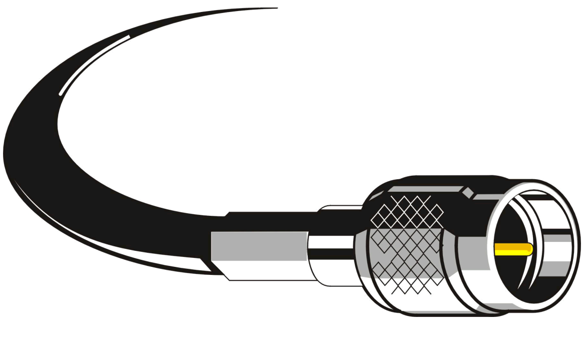
Hardware Manual

Polytec Scanning Vibrometer

PSV 300



Controller	OFV-3001 S
Scanning Head	OFV-056

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

Controller

Scanning Head

Pan-Tilt Head

Workstation

Sensor Head

Test Stand

Junction Box

Contents

1 Safety Information

1.1 Laser Safety

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

- In general, Polytec equipment complies with the standards **EN 60825-1** (DIN VDE 0837) and **CFR 1040.10** (US).
- 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 PSV conforms with **laser class II** and is generally very safe. Even when optimally focused, the laser radiation is not intense enough to harm the skin.
- The scanning head has been equipped with a **mechanical beam shutter** which can be used to block the laser beam during the warm-up phase or when the instrument is not in use, although switched on.
- The **emission indicator** on the scanning head indicates the activity of the laser and thus potential harm caused by emitted laser beams.
- The laser is switched on via a **key switch** on the controller. The key can only be removed when the controller is switched off.
- It is **not necessary to open** the housing of the scanning head when using the PSV as intended. Opening the housing will invalidate the warranty.

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

- Never look directly into the laser beam with the naked eye or with the aid of mirrors or optical instruments!
- Avoid staying in the scanning area! The laser beam can exit the scanning head at an angle of ±20°!
- Only switch the mechanical beam shutter to the ON position when you are making measurements!
- To position the scanning head, switch the beam shutter to the OFF position. Only when the head is roughly in place and has been fixed in a stable position, switch the beam shutter to ON.
- Do not use any reflective tools, watches etc. when you are working in the path of the laser beam!

1.2 Laser Warning Labels

1.2.1 EC Countries

The laser warning labels for the PSV in EC countries are shown in figure 1.1. Labels 2 and 3 are affixed in the language of the customer’s country. Their position on the scanning head is shown in figure 1.2.

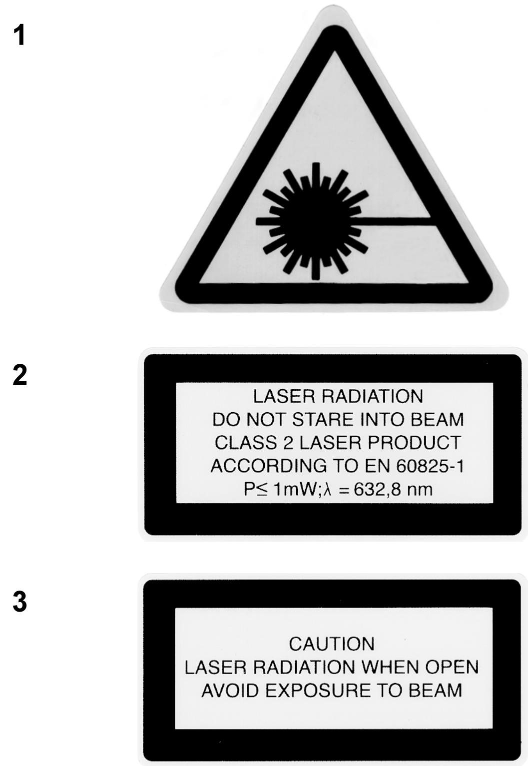


Figure 1.1: Laser warning labels for the PSV in EC countries

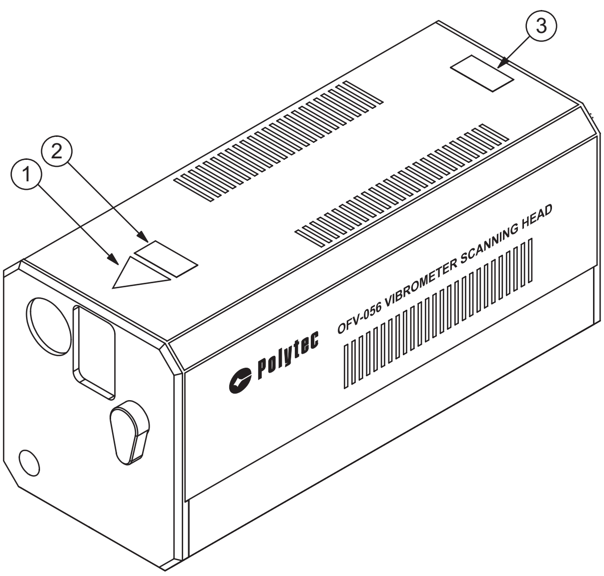


Figure 1.2: Position of the laser warning labels on the scanning head in EC countries

1.2.2 Non-EC Countries

The laser warning labels for the PSV in non-EC countries are shown in figure 1.3. Label **2** is affixed only within the USA. Their position on the scanning head is shown in figure 1.4.

1

CAUTION
LASER RADIATION
DO NOT STARE INTO BEAM
Helium Neon Laser
1 mW max / cw
CLASS II LASER PRODUCT

2

This equipment conforms
to provisions of
US 21 CFR 1040.10 and 1040.11

3

DANGER
Laser radiation when open
AVOID DIRECT EXPOSURE TO
BEAM

Figure 1.3: Laser warning labels for the PSV in non-EC countries

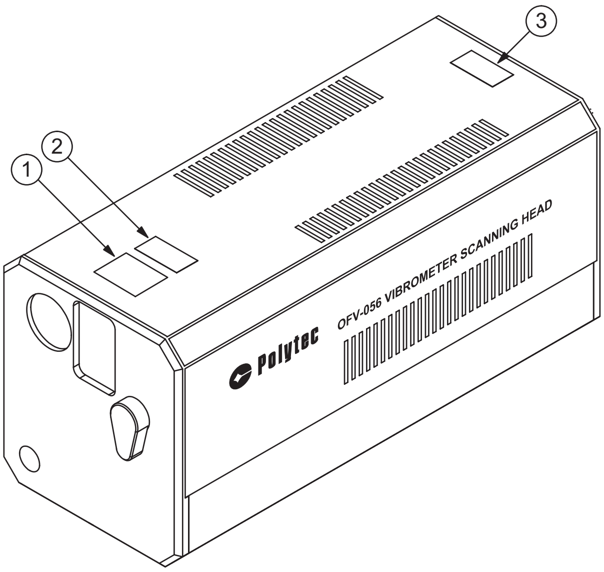


Figure 1.4: Position of the laser warning labels on the scanning head in non-EC countries

1.3 Electrical Safety

The PSV complies with the electrical safety class I. Electrical shock protection is achieved by a fully metallic housing connected to protective ground.

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

- The PSV controller and the workstation should only be connected via three pin mains cables to an AC mains supply 50/60 Hz with a grounded protective conductor with a nominal voltage which corresponds to the voltage set on the voltage selector.
- The mains voltage input of the workstation can also be designed as a wide range input like the junction box and therefore be connected to all mains voltages with nominal values between 100 V and 240 V.
- Defective mains fuses may only be replaced by fuses of the same kind with their rating given on the back.
- The PSV must not be used with open housing. As a general rule, before removing parts of the housing, the mains cable has to be unplugged.
- Air inlets and outlets must always be kept uncovered to ensure effective cooling. If the cooling fan stops working, the PSV is to be switched off immediately.

2 Introduction

2.1 Area of Application and System Summary

The **P**olytec **S**canning **V**ibrometer **PSV** measures the two-dimensional distribution of vibration velocities on the basis of laser interferometry. The system components are shown in figure 2.1.

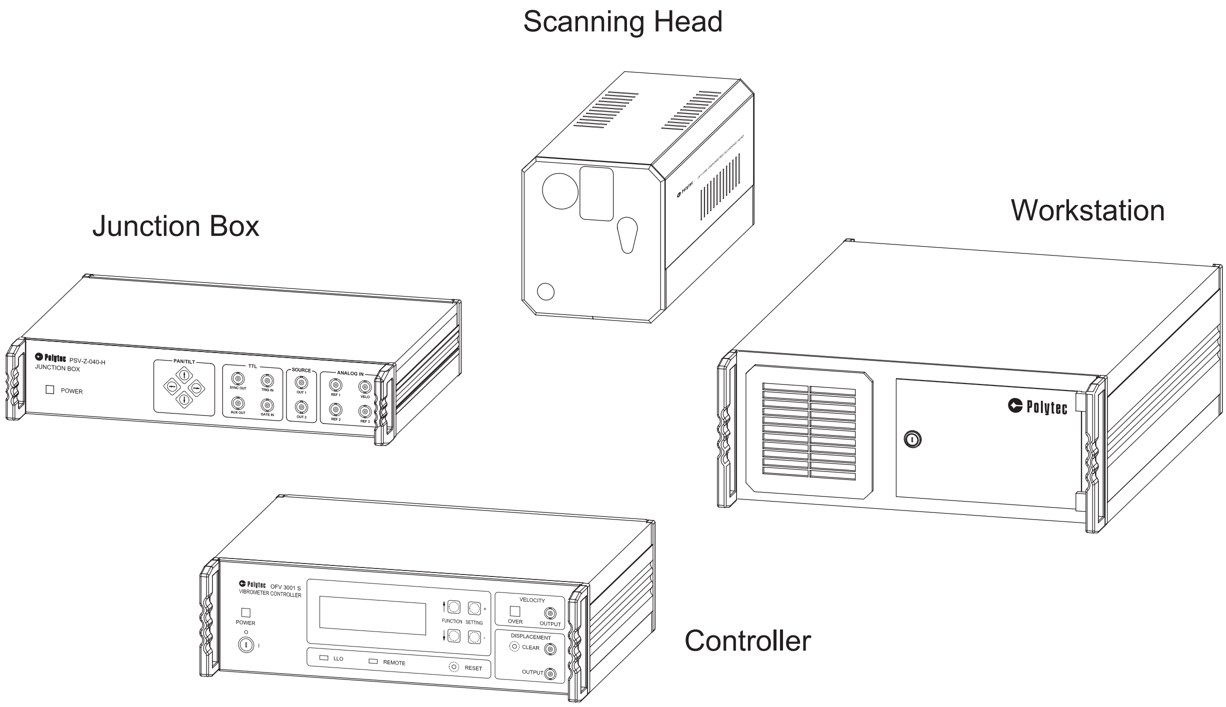


Figure 2.1: System components of the PSV

The interferometer signal is decoded in the **controller** with the velocity decoder. An analog voltage signal is thus generated which is proportional to the vibration velocity.

The **junction box** is the central connection point between the system components and provides the interfaces for peripheral devices.

The **scanning head** consists of the interferometer, the scanners to deflect the laser beam and a video camera to visualize the measurement object.

The measurement data is digitally recorded in the **workstation**. The software controls the data acquisition and offers user-friendly functions to evaluate the measurement data.

2.2 The Range of the PSV Models

The decoders and filters in the controller as well as the data acquisition board in the workstation determine the characteristics of the PSV. Depending on the application there are three different models on offer; their characteristics are summarized in table 2.1.

Table 2.1: Summary of the PSV models

PSV Model		PSV 300-H High Performance	PSV 300-F High Frequency	PSV 300-U Universal
Controller	Velocity decoder	OVD-04+PLL-DC	OVD-04 HF+PLL-DC	OVD-04 (+PLL-DC)[1]
	Measurement ranges $\frac{mm}{s}$/V	1/5/10/25/125/ 1000	1/5/10/25/125/ 1000	(1/5)[1] 10/25/125
	Maximum frequency	250 kHz	1.5 MHz	250 kHz
	Filter	400 Hz ... 102 kHz	5/20/100 kHz	5/20/100 kHz
Digital signal processing	Data acquisition board	PCI-4452	PCI-6111	PCI-4451
	Internal function generator	PCI-6711		
	Maximum bandwidth	80 kHz	1 MHz	40 kHz
	Input channels simultaneously	4	2	2
	Output channels of the internal function generator	3	1	(1)[1]

[1] The information in brackets is optional.

3 First Steps

3.1 Operating and Maintenance Requirements

Operating environment

The PSV can be operated in dry rooms under normal climate conditions (refer to specifications in chapter 7). In particular the optical components in the scanning head are sensitive to moisture, high temperature, jolting and dirt. A sufficient acclimatization period should be allowed for before switching the PSV on. Avoid condensation on the optical components caused by a rapid change in temperature.

Mains connection

Before taking the PSV into operation, please ensure that the supply voltage set with the voltage selectors of the controller and the workstation corresponds with the local mains voltage. Only replace defective fuses by fuses of the same kind and equal rating.

The mains voltage input of the workstation can also be designed as a wide range input and therefore be connected to all mains voltages with nominal values between 100 V and 240 V.

Assembly

The scanning head must not be positioned provisionally but mounted properly on a stable tripod using the threads provided.

Connecting cables

As a general rule the PSV must not be switched on until all cables have been connected. Make sure that all jack connections are connected properly and firmly. Plug in the SCSI-type connectors of the acquisition cable with great care at the right angles. Only use original RS-232 cables from Polytec for the RS-232 connections (1:1 wired). Protect all cables from mechanical damage and from high temperatures.

Warming-up

The helium-neon laser in the scanning head requires a certain period of time to reach optimum stability. The PSV should thus be switched on 30 minutes before the first measurements are made to ensure that it is in thermal equilibrium with the surroundings.

Cooling

It is very important to ensure that there is sufficient air circulation to keep the system components cool. The air vents of the scanning head must never be covered up and the back panels of the electronics cabinets must be at least 50 mm away from the wall.

Cleaning

The housing surfaces of the instrument can be cleaned with mild detergent solutions. Organic solvents must not be used.

Pan-tilt stage

Avoid any additional weight on the pan-tilt stage by placing objects on top of the scanning head or attaching things to it as this can put strain on the pan-tilt stage.

Installing other components

Always contact Polytec prior to connecting any other hardware or software components to the PSV which are not part of it as this is likely to damage the system and could invalidate the warranty.

Opening up the equipment Opening up of the equipment without authorization is not necessary for its operation and will invalidate the warranty.

3.2 Unpacking and Inspection

Unpacking The PSV consists of the following components:

- controller OFV-3001 S
- scanning head OFV-056
- junction box PSV-Z-040 (-H, -F, -U)
- workstation with keyboard and mouse
- monitor with monitor cable and mains cable
- tripod with fluid stage OFV-S2
- umbilical cable
- interferometer cable
- video cable
- acquisition cable
- DIO/DAC cable
- BNC cable
- 2 RS-232 cables (1:1 wired)
- 3 mains cables
- PSV 300-H, -F: hand set PSV-Z-051

optional

- TFT monitor with monitor cable and mains cable
- heavy duty tripod with motorized pan-tilt stage, connector box and mains cable PSV-Z-017 (instead of the OFV-S2)
- PSV 300-H: generator cable for the internal function generator
- PSV 300-U: hand set PSV-Z-051
- coaxial unit OFV-056-C
- acoustic gate unit PSV-Z-EQ with BNC cable
- system cabinet PSV-Z-035
- hand set OFV-310
- vertical test stand PSV-Z-018

Caution!

Protect the unpacked scanning head from hard jolts as these can lead to misalignment of the interferometer!

Inspection Please pay attention to the following steps when unpacking the PSV:

1. Check the packaging for signs of unsuitable handling during transport.

2. After unpacking, check all components for external damage (scratches, loose screws etc.).

3. In the case of a wrong delivery, damage or missing parts, inform your local Polytec representatives immediately and give them the serial numbers of the instruments. The identification labels can be found on the back of the instruments and also on the inside cover of this manual.

4. Carefully retain the original packaging in case you have to return the PSV.

Install the PSV as described in section 3.4 and carry out a functional test as described in section 3.5.

3.3 Control Elements

3.3.1 Controller

Front panel The front panel of the controller is shown in figure 3.1.

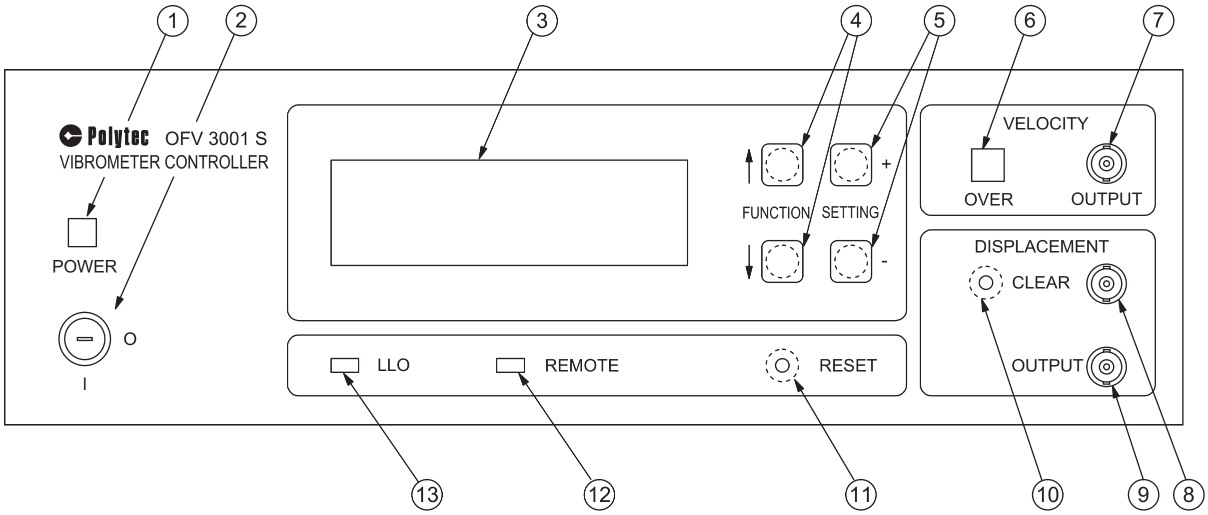


Figure 3.1: Front view of the controller

1 POWER LED

The LED lights up when the key switch on the controller is turned to position I and indicates that the controller is ready to operate.

2 Mains switch

This key switch disconnects the vibrometer from the mains (position O) and is used to turn it off in the case of danger.

Caution!
Always connect all connecting cables **before** switching the controller on!

3 Liquid Crystal Display (LCD) with background lighting

This display shows the settings of the controller. The organization of the display and how to use it to operate the controller without the software are described in section 5.12.

4 FUNCTION keys

These keys do not have a function, when the controller is operated via the software. When the controller is operated without the software, the cursor is moved up and down on the display using the ↑ and ↓ keys (refer to section 5.12.1).

5 SETTING keys

These keys do not have a function, when the controller is operated via the software. When the controller is operated without the software, these keys are used to change the settings (refer to section 5.12.1).

6 OVER indicator for the velocity

The LED lights up when the output voltage exceeds either the positive or negative full scale range (peak) of the velocity decoder. If it lights up permanently, the next highest range must be selected (refer to section 4.2.1).

7 Analog voltage output for the **VELOCITY** signal (BNC jack)

The voltage at this output is proportional to the instantaneous vibration velocity of the object to be measured. The voltage is positive if the object is moving towards the scanning head.

8 CLEAR socket for the displacement decoder (BNC jack)

This socket allows synchronized resetting of the optional displacement decoder. This input is only active if a displacement decoder is installed.

9 Analog voltage output for the **DISPLACEMENT** signal (BNC jack)

The voltage at this output is proportional to the instantaneous displacement of the object to be measured. The output is only active if a displacement decoder is installed.

10 CLEAR key for the displacement decoder

Using this key the optional displacement decoder can be reset manually.

11 RESET key

The controller processor can be reset using this key.

12 REMOTE LED

The LED lights up if the controller is being operated remotely via one of the interfaces. Manual operation with the keys ↑, ↓, +, – on the front panel is also possible, however, manual settings are not transferred to the software.

13 LLO LED

This LED lights up when the status **L**OCAL **L**OCK **O**UT has been activated via the software. The keys ↑, ↓, +, – on the front panel are then deactivated and the controller is operated exclusively via the software.

Back panel The back panel of the controller is shown in figure 3.2.

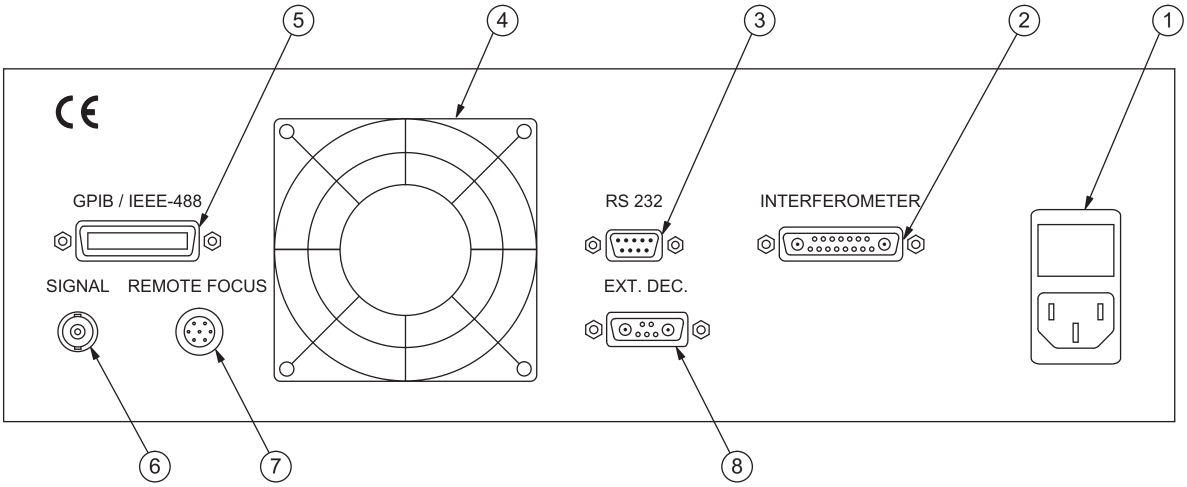


Figure 3.2: Rear view of the controller

1 **Mains connection** combination

Socket for standard power cord with built-in fuses and mains voltage selector

Warning!
Always disconnect from the mains **before** checking the fuses!

