 4.2.1](#)). Attention has to be paid to the following properties for the high pass filter:

- The changeover from the pass band to the stop band occurs with a more gradual frequency roll-off (-60dB/dec) than with the low pass filter.
- Near the cutoff frequency a significant amplitude error occurs (refer to [figure 4.1](#)).
- For frequencies $> 140\text{Hz}$, the amplitude error is $< -0,5\text{dB}$ (-5%)

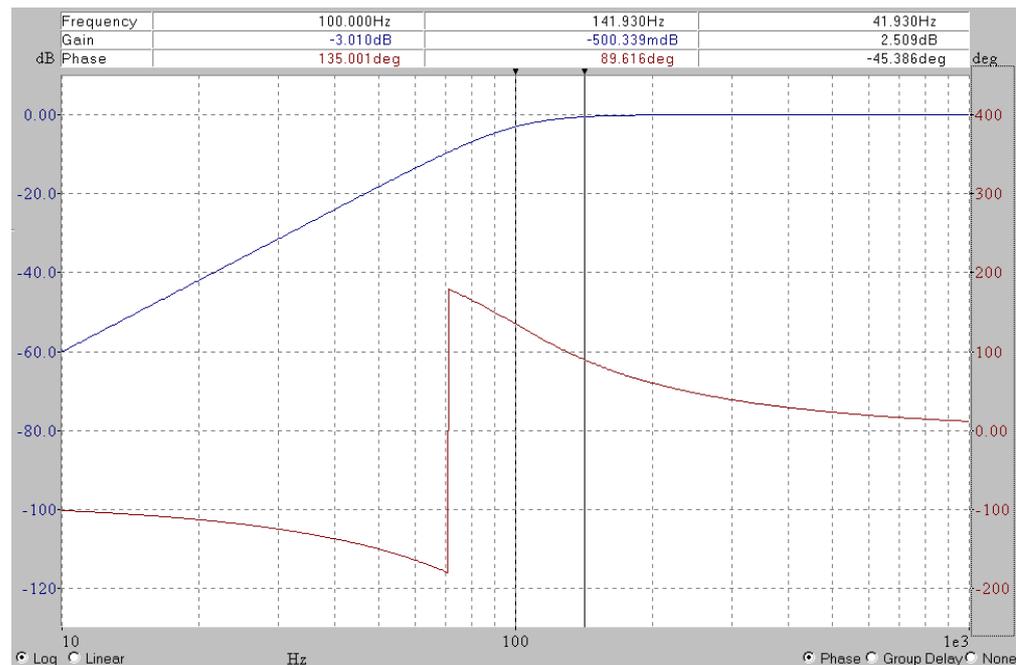


Figure 4.1: Amplitude and phase frequency response of a 3rd order Butterworth high pass filter

The lower graph in [figure 4.1](#) represents the phase frequency response. The 360° phase jump can only be seen on the diagram for presentation reasons.

4.2.4 Optimal Stand-off Distances

Visibility maxima

The light source of the PDV is a helium neon laser. This is a multi-mode laser in which a maximum of two modes can exist. The interference of the two modes leads to the intensity of the resulting optical signal varying periodically with the stand-off distance. The intensity increases to a maximum, i.e. maximum visibility is present if the difference of the optical path length is an integer multiple of the laser cavity length (138 mm). As the optical path difference is equal to twice the stand-off distance (the beam goes there and back), maximum visibility is present once per cavity length.

In practice, it is not usually necessary to search for maximum visibility as the PDV is even sensitive enough to make a measurement close to the minimum. A visibility minimum is indicated during the warm-up phase by periodic fluctuation of the optical signal level. You should, however, select the stand-off distance so that it is close to a visibility maximum.

The stand-off distance is measured from the front edge of the retaining ring for the front lens (refer to [section 7.2.4](#)). The optimal stand-off distances are:

$$\text{optimal stand-off distance} = 96\text{mm} + (n \cdot l)\text{mm}$$

$$n = 0; 1; 2; \dots \quad l = 138\text{mm}$$

i.e. for $l = 138\text{mm}$ the optimal stand-off distances are at:

96 mm; 234 mm; 372 mm; 510 mm; etc., refer also to [section 7.2.3](#) and [section 7.5](#)

5 Operating the PDV

5.1 Switching On and Off

Power supply You switch the PDV on by connecting the power supply to a wall socket. The display on the top of the laser vibrometer lights up and indicates that the PDV is ready to operate.

Battery operation You switch the PDV on by connecting the vibrometer cable of the battery charger to the connector 12V on the back of the laser vibrometer and pressing the rocker switch on the top of the battery charger in the direction of the laser LED. The display on the top of the laser vibrometer and the laser Led on the battery charger light up and indicate that the PDV is ready to operate.

For the PDV, the battery level is shown on the display (refer to [section 5.8](#)).

Note!

The background lighting of the display is equipped with a power saving mode. If no key is pressed for approximately 5 seconds, the lighting is switched off but the readout on the display is still active.

5.2 Blocking the Laser Beam

The PDV is equipped with a beam shutter. This can be used to block the laser beam without switching off the laser. This keeps the system in thermal equilibrium.

The beam shutter is the corrugated ring on the front lens. To block the laser beam, turn the corrugated ring to the left when looking in the direction of the emitted laser beam.

Warning!

Only open the beam shutter when you are making measurements!

5.3 Focusing the Laser Beam

On the PDV the stand-off distance can be adjusted using the focusing ring. Before focusing the laser beam make sure that the clamping screw on the focusing ring is undone (refer to [section 5.5](#)). When looking in the direction of the emitted laser beam, focus the laser beam as follows:

- Focus on infinity: Turn to the right
- Focus close-up: Turn to the left

Please pay attention to the information on optimal stand-off distances provided in [section 4.2.4](#).

5.4 Using the Signal Level Display

The signal level display helps you to optimize the focus of the laser beam. The signal level is shown as a bar on the display of the laser vibrometer (refer to [section 5.6.1](#)). The length of the bar is a measure of the amount of light scattered back from the object under investigation.

