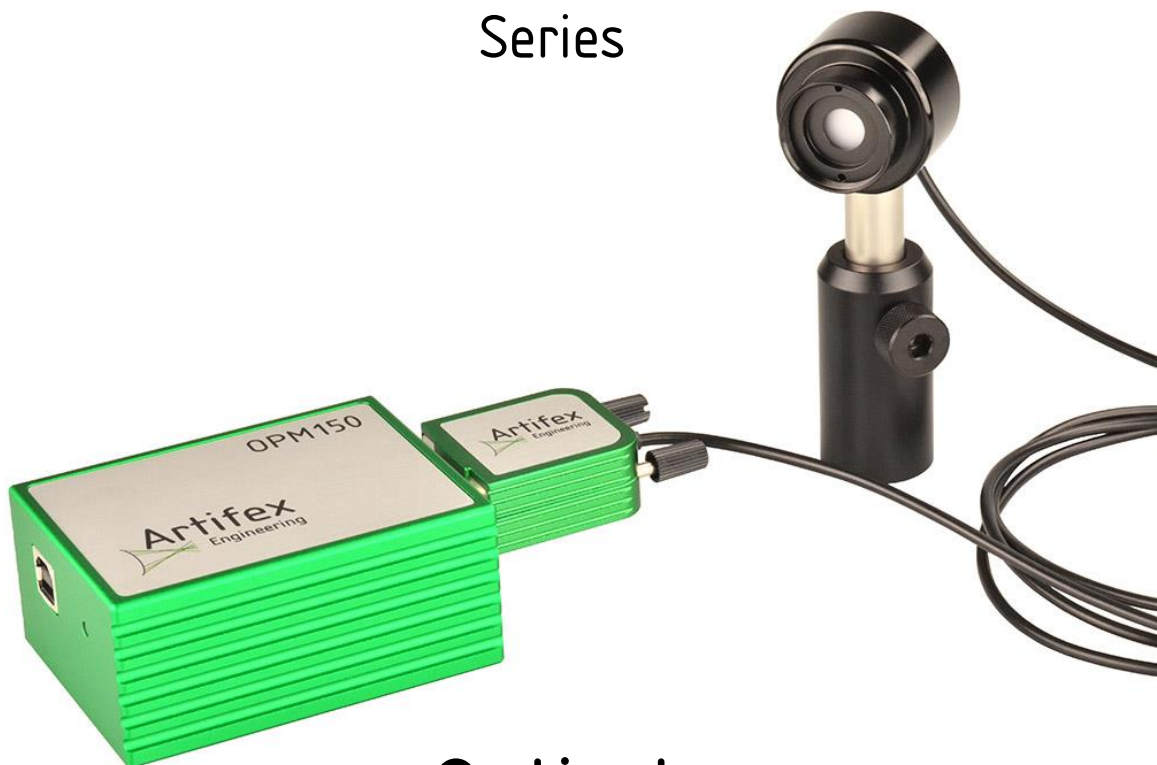


OPM150

Series



Optical Power Meter

Read this instruction manual before performing any task!

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Original Operating Instructions

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1 About this manual

1.1 Information about this manual

This manual is valid for units with firmware version FW2.4.

This manual enables you to handle the device in a safe and efficient manner. This manual is part of the device and must be kept in its vicinity to ensure that it is available to the personnel at all times.

The personnel must have carefully read and understood this manual before commencing any work. The compliance with all safety information and instructions provided in this manual is essential for safe operation.

Furthermore, all local work protection and general safety regulations applicable at the device's place of installation must be observed.

The illustrations used throughout this manual are intended to provide a general understanding and may deviate from the actual model of the machine.

1.2 Explanation of symbols

Safety instructions

Safety instructions are marked with symbols in these instructions. The safety instructions are always introduced by signal words which express the extent of the danger.



DANGER!

This combination of symbol and signal word indicates an immediately dangerous situation which could cause death or severe injuries if not avoided.



WARNING!

This combination of symbol and signal word indicates a possibly dangerous situation which could cause death or severe injuries if it is not avoided.

**CAUTION!**

This combination of symbol and signal word indicates a possibly dangerous situation which could cause slight injuries if it is not avoided.

**NOTICE!**

This combination of symbol and signal word indicates a possibly dangerous situation which could cause property and environmental damage if it is not avoided.



Tips and recommendations

This symbol highlights useful tips and recommendations as well as information designed to ensure efficient and smooth operation.

Special safety instructions

The following symbols are used in the safety instructions to draw attention to specific dangers:

**DANGER!**

This combination of symbol and signal word indicates an immediately dangerous situation due to electric shock. If an instruction so marked is not heeded, severe or even fatal injuries can be the consequence.

**DANGER!**

This combination of symbol and signal word indicates an immediately dangerous situation due to laseremission. If an instruction so marked is not heeded, severe or even fatal injuries can be the consequence.

1.3 Copyright

The contents of these instructions are copyrighted. Their use is permitted in the context of using the device. Any use extending beyond this is not allowed without written permission from the manufacturer.

1.4 Customer service

Our customer service is available for technical information and service:

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Email: info@artifex-engineering.com

Internet: www.artifex-engineering.com

We are also always interested in information and experiences gathered from use which could be valuable for the improvement of our products.

2 Safety

This section provides an overview of all safety aspects that are essential to the best possible protection of the personnel and the safe and trouble-free operation of the machine. Additional safety instructions for specific work tasks are contained in the sections regarding the individual life stages of the machine.