Caution!
Always check the settings of the voltage selector and the rating of the fuses **before** connecting to the mains!

2 **INTERFEROMETER** connector (Sub-D jack)

Jack for the interferometer cable to the junction box

3 **RS 232** interface (9-pin Sub-D jack)

Jack for the RS-232 cable to the workstation to control the PSV with the software

Note!
To control the PSV using the software, in the controller the transfer rate must be set to **9600 Baud** (refer to section 5.12.3)!

4 **Cooling fan**

Caution!
This opening must **always** be kept free to ensure sufficient cooling! The distance from the wall should be at least 50mm!

5 **IEEE-488/GPIB** interface

6 **SIGNAL** output (BNC jack)

The DC voltage at this output is proportional to the logarithm of the optical signal level.

7 **REMOTE FOCUS** interface (7-pin circular jack)

Interface for the optional hand set OFV-310 to focus the laser beam (refer to section A.3)

8 External decoder interface **EXT. DEC.** (optional)

Interface for an external digital displacement decoder

3.3.2 Scanning Head

On the underside of the scanning head, there is a 4-pin circular jack for the cable to the optional pan-tilt stage PSV-Z-017.

Front panel The front panel of the scanning head is shown in figure 3.3.

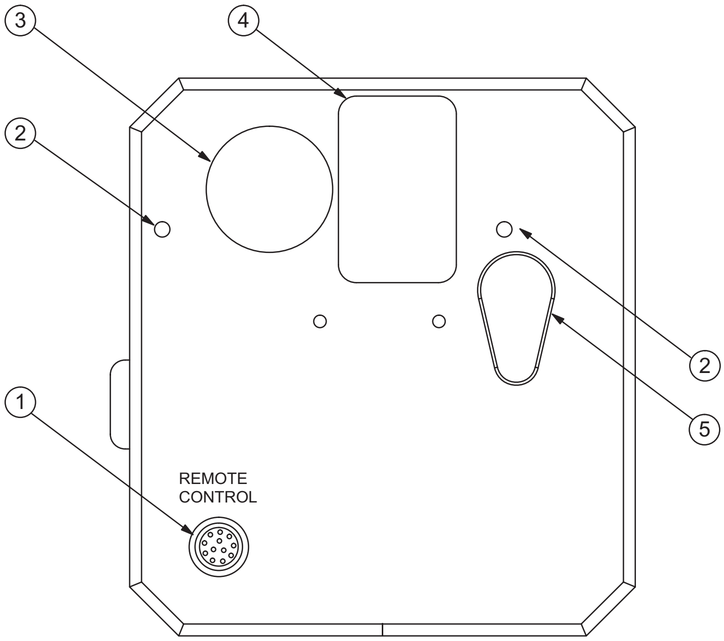


Figure 3.3: Front view of the scanning head

1 Connector **REMOTE CONTROL** for the hand set PSV-Z-051 (12-pin circular connector)

The hand set is used for focusing and positioning the laser beam (refer to section 5.6 and section 5.8).

2 Mounting holes for the optional **coaxial unit** OFV-056-C

The optional coaxial unit is used for scanning small parts at short distance (refer to section A.1).

3 **Video camera** front lens

The video camera is controlled via the software as described in your software manual.

4 **Laser beam** aperture

Focusing and positioning the laser beam is controlled via the software as described in your software manual. The laser beam can also be focused and positioned using the hand set as described in section 5.6 and section 5.8.

Warning!
Never look directly into the laser beam with the naked eye or with the aid of mirrors or optical instruments!

5 **Dust cover** switch bar

Rotating the switch bar to a vertical position closes the apertures for the laser beam and the video camera.

Caution!
To protect the lenses and scanner mirrors, **only** open the dust cover when your are making measurements!

Back panel

The back panel of the scanning head is shown in figure 3.4.

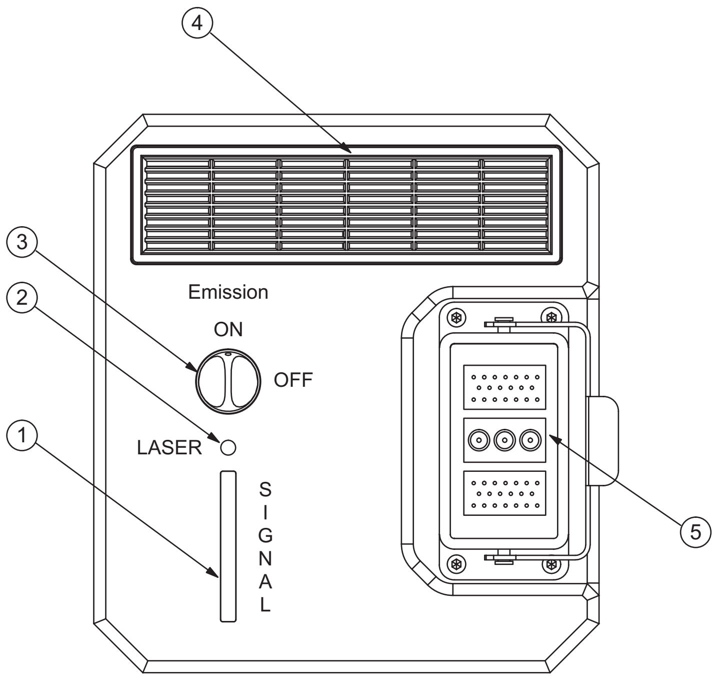


Figure 3.4: Rear view of the scanning head

1 Signal level display **SIGNAL**

The length of the bar is a measure of the amount of light scattered back from the measurement surface.

2 **LASER** LED

The LED lights up when the scanning head is correctly cabled to the junction box and the laser is turned on (key switch on the controller in position I). The LED indicates that the laser is active, even if the beam shutter is closed (refer to section 5.2).

3 Beam shutter **EMISSION ON/OFF**

In position OFF the laser beam is blocked.

Warning!
Only switch the beam shutter to the ON position when you are making measurements!

4 **Air vents**

Caution!
This opening must **always** be kept free to ensure sufficient cooling!

5 **Main connector** (industrial-style)

Jack for the umbilical cable to the junction box

3.3.3 Junction Box

Front panel for model -H

The front panel of the junction box for the PSV model -H is shown in figure 3.5.

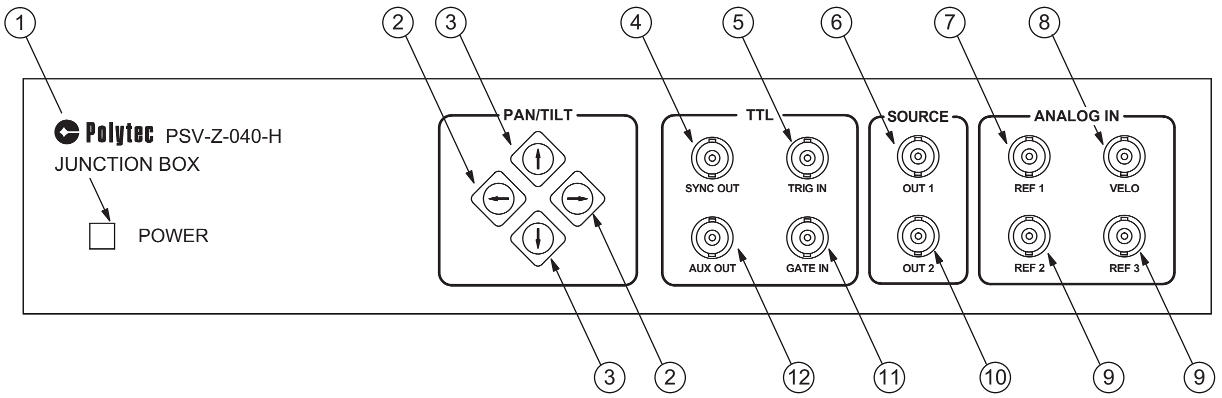


Figure 3.5: Front view of the junction box for the PSV model -H

1 **POWER** LED

The LED lights up when the junction box is correctly cabled to the controller and the key switch on the controller is turned to position I. The LED indicates that the junction box is ready to operate.

2 Control keys for the **pan-tilt head**, pan

Using these keys the optional pan-tilt stage is panned clockwise (→) or anti-clockwise (←) (refer to section 5.4). Alternatively it can be controlled via the software as described in the software manual.

3 Control keys for the **pan-tilt head**, tilt

Using these keys the optional pan-tilt stage is tilted upward (↑) or downward (↓) (refer to section 5.4). Alternatively it can be controlled via the software as described in the software manual.

4 TTL output **SYNC OUT** (BNC jack)

Synchronization pulse for the generator signal.

5 TTL input **TRIG IN** (BNC jack)
TTL input for an external trigger signal

6 Generator output **OUT 1** (BNC jack)
Output signal of the internal function generator.

7 Analog input **REF 1** (BNC jack)
Analog input for the reference signal

8 Analog input **VELO** for the velocity signal (BNC jack)
Analog input for the velocity signal from the controller

9 Analog inputs **REF 2** and **REF 3** (BNC jack)
Analog inputs for 2 additional reference signals

10 Generator output **OUT 2** (BNC jack)
Additional output signal of the internal function generator

11 TTL input **GATE IN** (BNC jack)
TTL input for an external gating signal.

12 TTL output **AUX OUT** (BNC jack)
TTL output for special applications, programmable via the optional Visual® Basic Engine PSV-Z-082

Front panel for models -F, -U

The front panel of the junction box for the PSV models -F and -U is shown in figure 3.6.

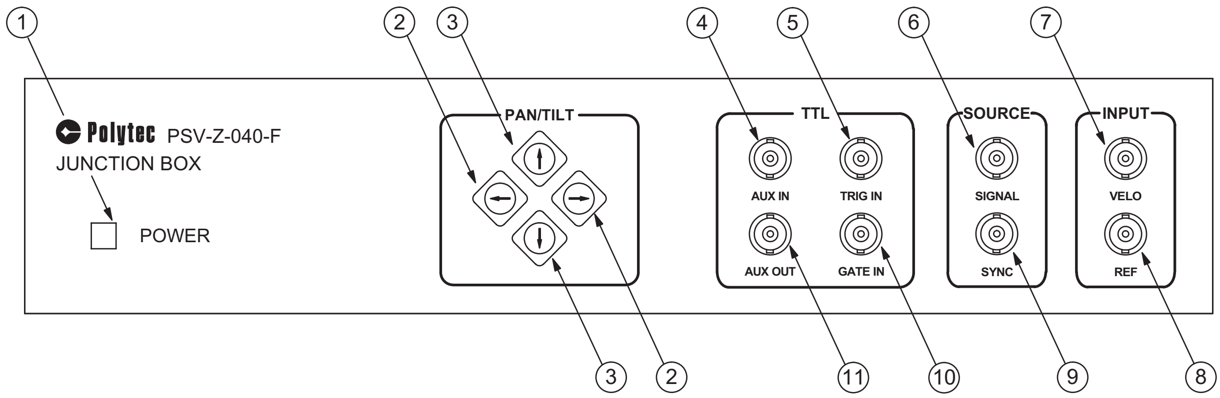


Figure 3.6: Front view of the junction box for the PSV models -F and -U

1 **POWER** LED
The LED lights up when the junction box is correctly cabled to the controller and the key switch on the controller is turned to position I. The LED indicates that the junction box is ready to operate.

2 Control keys for the **pan-tilt head**, pan
Using these keys the optional pan-tilt stage is panned clockwise (→) or anti-clockwise (←) (refer to section 5.4). Alternatively it can be controlled via the software as described in the software manual.

3 Control keys for the **pan-tilt head**, tilt

Using these keys the optional pan-tilt stage is tilted upward (↑) or downward (↓) (refer to section 5.4). Alternatively it can be controlled via the software as described in the software manual.

4 TTL input **AUX IN** (BNC jack)

TTL input for special applications

5 TTL input **TRIG IN** (BNC jack)

TTL input for an external trigger signal

6 Generator output **SIGNAL** (BNC jack)

Output signal of the internal function generator.

PSV 300-U: The output is only active if the corresponding option is installed.

7 Analog input **VELO** for the velocity signal (BNC jack)

Analog input for the velocity signal from the controller

8 Analog input **REF** (BNC jack)

Analog input for the reference signal

9 TTL output **SYNC** (BNC jack)

Synchronization pulse for the generator signal.

PSV 300-U: The output is only active if the corresponding option is installed.

10 TTL input **GATE IN** (BNC jack)

TTL input for an external gating signal.

PSV 300-U: The input is only active if the corresponding option is installed.

11 TTL output **AUX OUT** (BNC jack)

TTL output for special applications, programmable via the optional Visual® Basic Engine PSV-Z-082

Back panel for all models The back panel of the junction box for the PSV models -H, -F and -U is shown in figure 3.7.

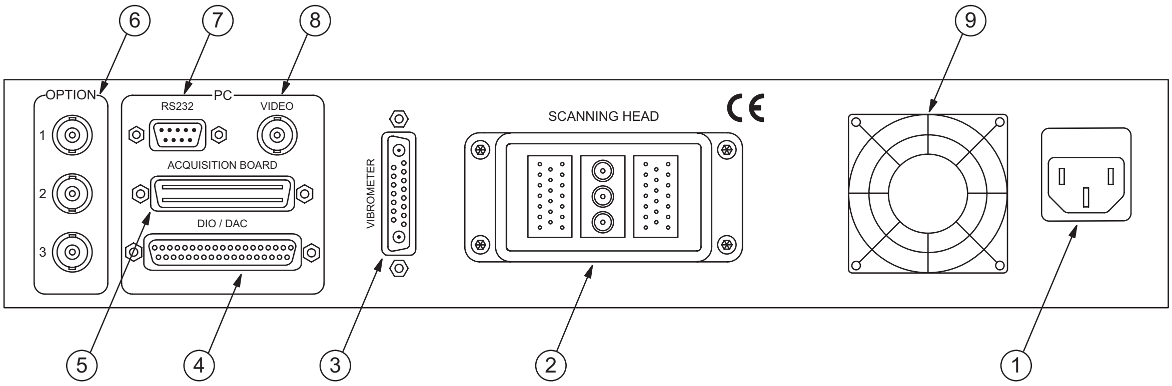


Figure 3.7: Rear view of the junction box

1 Mains connection combination

Mains socket with built-in fuses. The mains voltage input is designed as a wide range input.

Warning!
Always disconnect from the mains **before** checking the fuses!

Caution!
Always check the fuses **before** installing the PSV!

2 SCANNING HEAD connector (industrial-style)

Jack for the umbilical cable to the scanning head

3 VIBROMETER connector (Sub-D jack)

Jack for the interferometer cable to the controller

4 DIO/DAC connector (37-pin Sub-D jack)

Jack for the DIO/DAC cable to the workstation to control the scanner mirrors and the pan-tilt stage

5 ACQUISITION BOARD connector (SCSI-II type)

Jack for the acquisition cable to the workstation to transmit both measurement and control signals

6 Optional connectors **OPTION 1, 2, 3** (BNC jacks)

PSV 300-H: Connectors for the generator cable to the workstation for the internal function generator (optional)

PSV 300-F, -U: Up to three BNC jacks can be made available for special applications.

7 RS 232 interface (9-pin Sub-D connector)

Jack for the RS-232 cable to the workstation to control the video camera

8 VIDEO output (BNC jack)

Jack for the video cable to transmit the video signal to the workstation

9 Cooling fan

Caution!
This opening must **always** be kept free to ensure sufficient cooling! The distance from the wall should be at least 50mm!

3.3.4 Workstation

Front panel for all models

The front panel of the workstation for the PSV models -H, -F and -U is shown in figure 3.8. The lockable front flap is shown as transparent.

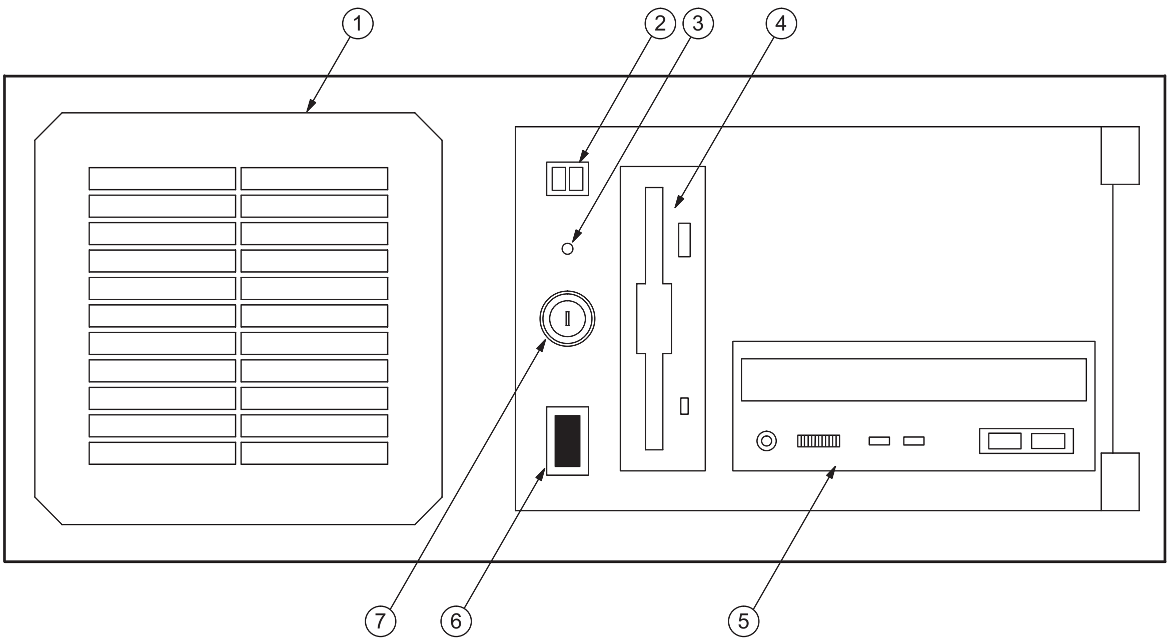


Figure 3.8: Front view of the workstation

1 Cooling fan

Caution!
This opening must **always** be kept free to ensure sufficient cooling!

2 POWER and **HDD** LED

The green LED (POWER) lights up when the workstation is switched on using the mains switch on the back and when the black key on the front is pressed. The red LED being lit indicates the activity of the hard disk drive (HDD) in the workstation.

3 RESET key

Using this key the control processor of the workstation can be reset and the workstation can be restarted. The setting of the workstation is subsequently the same as it was straight after switching on. You can press this key through the opening using a thin object.

4 3.5" disk drive

5 CD-ROM drive or rewriter

You will find an exact description of the drive in the user manual of the manufacturer.

6 On/Off key

Pressing the black key, the workstation will be switched on or off.

7 Lock with key in the front flap

To secure the workstation for unauthorized using, the front flap can be locked using the key.

Back panel for model -H

The back panel of the workstation for the PSV model -H is shown in figure 3.9. The order of the boards can be different from the picture.

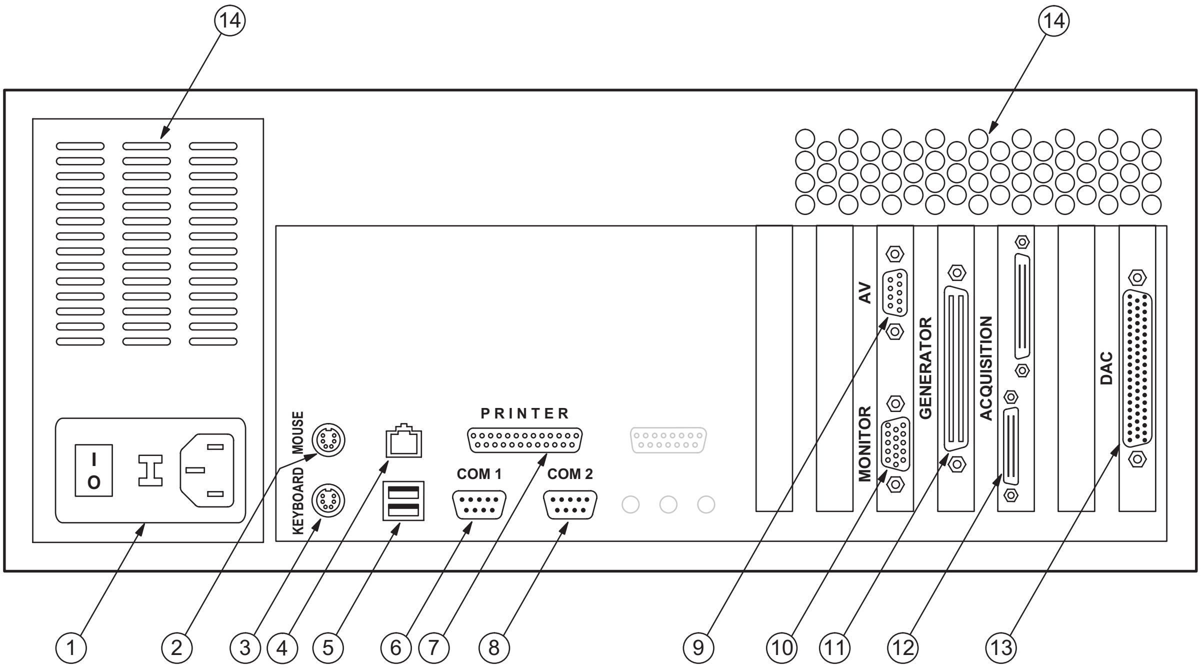


Figure 3.9: Rear view of the workstation for the PSV model -H

1 Mains connection combination

Mains socket with a mains switch and mains voltage selector. Instead of using the voltage selector, the mains voltage input can also be designed as a wide range input (refer to section 3.1). The mains switch disconnects the workstation from the mains (position O) and is used to turn it off in case of danger.

Caution!
If applicable, **always** check the setting of the mains voltage selector **before** connecting the workstation to the mains!

2 **MOUSE** connector (6-pin circular jack)

3 **KEYBOARD** connector (6-pin circular jack)

4 **Network** connector
Jack of the Ethernet network board

5 **USB** port (Universal Serial Bus)
Alternative jack for peripheral devices like mouse, keyboard, etc.