5.5 Fixing the Focal Point

You can fix the focus by locking the focusing ring using the clamping screw. To do so, first focus the laser beam and then hand-tighten the clamping screw with the provided Allen key size 1.5mm.

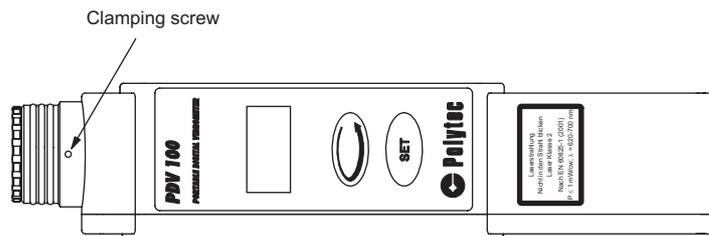


Figure 5.1: Clamping screw, on the focusing ring

5.6 Setting Parameters via the Display

5.6.1 Philosophy

The PDV is operated via the display using the selection key and the key SET.

Selection key  :

Using the selection key within the menus, a parameter is selected ().

Key SET:

Using the key SET, the setting of the selected  parameter is changed.

The main menu is shown in [figure 5.2](#) as an example of the display.



Figure 5.2: Example of the display

The parameters are run through on the display in a circle using the selection key .

The cursor ► on the left side marks a selected parameter. The parameter setting is changed with the key SET. Adjusted settings are activated immediately.

As the control processor has a flash memory, the settings are stored when the laser vibrometer is switched off and are reloaded when the laser vibrometer is switched on again. This saves time when making adjustments for repeated measurements.

5.6.2 Organization of the Menus

The menu structure is shown in [figure 5.3](#).



Figure 5.3: Organization of the menus in the PDV

The menus are organized as follows:

- INTRO:** The start menu only appears after switching on the laser vibrometer. After the menu INTRO is finished, the display automatically changes to the main menu.
- MAIN MENU:** In this menu, all settings for a measurement are made, i.e. the measurement range and the filters are selected. It also displays the signal level.
- SERVICE MODE:** In service mode, the laser can be switched on and off. In addition it provides information on the temperature in the laser vibrometer and test signals can be generated.

5.6.3 The Individual Menus

Menu INTRO After being switched on, the laser needs a certain settling time. During this settling time the menu INTRO plays. Once it is finished, the laser vibrometer indicates that it is ready to operate by automatically changing to the main menu. You can shorten the menu INTRO by pressing any key on the laser vibrometer.

Main menu The measurement range and the filters are set in the main menu. The individual settings are described in the following:

Velo

In this line you can set the velocity measurement range in mm/s (full scale). You will find information on setting the measurement range in [section 4.2.1](#).

LP

At this point along the line you can set the cutoff frequency of the low pass filter in kHz. You will find information on setting the low pass filter in [section 4.2.2](#).

HP

At this point along the line, you can set the high pass filter. Setting **Y** means that the high pass filter is switched on and setting **N** means that it is switched off. You will find information on setting the high pass filter in [section 4.2.3](#).

Service mode Service mode is there to check and calibrate the PDV. You can access service mode by holding the key SET pressed and then press the selection key . In service mode you can set the following operating modes:

Switching Laser Off and On

In service mode, you can switch the laser off by pressing the key SET several times until the following display appears.

Service Mode
Laser: -Off-

Quit service mode with the selection key and the laser remains switched off.

In service mode, you can switch the laser on again by pressing the key SET several times until the following display appears.

Service Mode
Laser: -On-

Quit service mode with the selection key and the laser remains switched on.

Displaying Temperature

In service mode, you can display the temperature in the laser vibrometer by pressing the key SET several times until the following display appears.

Service Mode
Temp: 30.5

The display shows the actual temperature in degrees Celsius. You quit service mode using the selection key.

Generating Test Signals

In service mode you can generate a sinusoidal test signal of 2.80V (RMS) with a frequency of approx. 1 kHz. This signal corresponds to 99% of the full scale and is available at the BNC jack ANALOG OUT on the back of the laser vibrometer. To generate the test signal you proceed as follows:

1. Paste a piece of reflective film (enclosed in the manual) on the measurement surface of the object under investigation.
2. Position the laser vibrometer at an optimal stand-off distance to the object (refer to [section 4.2.4](#)).
3. Connect the object vibration-free to the laser vibrometer and mount them onto a solid base.
4. Open the beam shutter and focus the laser beam on the reflective film with the focusing ring.
The bar graph display must fully light up.
5. Change into service mode by holding the key SET pressed and then press the selection key .
6. Generate the 2.80V test signal by then pressing the key SET several times until the following display appears.

<p>Service Mode</p> <p>Output = Full</p>
--

The 2.80 V test signal with approximate full scale is only emitted while this display is shown. This signal is there to check the calibration of the analog signal voltage output.

7. Quit service mode using the selection key .

In service mode you can generate a test signal of 0V at the BNC jack ANALOG OUT on the back of the laser vibrometer. To do so, proceed as follows:

1. Change into service mode by holding the key SET pressed and then press the selection key .
2. Generate the 0 V test signal by then pressing the key SET several times until the following display appears.

<p>Service Mode</p> <p>Output = Zero</p>
--

The 0V test signal is only emitted while this display is shown.

- Quit service mode using the selection key .

5.7 Overrange Indicator

The overrange indicator is shown on the display of the laser vibrometer on the right next to the measurement range indicator **Velo** (refer to [figure 5.4](#)).

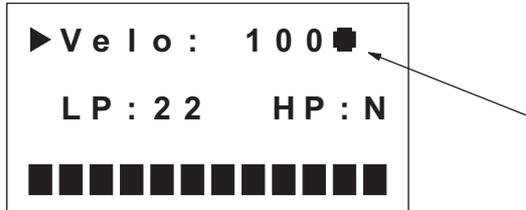


Figure 5.4: Display with overrange indicator

If the overrange indicator is lit up continuously, it means that the measurement range set is being exceeded. In this case, the next highest measurement range must be set. You will find further information on setting the measurement range in [section 4.2.1](#).