2.1 Intended use

The optical power meter OPM150 is designed exclusively as a measurement device for measuring optical power from monochromatic light sources such as lasers and non-white LEDs.

The intended use also includes adherence to all specifications in this manual.

Any use exceeding or differing from the intended use applies as misuse.

2.2 Basic dangers

The following section describes remaining risks which can arise from the device even with proper use.

To reduce risks of personal injury and property damage and avoid dangerous situations, the safety instructions listed here and the safety instructions in the other sections of these instructions must be followed.

2.3 Responsibility of the owner

Owner:

The owner is any such person who operates the optical power meter for commercial or economic purpose either itself or transfers it to a third party for use and bears the legal responsibility for the safety of the user, the personnel or third parties during the operation.

Owner's duties:

The optical power meter is used in commercial applications. Therefore, the owner of the respective optical power meter is subject to the statutory duties of work safety.

In addition to the safety instructions in this manual, the safety, work safety and environmental safety regulations applicable for the area in which the device is used must be adhered to. In the process, the following applies in particular:

- The owner must remain updated on the applicable work safety regulations and determine, in the scope of a risk assessment, additional dangers which can arise due to the special working conditions at the place in which the device is used. This must be implemented in the form of working instructions for the operation of the optical power meter.
- During the entire period of use of the optical power meter, the owner must check whether the working instructions meet the current status of the rules and regulations and to adapt them as necessary.
- The owner must clearly regulate and define responsibilities for the operation, fault rectification and cleaning.
- The owner must make sure that all persons who work with the optical power meter have read and understood this manual. Moreover, the owner must train the personnel in regular intervals and inform them of the dangers.
- The owner must adhere to all statutory provisions regarding the regular testing of electrical equipment and document this testing.

In addition, the owner is responsible for ensuring that the unit is always in a technically faultless condition.

2.4 Personnel requirements

Qualifications:

The various tasks described in this manual place different requirements on the qualification of the persons to whom these tasks are entrusted.



NOTICE!

Insufficiently qualified personnel can cause property damage!

Insufficiently qualified personnel cannot assess the risks when working with the unit.

- All work may only be performed by personnel who are qualified for this purpose.
- Keep insufficiently qualified personnel away from the work area.

Only persons who can be expected to reliably perform this work are permitted to carry out any work with this equipment. Persons whose ability to react is impaired by drugs, alcohol, medications, etc. are not permitted to work with this equipment.

2.5 Symbols on the unit

The following symbols and instruction signs are affixed in the work area. These symbols and instruction signs refer to the immediate vicinity in which they are affixed.

WARNING!

Danger due to illegible signage!



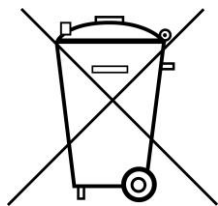
- Over time, stickers and signs can get dirty or in some other manner become illegible, so that dangers cannot be recognized, and necessary operating instructions cannot be followed. Thus, an injury hazard occurs.
- Keep all safety, warning, and operating instructions that are affixed to the device in legible condition.
- Replace damaged signs or stickers immediately.

Observe the operating manual



Do not use the indicated appliance until the operating manual has been read.

Do not dispose of with the household waste



Notice that the optical power meter may not be disposed of with the household waste. The worn-out unit can be taken to an electronics and metal recycling service for disposal. The manufacturer also accepts old units for disposal.

2.6 Scope of delivery

Depending on the chosen model, the scope of delivery will vary:

- OPM150 optical power meter
- USB cable
- USB-Stick with Software, drivers and manual

2.7 Transport inspection

On receipt, immediately inspect the delivery for completeness and transport damage.

Proceed as follows in the event of externally apparent transport damage:

- Do not accept the delivery or only accept it subject to reservation.
- Note the extent of the damage on the transport documentation or the shipper's delivery note.
- Initiate complaint procedures.



Issue a complaint in respect of each defect immediately following detection. Damage compensation claims can only be asserted within the applicable complaint deadlines.

2.8 Packaging

About the packaging

The individual optical power meter is packaged according to the expected transport conditions.

The packaging should protect the individual optical power meter from transport damage, corrosion and other types of damage. Therefore, do not destroy the packaging and save it for later transport and for storage.

Handling packaging materials

If the optical power meter no longer needs to be transported, dispose of the packaging materials in accordance with the respective statutory provisions and local regulations.



NOTICE!

Danger for the environment from improper disposal!

Packaging materials are valuable raw materials and can be reused in many cases or prepared and recycled. Dangers for the environment can arise through improper disposal of packaging material.

- Only dispose of packaging materials once it has been determined that the device will no longer be transported.
- Dispose of packaging materials in an environmentally friendly manner.
- Observe the locally applicable disposal regulations. If necessary, commission a specialist company with the disposal.

2.9 Transporting



NOTICE!

Property damage from improper transport!

Improper transport can damage the optical power meter.

- Always transport the optical power meter in the packaging provided for this purpose.
- Always proceed with caution with the transport of the optical power meter in the packaging.
- Do not throw the optical power meter.
- Protect the optical power meter from vibrations and moisture.
- Do not let the optical power meter fall.

2.10 Storage

Store the device in the packaging under the following conditions:

- Do not store outdoors.
- Store in a dry and dust-free area.
- Do not expose to any aggressive media.
- Protect from sun radiation.
- Avoid mechanical vibrations.
- Storage temperature: 15 to 35 °C.
- Relative air humidity: max. 60 %.