6 Serial interface **COM 1** (9-pin Sub-D connector)
Jack for the RS-232 cable to the junction box to control the video camera

7 Parallel **PRINTER** connector (25-pin Sub-D jack)

8 Serial interface **COM 2** (9-pin Sub-D connector)
Jack for the RS-232 cable to the controller to control the PSV via the software

9 **AV** connector (9-pin Sub-D jack)
Jack for the video cable to the junction box to transmit the video signal

10 **MONITOR** connector (15-pin Sub-D jack)

11 **GENERATOR** connector for the internal function generator (SCSI-II type)
Jack for the generator cable of the internal function generator to the junction box

12 **ACQUISITION** connector for the data acquisition (VHDIC type)
Jack for the Y-shaped acquisition cable to the junction box to transmit both measurement and control signals

13 **DAC** connector (62-pin Sub-D jack)
Jack for the DIO/DAC cable to the junction box to control the scanner mirrors and the pan-tilt stage

14 **Air vents**

Caution!
These openings must **always** be kept free to ensure sufficient cooling! The distance from the wall should be at least 50 mm!

Back panel for models -F, -U The back panel of the workstation for the PSV models -F and -U is shown in figure 3.10. The order of the boards can be different from the picture.

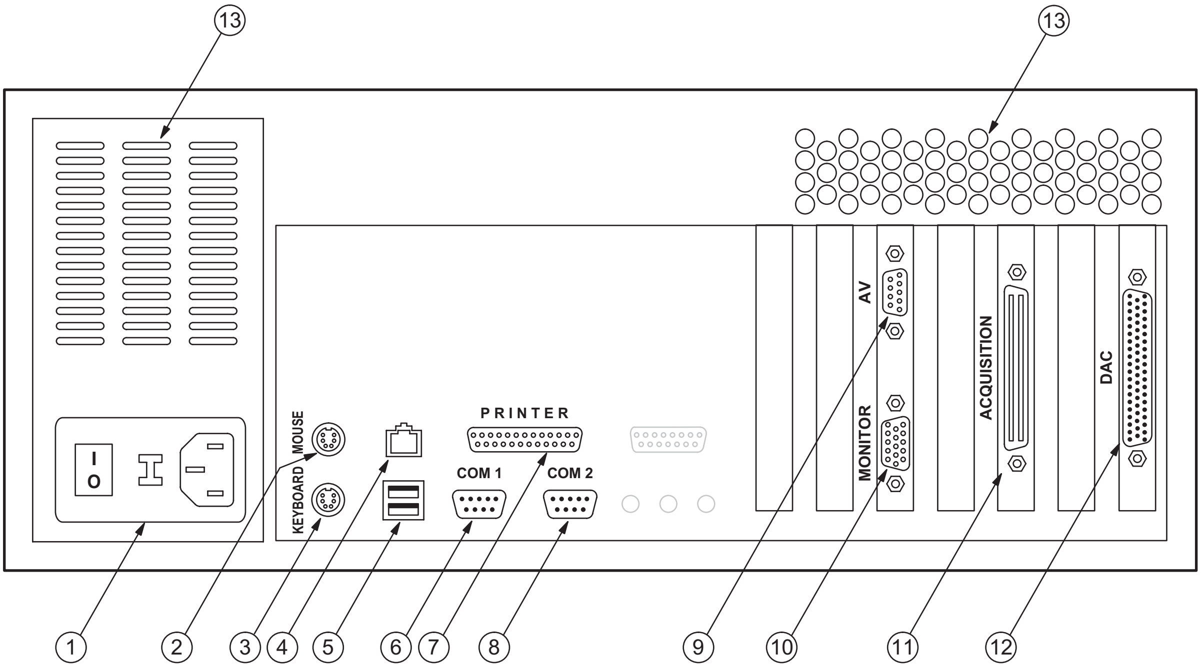


Figure 3.10: Rear view of the workstation for the PSV models -F and -U

1 Mains connection combination

Mains socket with a mains switch and mains voltage selector. Instead of using the voltage selector, the mains voltage input can also be designed as a wide range input (refer to section 3.1). The mains switch disconnects the workstation from the mains (position O) and is used to turn it off in case of danger.

Caution!
If applicable, **always** check the setting of the mains voltage selector **before** connecting the workstation to the mains!

2 MOUSE connector (6-pin circular jack)

3 KEYBOARD connector (6-pin circular jack)

4 Network connector

Jack of the Ethernet network board

5 USB port (Universal Serial Bus)

Alternative jack for peripheral devices like mouse, keyboard, etc.

6 Serial interface **COM 1** (9-pin Sub-D connector)

Jack for the RS-232 cable to the junction box to control the video camera

7 Parallel **PRINTER** connector (25-pin Sub-D jack)

8 Serial interface **COM 2** (9-pin Sub-D connector)

Jack for the RS-232 cable to the controller to control the PSV via the software

9 **AV** connector (9-pin Sub-D jack)

Jack for the video cable to the junction box to transmit the video signal

10 **MONITOR** connector (15-pin Sub-D jack)

11 **ACQUISITION** connector for the data acquisition (SCSI-II type)

Jack for the acquisition cable to the junction box to transmit both measurement and control signals

PSV 300-U: The PSV model -U has two VHDIC connectors instead of the SCSI-II type connector (refer to PSV model -H).

12 **DAC** connector (62-pin Sub-D jack)

Jack for the DIO/DAC cable to the junction box to control the scanner mirrors and the pan-tilt stage

13 **Air vents**

Caution!

These openings must **always** be kept free to ensure sufficient cooling! The distance from the wall should be at least 50 mm!

3.4 Installation

3.4.1 Mechanical Assembly

Scanning head

The scanning head is mounted on either a tripod with fluid stage (OFV-S2) or a heavy duty tripod with motorized pan-tilt stage (optional PSV-Z-017). The heavy-duty tripod can also be mounted on a trolley (optional). The scanning head mounted on the fluid stage and on the tripod is shown in figure 3.11.

Figure 3.11: Scanning head mounted on the fluid stage and on the tripod

Before attempting to mount the scanning head, all locking mechanisms of the trolley and the tripod, particularly screws, should be checked to make sure they are tight. A loose screw may cause the stand to be unstable and possibly collapse.

Note!
It is best to carry out the following assembly when someone is there to help you!

Tripod with fluid stage OFV-S2

If your PSV is equipped with a fluid stage, you must 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 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. A suitable quick release hexagonal plate has been pre-mounted on the scanning head. Use this plate to position the scanning head on the fluid stage.

   The safety lever clicks into place automatically.
5. Ensure that the quick release plate is attached all the way around. This needs to be done before the scanning head is ready to use.
6. Whenever you want to remove the scanning head from the fluid stage, one person should hold the scanning head while the second person opens the safety lever.
7. Keep the assembly instructions for the tripod and the fluid stage in a safe place.

Tripod with pan-tilt stage PSV-Z-017 (optional)

If your PSV is equipped with a pan-tilt stage you must proceed with the assembly as follows:

1. Unpack the pan-tilt stage and check it for external damage (scratches, loose screws, etc.).
2. Check the contents of the assembly kit:

   1 Adapter plate with 3 Allen screws M6x16
   1 Connector box with 4 Allen screws M8x40
   3 Allen screws M8x16 with washers
   1 Mounting plate with 2 Allen screws M6x20
   2 Allen screws M6x16 with washers
   1 Allen key size 5
   1 Allen key size 6

> **Caution!**
>
> Make sure that the screws are always tightened, to ensure that the system is both stable and functions accurately!

3. Attach the mounting plate on the underside of the scanning head with 2 Allen screws M6x20. To do this use the Allen key size 5.

> **Caution!**
>
> Make sure that the mounting plate is correctly aligned! The FRONT labeled side of the plate has to be mounted in the direction of the front panel of the scanning head as shown in figure 3.12.

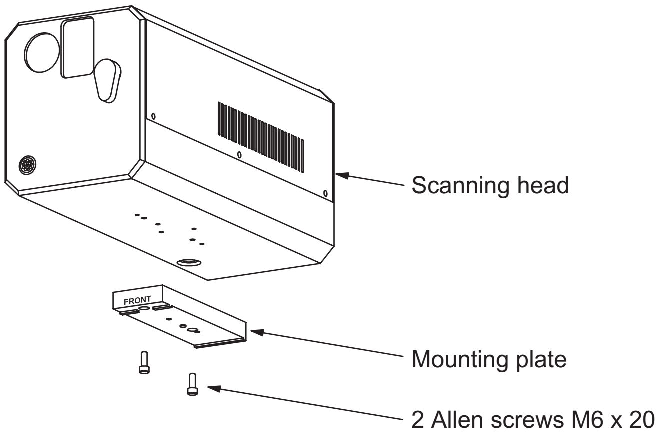


Figure 3.12: Fixing the mounting plate on the scanning head

4. Unpack the tripod and check it for external damage (scratches, loose screws, etc.).

5. Assemble the tripod as described in the assembly instructions from the manufacturer MANFROTTO.

6. Unscrew the plate on the top of the tripod and keep the plate and the screws in case you may need them at a later date.

7. Now mount the adapter plate on the top of the tripod using the 3 Allen screws M6x16 as also shown in figure 3.13. Ensure that the knob on the underside of the tripod is always tightened securely.

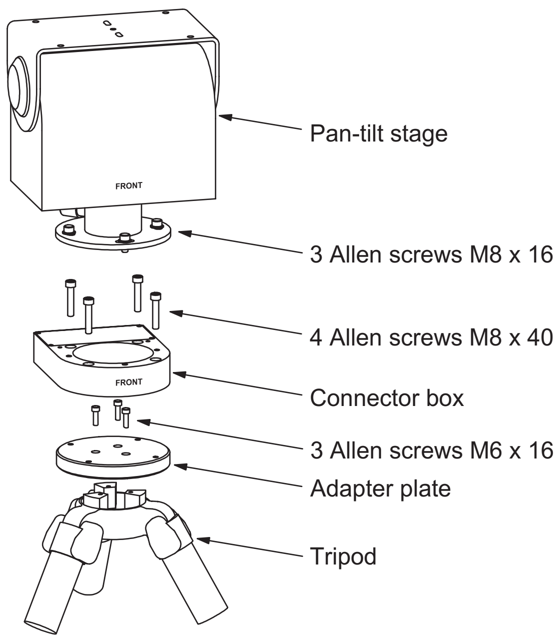


Figure 3.13: Mounting the pan-tilt stage on the tripod

8. Screw the connector box on the adapter plate using the 4 Allen screws M8x40. To do this, use the Allen key size 6.

9. Fix the pan-tilt stage on the connector box using the 3 Allen screws M8x16 and the washers.

> **Caution!**
>
> Make sure that the pan-tilt stage is correctly aligned to the connector box! The FRONT labeled sides have to be mounted in the same direction.

10. Then mount the scanning head with its mounting plate on the pan-tilt stage using the 2 Allen screws M6x16 and the washers as shown in figure 3.14.

> **Caution!**
>
> Make sure that the FRONT labeled sides of the components are mounted in the direction of the front panel of the scanning head!

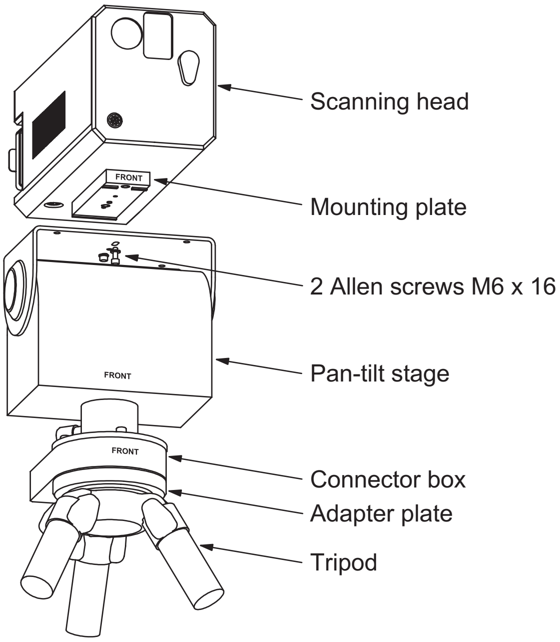


Figure 3.14: Mounting the scanning head on the pan-tilt stage

11. Keep the assembly instructions for the tripod and pan-tilt stage in a safe place.

For cabling the pan-tilt stage, refer to section 3.4.2.

System cabinet PSV-Z-035 (optional)

You receive the system cabinet PSV-Z-035 ready assembled. The positions of the individual system components in the cabinet is shown in figure 3.15.

1. Undo the housing feet of the system components and keep the housing feet and the screws in a safe place.

2. Place the controller at the bottom as the air vents are situated in the bottom plate.

> **Caution!**
>
> To ensure sufficient cooling, the controller must be situated at the bottom and the junction box at the top of the system cabinet!

3. Insert the workstation above the controller.

4. Are the air vents of your junction box in the top plate? If not, please exchange the top and bottom plate.

5. Insert the junction box above the workstation.

6. Fix all front panels with the screws provided.

7. Place the other system components as shown in figure 3.15.

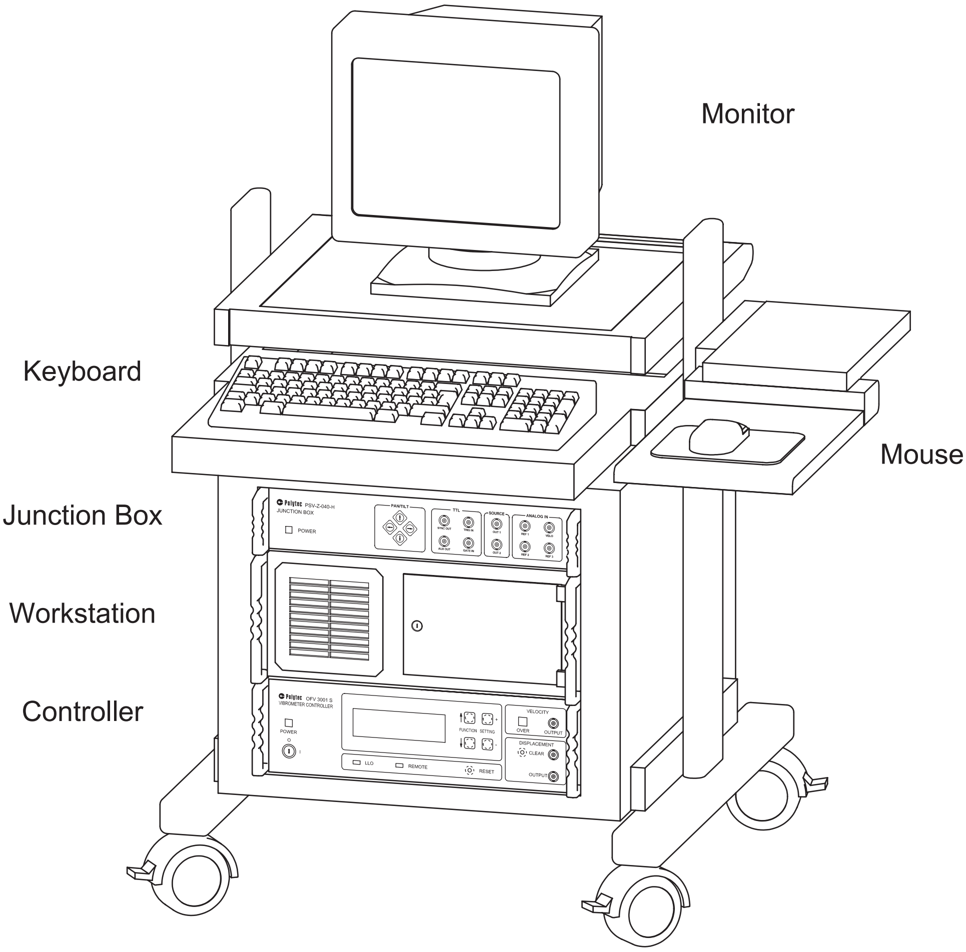


Figure 3.15: Position of the PSV components on the system cabinet

All system components should now be correctly mounted.

3.4.2 Cabling

The individual steps on cabling the PSV are described in the following. The complete cabling is shown in figure 3.16 to figure 3.18. All connections must be made easily. If not, check the plugs for bent contact pins to avoid serious damage being incurred. Secure the connections correspondingly. Should any problems occur in cabling, please contact your local Polytec representative.

Caution!
Always connect all components to each other **before** plugging in the mains cables!

Workstation

1. Connect the keyboard to the socket KEYBOARD on the back of the workstation.
2. Connect the mouse to the socket MOUSE on the back of the workstation.
3. Plug the monitor cable into the back of the monitor and into the socket MONITOR on the back of the workstation.

Controller ⇔ workstation

4. To operate the controller via the software, plug an **RS-232** cable into the jack RS 232 on the back of the controller and into either of the jacks COM1 or COM2 on the back of the workstation.

Controller ⇔ hand set OFV-310

5. If applicable, connect the optional hand set OFV-310 to the circular jack REMOTE FOCUS on the back of the controller.

Controller ⇔ junction box

6. Plug the **Interferometer** cable into the Sub-D jack INTERFEROMETER on the back of the controller and into the Sub-D jack VIBROMETER on the back of the junction box.
7. For transmission of the velocity signal, plug the **BNC** cable into the BNC jack VELOCITY OUTPUT on the front of the controller and into the BNC jack VELO on the front of the junction box.

Reference signal

8. **PSV 300-H:** If required, connect the reference signal to the BNC jack REF1 on the front of the junction box for the model -H.

   PSV 300-F, -U: If required, connect the reference signal to the BNC jack REF on the front of the junction box for the models -F and -U.
9. **Only PSV 300-H:** You can connect two additional reference signals to the BNC jacks REF2 and REF3 on the front of the junction box for the model -H.

External trigger

10. If required, connect the external trigger signal to the BNC jack TRIG IN on the front of the junction box.

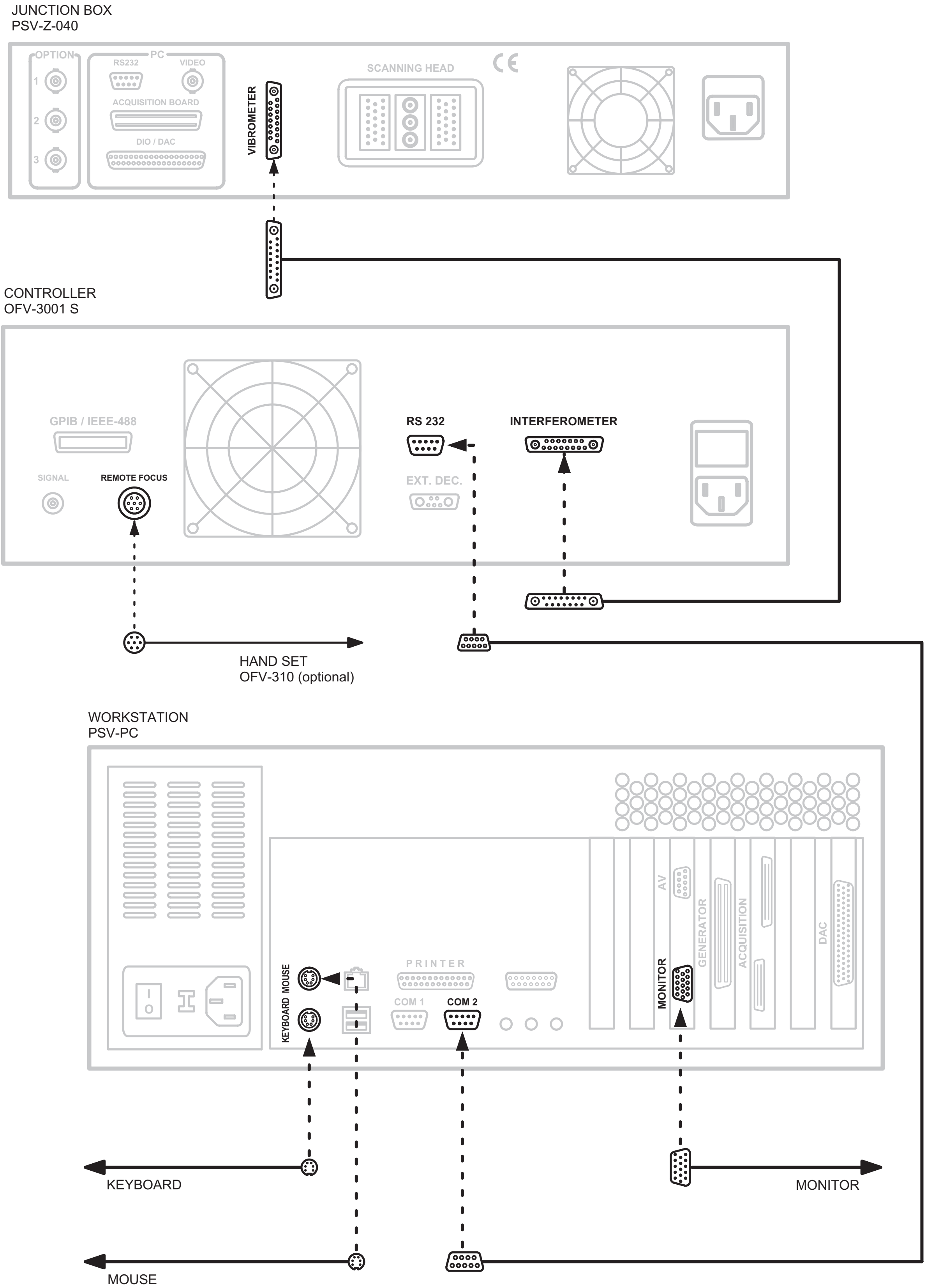


Figure 3.16: Cabling of the controller’s back panel

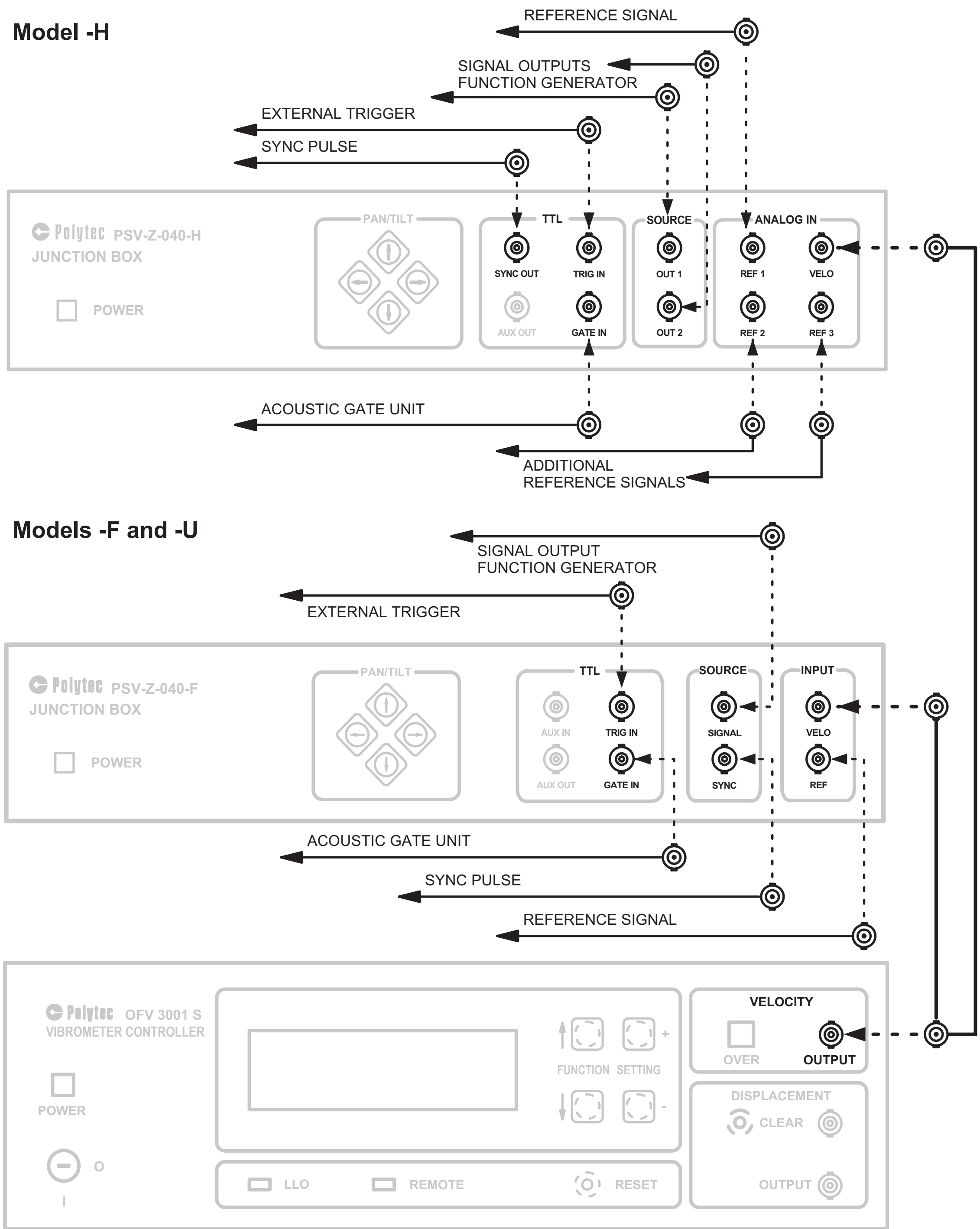


Figure 3.17: Cabling of the front panels of the controller and the junction box

Internal function generator

11. **PSV 300-H:** If required, the signal of the internal function generator is available at the BNC jacks OUT 1 and OUT 2 on the front of the junction box for the model -H and at the BNC jack OUT 3 of the generator cable.