5.8 Battery Level Indicator

The battery level indicator is shown on the display of the laser vibrometer on the right next to the overrange indicator (refer to [figure 5.5](#)).

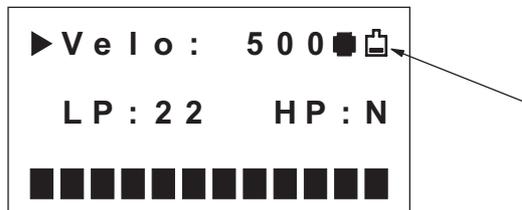


Figure 5.5: Display with battery level indicator

If the battery level indicator is lit up continuously, it means that the battery is very low. From now you have got approximately another 15 minutes operating time available. You will find further information on the battery and on charging the battery in [section A.2](#). For information on safe handling of lithium ion batteries, refer to [section 1.4](#) and [section 1.5](#).

5.9 Measurement Signal Output

Analog The measurement signal is available at the BNC jack ANALOG OUT on the back of the laser vibrometer as an analog voltage signal.

Digital The measurement signal is available at the Triax jack DIGITAL OUT on the back of the laser vibrometer as a digital signal in S/P-DIF format.

6 Fault Diagnosis

Some simple tests are described in the following for you to carry out yourself in the case of malfunction. In the case of more difficult problems with the individual functions, please contact our service personnel. The tests described here are not meant to lead you to carry out maintenance work yourself but to provide our service personnel with information which is as accurate as possible.

Testing the PDV is limited to such tests in which the housing does not have to be opened. Opening the housing can cause a malfunction and will invalidate the warranty.

If required, please contact our service department. Based on your fault description, further procedure will be determined.

If the PDV has to be sent back for repair, always use the original packaging and enclose an exact description of the fault.

6.1 No Laser Beam

If no laser beam is emitted, check the following:

1. Is the beam shutter opened?
2. Is the PDV connected to the mains as described in [section 3.5.2](#)?
3. Is the display on the top of the laser vibrometer lit up, or does it show a menu?

If the display is not lit up, or is not showing anything, it can be assumed that there is a fault with the mains supply.

4. Does the housing feel warm to the touch as normal after about 15 minutes in operation indicating that the laser is active?
5. Is the display showing the following warning?

<p>WARNING Over Temp. Laser: -Off-</p>

The laser has been switched off because the temperature limit inside the laser vibrometer has been exceeded. Switch off the instrument and let it cool down.

Battery operation only

6. Is the display showing the following warning?



The laser has been switched off because the battery is empty. To avoid completely draining the battery and thus shortening its useful life, set the rocker switch of the battery charger in the direction of the charge level indicator. Then reload the battery as described in [section A.1.2](#) under Charging battery.

6.2 No Measurement Signal

If the laser beam is emitted but there is no measurement signal, proceed as follows:

1. Put a matt white test surface, e.g. a piece of paper, in the beam path approximately 23cm away from the retaining ring for the front lens. Focus the laser beam on the test surface using the focusing ring. Does the signal level display react?

If the signal level display does not react, either the optics or the input section of the electronics are faulty.

2. Connect an oscilloscope to the BNC jack ANALOG OUT on the back of the laser vibrometer and check if the output reacts to moving the test surface.

Note!

Pay attention to the high pass filter being switched off (HP=N). Otherwise you have to move the test surface rapidly.

3. If the output does not react, check if a significant DC offset is indicated.

Normally a DC voltage less than $\pm 10\text{mV}$ can be measured.

4. Set the oscilloscope to 1V/DIV and block the laser beam. Is the output signal noisy or does the oscilloscope show a straight line?

Noise must occur when the laser beam is blocked.

6.3 Focusing Ring can not be Moved

Make sure that the clamping screw on the focusing ring is undone (refer to [section 5.5](#)).

7 Technical Specifications

7.1 Standards Applied

Laser safety	EN60825-1(Safety of Laser Products), complies to US 21 CFR 1040.10 and 1040.11, except for deviations pursuant to Laser Notice no. 50, dated 26 July 2001
Electrical safety	IEC/EN 61010 (Safety requirements for electrical equipment for measurement, control and laboratory use)
EMC:	IEC/EN 50081-1 (Electromagnetic compatibility (EMC))
Emitted interference:	Class B, IEC/EN 61000-3-2 and 61000-3-3
Immunity to interference:	IEC/EN 61000-4-2 and following

7.2 Laser Vibrometer PDV 100

7.2.1 General Data

Power Supply

Supply voltage:	11V... 14.5VDC
Power consumption:	max. 15W
socket type:	Binder 718/768 (M8)
	pin 1 internally used
	pin 2 +12V (corresponding cable color: white)
	pin 3 internally used
	pin 4 0 V (corresponding cable color: black)

Caution!

Do **not** connect the pins 1 and 3 as this causes damage to the PDV 100!

Ambient Conditions

Operating temperature:	+5°C...+40°C (41°F... 104°F)
Storage temperature:	-10°C...+65°C (14°F... 149°F)
Relative humidity:	max. 80%, non-condensing

Housing

Protection rating: IP 64
 Display: LCD, 3-line, with background lighting
 Dimensions: refer to [section 7.2.4](#)
 Weight: ca. 2.6 kg

Calibration

Calibration recommended: every 2 years

7.2.2 Metrological Properties

Signal Output ANALOG OUT

Signal voltage output for the velocity signal

Output swing: $\pm 4V$
 Frequency range: 0.5Hz... 22kHz
 Resolution of the D/A converter: 24 bit
 Output impedance: 50Ω
 load resistance: min. $10k\Omega$ (–0.5% additional error)
 Overrange indicator threshold: typ. 94% of full scale
 DC offset: max. $\pm 10mV$
 Best resolution: $0.02 \frac{\mu m}{s} / \sqrt{Hz}$ (rms)
 Spurious free dynamic range (SFDR): $> 90 dB$
 Harmonic distortions: $< 1\%$ THD
 Propagation delay: typ. 1.1 ms
 Calibration accuracy: $\pm 1\%$ (20Hz... 22kHz)

Measurement Ranges

measurement range ¹ full scale (peak)	Scaling factor (analog output)	Resolution ²	Maximum acceleration
mm/s	$\frac{mm}{s}/V$	$\frac{\mu m}{s} / (\sqrt{Hz})$	m/s ²
20	5	< 0.02	2760
100	25	< 0.02	13800
500	125	< 0.1	69000

¹ adjustable via the display

² The resolution is defined as the signal amplitude (rms) at which the signal-to-noise ratio is 0dB in a 1 Hz spectral bandwidth (RBW), measured on 3M Scotchlite Tape® (reflective film).