Under certain circumstances there are instructions for the storage on the packaging, which exceed the requirements specified here. Follow these accordingly.

3 Product Overview

The OPM150 series of optical power meters is designed for use with photodiode-based detector heads and integrating spheres from Artifex Engineering. The amplifiers employ precision transimpedance input stages to provide for high common mode rejection and linearity throughout the full dynamic range.

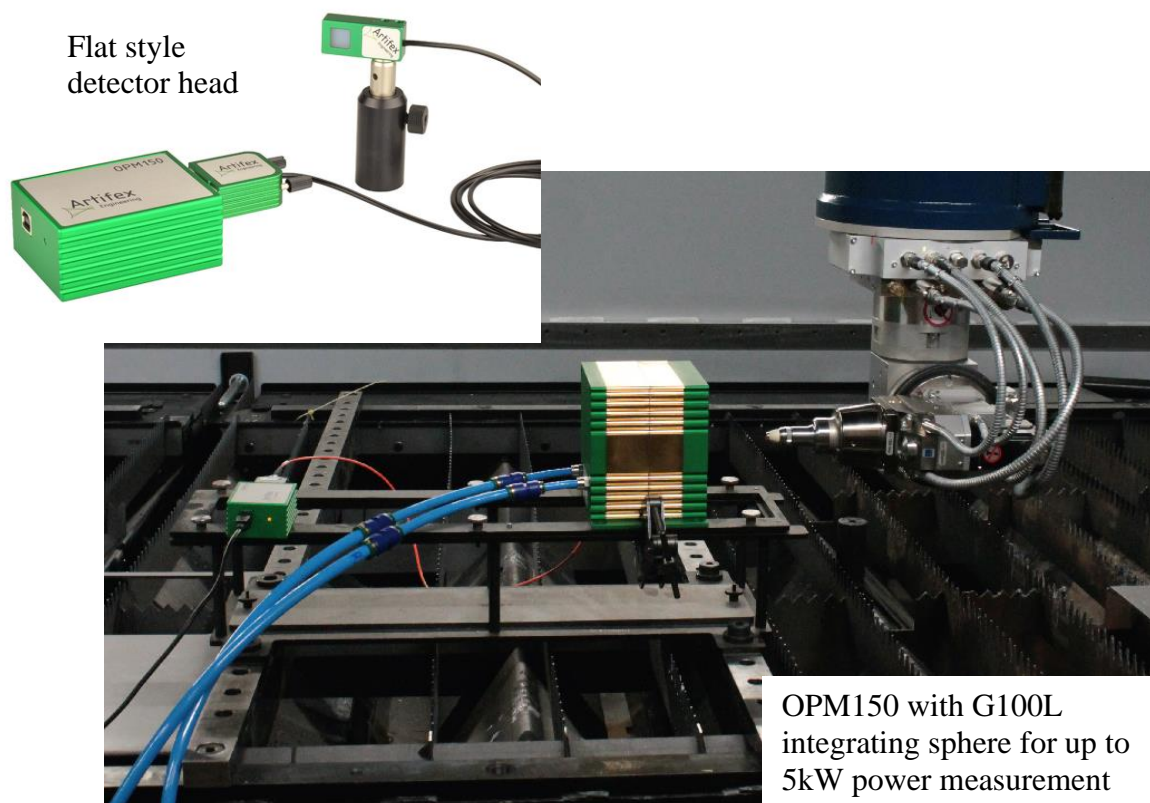
These optical power meters are particularly suitable for OEM applications, in the laboratory or for field use such as laser servicing. The unit is USB powered: no external power supply is required. The optical power is sampled at up to 600samples/s using the graphical software supplied. The high sensitivity and large dynamic range allow measurement of a wide range of optical sources such as lasers and LEDs.

The OPM150 series is insensitive to electromagnetic interference by design, an important factor when working in “dirty” industrial environments.

The OPM150 may be controlled via the USB port using the graphical user interface software provided with the instrument. Alternatively, the amplifier may be controlled through direct commands via the USB interface (virtual COM-port). This mode of operation is particularly interesting for OEM applications.

The software development kit comprising the GUI source code, a Python library as well as a LabVIEW® demo VI allows for easy integration.

A wide range of detector heads for free beam and fibre coupled measurement are available. These include large area photodiode heads as well as integrating spheres covering the range 250-2490nm and from 2nW up to 12kW.



® LabVIEW is a registered trademark of the National Instruments Corporation

4 Absolute Maximum Ratings

Table 1: Absolute Maximum Ratings

Average Input Current	15mA
Temperature Range	0 – 60 °C

5 Ordering Information

Table 2: Available Models

Model Number	Order Code	Application Description
OPM150 10kHz	30.070.00002	CW as well as pulsed sources with repetition rate >300kHz USB digital output
OPM150 100kHz	30.070.00058	CW sources only USB digital output and BNC analogue output
OPM150 5Hz	30.070.00112	CW as well as pulsed sources with repetition rate >500Hz USB digital output

For customized systems (eg: customized gain or receptacles), please contact us.