    PSV 300-F, -U: If required, the signal of the internal function generator is available at the BNC jack SIGNAL on the front of the junction box for the models -F and -U.

12. **PSV 300-H:** If required, the synchronized pulse of the generator signal is available at the BNC jack SYNC OUT on the front of the junction box.

    PSV 300-F, -U: If required, the synchronized pulse of the generator signal is available at the BNC jack SYNC on the front of the junction box.

Acoustic gate unit

13. If applicable, connect the optional acoustic gate unit PSV-Z-EQ to the BNC jack GATE IN on the front of the junction box.

Junction box ⇔ workstation

14. To control the video camera, plug an **RS-232** cable into the jack RS 232 on the back of the junction box and into either of the jacks COM1 or COM2 on the back of the workstation.

15. Plug the **Video** cable into the BNC jack VIDEO on the back of the junction box and into the 9-pin Sub-D jack AV on the back of the workstation.

Caution!

Plug in the SCSI-type connectors with great care at the right angles so as not to damage them!

16. **PSV 300-H, -U:** Plug the Y-shaped **Acquisition** cable into the SCSI-type connector ACQUISITION BOARD on the back of the junction box and into the two VHDIC-type connectors ACQUISITION on the back of the workstation.

    PSV 300-F: Plug the **Acquisition** cable into the SCSI-type connector ACQUISITION BOARD on the back of the junction box and into the SCSI-type connector ACQUISITION on the back of the workstation.

17. Plug the **DIO/DAC** cable into the 37-pin Sub-D jack DIO/DAC on the back of the junction box and into the 62-pin Sub-D jack DAC on the back of the workstation.

18. **Only PSV 300-H:** If required, plug the **Generator** cable into the three BNC jacks OPTION 1, 2 and 3 on the back of the junction box and into the SCSI-type connector GENERATOR on the back of the workstation.

Caution!

The cable numbers of the generator cable have to be in accordance with the corresponding number of the jack (OPTION 1, 2 or 3) on the junction box!

Junction box ⇔ scanning head

19. The umbilical cable has both a jack with a straight cable exit and a jack with a cable exit on the side. The cabling can be freely selected depending on the way the scanning head has been mounted. Plug the **Umbilical** cable into the industrial-style connector on the back of the scanning head and into the industrial-style connector SCANNING HEAD on the back of the junction box.

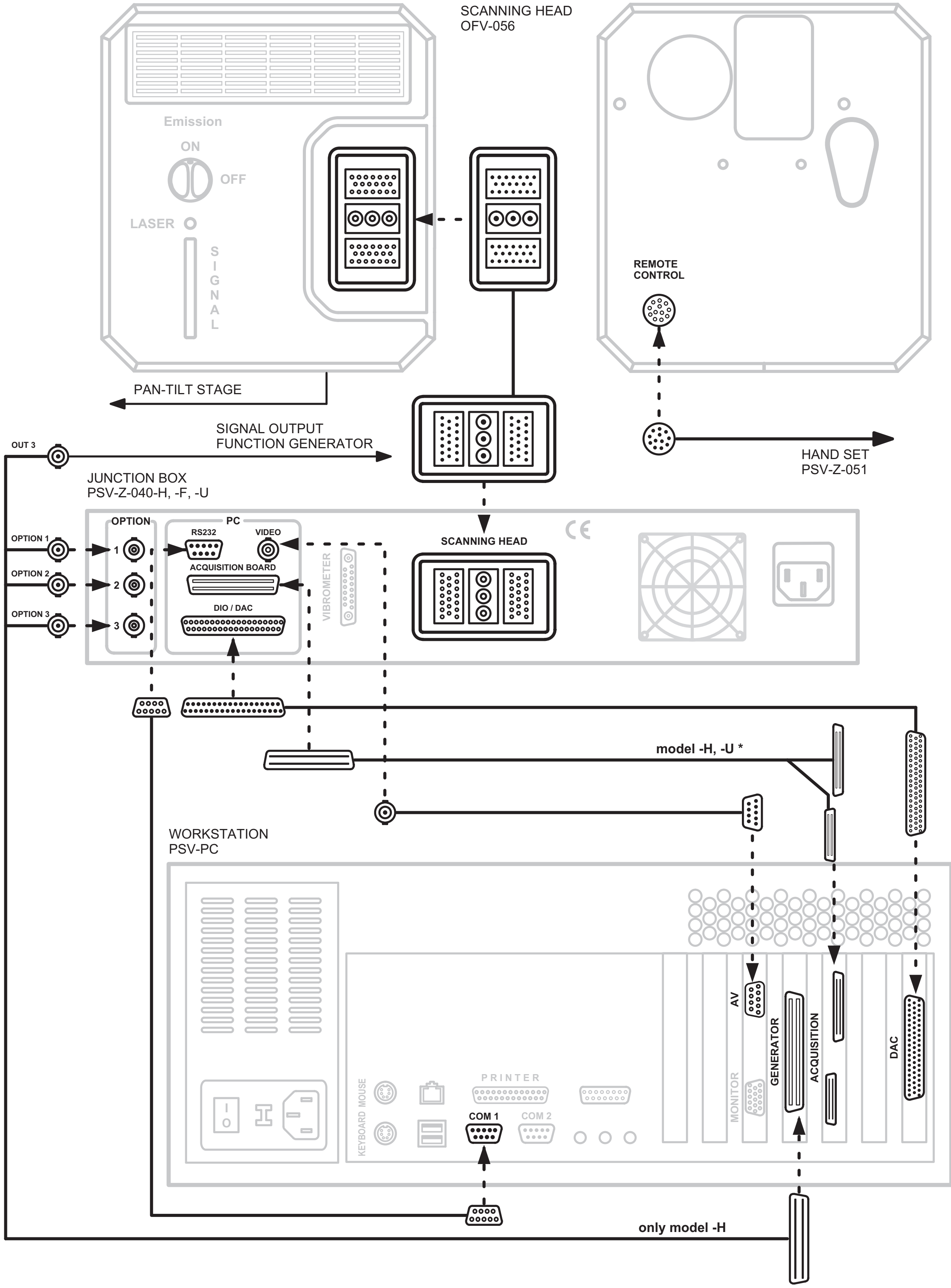


Figure 3.18: Cabling of the back panel of the junction box (* Model -F has one 68-pin SCSI-type connector instead of the two VHDIC-type connectors.)

Scanning head ⇔ hand set PSV-Z-051

20. If required, connect the hand set PSV-Z-051 to the 12-pin circular jack REMOTE CONTROL on the front of the scanning head.

Pan-tilt stage PSV-Z-017

21. If applicable, plug the **Scanning Head** cable from the connector box of the optional pan-tilt stage into the 4-pin circular jack on the underside of the scanning head.
22. Plug the **Pan-Tilt** cable from the connector box of the pan-tilt stage into the circular jack on the pan-tilt stage.

Mains connection

23. Plug a mains cable into the back of the workstation and into a wall socket providing protective grounding.

> **Caution!**
>
> **Always** check the setting of the voltage selectors on the back of the workstation and the controller as well as the rating of the fuses on the back of the controller and the junction box **before** connecting to the mains!

24. Plug a mains cable into the back of the junction box and into a wall socket providing protective grounding.
25. Plug a mains cable into the back of the controller and into a wall socket providing protective grounding.
26. If applicable, plug a mains cable into the connector box of the pan-tilt stage and into a wall socket providing protective grounding.

> **Caution!**
>
> **Always** check the setting of the voltage selector on the connector box of the pan-tilt stage **before** connecting to the mains!

The PSV is now completely installed. Carry out a functional test as described in section 3.5.

3.5 Functional Test

For an initial functional test of the PSV you proceed as follows:

Preparing

1. Install the PSV as described in section 3.4.
2. Make sure that the key switch on the controller is in position O and the beam shutter on the scanning head is in position OFF.
3. Position the scanning head roughly such that its laser beam aperture points to a test surface.

Switching on

4. Switch the controller on by turning the key switch to position I.

   On the front of the controller the LED POWER lights up. Providing all connecting cables have been installed correctly, the LED POWER on the front of the junction box and the emission LED LASER on the scanning head also light up. Laser light is not yet emitted as the beam shutter is still closed.

5. Switch on the workstation, start the PSV software and change to the Acquisition Mode as described in your software manual.

   On changing to the Acquisition Mode, control of the system by the software is activated. On the front of the controller both LEDs LLO and REMOTE light up.

6. Before now opening the beam shutter, remember the information on laser safety provided in section 1.1!
7. Open the dust cover and the beam shutter of the scanning head.

   The laser beam is now emitted from the scanning head.

Test

8. Test the function of the scanning head controls (focus and position of the laser beam, zoom and focus of the video camera, movement of the pan-tilt stage) as described in your software manual.
9. Put a matt white test surface, e.g. a piece of paper, at approximately 20 cm from the front panel of the scanning head in the beam path.
10. Focus the laser beam on the test surface.

    The signal level display will light up to show that the scanning head and the input section of the controller are working correctly.

If the functional test has been successful you can now make measurements as described in chapter 4.

If your PSV does not perform as described above, read through the information on fault diagnosis provided in chapter 6 and, if necessary, contact your local Polytec representatives.

4 Making Measurements

Data acquisition and storage for the PSV is fully controlled via the software. A live video image of the object is displayed on the monitor and automatic scan sequences are defined directly on the live video image of the object. All acquisition properties are set in the software. For evaluation, the acquired data is directly overlaid onto the recorded video image. Data can also be exported to various software packages e.g. for modal analysis.

Note!

If you control the PSV using the software via the IEEE-488/GPIB interface, the IEEE-488/GPIB address of the controller must be set to 5!

4.1 Start-up

To make a measurement with the PSV you proceed as follows:

Setup

1. Make sure that the key switch on the controller is in position O and the beam shutter on the scanning head is in position OFF.

2. Position the scanning head roughly so that its laser beam aperture points in the direction of the object to be measured. If possible set the scanning head up at an optimal stand-off distance to the object to be measured. You will find information about optimal stand-off distances in section 4.3.

Switching on

3. Turn the controller on by setting the key switch to position I. Please allow 30 minutes for the laser to warm up before making measurements.

   On the front of the controller the LED POWER lights up. Providing all connecting cables have been installed correctly, the LED POWER on the front of the junction box and the emission LED LASER on the scanning head also light up. Laser light is not yet emitted as the beam shutter is still closed.

4. Switch on all optional devices.

5. Switch on the workstation, start the software and change to the Acquisition Mode as described in your software manual.

   On changing to the Acquisition Mode, control of the system by the software is activated. On the front of the controller both LEDs LLO and REMOTE light up.

6. Before now opening the beam shutter, remember the information on laser safety provided in section 1.1!

7. Open the dust cover on the front of the scanning head and the beam shutter on the back.

   The laser beam is now emitted from the scanning head.

Measuring

8. Data acquisition is now fully controlled by the software. Once the laser has warmed up you can make measurements as described in your software manual.

4.2 Selecting Suitable Settings

4.2.1 Measurement Range

When selecting a suitable measurement range, the maximum expected values for velocity, acceleration and frequency have to be taken into consideration. Orientation purely on the velocity is often not enough, as the various measurement ranges have different bandwidths and maximum accelerations. The respective values are given in the specifications (refer to section 7.1.3).

Most of the applications are covered by the $10\,\frac{mm}{s}/V$ range. It should therefore be selected for initial measurements with the PSV. A higher range only has to be selected if the overrange indicator OVER on the front of the controller lights up permanently at scan points with high amplitude.

For low-frequency applications the ranges $1\,\frac{mm}{s}/V$, $5\,\frac{mm}{s}/V$ and $25\,\frac{mm}{s}/V$ are available. These measurement ranges can be used from the frequency 0 Hz (full DC capability). For both measurement ranges $1\,\frac{mm}{s}/V$ and $5\,\frac{mm}{s}/V$ please pay attention to the information on setting the tracking filter provided in section 4.2.3.

For high-frequency applications the top three ranges of model PSV 300-F ($25\,\frac{mm}{s}/V$; $125\,\frac{mm}{s}/V$; $1\,000\,\frac{mm}{s}/V$) provide an extended frequency range of up to 1.5 MHz which can be digitally processed up to 1 MHz by the software.

If either the positive or negative end of the measurement range is reached the overrange is indicated in the software and the indicator OVER on the front of the controller lights up. As a general rule, the next highest measurement range should then be selected. Please note however, that the indicator is activated by very short overrange already which could be caused by noise spikes. In such cases the measurement range can be retained as long as it is suitable for the amplitude of the required signal. Observing the signal in the time domain will provide clarification on this.

4.2.2 Low Pass Filter

The controller is equipped with an adjustable analog low pass filter which adapts the bandwidth of the measurement signal to the application. When displaying a signal in the time domain, the signal-to-noise ratio can be improved by limiting the bandwidth to the necessary extent. When analyzing in the frequency domain, this filter has no additional benefit. With the filter switched on, its influence on both amplitude and phase of the velocity signal has to be taken into consideration.

Note that the software uses appropriate antialias filters which are automatically adapted to the bandwidth set.

PSV 300-H

In the PSV 300-H, low pass filters with 8th order Butterworth characteristics are used. Multiples of 0.4 kHz up to a maximum of 102.4 kHz can be selected for the cutoff frequency. The amplitude error in the pass band can be roughly estimated as follows:

- Up to 75% of the cutoff frequency, the maximum amplitude error is ±1%.
- At the cutoff frequency, the amplitude error is −3 dB (approx. −30%).

The phase shift increases with the frequency as shown in figure 4.3. Up to approximately 50% of the cutoff frequency the phase shift increases proportionally to the frequency.

The complete amplitude frequency response of an 8th order Butterworth low pass filter is shown in figure 4.1. The frequency is normalized to the cutoff frequency f_c.

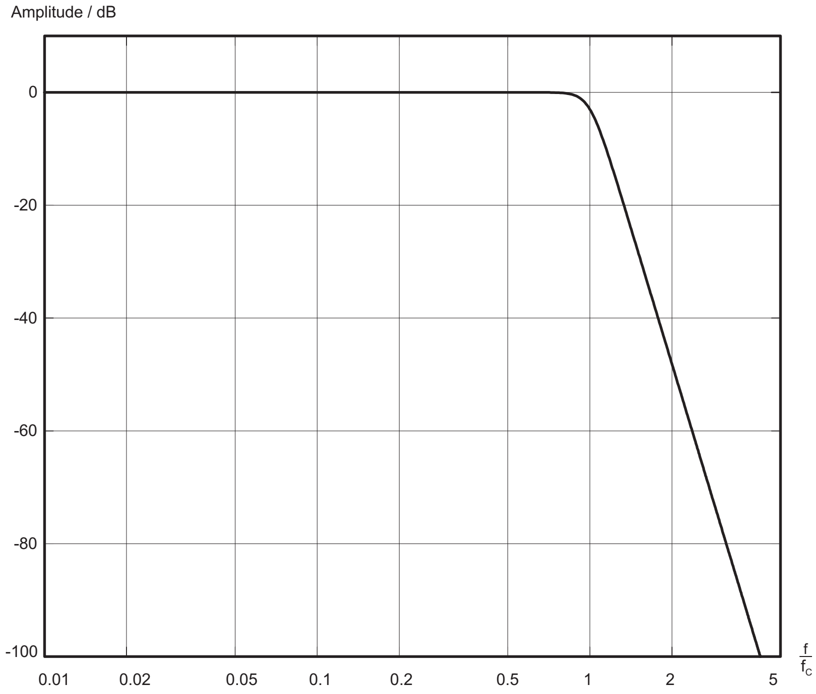


Figure 4.1: Amplitude frequency response of an 8th order Butterworth low pass filter

The amplitude error in the pass band caused by the filter can be determined from figure 4.2.

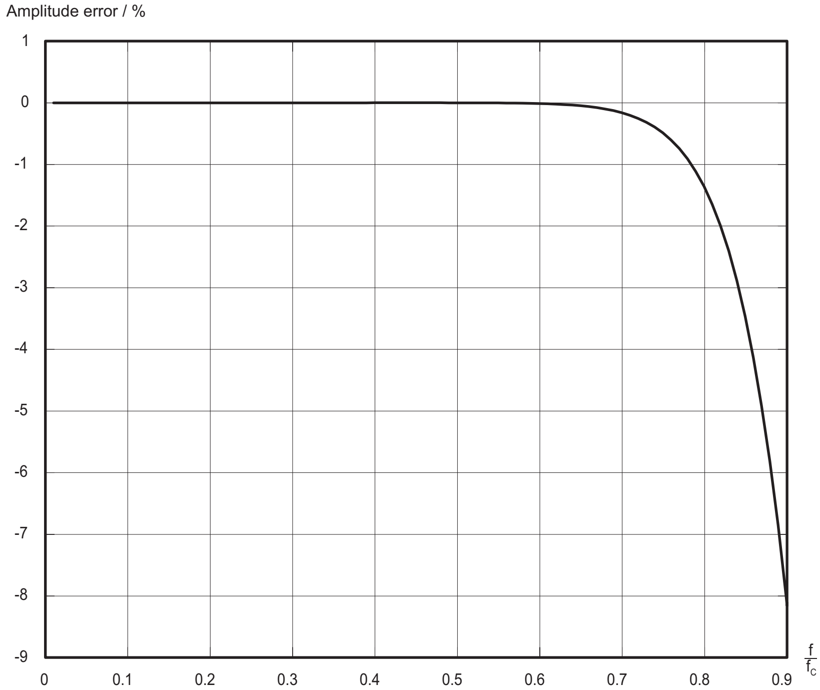


Figure 4.2: Amplitude error of an 8th order Butterworth low pass filter

The phase frequency response of the filter is shown in figure 4.3.

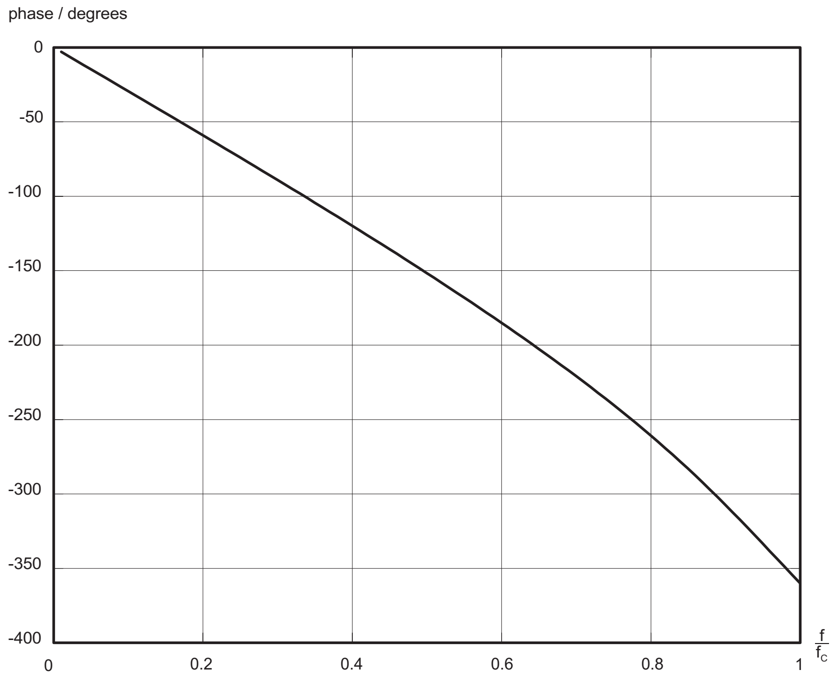


Figure 4.3: Phase frequency response of an 8th order Butterworth low pass filter in the pass band

PSV 300-F, -U In the PSV 300-F and -U low pass filters with 3rd order Bessel characteristics and cutoff frequencies of 5 kHz, 20 kHz or 100 kHz are used. Characteristic for Bessel filters is the phase linearity from the frequency zero up to the cutoff frequency, i.e. the phase shift increases in proportion to the frequency. The filter however, causes amplitude errors in the pass band which can be roughly estimated:

- Up to 20% of the cutoff frequency, the maximum amplitude error is ±1%.
- At the cutoff frequency, the amplitude error is −3 dB (approx. −30%).