Signal Output DIGITAL OUT

Digital output for the velocity signal

Data format:	S/P-DIF, 24 bit, 48kSa/s
Frequency range:	0 Hz... 22 kHz
Propagation delay:	approx. 1 ms
Calibration accuracy:	$\pm 0,2\%$ (0,05 Hz... 22 kHz)

Low Pass Filter

Filter type:	digital, FIR type
Cutoff frequencies (-0.1 dB):	1 kHz, 5 kHz, 22 kHz (adjustable via the display)
Frequency roll-off:	> 120 dB/dec
Stop band attenuation:	> 100 dB
Frequency response:	see following table and figure 7.1

Filter setting	Pass band ± 0.1 dB	Stop band (attenuation > 40 dB)
1 kHz	0.5 Hz... 1 kHz	> 4.3 kHz
5 kHz	0,5 Hz... 5 kHz	> 8.4 kHz
22 kHz	0.5 Hz... 22 kHz	> 25 kHz

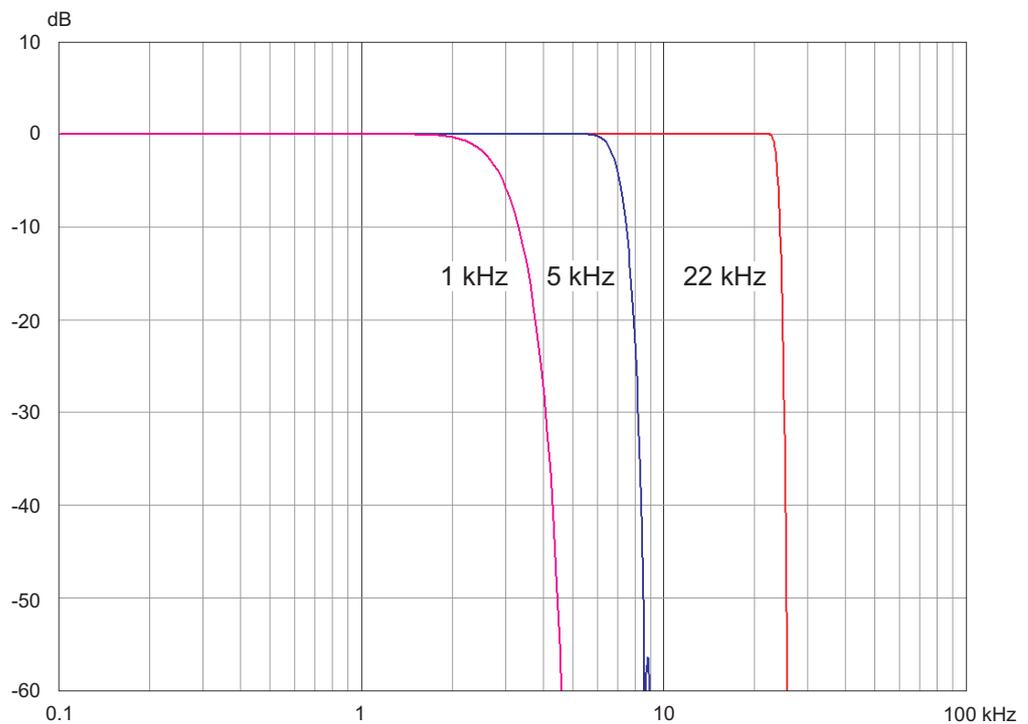


Figure 7.1: Frequency response of the low pass filter

High Pass Filter

Filter type: analog, 3rd order Butterworth
 Cutoff frequency (−3 dB): 100 Hz ± 10% (switchable via the display)
 Frequency roll-off: −60 dB/dec

7.2.3 Optics

Laser

Laser type: helium neon
 Wavelength: 633 nm
 Cavity length: 138 mm
 Laser class: 2
 Laser output power: typ. 0.6 mW

Stand-off distance ¹	[m]	0.1 ... ca. 30 ²
Aperture diameter (1/e ²) (typ.)	[mm]	typ. 6.5
Spot size (typ.)	[μm]	
@ 234 mm		30
@ 1 m		124
@ 2 m		250
@ 3 m		370
@ 5 m		616
@ each additional meter plus		130
depth of focus ³ (@ 2 m distance)	[mm]	210
Visibility maxima ¹	[mm]	96 + n · 138 ⁴

¹ Measured from the front edge of the retaining ring for the front lens, refer to [section 7.2.4](#)

² The maximum stand-off distance depends on the surface properties of the object.

³ max. 3 dB loss of signal of the optimum

⁴ n = 0; 1; 2; ...