Figure 1: 30.070.00002 and 30.070.00112



30.070.00058

6 Specifications

Table 3: Specifications of the OPM150

Parameter	Conditions	Min	Typ	Max	Units
Input					
Current ranges (full scale)	Range: 1 2 3 4 5		10 or 4 ¹ 1 100 10 1		mA “ μA “ “
Connectors		DB9			
Output					
USB		Digital output of measured current			
Accuracy		± 1			%
Linearity			± 0.1	± 0.2	dB
Additional Output (30.070.00058 only)					
Connector		BNC ²			
Output scale (linear analogue $V_{out} = scale \times I_{in}$)	Range: 1 2 3 4 5		1 10 0.1 1 10		V / mA “ V / μA “ “
Output range (full scale)				4	V
Analogue bandwidth		100			kHz
Rise / Fall time (10% - 90%)				3.5	μs
Output impedance				<50	Ω
Minimum load impedance	Minimum load to ensure accurate reading	10			kΩ
Power Supply					
Type		USB 2.0 or higher			
Dimensions³					
	30.070.00002 and 30.070.00112 30.070.00058	60 x 36 x 85 mm (w x h x l) 60 x 54 x 85 mm (w x h x l)			mm

¹ 10mA for 30.070.00002 and 30.070.00112; 4mA for 30.070.00058.

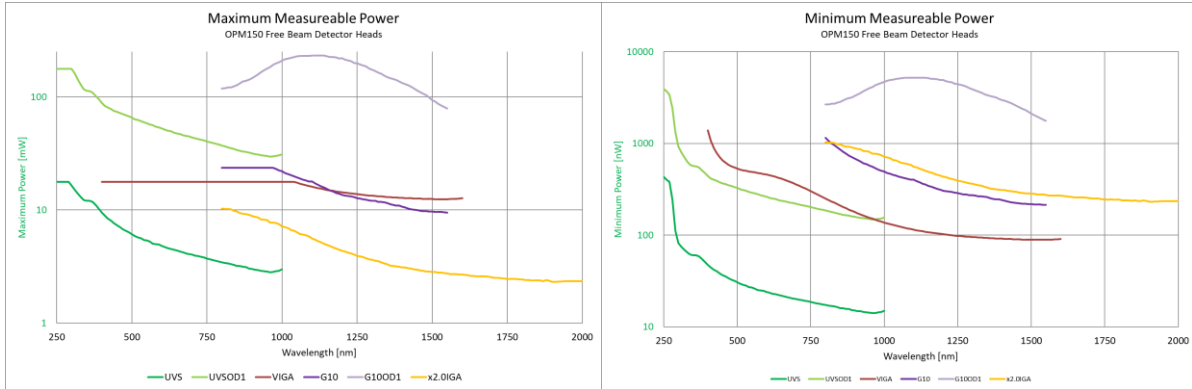
² BNC analogue output on article 30.070.00058 only.

³ Including receptacles.

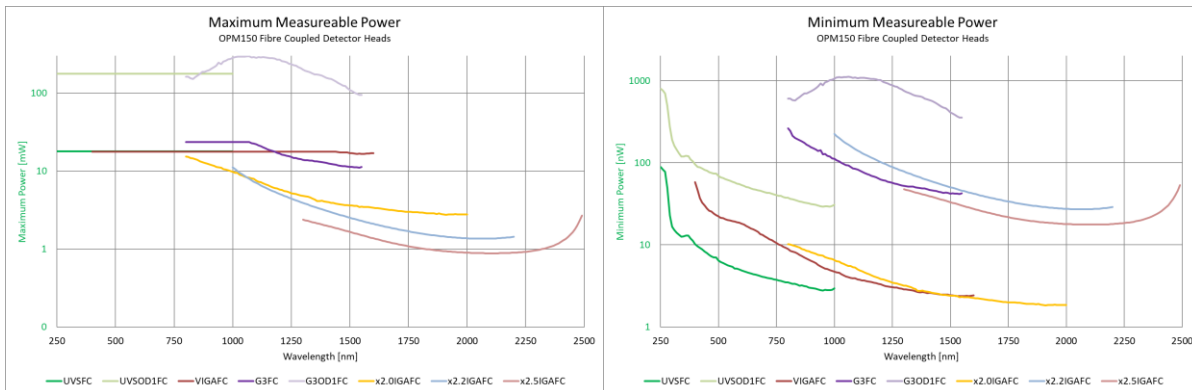
6.1 Detector Heads

A wide range of detector heads for free beam and fibre coupled measurement are available. These include large area photodiode heads as well as integrating spheres covering the range 250-2490nm and from 2nW up to 12kW.

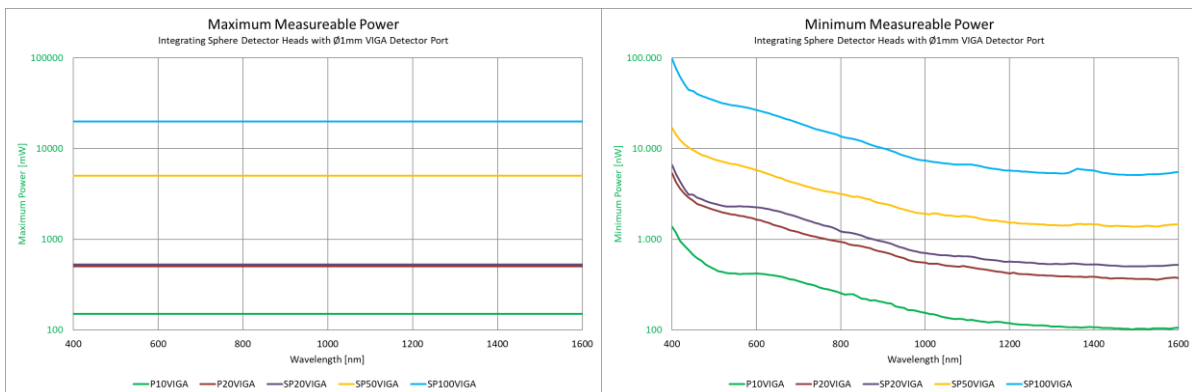
6.1.1 Free Beam Large Area Photodiode Heads



6.1.2 Fibre Coupled Heads



6.1.3 Integrating Spheres with Ø1mm VIGA Detector Port (example only, other standard photodiodes available)



Detailed specifications of the detector heads are given in the OPM150 brochure and on our website.