The phase shift increases in proportion to the frequency from Zero degree at the frequency Zero to approximately −100 degrees at the cutoff frequency (refer to figure 4.6). Due to this linear phase frequency response, the filter shows optimal transmission behavior for pulses, as all frequencies of a complex wave are subjected to the same time delay. Thus the shape of the pulse is not falsified but it is merely delayed.

The complete amplitude frequency response of a 3rd order Bessel low pass filter is shown in figure 4.4. The frequency is normalized to the cutoff frequency f_c.

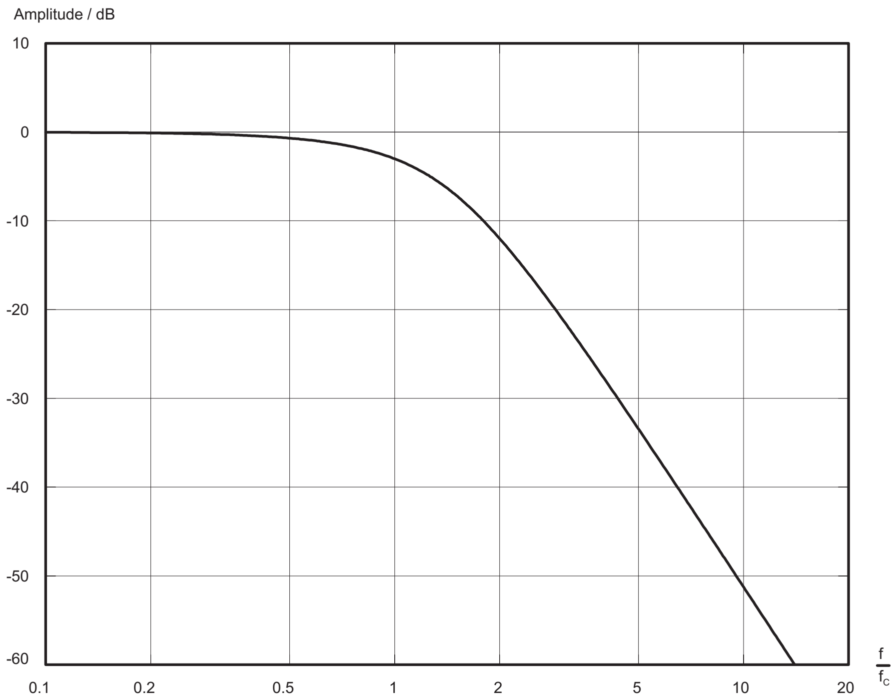


Figure 4.4: Amplitude frequency response of a 3rd order Bessel low pass filter

The amplitude error caused by the filter can be determined from figure 4.5.

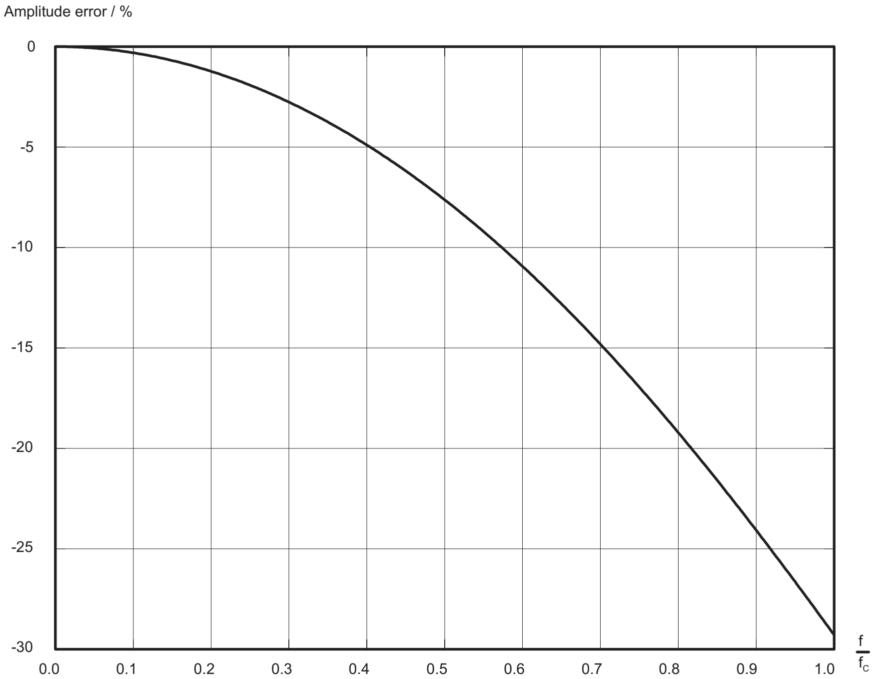


Figure 4.5: Amplitude error of a 3rd order Bessel low pass filter in the pass band

The phase frequency response of the filter is shown in figure 4.6.

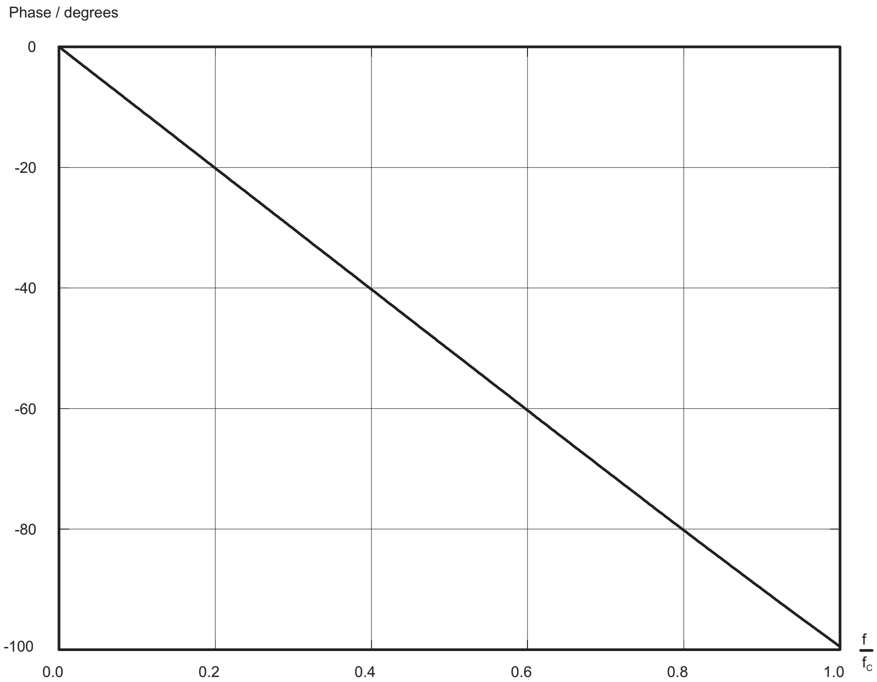


Figure 4.6: Phase frequency response of a 3rd order Bessel low pass filter in the pass band

Phase shift caused by the velocity decoder

An additional time delay is caused by the velocity decoder. It depends on the measurement range and is approximately a few microseconds. The resulting overall phase shift $\Delta\Phi$ can be estimated using the following simple equation:

$$\Delta\Phi = \Phi_{LP} + p_s \cdot f \qquad \text{Equation 4.1}$$

Φ_{LP} ... phase shift of the low pass filter, refer to figure 4.3 and figure 4.6

p_s ... specific phase roll-off, refer to specifications in section 7.1.3

f ... frequency in kHz

4.2.3 Tracking Filter

The tracking filter is used to improve the signal-to-noise ratio of the interferometer signal. This is particularly good for bridging short dropouts which occur due to the speckled natured of the light scattered back. The bridging capability is generally better with a high time constant SLOW, however, it may not be possible to follow highly dynamic signals any more. In this case, FAST or OFF have to be selected. The best setting therefore has to be determined from case to case or be estimated based on the range diagram in figure 4.7. The range diagram shows the dynamic limits for both settings of the tracking filter, plotted versus the frequency.

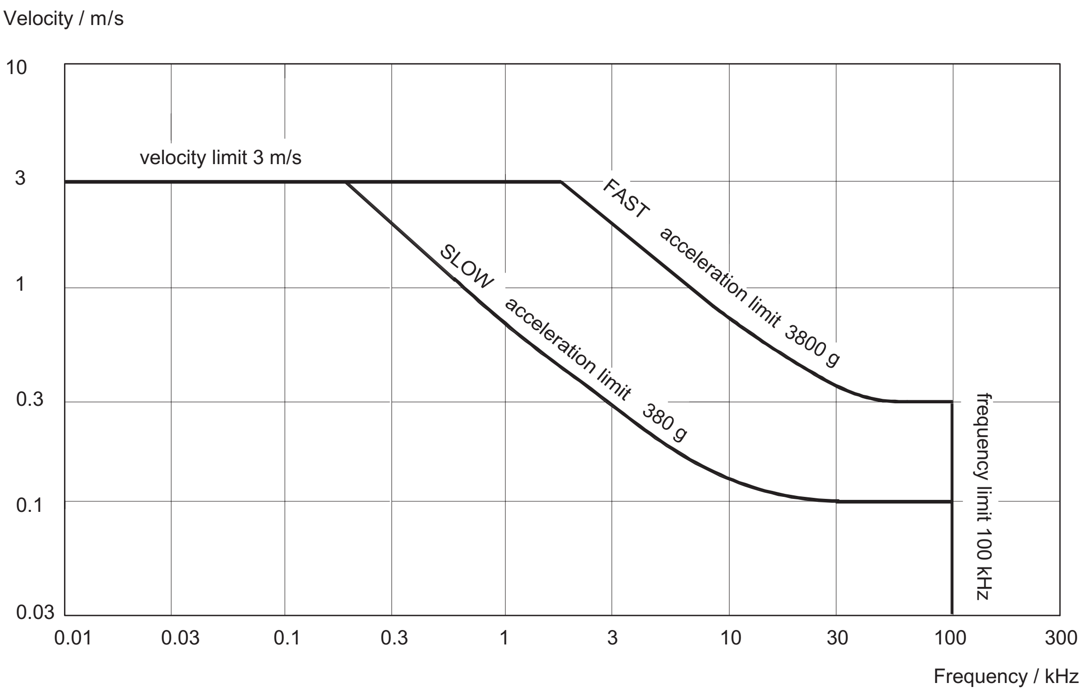


Figure 4.7: Operating ranges of the tracking filter

A constant velocity limit of approximately 3 m/s is characteristic for the lower frequency range. If the velocity exceeds this value, it means that the tracking filter generally has to be switched OFF. In the medium frequency range, the velocity limit changes over to become an acceleration limit, i.e. the velocity limit decreases in inverse proportion to the frequency. In the upper frequency range a constant velocity limit becomes effective again.

To set the tracking filter, the diagram in figure 4.7 can be summarized in the following general rules:

- For frequencies above 100 kHz as a general rule the tracking filter should be switched off. In principle it can follow higher frequencies but in this range amplitude errors of up to approximately 10% can occur due to dynamic errors.
- For medium velocities and frequencies, the acceleration limits of the tracking filter have to be taken into consideration. The optimal setting must be found with the diagram. If the velocity or acceleration limits are exceeded, the tracking filter loses lock (refer to section C.2). This will cause serious signal distortions, an example of which can be seen in figure 4.8.

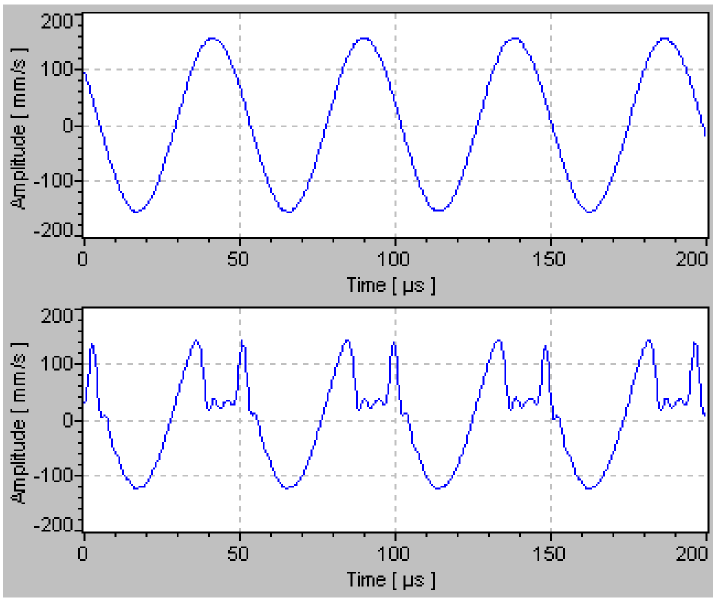


Figure 4.8: True velocity signal (top) and signal when the tracking filter loses lock (bottom)

The upper trace in figure 4.8 shows the sinusoidal velocity signal with the tracking filter in position OFF. The lower trace shows the velocity signal with the tracking filter in position SLOW. The tracking filter is on the limit of the range where it loses lock, the signal is partly distorted.

- In the measurement ranges $1\,\frac{\mathrm{mm}}{\mathrm{s}}/\mathrm{V}$, $5\,\frac{\mathrm{mm}}{\mathrm{s}}/\mathrm{V}$ and $10\,\frac{\mathrm{mm}}{\mathrm{s}}/\mathrm{V}$, the tracking filter should be set to SLOW as a general rule.
- Using the velocity decoder PLL-DC the tracking filter is particularly important. For technical reasons the PLL-DC is more sensitive to dropouts than the decoder OVD-04. Thus the tracking filter should be set to SLOW as long as the acceleration limit is not exceeded (refer to figure 4.7).

4.3 Optimal Stand-off Distances for the Scanning Head

The stand-off distance is measured from the front panel of the scanning head. The optimal stand-off distances are:

$$14\,\text{mm} + n \cdot 203\,\text{mm}, \qquad n = 0; 1; 2; \ldots$$

i.e. at 14 mm; 217 mm; 420 mm; 623 mm; etc.

Maxima of visibility

The light source of the PSV is a helium neon laser. This is a multimode 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. a maximum of visibility is present if the optical path difference is an even-numbered multiple of the length of the laser cavity (203 mm). As the optical path difference is equal to twice the stand-off distance (the beam goes there and back), a maximum of visibility is present once per laser cavity length.

In practice, it is not usually necessary to search for the maximum of visibility as the PSV is sensitive enough to make a measurement even close to the minimum. A minimum is indicated during the warm-up phase by periodic fluctuation on the signal level display.

5 Operating the PSV

5.1 Switching On and Off

Controller

The controller is switched on by turning the key switch on the front panel to position I. The LED POWER above the key switch lights up and shows that the controller is ready to operate.

Is the PSV correctly cabled as described in section 3.4.2, the LED POWER on the front of the junction box also lights up and shows that the junction box is ready to operate. Also the LED LASER on the scanning head lights up and shows that the scanning head is ready to operate and that the laser is active, even if the beam shutter is closed (refer to section 5.2 and section 5.3).

Workstation

To switch on the workstation, set the main switch on the back to position I. Then open the front flap using the key and push the black button.

5.2 Blocking the Laser Beam

The scanning head is equipped with a beam shutter. This can be used to block the laser beam without switching off the laser, thus keeping the system in thermal equilibrium.

The rotary knob for the beam shutter is on the back of the scanning head and is labeled EMISSION ON/OFF. To block the laser beam, turn the knob clockwise until the red mark points at OFF.

Warning!

Only switch the beam shutter to the ON position when you are making measurements!

Warning!

To position the scanning head, switch the beam shutter to the OFF position. Only when the head is roughly in place and has been fixed in a stable position, switch the beam shutter to ON for precise adjustment.

5.3 Indicating Laser Activity

On the back of the scanning head the LED LASER below the rotary knob of the beam shutter indicates the laser activity. The LED is lit when the laser is active (key switch on the front of the controller in position I). The LED is lit regardless of whether the beam shutter is open or closed.

5.4 Setting up the Scanning Head

Fluid stage

If your PSV is equipped with a tripod and a fluid stage, you can manually setup the scanning head using the three hand-grips as described in the assembly instruction provided by the manufacturer MANFROTTO.

Pan-tilt stage (optional)

If your PSV is equipped with a heavy-duty tripod and a motorized pan-tilt stage, it is easier to setup the scanning head. You control the pan-tilt stage either with the software (refer to your software manual) or using the four control keys on the front of the junction box.

The scanning head can be panned to the left and right by ±90 degrees using the control keys ← and →. It can be tilted upward and downward by ±84° using the control keys ↑ and ↓.

> **Caution!**
>
> Avoid any additional weighting on the pan-tilt stage by placing objects on top of the scanning head or attaching things to it! This may put strain on the pan-tilt stage.

Stand-off distance

Please pay also attention to the information on optimal stand-off distances for the scanning head provided in section 4.3.

5.5 Dust Cover on the Scanning Head

The scanning head is equipped with a dust cover to protect the scanner mirrors and the front lens of the video camera when you are not making measurements.

The dust cover is closed by rotating the switch bar on the front of the scanning head into vertical position.

> **Caution!**
>
> To protect the lenses and scanner mirrors, **only** open the dust cover when your are making measurements!

5.6 Focusing the Laser Beam

Hand set PSV-Z-051

The hand set PSV-Z-051 is connected to the circular jack REMOTE CONTROL on the front of the scanning head. You can focus the laser beam using the emphasized part of the hand set shown in figure 5.1.

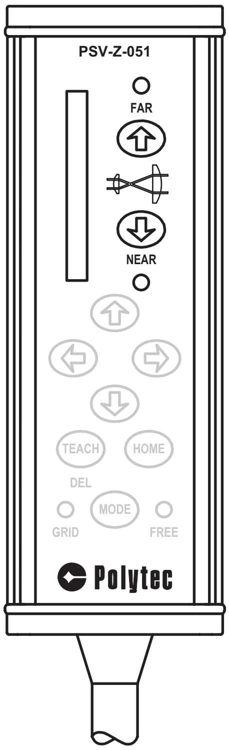


Figure 5.1: Focusing the laser beam using the hand set PSV-Z-051

> **Note!**
>
> **Never** use the hand set PSV-Z-051 together with the optional hand set OFV-310 (refer to section A.3)!

Using the two arrow keys FAR and NEAR, the laser beam is focused as follows:

- Focusing on infinity: key ↑ FAR
- Focusing close-up: key ↓ NEAR

If you press the keys for more than approximately one second, the motor switches over to fast mode. For fine positioning, the keys can be repeatedly pressed briefly. At the end of the adjustment range, the motor stops automatically and the respective LED FAR or NEAR lights up.

Beside the keys for focusing, there is a signal level display which helps you to optimize the focus. The signal shown is identical to that on the scanning head and on the display of the controller.

Software When the PSV is controlled via the software (LEDs REMOTE and LLO are lit up), you can use the software to focus the laser beam, please refer to your software manual.

Controller When the controller is operated without the software, you can focus the laser beam via the menu FOCUS (refer to section 5.12.3).

Hand set OFV-310 (optional) To focus the laser beam, you can also use the optional hand set OFV-310 instead of the hand set PSV-Z-051 (refer to section A.3).

5.7 Optimizing the Focus of the Laser Beam

The signal level display helps you to optimize the focus of the laser beam. The signal level is shown as a bar display:

- on the back of the scanning head
- on the display of the controller
- in the software (refer to your software manual)
- on the hand set PSV-Z-051 (refer to section 5.6)
- on the optional hand set OFV-310 (refer to section A.3).

5.8 Positioning the Laser Beam

Hand set PSV-Z-051

The hand set PSV-Z-051 is connected to the circular jack REMOTE CONTROL on the front of the scanning head. You can position the laser beam using the clearly visible part of the hand set shown in figure 5.2. To do so, proceed as follows:

1. Switch on the workstation and start the PSV software.

2. Change to the Acquisition Mode as described in your software manual.

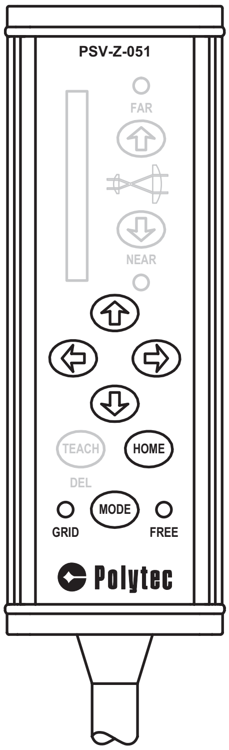


Figure 5.2: Positioning the laser beam using the hand set PSV-Z-051

3. Press the MODE key on the hand set to select the kind of movement.

   The laser beam can be positioned in the GRID mode or in the FREE mode.

GRID mode (LED GRID is lit up)

You move the laser beam on already defined scan points using the arrow keys. The order in which the software approaches the scan points is determined by an internal algorithm. Using the keys $\rightarrow$ or $\uparrow$, you move the laser beam forwards along the scan points and backwards using the keys $\leftarrow$ or $\downarrow$. If you press the HOME key, the laser beam is positioned on the first scan point.

Note!
The longer you hold the arrow key pressed, the faster the laser beam moves!

FREE mode (LED FREE is lit up)

You move the laser beam freely using the arrow keys. To do so, press the arrow key for the direction you require. If you press the HOME key, then the laser beam is positioned so that it is emitted from the scanning head perpendicular to the front panel (position (0;0), is indicated in the software).

Software

When the PSV is controlled via the software (LEDs REMOTE and LLO are lit up), you can use the software to position the laser beam, please refer to your software manual.

5.9 Defining and Deleting Scan Points (APS)

Note!

Defining and deleting individual scan points is only available if you have the software option APS Professional (PSV-Z-062)!

Hand set PSV-Z-051

The hand set PSV-Z-051 is connected to the circular jack REMOTE CONTROL on the front of the scanning head. You can define and delete individual scan points using the clearly visible part of the hand set shown in figure 5.3. To do so, proceed as follows:

1. Switch on the workstation and start the PSV software.
2. Change to the Acquisition Mode then to Define Scan Points and select the Point Mode as described in your software manual.