7.2.4 Dimensions

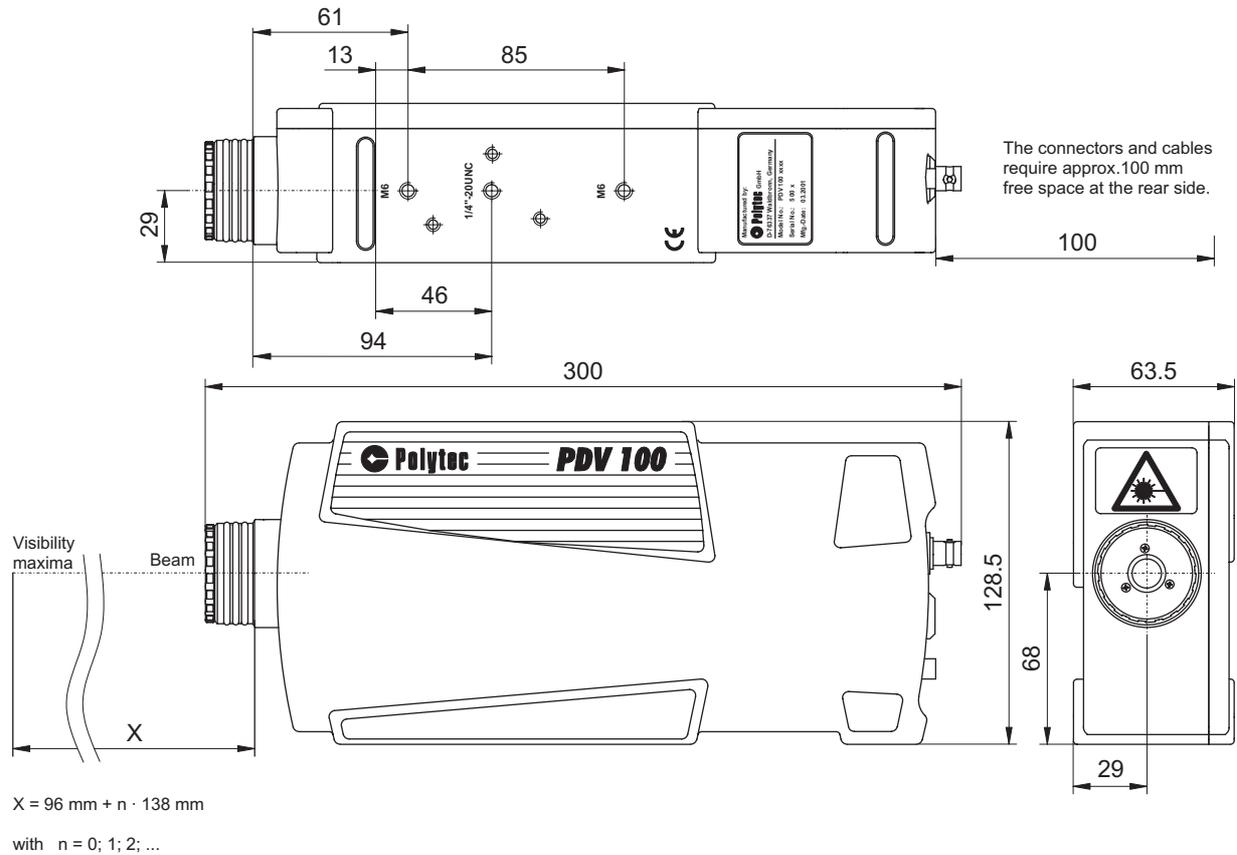


Figure 7.2: Views of the PDV 100 (Dimensions not specified are given in mm.)

7.3 Power Supply PDV-AC

Mains connection

Mains voltage:	100...240VAC $\pm 10\%$, 50/60Hz
Output voltage:	12VDC
Power consumption:	max. 20W