Furthermore, we offer a variety of accessories such as filter, adapters and tools to assist in use of these devices. Details are also found in the OPM150 brochure and on our website.

6.2 Case Dimensions

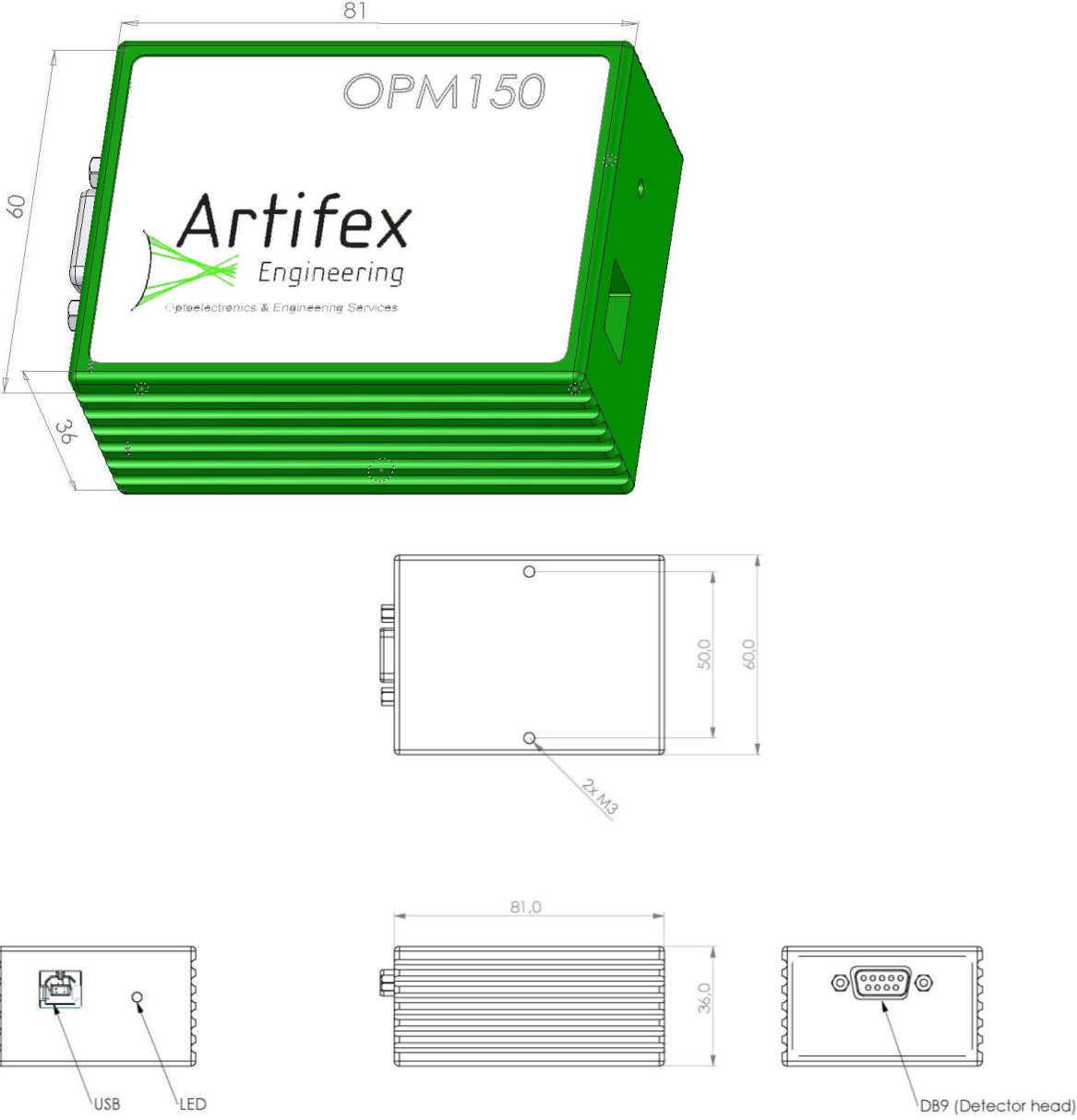


Figure 2: Case Dimensions; units mm

6.3 Front Panel



Figure 3: Front Panel

6.3.1 Detector Head Input Receptacle

This DB9 receptacle is used to connect detector heads manufactured by Artifex Engineering. Other brands of detector heads are not compatible with this input receptacle even if they come with a DB9 connector.

6.4 Back Panel



Figure 4: Back Panel

6.4.1 USB Receptacle

Communication with the OPM150 may be performed via USB 2.0 or higher with a baud rate of 115 200 bit/s. The system is fitted with a standard USB A-type receptacle. The appropriate USB cable is supplied with the system.

7 Principles of Operation

The OPM150 measures small currents generated from photodiodes in our optical power detector heads. Photodiodes are useful for power measurement in the visible and near infrared due to their inherent sensitivity and speed of measurement. Photodiodes produce a current which is proportional to the incident light power over a wide dynamic range.