To define scan points, select the FREE mode using the MODE key on the hand set (LED FREE is lit up).

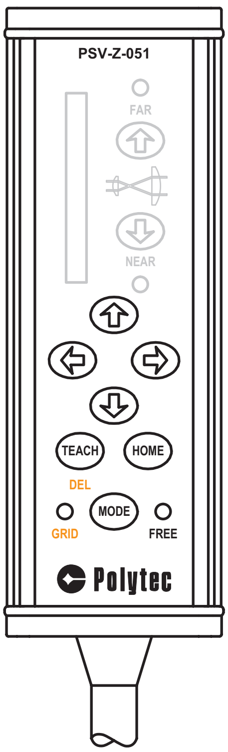


Figure 5.3: Defining and deleting scan points using the hand set PSV-Z-051

3. Using the four arrow keys, move the laser beam to the desired position.
4. Press the TEACH button and the scan point is defined.

   The newly defined scan point is shown in the software.

5. Repeat steps 3 and 4 until all desired scan points are defined.

> **Note!**
>
> To get a 3D view style of the data, you have to define connections in the software. Please refer to your software manual.

To delete defined scan points, select the GRID mode using the MODE key on the hand set (LED GRID is lit up). The TEACH key now functions as DEL key (for deleting).

6. Using the arrow keys, move the laser beam forwards or backwards to the scan point you want to delete.
7. Press the DEL key and the selected scan point is deleted.
8. Repeat steps 6 and 7 until all desired scan points are deleted.

> **Note!**
>
> If you press the DEL key for more than approximately one second, the scan points will be deleted one after the other!

Software

When the PSV is controlled via the software (LEDs REMOTE and LLO are lit up), you can use the software to define and delete scan points, please refer to your software manual.

5.10 Settings

Software

When the PSV is controlled via the software (LEDs REMOTE and LLO are lit up), all settings are adjusted via the software, refer to your software manual. In this case the keys FUNCTION and SETTING on the front of the controller do not have a function.

You will find information on setting the measurement range and the filters in section 4.2.

Controller

When the controller is operated without the software, you can set the measurement range and the filters via a menu on its display using the keys FUNCTION and SETTING (refer to section 5.12).

5.11 Overrange Indicator

Software

Overranging is indicated in the software. Please refer to your software manual.

Controller

If the LED OVER on the front of the controller is lit up continuously, it means that the measurement range set is being exceeded. In this case the next highest measurement range must be selected. You will find further information on setting the measurement range in section 4.2.1.

5.12 Operating the Controller without the Software

5.12.1 Operating Philosophy

In normal operation the keys FUNCTION and SETTING on the controller are deactivated and all settings are adjusted via the software. It is also possible to make measurements without using the workstation. In this case you can only make single-point measurements and you can not make use of the digital data processing of the PSV. The velocity signal is then available at the BNC jack VELOCITY OUTPUT on the front of the controller.

The controller is operated via a menu on its display using the keys FUNCTION and SETTING. The operating structure is mainly self-explanatory. The individual menus are described in section 5.12.3.

FUNCTION: Using the keys ↑ and ↓ a menu is selected and within the menu a parameter is selected.

SETTING: Settings are changed using the keys + and –.

The menu SETTINGS is shown in figure 5.4 as an example of the display.

			Focus ↑
⇒	Tracking Filter	Fast	
	Velocity Decoder	HF	
	Velocity Range	125 mm/s/V	
	Velocity Filter	off (1.5 MHz)	
	Signal		
			Config ↓

Figure 5.4: Example of the controller's display

The parameters are run through vertically on the display using the keys ↑ and ↓. Once the end of the display page is reached, it changes to the next menu. The possibility of branching off to other menus is shown at the top and the bottom on the right.

The cursor ⇒ on the left marks a selected parameter. The setting of the parameter is changed to higher and lower values with the keys + and –. Adjusted settings are activated straight away.

As the control processor has a battery supported memory, the settings are stored when the instrument is switched off and reloaded when it is switched on again or after RESET. This saves time making adjustments for repeated measurements.

5.12.2 Organization of the Menus

The organization of the menus is shown in figure 5.5.

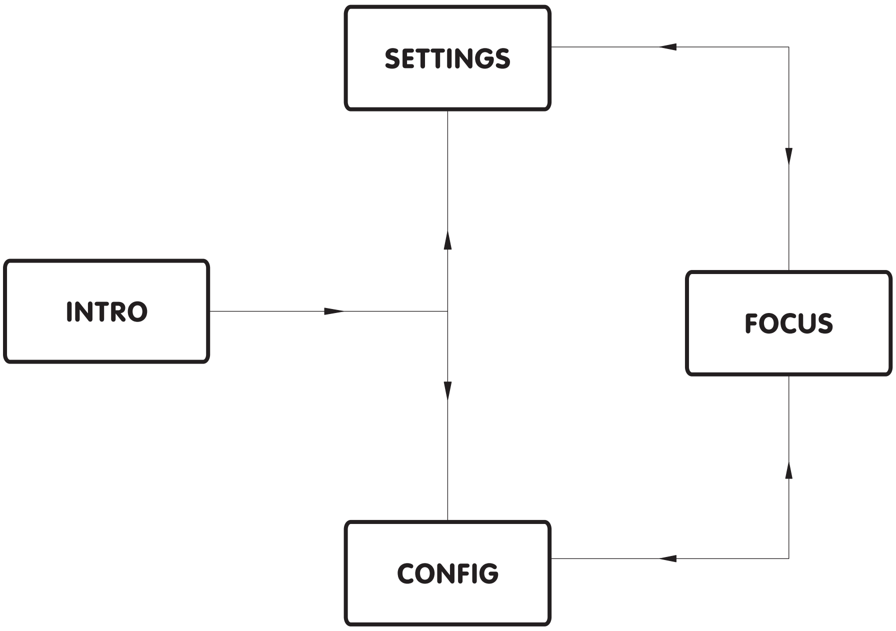


Figure 5.5: Organization of the controller’s menus. Menu FOCUS is optional.

The menus are organized as follows:

INTRO: The start menu appears after switching on the controller or after RESET.

SETTINGS: This is the most important menu in which all settings for a measurement in stand-alone operation are made i.e. the measurement ranges and the filters are selected. It also displays the signal level.

CONFIG: This menu provides information on the configuration of the controller i.e. the decoders and interfaces installed. The interfaces can be configured in this menu.

FOCUS: The laser beam can be focused in this menu. It also displays the signal level.

5.12.3 The Individual Menus

Menu INTRO After being switched on or RESET, the controller shows that it is ready to operate with the menu INTRO. It is not possible to change back to this menu as it does not have a control function.

Menu CONFIG This menu provides information on the decoders and interfaces installed. The individual configurations are described in the following.

Velocity Decoder

This line shows the velocity decoders installed and the number of available velocity measurement ranges. The following abbreviations are used for the individual decoders:

Table 5.1: Abbreviations of the individual velocity decoders

Abbreviation	Decoder
DC	PLL-DC
HF	OVD-04

Example:
3DC + 4HF means that the velocity decoder PLL-DC with 3 measurement ranges and the velocity decoder OVD-04 with 4 measurement ranges are installed.

IEEE Bus Interface

When operating the controller via the IEEE-488/GPIB interface on the back in this line the instrument address can be set in the range **1...30**.

> **Note!**
>
> If you control the PSV using the software via the IEEE-488/GPIB interface, the IEEE-488/GPIB address of the controller must be set to **5**!

Serial Interface

When operating the controller via the RS-232 interface on the back in this line it is possible to switch between the transfer rates **4800 Baud** and **9600 Baud**.

> **Note!**
>
> For all PSV models, here the transfer rate must be set to **9600 Baud**!

Menu SETTINGS

In the menu SETTINGS the measurement ranges and filters are set. The contents of the menu depends on the decoders installed. The individual settings have the following meaning.

Tracking Filter

In this line you can set the tracking filter. The input signal is pre-processed with the tracking filter. You will find information on the settings **OFF / SLOW / FAST** of the tracking filter in section 4.2.3.

Velocity Decoder

In this line you can set the active velocity decoder. This line is only present if both decoders OVD-04 and PLL-DC are installed. The velocity decoders are abbreviated as described above in table 5.1.

> **Note!**
>
> If the DC decoder is selected and the velocity measurement range $1\,\frac{\mathrm{mm}}{\mathrm{s}}/\mathrm{V}$ is set, it is not possible to change to the HF decoder because the HF decoder does not have this velocity measurement range available.

Velocity Range

In this line you can set the velocity measurement range. The possible settings depend on the velocity decoder selected. You will find information on setting the velocity measurement range in section 4.2.1.

Velocity Filter

In this line you can set the cutoff frequency of the low pass filter. The possible settings depend on the PSV model. In position OFF, the upper frequency limit of the active velocity decoder is shown. You will find information on setting the low pass filter in section 4.2.2.

Signal

This line shows the optical signal level as a bar display.

Menu FOCUS

In this menu, the laser beam is focused using the – and + keys. The movement of the motor to position the front lens is shown on the display of the controller with following symbols:

< and >	Motor is running slowly
<< and >>	Motor is running quickly
I<< and >>I	Motor has stopped at the end of the adjustment range

The bar in the lower line of the display shows the optical signal level.

6 Fault Diagnosis

Simple tests are described in the following which you can carry out yourself in the case of malfunction. In the case of more difficult faults in 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 PSV is limited to such tests in which the housing does not have to be opened. Opening the housing without authorization invalidates the warranty.

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

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

6.1 General Tests

If any system component of the PSV does not function properly, please first check the following:

1. Is the PSV correctly cabled as described in section 3.4.2?
2. Are there only original RS-232 cables from Polytec used (1:1 wired)?
3. Is the transfer rate set to 9600 Baud (refer to section 5.12.3)?
4. If you control the PSV using the software via the IEEE-488/GPIB interface: Is the IEEE-488/GPIB address of the controller set to 5 (refer to section 5.12.3)?

Check whether the data acquisition board is correctly installed. To do so, proceed as follows:

5. Double-click the icon Measurement&Automation on the desktop.
6. Change into the folder Devices and Interfaces.

   The data acquisition board is correctly installed, if in the folder PCI-4451 or PCI-4452 or PCI-6111 is listed. If not, please check whether the data acquisition board is properly inserted into its slot in the workstation.

6.2 No Laser Beam

If no laser beam is emitted, check the following:

1. Is the PSV correctly cabled as described in section 3.4.2?
2. Is the key switch on the front of the controller in position I?
3. Is the dust cover on the front of the scanning head open (switch bar in horizontal position)?
4. Is the beam shutter on the back of scanning head in position ON?
5. Is the LED LASER on the back of the scanning head lit up?

Warning!

Always disconnect from the mains **before** checking the fuses!

If the LED is not lit up, it can be assumed that there is a fault with the power supply of the controller. In this case disconnect the mains plug and check the fuses on the back panel. Please note that there are two active fuses which can both lead to failure.

6. Is the LED POWER on the front of the junction box lit up?

Warning!

Always disconnect from the mains **before** checking the fuses!

If the LED is not lit up, it can be assumed that there is a fault with the power supply of the junction box. In this case disconnect the mains plug and check the fuses on the back panel. Please note that there are two active fuses which can both lead to failure.

6.3 No Velocity Signal

If the laser beam is emitted but there is no velocity signal, check the following:

1. Is the PSV correctly cabled as described in section 3.4.2?
2. Put a matt white test surface such as a piece of paper at approximately 20 cm from the front panel of the scanning head in the beam path. Does the signal level display react?

   If the signal level display does not react, the input section of the controller is faulty.

Data acquisition

Check the correct function of the data acquisition board and the software as follows:

3. Disconnect the BNC cable for the velocity signal from the BNC jack VELO on the front of the junction box.
4. Feed the signal of a function generator to this BNC jack.
5. Display the time signal in an analyzer as described in your software manual.

   The data acquisition board and the software work properly, if the signal of the function generator is displayed correctly. In this case there is a problem in the controller.

Output signal

Now check the output signal of the controller as follows:

6. Re-connect the velocity signal to the BNC jack VELO on the front of the junction box.
7. Display the time signal in an analyzer as described in your software manual.
8. Set the measurement range to $10\,\frac{mm}{s}/V$. Does the output signal react to the test surface moving?
9. If the output signal does not react, check whether a significant DC offset is present.

   Normally a DC voltage of less than ±50 mV is measured.

10. Block the laser beam. Is the output signal noisy or is a straight line shown?

    Noise must occur when the laser beam is blocked.

7 Technical Specifications

7.1 Controller OFV-3001 S

7.1.1 General Data

Mains voltage:	100/115/230 VAC ±10%, 50/60 Hz, adjustable on the back panel
Power consumption:	max. 150 VA
Fuses:	1.0 A/slow-blow for 230 V 2.0 A/slow-blow for 100/115 V
Protection class:	I (protective grounding)
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
Dimensions:	450 mm × 355 mm × 135 mm
Weight:	10.8 kg
Calibration recommended:	every 2 years

7.1.2 Low Pass Filter

PSV 300-H

(for typ. amplitude and phase frequency response refer to section 4.2.2)

Filter type:	Butterworth 8th order
Cutoff frequencies:	400 Hz ... 102.4 kHz, adjustable in steps of 400 Hz
Frequency roll-off:	−160 dB/dec = −48 dB/oct
Stop band rejection:	> 80 dB

PSV 300-F, -U

(for typ. amplitude and phase frequency response refer to section 4.2.2)

Filter type:	Bessel 3rd order
Cutoff frequencies:	5 kHz, 20 kHz, 100 kHz, adjustable
Frequency roll-off:	−60 dB/dec = −18 dB/oct
Stop band rejection:	> 70 dB

7.1.3 Signal Voltage Output VELOCITY OUTPUT

General Data

Output swing:	±10 V
Output impedance:	50 Ω
Minimum load resistance:	10 kΩ (–0.5% additional error)
Overrange indicator threshold:	typ. 95% of full scale
Maximum DC-offset:	Velocity decoder PLL-DC: ±50 mV
	Velocity decoder OVD-04: ±20 mV

Measurement Ranges

Velocity decoder	Measurement range (scaling factor)	Full scale output (peak-peak)	Resolution[1]	Maximum frequency[2]		Maximum acceleration	
				-H, -U	-F	-H, -U	-F
	$\frac{mm}{s}$/V	$\frac{mm}{s}$	$\frac{\mu m}{s}$	kHz	kHz	g	g
PLL-DC	1	20	0.3	20	20	150	150
	5	100	0.3	50	50	1600	1600
	25	500	0.8	50	50	8000	8000
OVD-04	10	200	0.5	200	200	12000	12000
	25	500	2	250	1000	40000	160000
	125	2,500	5	250	1500	200000	1200000
	1000	20000	10	250	1500	1600000	9600000

[1] Resolution is defined as the signal amplitude (rms) at which the signal-to-noise ratio is 0 dB in a 10 Hz spectral bandwidth (RBW), measured at 3M Scotchlite Tape®.

[2] –1 dB maximum error

Calibration Accuracy

Velocity decoder	Measurement range	Amplitude error	
		@ T = (25±5) °C (T = (77±9)°F)	full operating temperature range
	$\frac{mm}{s}$/V	% of rms reading	% of rms reading
PLL-DC	1		
	5	±1.0	±1.2
	25		
OVD-04	10	±1.0	±1.5
	25	±1.0	±2.0
	125	±1.5	±2.5
	1000	±1.5	±2.5

Conditions: sinusoidal vibration, f = 1 kHz, amplitude 70% of full scale range, load resistance ≥ 1 MΩ

Amplitude Linearity

Maximum linearity error: ±1% of rms. reading (one particular range)
±2.5% of rms. reading (overall)

Linearity error is defined as the amplitude-dependent, relative deviation of the scaling factor referred to the nominal scaling factor under calibration conditions.

Amplitude Frequency Response (Flatness)

Velocity decoder	Measurement range $\frac{mm}{s}/V$	Max. additional error referred to f = 1 kHz
PLL-DC[1]	1	0 Hz - 15 kHz : ±0.1 dB 15 kHz - 20 kHz : +0.1 dB/−0.25 dB
	5 and 25	0 Hz - 20 kHz : ±0.1 dB 20 kHz - 50 kHz : ±0.2 dB
OVD-04	10	0.5 Hz - 10 Hz : ±0.5 dB 10 Hz - 20 kHz : ±0.05 dB 20 kHz - 100 kHz : +0.05 dB/−0.2 dB 100 kHz - 200 kHz : +0.05 dB/−1 dB
	25, 125 and 1 000	0.5 Hz - 10 Hz : ±0.5 dB 10 Hz - 20 kHz : ±0.05 dB 20 kHz - 100 kHz : ±0.15 dB 100 kHz - 200 kHz : ±0.3 dB 200 kHz - 1 MHz : ±0.8 dB[2]

[1] The measurement ranges of this decoder can be used from the frequency 0 Hz (full DC capability).

[2] PSV 300-F only

Phase Frequency Response

With the low pass filter switched off, the velocity decoder behaves as a system of constant time delay up to approximately 60% of the maximum frequency of the measurement range set, i.e. the phase shift is proportional to the frequency. The phase shift depends, however, on the range settings.

Velocity decoder	Measurement range	Time delay (typ.)		Specific phase roll-off p_s (typ.)	
		-H, -U	-F	-H, -U	-F
	$\frac{mm}{s}/V$	µs	µs	°/kHz	°/kHz
PLL-DC	1	24	24	−8.6	−8.6
	5	7.1	7.1	−2.6	−2.6
	25	6.0	6.0	−2.2	−2.2
OVD-04	10	6.1	6.1	−2.2	−2.2
	25	5.5	1.9	−2.0	−0.7
	125	5.5	1.9	−1.9	−0.7
	1 000	3.5	0.9	−1.3	−0.33

Harmonic Distortions

Measurement range	THD @ f = 1 kHz	
$\frac{mm}{s}$/V	up to 70% of full scale range	up to full scale
1, 5, 10 and 25	< 0.2% (< −54 dB)	< 0.3% (< −50 dB)
125 and 1 000	< 0.3% (< −50 dB)	< 0.5% (< −46 dB)

7.1.4 Interfaces

RS-232:	8 data bits, no parity, baud rate 4800 or 9600 9-pin female Sub-D cable to the workstation, 1:1 wired
IEEE-488/GPIB:	according to IEEE-488.1
REMOTE FOCUS:	special interface for the optional hand set OFV-310
EXT.DEC.:	special interface for an external digital displacement decoder
SIGNAL:	0 V...3 V DC, proportional to the logarithm of the optical signal level, load resistance ≥ 10 kΩ

7.2 Junction Box PSV-Z-040

7.2.1 General Data

Mains voltage:	100 ... 240 VAC ±10%, 50/60 Hz
Power consumption:	max. 75 VA
Fuses:	2.0 A/slow-blow
Protection class:	I (protective grounding)
Operating temperature:	+5°C ... +40°C (41°F ... 104°F)
Storage temperature:	−10°C ... +60°C (49°F ... 149°F)
Relative humidity:	max. 80%, non-condensing
Dimensions:	450 mm × 355 mm × 90 mm
Weight:	5.8 kg

7.2.2 Interfaces

RS-232

Baud rate:	9600 Baud
Data format:	8 data bits, 1 stop bit, no parity bit
Cable:	9-pin female Sub-D cable, 1:1 wired
Pins:	pin 2: received data Red (←)
	pin 3: transmitted data Axed (→)
	pin 5: reference potential GND
	pin 1; 4; 6; 7; 8; 9: N/A

VELO, REF (REF1 ... REF3 at Model -H)

Input impedance:	1 MΩ in parallel with 100 pF
Input coupling:	AC/DC, adjustable in the software
	AC −3 dB cutoff frequency: 3.4 Hz
Over voltage protection:	±42 V

TRIG IN

Compatibility:	TTL
Input voltage:	max. +5.5 V
Input current:	max. 1 mA

GATE IN

Compatibility:	TTL
Input voltage:	max. +7.0 V

OUT 1, OUT 2, OUT 3 (Only Model -H)

Output voltage swing:	max. ±10 V referred to GND
Output current:	max. ±5 mA
Output impedance:	< 0.1 Ω
Short circuit protection:	permanently short circuit proof
Load resistance:	min. 2kΩ
Load capacity:	unlimited

SIGNAL (Only Model -F, -U)

Output voltage swing:	max. ±10 V referred to GND
Output current:	max. ±5 mA
Output impedance:	50 Ω
Short circuit protection:	permanently short circuit proof
Load resistance:	min. 2 kΩ
Load capacity:	unlimited

SYNC (SYNC OUT at Model -H)

Compatibility:	TTL
Output HIGH voltage:	min. 4.35 V (I_{out} = 3.5 mA)
Output LOW voltage:	max. 0.4 V (I_{out} = 5 mA)

AUX OUT

Compatibility:	TTL
Output HIGH voltage:	min. 2.4 V (I_{out} = 15 mA)
Output LOW voltage:	max. 0.5 V (I_{out} = 64 mA)

AUX IN (Only Model -F, -U)

Compatibility:	TTL
Input voltage:	max. +7.0 V

7.3 Scanning Head OFV-056

7.3.1 General Data

Laser type:	helium neon
Wavelength:	633 nm
Cavity length:	203 mm
Laser class:	II
Laser output power:	< 1 mW
Power consumption:	ca. 15 W
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
Dimensions:	refer to section 7.3.5
Weight:	11 kg

7.3.2 Optics

Front lens[1]		Long range (QR)	Mid range (MR)
Focal length	mm	100	60
Minimum stand-off distance	mm	450	175
Aperture diameter ($1/e^2$)	mm	12	7
Spot size (typ.)	µm		
@ 175 mm		-	10
@ 450 mm		15	33
@ 1 000 mm		42	79
@ each additional meter plus		50	84
Maxima of visibility[2]	mm	$14 + n \cdot 203$, n = 0; 1; 2;...	

[1] A label shows the front lens model which is fitted. The label can be seen through the top left air vents of the scanning head (refer to figure 7.1).