Housing

Protection rating:	with protective insulation, IP40
Cable length:	3 m

7.4 Mounting Plate OFV-P7

Dimensions

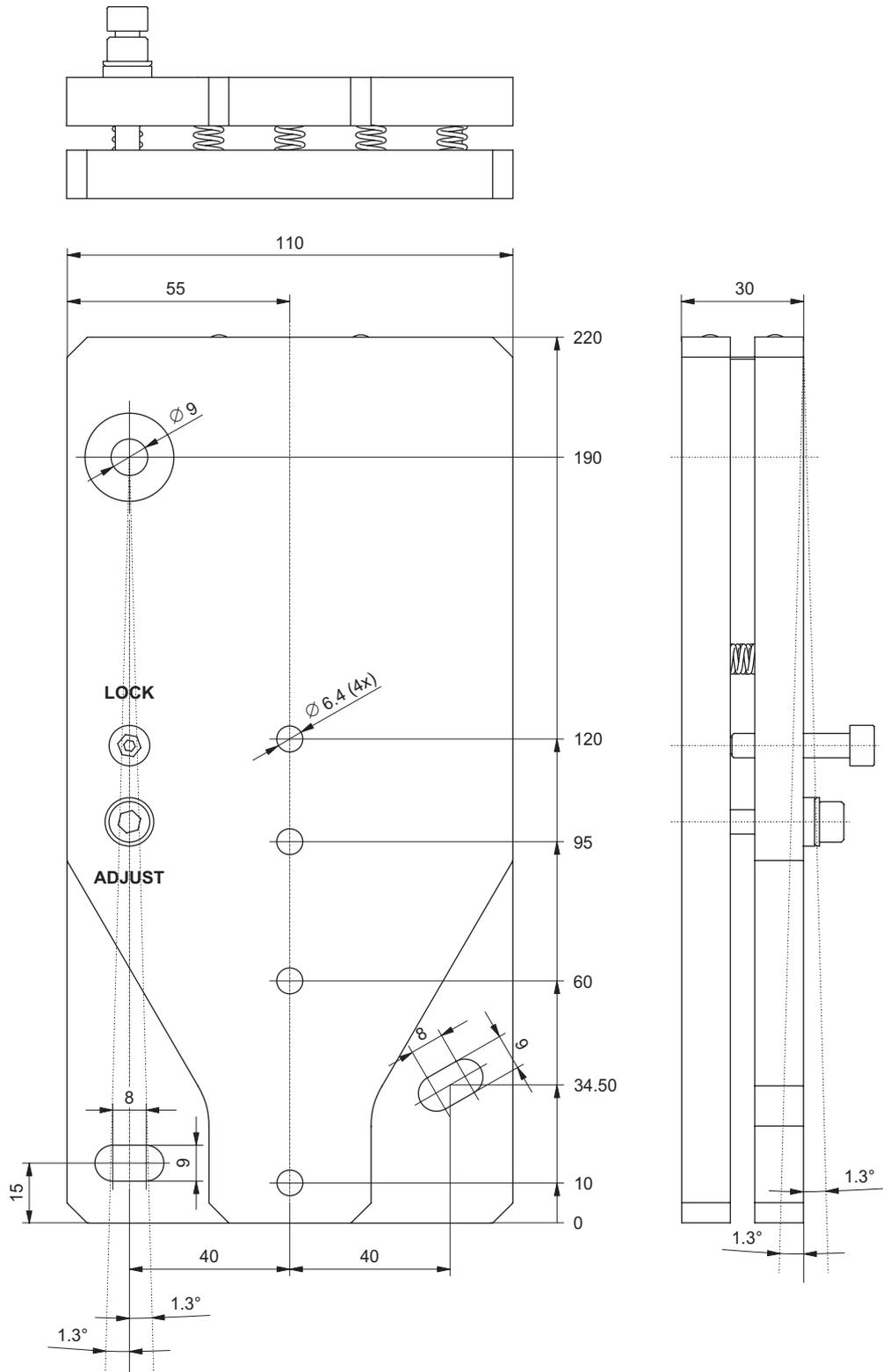


Figure 7.3: Views of the mounting plate OFV-P7 (dimensions not specified are given in mm)

7.5 Table of the Visibility Maxima

Visibility maxima (in mm)					
96	1200	2304	3408	4512	5616
234	1338	2442	3546	4650	5754
372	1476	2580	3684	4788	5892
510	1614	2718	3822	4926	6030
648	1752	2856	3960	5064	6168
786	1890	2994	4098	5202	6306
924	2028	3132	4236	5340	6444
1062	2166	3270	4374	5478	...

7 Technical Specifications

Appendix A: Optional Accessories

A.1 CarrierBag PDV/BS with Battery and Battery Charger

The carrier bag PDV-BS contains the following components:

- Lithium ion battery PDV-LI
- Battery charger PDV-CH

Optional

- Motor vehicle supply cable PDV-DC
- Reserve lithium ion battery PDV-LI

The carrier bag PDV-BS with the PDV 100 is shown in [figure A.1](#). If required you can store additional PDV accessories in the pockets and under the straps of the carrier bag.



Figure A.1: Carrier bag PDV-BS with battery, battery charger and PDV 100

The electrical installation of the carrier bag makes it possible to use the laser vibrometer as a mobile unit with the power supplied by the lithium ion battery or as a stationary unit connected up to the AC system using the plug-in power supply PDV-AC provided with the PDV. The plug-in power supply for the laser vibrometer can also be stored in the carrier bag as also shown in [figure A.1](#).

A.1.1 Safety Information

Power supply To reduce the risk of an electric shock or malfunction, only use the plug-in power supply PDV-AC provided by the manufacturer. Do not expose the plug-in power supply to rain or moisture.

It is not necessary to open the housing when using the power supply as intended. Always use the accurate plug adapter.

Battery charger Lithium ion batteries require a very strict compliance with the charging parameters. For this reason only use the battery charger PSV-CH provided by Polytec. Using any other battery chargers may result in fire or explosion of the battery.

Note!

When loading the batteries it is **recommended** to open the cover of the carrier bag to ensure unimpeded air circulation.

Safety when Using Lithium Ion Batteries

Warning!

Incorrect use of the battery may result in an excessive rise in temperature (heat accumulation), fire or explosion leading to serious personal injury!

Please pay attention to the following **safety precautions** when using lithium ion batteries:

- Do not throw the battery into fire or expose it to extreme heat!
- Do not leave the battery in the direct sun, near a radiator, or in a closed car on a warm day!
- Do not reconstruct, disassemble, deform, or short-circuit the battery!
- Do not touch the terminals of the battery with metal objects such as necklaces, keys, coins and hairpins! Replace the protective cap on the battery cable connector if the battery is being stored.
- Do not allow the battery to come into contact with sea water or water of any kind!
- Do not drop the battery or subject it to great shocks!
- Do not use any batteries which are emitting a fluid or which show external damage.

Safety when Charging the Lithium Ion Battery

Warning!

Incorrect use of the battery may result in an excessive rise in temperature (heat accumulation), fire or explosion leading to serious personal injury!

Please pay attention to the following **safety precautions** when charging the lithium ion battery:

- To charge the battery, only use the battery charger provided by the manufacturer!
- Never connect the battery directly to a mains supply or an on-board plug socket!
- While charging, do not place the battery in direct sunlight. If the battery gets too hot, a built-in safety device is activated, preventing the battery from charging further. Heating the battery can destroy this safety device and can cause an explosion or ignition of the battery.
- If the given charge time for the battery is significantly exceeded without the battery reaching full capacity, please abort the charging process. Doing so may cause the battery to overheat, explode, or ignite.

A.1.2 Functional Description of the Battery Charger PDV-CH

Control elements

The view from above of the battery charger is shown with the control elements in [figure A.2](#).

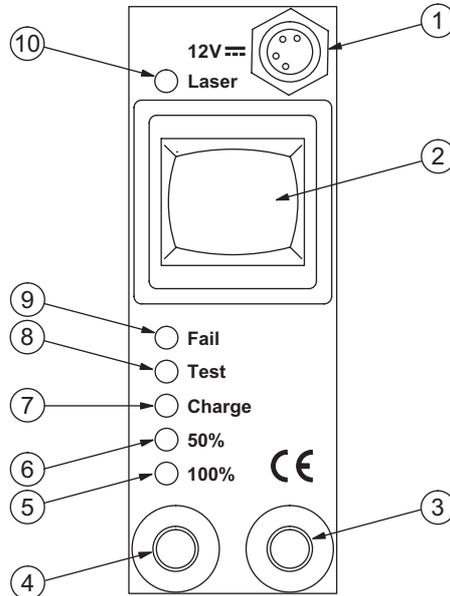


Figure A.2: The view from above of the battery charger

- 1 Connector for **12V** DC voltage (4-pin circular connector)
 Socket for the cable of the plug-in power supply PDV-AC to operate the battery charger or the laser vibrometer respectively
- 2 Rocker switch for the operating modes of the battery charger
 - Switch in direction Laser LED: The laser vibrometer is switched on and ready to use, the green Laser LED is lit. The battery charger is switched off.
 - Switch in the middle position: All functions are switched off.
 - Switch in direction charge level indicators: The battery charger is switched on and a lamp test is carried out (refer also to Charging battery). The laser vibrometer is switched off.
- 3 Vibrometer cable with 4-pin circular jack
 Cable to connect up the laser vibrometer

Note!