The source current is converted to a voltage through a precise transimpedance amplifier (= current to voltage amplifier).

This amplifier is very linear over the full measurement range of the device. The OPM150 has 5 gain ranges. The gain switch is a semiconductor device, free from degradation.

The measured photocurrent may be read out from the USB port. The voltage generated is converted internally to a digital value via a 12-bit A/D converter. This process and all calculations and communication with the PC are controlled by a microcontroller. The measurement process is started via a command over the USB interface (software trigger). Alternatively, a continuous measurement stream can be started which samples at approximately 600 S/s.

7.1 Input Receptacle

This DB9 receptacle is used to connect detector heads manufactured by Artifex Engineering. Other brands of detector heads are not compatible with this input receptacle even if they come with a DB9 connector due to differences in the internal pinning of third-party devices.

The OPM150 series uses a “smart head” system. That is, the identification of the detector head and its calibration file are stored in a storage chip inside the electrical connector of the detector head. The internal connection of this receptacle is as follows:

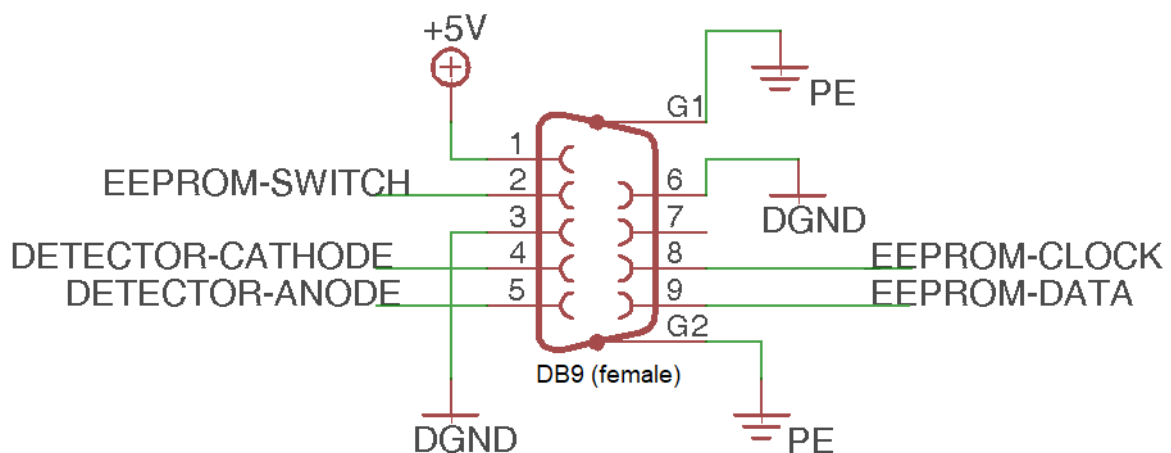


Figure 5: Internal Pinning of the DB9 Detector Head Input Receptacle

7.2 Gain

The amplifier has 5 gain ranges which may be selected via the appropriate menu in the GUI. These gain ranges are 10^3V/A , 10^4V/A , 10^5V/A , 10^6V/A and 10^7V/A .

Using the USB interface for direct communication, the gain can be selected with the commands V1, V2, ... V5.

8 Quick Start Guide

1. Start the PC (Windows[®] operating system).
2. Connect one or more OPM150 units to USB-Ports.
3. Connect an OPM150 detector head to each OPM150 base unit.
4. Start the OPM150 software.
5. Select the OPM150 units to be used for measurement.
6. Select the appropriate wavelength on the graphical interface.
7. Switch on the light source to be measured.
8. Start the measurement.

[®] „Windows“ is a registered trade mark of the Microsoft Corporation.

9 Installation of the Software Package

The complete software package comes on the data storage medium provided with the instrument:



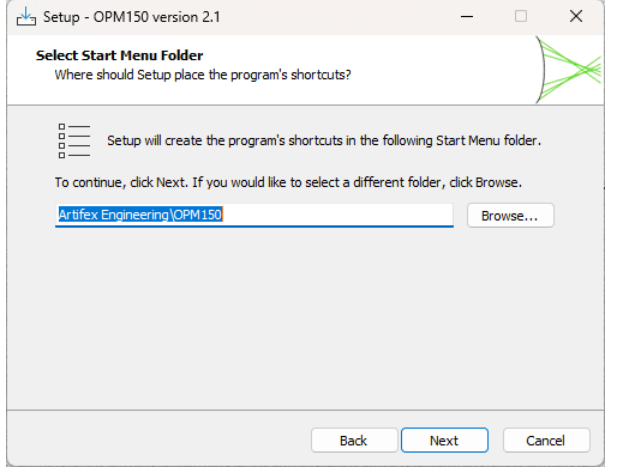
Fold out the connector of the storage device and insert it into a USB-port on the computer on which the OPM150 software is to be installed. Open the folder for this storage device. The contents appear as follows:

Name	Änderungsdatum	Typ	Größe
Documentation	23.01.2025 16:00	Dateiordner	
Driver	23.01.2025 16:00	Dateiordner	
Driver_WinXP	23.01.2025 16:00	Dateiordner	
Filter	12.08.2016 17:37	Dateiordner	
SDK	23.01.2025 16:00	Dateiordner	
Setup WindowsXP and Vista	23.01.2025 16:00	Dateiordner	
Artifex.ico	28.03.2010 15:12	ICO-Datei	4 KB
autorun.inf	28.03.2010 15:12	Setupinformationen	1 KB
Setup_OPM150.exe	23.01.2025 15:59	Anwendung	3.263 KB