[2] Measured from the front panel of the scanning head

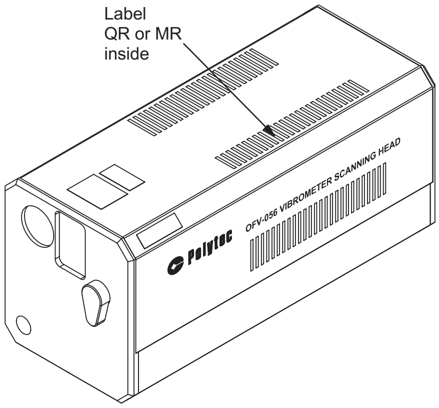


Figure 7.1: Position of the label for the front lens model

7.3.3 Scanner

Type:	servo-controlled galvo motor
Maximum deflection	horizontal: ±20°
	vertical: ±20°
Angular resolution:	<0.002°
Pointing stability:	<0.01°/hour (after warming-up)

7.3.4 Video Camera

Video system:	CCIR/PAL	
Sensor:	color CCD 1/4", 752x582 pixels	
Signal-to-noise ratio:	>50 dB	
Zoom:	72x (4x digital zoom)	
Lens:	F 1.4 / f = 4.1 ... 73 mm, auto focus, auto iris	
	18-fold motor-driven zoom	
Angle of view (horizontal):	> 48° ... 2.7°	
Minimum stand-off distance:	@ wide end:	10 mm
	@ tele end:	800 mm
Minimum illumination:	3 lux	

7.3.5 Dimensions

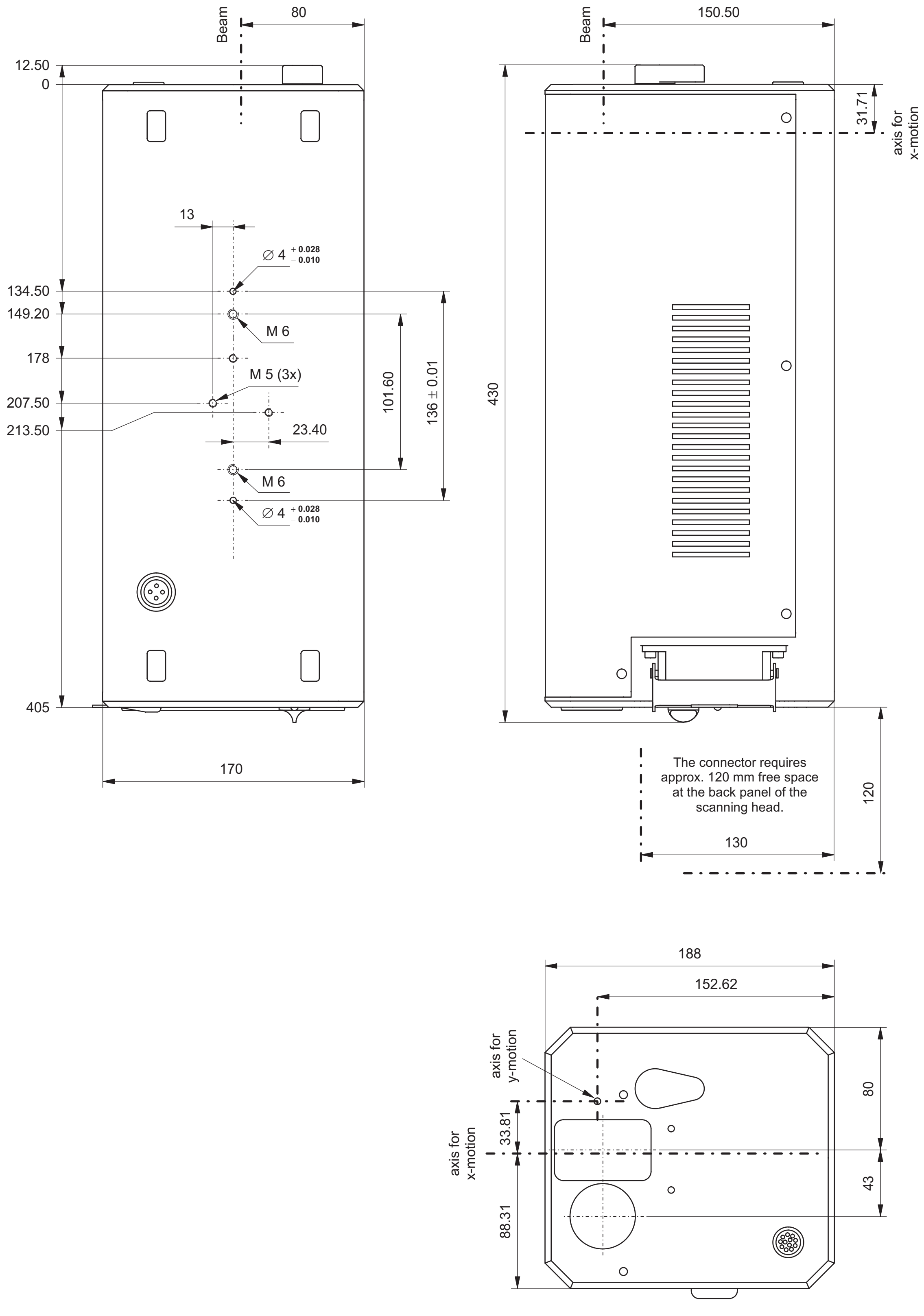


Figure 7.2: Views of the scanning head OFV-056

7.4 Workstation PSV-PC

Industrial Workstation

Mains voltage:	workstation with voltage selector: 115/230 VAC, 50/60 Hz, adjustable on the back panel workstation with wide range input: 100...240 V, 50/60 Hz
Power consumption:	max. 350 VA
Processor:	min. Pentium III, 700 MHz
Hard disk drive (HDD):	> 18 GB
Operating system:	Microsoft® Windows2000®
Network board:	Ethernet card
CD drive/writer:	refer to user manual of the drive manufacturer
Housing:	industrial PC housing

Desktop PC

Mains voltage:	workstation with voltage selector: 115/230 VAC, 50/60 Hz, adjustable on the back panel workstation with wide range input: 100...240 V, 50/60 Hz
Power consumption:	max. 350 VA
Processor:	min. Pentium III, 700 MHz
Hard disk drive (HDD):	> 18 GB
Operating system:	Microsoft® Windows2000® or WindowsXP®
Network board:	Ethernet card
CD drive/writer:	refer to user manual of the drive manufacturer
Housing:	desktop PC housing

Data Acquisition

PSV-Model	**PSV 300-H**	**PSV 300-F**	**PSV 300-U**
Data acquisition board	PCI-4452	PCI-6111	PCI-4451
Input channels simultaneously	4	2	2
Resolution	16 bit	12...16 bit effectively (depending on the bandwidth)	16 bit
Maximum bandwidth	80 kHz	1 MHz	40 kHz
Maximum number of FFT lines	6400 optional 12800	6400 optional 12800	3200 optional 6400

For further information, please refer to the manual of the data acquisition board which is installed on the workstation. Switch on the workstation and in the Start menu of the task bar, select Programs > National Instruments > NI-DAQ > Documents. There click on the corresponding manual for the data acquisition board of your PSV model.

7.5 Motorized Pan-Tilt Stage PSV-Z-017 (optional)

Mains voltage:	115/230 VAC, 50/60 Hz, adjustable on the connector box
Power consumption:	max. 30 W
Operating temperature:	−20°C ... +50°C (−4°F... 122°F)
Relative humidity:	max. 95 %, non-condensing
Maximum angle of rotation:	pan (horizontal): ±90°
	tilt (vertical): ±84° (limited by limit switch)
Rotation velocity:	horizontal: 6°/sec.
	vertical: 5°/sec.
Backlash:	±0.5° (testing moment 10 Nm)
Dimensions:	top mount: 276 mm × 149 mm × 286 mm
Weight:	12 kg
Max. load:	18 kg

Appendix A: Optional Accessories for the Scanning Head OFV-056

A.1 Coaxial Unit and Accessories

A.1.1 Close-Up Unit OFV-056-CF97 or OFV-056-CF99

You can scan small objects at short distance using the close-up unit shown in figure A.1. Thereby the beam path of the laser is overlaid to the video image to equalize the parallax error.

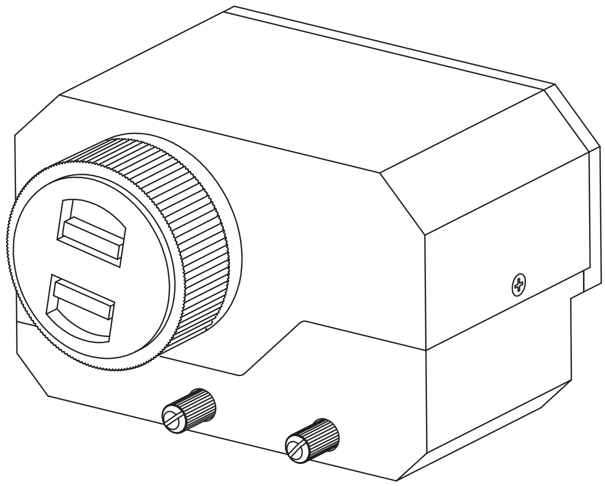


Figure A.1: Close-up unit OFV-056-C

To ensure a clearly visible laser spot on the video image, only a small part of the laser light is used for the video camera. The size of that part depends on the back scattering properties of the surface. Two models of the close-up unit are available which have different special coated beam splitters:

- **OFV-056-CF97** for mat surfaces
  (reduces the intensity of the laser light by 97%)
- **OFV-056-CF99** for highly reflective surfaces
  (reduces the intensity of the laser light by 99.8%)

Technical Specifications

Max. scan angle in x-direction:	±5°
Max. scan angle in y-direction:	±4°
Dimensions:	135 mm x 90 mm x 100 mm and figure A.2
Weight:	1.3 kg

Block Filter OFV-056-F

If the intensity of the laser light is still too high the supplied helium neon block filter should be additionally mounted. The block filter is screwed directly to the the camera aperture of the scanning head and reduces once more the intensity of the laser light back scattered to the video camera by 98%.

Close-Up Lenses

Together with the close-up unit a set of close-up lenses with different focal distances (1, 2 and 4 diopters) is delivered. A maximum of two close-up lenses or one close-up lens and the block filter can be mounted. The close-up lenses are also screwed directly to the camera aperture of the scanning head before mounting the close-up unit. The stand-off distances and the scan fields of the close-up lenses and of combinations of the lenses are shown in table A.1.

Table A.1: Stand-off distances and scan fields of the close-up lenses

Lens or combination Diopters	Stand-off distance[1] mm	Min. scan field (X x Y) mm	Nom. scan field[2] (X x Y) mm	Max. scan field (X x Y) mm	Spot diameter[3] µm
2	320...450	5 x 4	20 x 16	70 x 55	40
2 + 1	250...350	4 x 3	16 x 8	60 x 45	30
4	200...260	3 x 2.4	12 x 10	50 x 40	25
4 + 1	175...215	2.5 x 2	10 x 8	45 x 34	20
4 + 2	152...175	2 x 1.6	8 x 6.4	40 x 30	15

[1] measured from the front panel of the scanning head

[2] at 18x optical zoom

[3] with front lens model MR

Mounting the Close-Up Unit

For transportation the close-up unit is secured on the back with a transparent perspex plate. For mounting the close-up unit, you proceed as follows:

1. Before mounting, undo the perspex plate and keep it in a safe place.
2. If required first screw the close-up lenses or the block filter to the camera aperture.
3. Fix the close-up unit on the front of the scanning head using the two knurled screws.

Caution!

Pay attention to the correct fit of the precision pins and **only** hand-tighten the knurled screws!

Dimensions

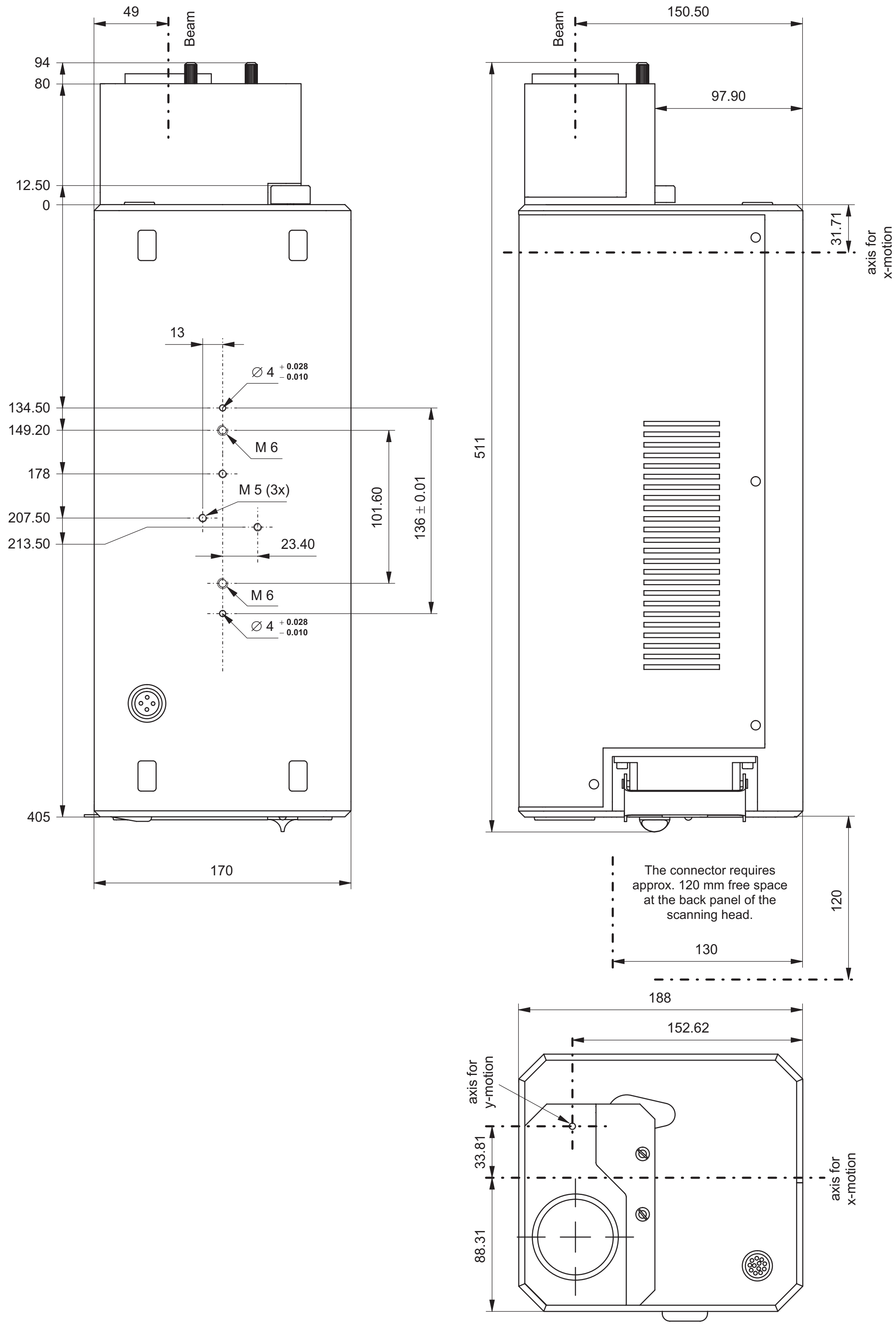


Figure A.2: Views of the scanning head with close-up unit mounted

A.1.2 Micro Scan Lenses OFV-CL-xxx

By attaching the micro scan lenses, scan fields down to 1 mm x 1.2 mm are achieved at a fixed stand-off distance. The specialty of the micro scan lenses is that the laser beam nearly perpendicular meets the measurement surface as also shown in figure A.3 for the OFV-CL-150. Without loss of signal quality, mirror like objects can be scanned up to a tilt of ±4°.

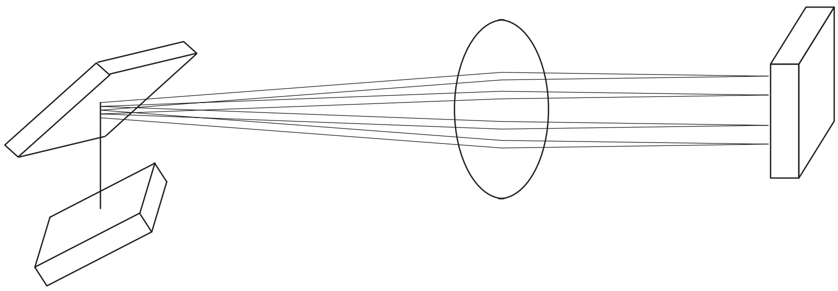


Figure A.3: Function principle of the micro scan lenses

Assembly

Undo the protective cap from the objective of the close-up unit and screw the micro scan lens onto the objective.

Technical Specifications

The stand-off distances and scan fields of the different micro scan lenses are shown in table A.2.

Table A.2: Stand-off distances and scan fields of the micro scan lenses

Micro scan lens	Stand-off distance[1] mm	Min. scan field (X x Y) mm	Nom. scan field[2] (X x Y) mm	Max. scan field (X x Y) mm	Spot diameter[3] µm	Depth of field mm
OFV-CL-80	160	1.2 x 1.0	5 x 4	14 x 10	7	0.4
OFV-CL-150	230	1.8 x 1.3	7 x 5	23 x 17	13	1.3
OFV-CL-300	380	2.6 x 3.5	10 x 14	46 x 35	25	5.0

[1] measured from the front panel of the scanning head

[2] at 18x optical zoom

[3] with front lens model MR

The nominal scan field values are suitable for orientation. Stronger zoom is achieved by interpolation which might reduce the quality of the video image.

Fiber Optical Ring-Light PSV-Z-056

To enhance the quality of the video image the optional fiber optical ring-light can be mounted on the micro scan lenses OFV-CL-80 and OFV-CL-150. For mounting the ring-light, you proceed as follows:

1. Mount the ring-light on the micro scan lens and hand-tighten the knurled screw.
2. Undo the protective cap from the other end of the fiber cable.
3. Insert the fiber cable into the 'Modulamp' receptacle of the light source and tighten the fiber optic positioning thumbscrew.

Warning!
Never look directly at the ring-light when the light source is switched on!

For more information about the light source, please refer to the user manual of the manufacturer.

A.2 Vertical Test Stand PSV-Z-018

You can adjust the stand-off distance of the mounted scanning head precisely using the vertical test stand shown in figure A.4. The test stand is especially suitable for scanning very small parts with the close-up unit on the scanning head.

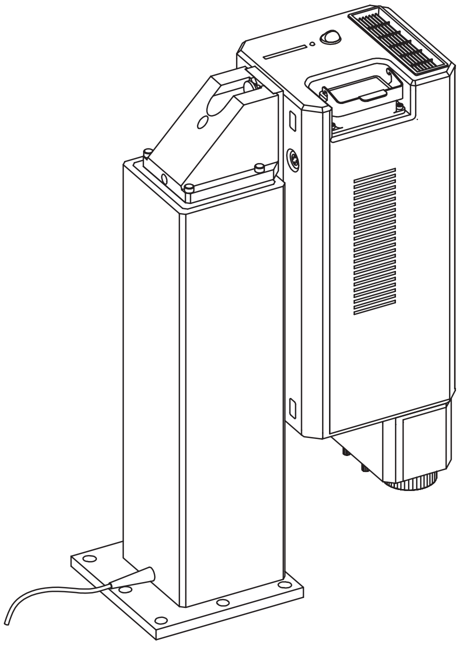


Figure A.4: Vertical test stand PSV-Z-018 with scanning head and close-up unit mounted

Assembly

For mounting the scanning head at the telescope drive, you proceed as follows:

1. Fix the telescope drive at the measurement location using the 6 screws of the assembly kit (refer to figure A.5, picture 1).

   Use either the metric screws ***or*** *the separately packed screws with thread basing on inch-system (1/4-20 x 1/2" UNC).*

2. If applicable, undo the quick release hexagonal plate or the mounting plate for the pan-tilt head from the scanning head.

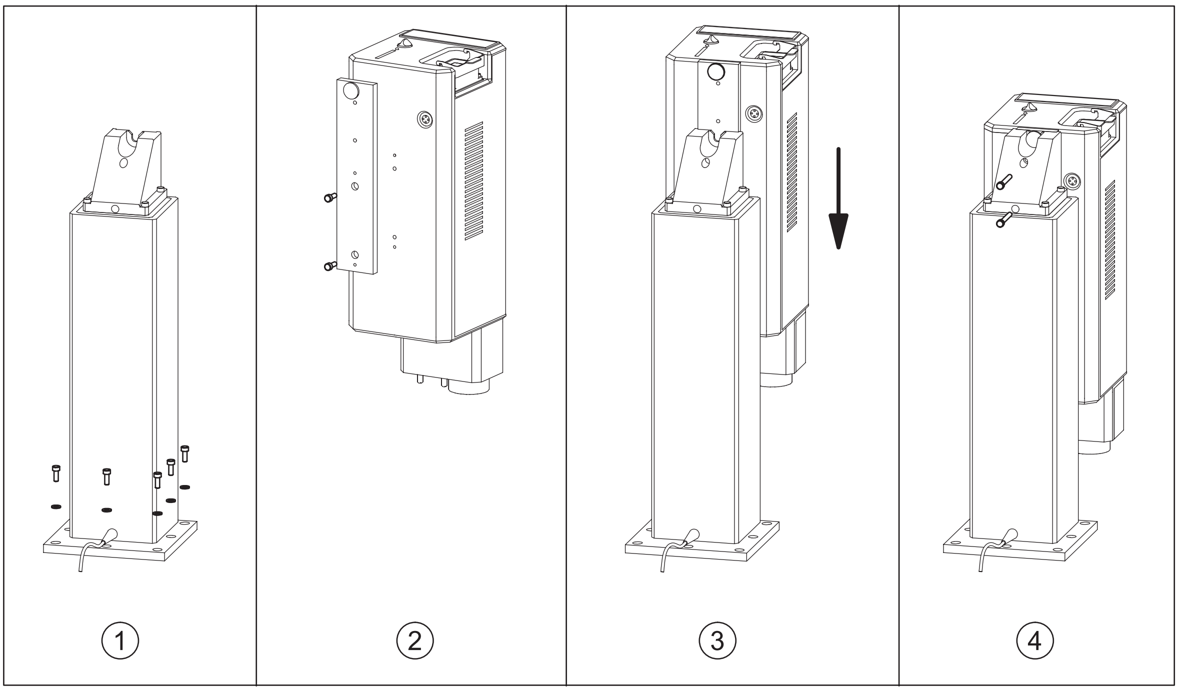


Figure A.5: Mounting the scanning head to the telescope drive

3. Attach the adapter plate on the underside of the scanning head as shown in figure A.5, picture 2.

4. Hang up the scanning head with the adapter plate above at the telescope drive (refer to figure A.5, picture 3).

5. Secure the scanning head by fixing the adapter plate to the telescope drive using 2 Allen screws (refer to figure A.5, picture 4).