Secure the cable junction at the laser vibrometer with the knurled nut! When disconnecting the cable, always pull the plug and not the cable.

- 4 Battery cable with 3-pin circular jack
Cable to connect up the lithium ion battery
- 5 Charge level indicator **100%** LED
The green **100%** LED **lights up**, when the battery has attained its specified capacity. While this LED is lit up, the battery is still charging to attain the maximum capacity possible.
The green **100%** LED **flashes**, when the charging process has completely finished and the battery is switched off. You can then switch off the battery charger using the rocker switch.
- 6 Charge level indicator **50%** LED
The yellow **50%** LED lights up, when the battery has attained at least half its capacity. This is not equivalent to half the duration of the charging process.
- 7 Charge level indicator **Charge** LED
The yellow **Charge** LED lights up when the charging process starts and during the entire charging process.
- 8 **Test** LED for the battery check
The yellow **Test** LED lights up, while the battery level is being tested. This can take up to 4 minutes (refer also to Charging battery).
- 9 **Fail** LED
The red **Fail** LED flashes if the battery is not connected or is faulty. First of all check the connection of the battery cable. With an exhaustively discharged battery, the Fail LED can also initially flash. Switch the battery charger off and then on again. As a general rule, the fault state will not occur again the second time. If the fault state persists, then there is a fault with the battery. Disconnect the battery from the battery charger.

Caution!

Do **not** attempt to charge a faulty battery again or try to repair it. Disconnect the faulty battery from the battery charger and dispose of the battery appropriately!

10 Laser LED

The green **Laser** LED lights up when you have pressed the rocker switch in the direction of the Laser LED. Thus the laser vibrometer is switched on and the battery charger is switched off.

Mains connection

Using the plug-in power supply PDV-AC supplied with the laser vibrometer PDV, the battery charger can be connected up to all AC systems with a nominal voltage of 100V to 240V. To do so, connect the cable of the plug-in power supply with the **12V** circular jack on the top of the battery charger and plug the power supply into a wall socket.

Note!

Before connecting the plug-in power supply to the mains voltage, check whether the plug-in power supply is equipped with a socket inset suitable for your country. If not, contact your nearest Polytec representative!

Charging battery

Before operating the laser vibrometer with a battery, you have to charge the battery. To do so, proceed as follows:

1. Make sure that the rocker switch on the top of the battery charger is in the middle position.
2. Remove the protective cap from the battery cable connection of the battery and store the protective cap in a safe place.

Note!

If you carry the battery around with you in the carrier bag without using it, or store it for a long time, please make sure that you put the protective cap back on the battery cable connection!

3. Connect the battery cable of the battery charger to the lithium ion battery.

Note!

The laser vibrometer can remain attached to the battery charger during the charging process but it is not switched on. If you use the laser vibrometer during the charging process, you will have to use a second plug-in power supply PDV-AC.

4. Connect the cable of the of the plug-in power supply PDV-AC to the top of the battery charger and plug the power supply into a wall socket.
5. Press the rocker switch on the battery charger in the direction of the charge level indicators.

The charging process starts with a lamp test, in which all LEDs light up twice briefly. After that the battery level is tested. The yellow Test LED lights up. The process can last up to 4 minutes, but is completed after a few seconds as a general rule.

If the battery is faulty, the red Fail LED will flash.

Caution!

Do **not** attempt to charge a faulty battery again or try to repair it. Disconnect the faulty battery from the battery charger and dispose of the battery appropriately!

If the battery level is perfect, the actual charging process will begin.

The yellow Charge LED lights up during the entire charging process. It will take approximately 5 hours to charge a battery which has been completely discharged. A buzzing sound coming from the battery charger and the plug-in power supply during the charging process is normal.

Loading the battery is done in several stages. The charge level of the battery thereby is shown by the 50% and the 100% LED:

As soon as the **50% LED lights up**, the battery has attained half its capacity. This state is attained after approx. 4 hours on a completely discharged battery.

As soon as the **100% LED lights up**, the battery has attained its specified capacity. While the 100% LED is lit, charging is continued for approx. 15-30 minutes until the maximum available capacity has been attained.

As soon as the **100% LED flashes**, the charging process has completely finished and the battery is switched off.

6. Once the battery has been completely charged, press the rocker switch back into the middle position.

Pay attention to this additional **information** on charging the battery:

- The charging process can be interrupted during any phase and can be continued later. A partially charged battery can be used to operate the laser vibrometer but will not attain the maximum operating time.
- Overcharging the battery is safely prevented through the charge electronics.
- It is a good idea to end the charging process after 2-3 hours for batteries which are to be stored - at the latest when the 50% LED lights up.
- Batteries which have been stored for a long time must be completely recharged before being used.
- The battery charger can also be operated using the motor vehicle supply cable PDV-DC (refer to [section A.2](#)). To do so, instead of plugging the plug-in power supply into the 12 V socket on top of the battery charger, plug in the motor vehicle supply cable and plug it into a 12V on-board plug socket or into a motor vehicle cigarette lighter. The battery is charged in the same way as with mains operation.
- To charge a reserve battery, connect it to the battery cable of the battery charger instead of the first battery.

Caution!

Only use original lithium ion batteries from Polytec!

Battery operation

To operate the laser vibrometer with a battery, please proceed as follows:

1. Make sure that the rocker switch on the top of the battery charger is in the middle position.
2. Plug the vibrometer cable of the battery charger into the 12 V socket on the back of the laser vibrometer and secure the jack with the knurled nut.