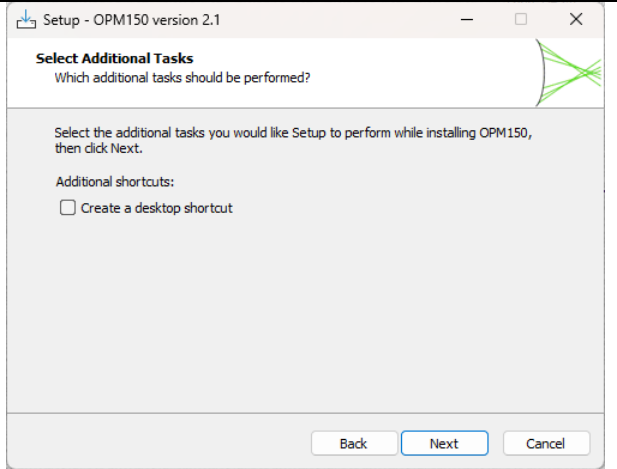
Double click on the file “Setup_OPM150.exe”. The following frames appear.

<p>Choose the language you want for the installation instructions. This is not the language of operation of the OPM150 software itself.</p>	
<p>Accept the suggested folder for the storage location of the software or select a different folder. Click “Next”.</p>	

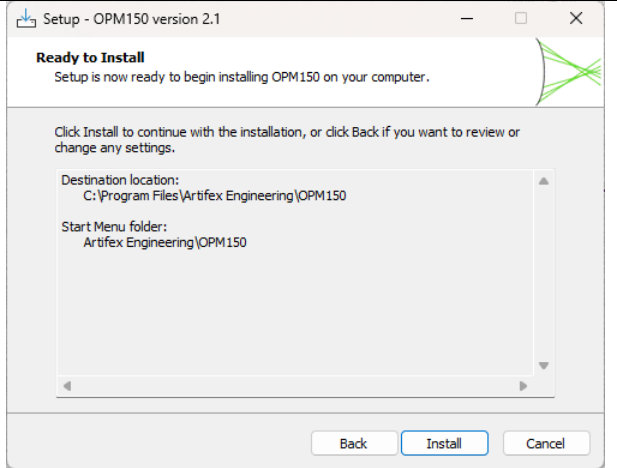
Accept the suggested folder for the storage location of the software shortcuts or select a different folder. Click “Next”.



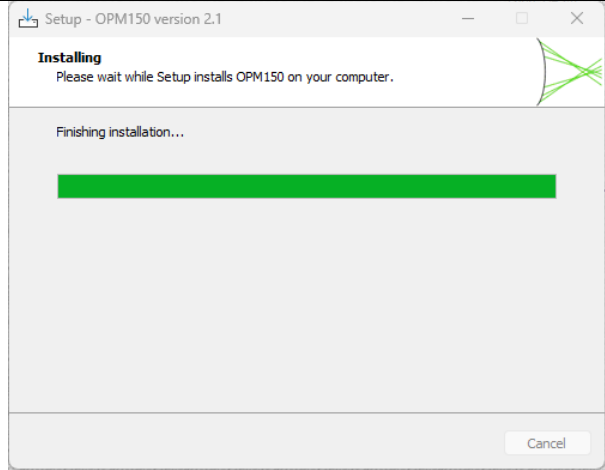
If desired, add a desktop shortcut. Click “Next”.



Click “Install” to continue with the installation.



The following frame shows the progress of installation.



After completion of the software installation, a prompt appears for the installation of the software drivers. Click “Weiter”.



The driver installation is ready. Click “Fertig stellen”.

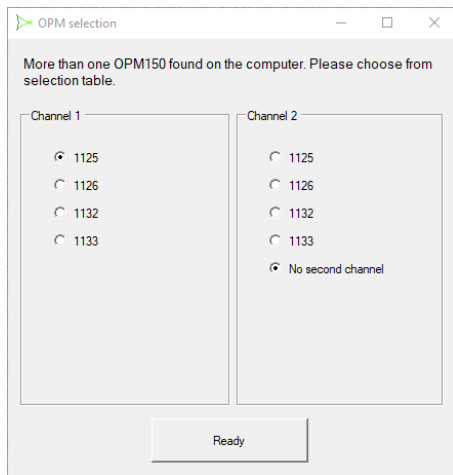


The driver installation is complete. Click “Finish”.



10 Using the Application Software

The OPM150 software can run up to two unit simultaneously. Up to 8 units can be connected to a computer and managed. Each unit must have a detector connected in order to be active. When starting the software, the user is prompted to choose which units are to be handled by the software and to which channel number they are to be allocated.



Make the appropriate selection and then click on „Ready“ to continue. Changing this selection requires shutting down and restarting the software.

The graphical user interface (GUI) is simple and easy to use. All important features can be reached directly in the main window. The main window comprises a pull-down menu, a tool bar, the diagramme frame and a status bar.