Cabling

For the electrical connection of the test stand, you proceed as follows:

1. Connect the cable of the telescope drive to the motor connection **3** of the drive control in figure A.6.

2. Plug the hand set cable into the Sub-D jack **2** in figure A.6.

3. Plug the mains cable into connection **1** of the drive control and into a wall outlet providing protective grounding.

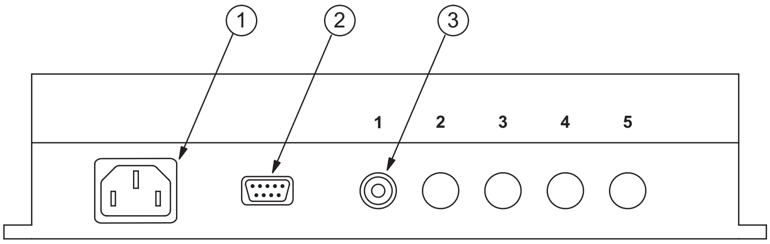


Figure A.6: Connections on the drive control

4. To move the scanning head upstairs, press the arrow key ↑ on the hand set. Move the scanning head downstairs by pressing the arrow key ↓ on the hand set.

5. If you press the arrow key for more than approximately 2 seconds, the motor switches over to fast mode. After approximately 3 seconds the motor reaches its maximum velocity. For fine positioning, the arrow key can be repeatedly pressed briefly.

Technical Specifications

Drive control

Mains voltage:	230 V / 50 Hz **or** 115 V / 50-60 Hz
Power output:	24 VDC / 5 A
Protection rating:	IP 66
Operating temperature:	0°C ... +40°C (32°F ... 104°F)
Dimensions:	130 mm x 80 mm x 360 mm
Weight:	2.8 kg

Telescope drive

Protection rating:	IP 30
Operating temperature:	+10°C ... +40°C (50°F ... 104°F)
Operating time - intermittent:	max. 1 min. (9 min. break)
Operating time - continuous:	max. 2.5 min.
Velocity stages:	3
Max. velocity:	5.5 mm / s
Min. travel:	approx. 0.1 mm
Max. travel:	300 mm
Dimensions:	180 mm x 180 mm x 590 mm (+ 300 mm throw)
Weight:	13.8 kg

A.3 Hand Set OFV-310 (optional)

You can focus the laser beam using the optional hand set OFV-310 shown in figure A.7.

> **Note!**
>
> **Never** use the optional hand set OFV-310 together with the hand set PSV-Z-051 (refer to section 5.6)!

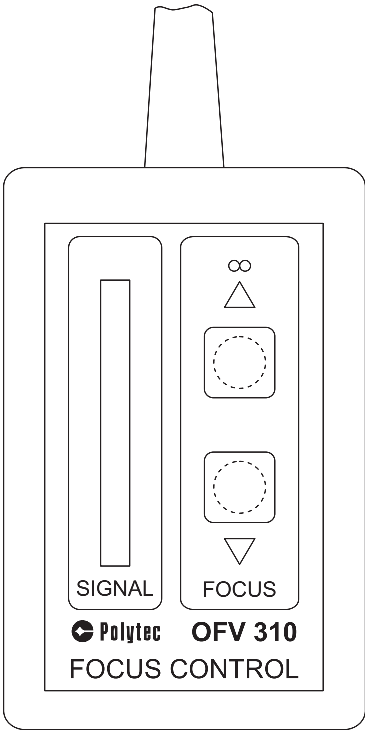


Figure A.7: Hand set OFV-310

The optional hand set OFV-310 is connected to the jack REMOTE FOCUS on the back of the controller. Using the two keys, the laser beam is focused as follows:

- Focusing on infinity: key Δ
- Focusing close-up: key ∇

If you press the keys for more than approximately one second, the motor switches over to fast mode. For fine positioning, the keys can be repeatedly pressed briefly. At the end of the adjustment range, the motor stops automatically and the respective directional symbol Δ or ∇ lights up.

There is also a signal level display on the hand set which helps you to optimize the focus. The signal shown is identical to that on the scanning head and on the display of the controller.

Appendix B: Basics of Measurement Procedure

B.1 Theory of Interferometric Velocity and Displacement Measurement

Optical interference can be observed when two coherent light beams are made to coincide. The resulting intensity e.g. on a photo detector varies with the phase difference $\Delta\varphi$ between the two beams according to the equation

$$I(\Delta\varphi) = \frac{I_{max}}{2} \cdot (1 + \cos\Delta\varphi)$$ Equation B.1

The phase difference $\Delta\varphi$ is a function of the path difference ΔL between the two beams according to

$$\Delta\varphi = 2\pi \cdot \frac{\Delta L}{\lambda}$$ Equation B.2

where λ is the laser wavelength.

If one of the two beams is scattered back from a moving object (the object beam), the path difference becomes a function of time $\Delta L = \Delta L(t)$. The interference fringe pattern moves on the detector and the displacement of the object can be determined using directionally sensitive counting of the passing fringe pattern.

On scattering from the object the object beam is subjected to a small frequency shift which is called Doppler shift f_D and is a function of the velocity component in the direction of the object beam according to

$$f_D = 2 \cdot \frac{|v|}{\lambda}$$ Equation B.3

Superimposing object beam and internal reference beam i.e. two electromagnetic waves with slightly different frequencies generates a beat frequency at the detector which is equal to the Doppler shift. The ratio B.3 to determine the velocity is, however, independent of its sign. The direction of the velocity can be determined by introducing an additional fixed frequency shift f_B in the interferometer to which the Doppler shift is added with the correct sign. Thus the resulting frequency at the detector f_{mod} is given by

$$f_{mod} = f_B + 2 \cdot \frac{v}{\lambda}$$ Equation B.4

Interferometers of this type which are directionally sensitive are described as heterodyne.

B.2 Optical Configuration in the Scanning Head

In Polytec's vibrometers, the velocity and displacement measurement is carried out using a modified Mach-Zehnder interferometer. The optical configuration in the scanning head is shown schematically in figure B.1.

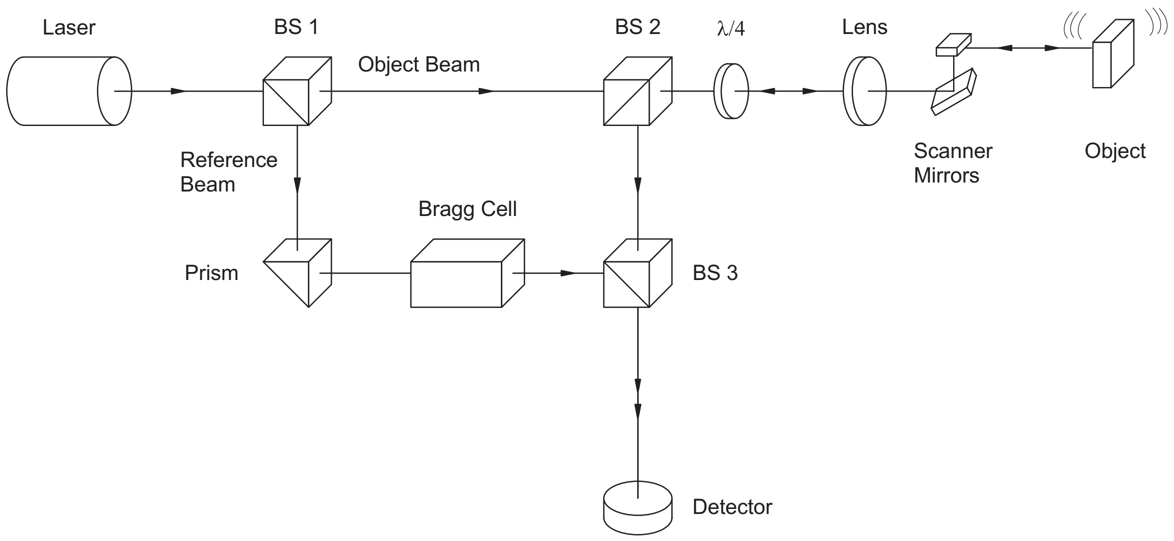


Figure B.1: Optical configuration in the scanning head

The light source is a helium neon laser, which provides a linear polarized beam. The polarizing beam splitter BS1 splits the beam into the object beam and the reference beam.

The object beam passes through the polarizing beam splitter BS2 as well as a λ/4-plate, is then focussed by the lens on the object and scattered back from there. The polarizing beam splitter BS2 then functions as an optical directional coupler together with the λ/4-plate, and deflects the object beam to the beam splitter BS3. As both arms of the 'internal' interferometer are symmetrical, the optical path difference between the object beam and the reference beam vanishes within the interferometer. The resulting path difference is equal to twice the distance between the beam splitter BS2 and the object.

The Bragg cell in the reference arm of the interferometer generates the additional frequency offset to determine the sign of the velocity.

The resulting interference signal of the object beam and reference beam is converted into an electrical signal in the photo detector and subsequently decoded in the controller.

Appendix C: Functional Description of the Controller

C.1 Overview

The main function of the controller is to demodulate the radio frequency signal (RF signal) provided by the interferometer in the scanning head. The frequency of the signal is the carrier of the velocity information. Secondary functions such as human interfacing, display and filters improve the user friendliness of the system. An overview of the functional structure of the controller is shown in figure C.1.

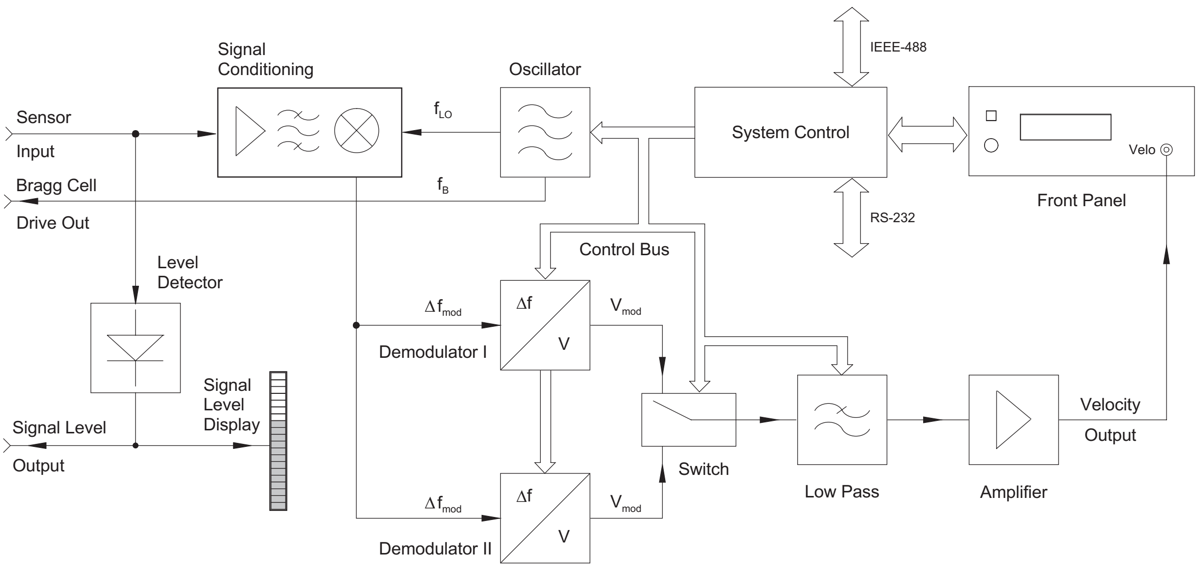


Figure C.1: Block diagram of the controller OFV-3001 S

The RF signal from the scanning head (sensor input) initially passes the functional block signal conditioning where it is pre-processed to optimally drive the following blocks. Subsequently follows the velocity signal decoding. If the controller is fully equipped there are two velocity decoders installed (demodulator I and demodulator II).

The velocity is modulated on the radio frequency of the input signal. In the velocity decoder, an AC-voltage is generated which is proportional to the instantaneous velocity of the object with the aid of so-called FM-demodulators.

The individual demodulators require different reference frequencies which are in a fixed relationship to the driver frequency of the Bragg cell in the interferometer. They are generated in the central oscillator block, synchronized with the driver signal for the Bragg cell.

The velocity decoder is followed by a low pass filter which suppresses spurious RF components and limits the bandwidth of the output signal to reduce background noise. Via the system control, various cutoff frequencies can be set for the low pass filter.

The last block in each signal path is an amplifier which scales the output signals and can optimally drive subsequent signal processing units.

The system control manages communication of the controller with the environment via the front panel and workstation interfaces and also the internal setting of all parameters for the individual functional blocks.

C.2 Signal Conditioning

The RF signal from the scanning head first of all has to be pre-processed to optimally drive the various demodulators. The signal conditioning includes the following functions:

- Measurement of the input signal level
- Stabilization of the signal amplitude
- Limitation of the bandwidth
- Dropout reduction via the tracking filter
- Down-mixing of the frequency

Measurement of the input signal level

The measurement of the input signal level is required to provide the user with information of the back scattering properties of the object and as a help to optimally focus the laser beam. The level is converted to a logarithmically scaled DC voltage. This signal is visualized on the scanning head and on the controller as a bar display and is available at the BNC jack SIGNAL for external usage.

Stabilization of the signal amplitude

Stabilization of the signal amplitude is necessary for the following signal processing steps as the input signal level can fluctuate by several orders of magnitude due to the extremely different back scattering properties of the objects.

Limitation of the bandwidth

Limitation of the bandwidth at the input of the signal processing electronics is required because, for low velocities, only a narrow section of the system bandwidth is occupied by the FM signal. In the remaining bandwidth only noise is recorded. For this reason, at the input section of the controller, a switchable filter is installed which limits the noise bandwidth depending on the velocity measurement range set.

Dropout reduction via tracking filter

The dropout reduction via tracking filter plays a very important role in optical signal processing. The light scattered back from the object has a speckled nature, i.e. at any instant the detector sees a light or a dark speckle. The low signal amplitude of the dark speckle can lead to loss of signal, so-called dropouts. When decoding the velocity, this interruption of the input signal causes short but high noise signals, so-called spikes which make it very difficult to analyze the output signal. These dropouts are effectively reduced by a so-called tracking filter integrated in the input section of the controller. This is done by an electronic circuit to regenerate high frequency signals based on the principle of the phase locked loop (PLL).

The principle of signal regeneration by the tracking filter is based on replacing the input signal with a distorted amplitude by a stable signal from a voltage controlled oscillator which is synchronized with the frequency and the phase of the input signal. Suitable circuit design can make it possible to maintain the synchronized condition approximately, even if the input signal is temporarily lost. The mechanical analog for this design is a flywheel which may lose a small portion of its energy if the driving force is briefly interrupted but continues to run at almost the same number of revolutions per minute and can drive a subsequent mechanism without disruption. It is easy to see that this effect gets better, the higher the inertia of the wheel is. At the same time the flywheel however, loses the ability to follow rapid changes in the revolutions per minute, i.e. the dynamic response of the drive system gets worse. The same correlation also applies to the electronic tracking filter which thus always represents a compromise between the regeneration effect and the dynamic tracking behavior of the input signal. Basically, good dropout elimination or noise suppression is always involved with limited dynamic response. If the maximum acceleration is exceeded, the synchronization between the input signal and the oscillator is lost (the tracking filter loses lock) which leads to drastic signal distortions at the signal output. Practical advice for setting the tracking filter can be found in section 4.2.3.

The internal structure of the tracking filter circuit is shown in figure C.2. The function of the voltage controlled oscillator (VCO) has already been mentioned. The control signal which synchronizes the oscillator is generated in the phase detector which monitors the phase difference between the input signal and the oscillator signal. The dynamic characteristics of the configuration are mainly determined by the internal low pass filter. The maximum acceleration which the tracking filter can still follow depends on the filter bandwidth. The low pass time constant is switched between SLOW and FAST via the system control and thus adapts the dynamic characteristics to the application. The tracking filter can be turned off via a bypass if the accelerations are too high or in the case of good optical signals.

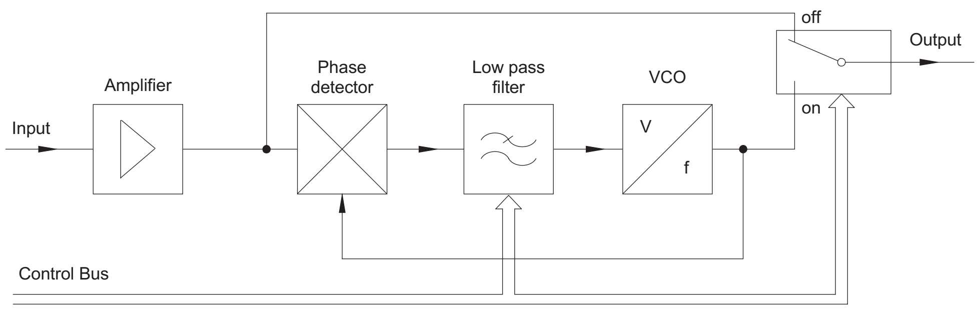


Figure C.2: Block diagram of the tracking filter circuit

Down-mixing of the frequency

Down-mixing of the frequency in the input section is required to convert the carrier frequency of the input signal from 40.4 MHz originally to lower intermediate frequencies. With these intermediate frequencies, the velocity decoder can work optimally in the individual measurement ranges. Down-mixing is carried out by a mixing process which does not affect the modulation content of the FM signal. The variable frequency f_{LO} is produced by the so-called local oscillator in a fixed relationship to the drive frequency of the Bragg cell.

C.3 Oscillator Section

The oscillator section generates all drive frequencies for operating the other subassemblies in the vibrometer. The drive frequency for the Bragg cell is of central importance as it directly determines the optical frequency offset in the interferometer and thus the center frequency of the carrier signal.

The variable mixing frequency f_{LO} is automatically set by the system control dependent on the selected velocity measurement range.

C.4 Velocity Decoder

C.4.1 The Various Velocity Decoders

Technically it is just about impossible to attain all desirable and realizable characteristics of the velocity decoder in a single universal subassembly. The modular concept of the controller thus permits the use of three different velocity decoders whereby a maximum of two can be installed at the same time. The selection of the decoders depends on the application. The models available are the OVD-04, OVD-04HF and PLL-DC which feature the following characteristics.

OVD-04

The OVD-04 as a broad band decoder is suitable universally for almost all vibrometer applications in the frequency range up to 250 kHz. Four measurement ranges from 10 $\frac{mm}{s}$/V to 1 000 $\frac{mm}{s}$/V cover most technical applications with sufficient amplitude resolution. Characteristic is the excellent amplitude and phase frequency response with extremely good amplitude flatness up to the highest frequencies. A special feature of the OVD-04 is the DC capability of the measurement ranges 125 $\frac{mm}{s}$/V and 1 000 $\frac{mm}{s}$/V. For detailed information, please request the respective application note.

OVD-04 HF

The OVD-04HF is a special version of the OVD-04 which provides an extended frequency range up to 1.5 MHz when operating in the measurement ranges 25 $\frac{mm}{s}$/V; 125 $\frac{mm}{s}$/V and 1 000 $\frac{mm}{s}$/V.

PLL-DC

The PLL-DC is a decoder which has been specially developed for applications at the lower end of the velocity and frequency range of vibrations. It is an excellent supplement to the broad band decoder OVD-04, as with its three measurement ranges 1 $\frac{mm}{s}$/V, 5 $\frac{mm}{s}$/V and 25 $\frac{mm}{s}$/V it extends the application range for low frequencies to cover also very low velocities. The lower frequency limit of the PLL-DC is 0 Hz, i.e. there is no amplitude roll-off at very low frequencies. Thus it is optimally suited for vibration measurements over long distances on buildings or other structures with low resonance frequencies.

C.4.2 Operating Principle

The velocity decoder determines the essential measurement properties of the vibrometer. Velocity decoding is in principal an FM demodulation process which converts the velocity dependent Doppler frequency of the interferometer signal into an AC voltage. The linearity and bandwidth of the demodulator determine the accuracy of the vibrometer. In contrast to FM radio which works with the same modulation procedure, considerably higher frequency deviations occur in the vibrometer which make significantly higher demands on the demodulators:

FM radio:	max. frequency deviation 75 kHz, max. modulation frequency 53 kHz (Stereo)
Vibrometer:	max. frequency deviation 32 MHz, max. modulation frequency 1.5 MHz

In the OFV-3001S controller, different respectively optimally adapted demodulators are switched on in the individual velocity measurement ranges. The decoders and measurement ranges are selected via the system control and the internal bus. At the same time, the corresponding settings on the subassemblies oscillator and signal conditioning are carried out internally.

C.4.3 Low Pass Filter

The signal generated by the FM demodulator always contains spurious RF components and its noise bandwidth corresponds with the maximum frequency of the respective measurement range. A subsequent low pass filter suppresses the RF components and limits the noise bandwidth according to its cutoff frequency. This makes a rough adaptation of the measurement bandwidth to the application possible which makes the signal evaluation in the time domain significantly easier due to the improved signal-to-noise ratio.

The filters are adjusted via the system control. In position OFF the low pass filter has no effect. With the filter switched on, its influence on both amplitude and phase of the measurement signal has to be taken into consideration. The filter characteristics as well as rules of thumb for using them are provided in section 4.2.2.

Appendix D: Declaration of Conformity

CE

Konformitätsbescheinigung / Declaration of Conformity

für / for

Gegenstand / Objekt :	**Scanning Vibrometer**
Controller Typ / Model :	**OFV-3001-SU3/ -SU5/ -SF6/ -SH6 ID 31955 / ID 31965 / ID 31969 / ID 31966**
Sensor Typ / Model :	**OFV 056 ID 31956**
Junction Box / Model :	**PSV-Z-040-U, PSV-Z-040-F, PSV-Z-040-H ID 31971, ID 31972, ID 32615**

Der Hersteller / The manufacturer

Polytec GmbH
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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 / EN 50081 - 2	Elektromagnetische Verträglichkeit (EMV) Fachgrundnorm Störaussendung Electromagnetic compatibility / Emission - EN 55011 Grenzwertklasse: B (FCC Class B)
EN 50082 - 1 / EN 50082 - 2	Elektromagnetische Verträglichkeit (EMV) Fachgrundnorm Störfestigkeit Electromagnetic compatibility / Immunity - VDE 0843 - 2... - 5 (IEC 801 - 1... - 5)

Ausgestellt von / Issued by

Mehl Sell

Polytec GmbH

18.12.2000
Datum / Date

Figure D.1: PSV 300 declaration of conformity

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