The connection must be easy to plug in. If not, check the plug for bent contact pins to avoid serious damage being incurred.

3. Press the rocker switch in the direction of the Laser LED.

The green Laser LED on the battery charger and the display on the laser vibrometer light up and indicate that the PDV is ready to operate.

Note!

The background lighting of the display is equipped with a power saving mode. If no key is pressed for approximately 5 seconds, the lighting is switched off but the readout on the display is still active.

With a completely charged battery, the laser vibrometer can be operated for 4-5 hours. As the battery gets older and in low ambient temperatures, the operating time gets shorter. About 30-60 minutes before the battery is exhausted, you will be given a warning. The battery level indicator in the display on the laser vibrometer lights up. If you continue to operate the laser, it will switch itself off for safety reasons after several minutes to prevent the battery from discharging exhaustively. The remaining charge in the battery is used to display the following warning message for 15-30 minutes on the laser vibrometer display.

WARNING
Batt. empty
Laser: -Off-

At the latest at this stage you should switch off the laser vibrometer and recharge the battery. Otherwise the internal battery protection will completely disconnect the battery from the charge once it has reached the exhaustive discharge threshold and both the display on the laser vibrometer and the Laser LED on the battery charger go out. To protect the battery, the laser vibrometer can be operated with the plug-in power supply if there is a mains connection available. The plug-in power supply can therefore also be connected to the battery charger when being run on batteries and can be kept in the carrier bag.

Note!

As soon as the plug-in power supply connected to the battery charger is plugged into a mains socket, the laser vibrometer connected to it is supplied with power from the mains connection and not from the battery.

Mains operation

You can also operate the laser vibrometer using the mains connection with the aid of the plug-in power supply - even if the battery is connected. As soon as you plug the power supply connected to the battery charger into a mains wall socket and press the rocker switch in the direction of the Laser LED, the power supply for the laser vibrometer is automatically changed over to mains operation. In doing so, no power is sourced from the battery, but it does not get charged either. The display of the laser vibrometer then remains lit up constantly; power saving mode is not activated.

A.1.3 Taking Back the Battery**Note!**

Batteries must not be disposed in domestic waste!

The consumer is legally obliged to pass back batteries after use, e.g. at public collecting points or wherever batteries of this type are being sold.

A.1.4 Technical Specifications**Battery Charger PDV-CH****Power supply**

Supply voltage:	12VDC \pm 2V (Mains: 100...240VAC, 50/60Hz with plug-in power supply PDV-AC)
Power consumption:	max. 30 W
Charging current:	1.1 A
Charging time:	ca. 5 h

Ambient conditions

Operating temperature:	+5°C...+40°C (41°F... 104°F)
Storage temperature:	-10°C...+65°C (14°F... 149°F)
Relative humidity:	max. 80%, non-condensing

Housing

Dimensions:	110 mm x 45 mm x 120 mm
Weight:	0.5 kg
Protection rating:	IP 65
Length of the vibrometer cable:	2 m
Length of the battery cable:	0.3 m

**Battery
PDV-LI**

Electrical data

Type:	lithium ion battery (rechargeable)
Identification number:	8932
Voltage:	nom. 14.4V
Capacity:	nom. 4.6Ah
Operating time with PDV 100:	min. 4h
Charge/discharge cycles:	min. 500 (with capacity decline to 60%)

Housing

Dimensions:	80mm x 70mm x 115mm
Weight:	0.8 kg

**Carrier bag
PDV-BS**

Dimensions:	370mm x 160mm x 150mm
Weight:	5.5 kg (incl. PDV, plug-in power supply, 1 battery and battery charger)

A.2 Motor Vehicle Supply Cable PDV-DC

You use the motor vehicle supply cable PDV-DC to operate the laser vibrometer or the battery charger PDV-CH from a 12V on-board plug socket **or** a motor vehicle cigarette lighter. To do so, connect the 4-pin circular jack of the motor vehicle supply cable with the 4-pin circular connector **12V** on the back of the laser vibrometer or on the top of the battery charger. Then plug the connecting plug into the 12V on-board plug socket or, using the red adapter, into the motor vehicle cigarette lighter.

We do not recommend operating the PDV while the engine is running.

Note!

Use the red adapter for operation from a motor vehicle cigarette lighter.

Technical Specifications

Connector:	12VDC on-board plug socket with built-in fuse
Fuse:	2A/slow-blow
Cable length:	4 m

Appendix B: Declaration of Conformity

**Konformitätsbescheinigung / Declaration of Conformity**

für / for

Gegenstand / Objekt : Portable Digital Vibrometer**Typ / Model :** PDV-100**Zubehör****Typ / Model :**

Der Hersteller / The manufacturer

**Polytec GmbH
Polytec Platz 1-7
76337 Waldbronn / Germany**

bestätigt das Einhalten der Richtlinien 89 / 336 / EWG und 73 / 23 / EWG
confirms the compliance with the directive 89 / 336 EEC and 73 / 23 / EEC.

Das Gerät stimmt überein mit den folgenden Normen / The unit comply to the following standards:

EN 50825 - 1	Sicherheit von Laser-Einrichtungen / Safety of laser products
EN 61010	Sicherheitsbestimmungen für elektrische Meß-, Steuer-, Regel- und Laborgeräte / Safety requirements for electrical equipment for measurement, control and laboratory use
EN 50081 - 1	Elektromagnetische Verträglichkeit (EMV) Fachgrundnorm Störaussendung Electromagnetic compatibility / Emission - EN 55022 Grenzwertklasse: B (FCC Class B) - EN 61000-3-2, EN 61000-3-3
EN 61000-6-2	Elektromagnetische Verträglichkeit (EMV) Fachgrundnorm Störfestigkeit Electromagnetic compatibility / Immunity - EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-11

Ausgestellt von / Issued by

Polytec GmbH

13. November 2001
Datum / Date

Figure B.1: Declaration of conformity for the PDV 100

B Declaration of Conformity

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