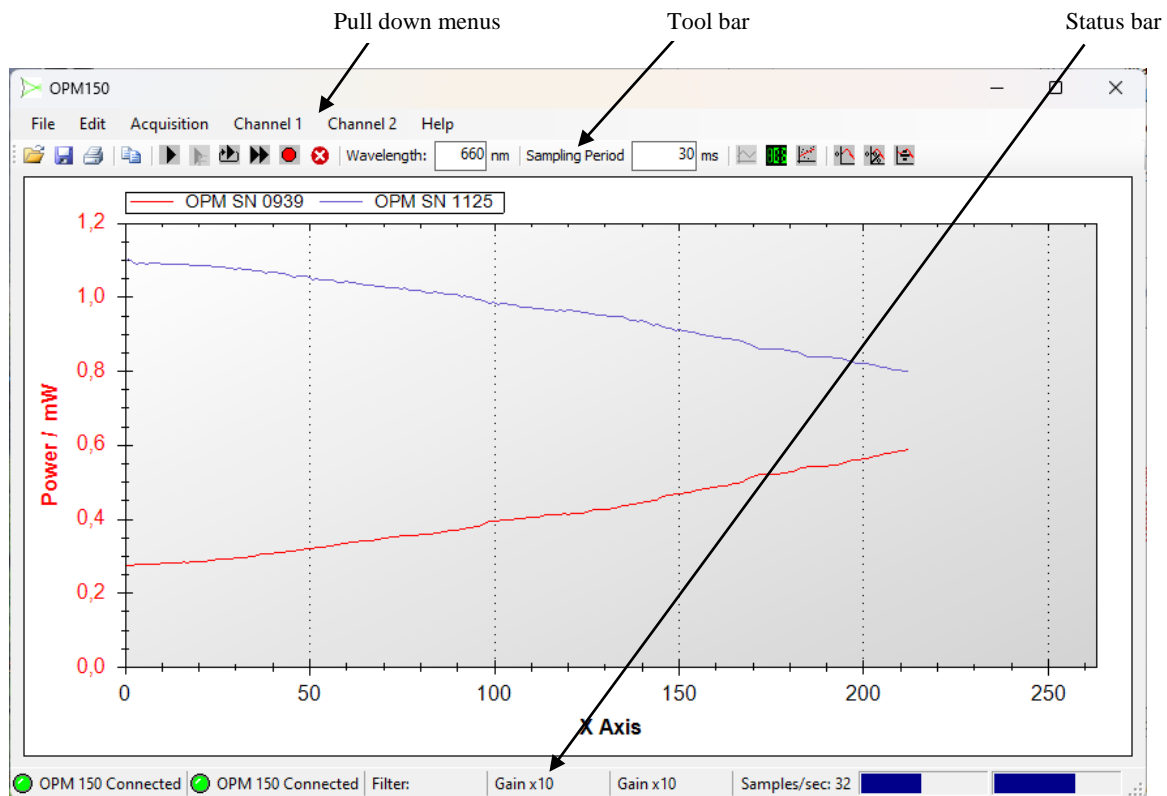


Figure 6: The Graphical User Interface (GUI)

10.1 The Functions of the Pull-Down Menus

File: **Open** – Loads a *.TZA data format file.

Save – The programme allows saving measurement data in two formats: *.TZA and *.CSV. If a file name and folder have not been previously selected, the user will be prompted accordingly. If a file has previously been saved, this function will overwrite the file.

The *.TZA format is specific for this application. The *.CSV format is appropriate for exporting data into a format which can be read by Microsoft Excel and various other programmes. See “The *.CSV Format”, pg. 37 for further information on this data format.

Save as – This function always prompts for the file name and folder. Otherwise, identical to “Save”.

Export – Exports the present graph frame into a graphic file in one of the following formats: *.emf, *.png, *.gif, *.jpg, *.tif oder *.bmp.

Print – Prints the present graph frame using the printer selected in the following frame.

Page setup – Change the page formatting for the print.

Preview – Printer preview.

End – Ends the programme.

Edit: **Copy** – Copies the present graph frame into the PC's intermediate storage for further use with other programmes. For example, the graph can now be inserted into a text document using the paste function.

Preferences – Opens a new window in which various settings such as the units of power measurement and user language can be made. For details, see „10.4 Preferences“ pg. 35.

Acquisition: **Logger Mode** – Starts a measurement. All measurement data are always displayed throughout the measurement. The latest data are displayed at the right edge of the graph. Each measurement point is numbered sequentially, displayed as the X-axis.

Scroll Mode – Starts a measurement. The graph displays a fixed number “n” of measurement data. The value of “n” is set in the settings menu as “Graph width”. The frame fills until “n” data points have been registered. Once “n” data points have been measured, the last “n” data are always visible, scrolling from right to left through the frame.

Repeat Mode – Starts a measurement. The graph displays a fixed number “n” of measurement data. The value of “n” is set in the settings menu as “Graph width”. The frame fills until “n” data points have been registered. Once “n” data points have been measured, the data is deleted, and the frame fills again. This is equivalent to the display mode on a standard oscilloscope.

Fast Logger Mode – Starts a measurement. The measurement data is sampled with maximum speed (> 600 samples/sec). The auto gain is temporarily deactivated during the operation of this mode. Note that this mode of operation is only available when only one OPM150 unit is activated upon starting the

software. When two channels are activated, this mode of operation is greyed out and cannot be activated.

Stop – Stops a measurement.

Clear Graph – Clears the graph. This may also be performed during a measurement.

Channel 1 (2): **Gain Level 1V/mA ... Gain Level 10000V/mA** – Selects the electrical gain of the amplifier. The selected gain is indicated by a check mark and appears in the status bar at the bottom of the GUI window.

Auto Gain – Automatically selects the optimum gain setting during the measurement. When active, the momentary selected gain setting is displayed in the status bar at the bottom of the GUI window.

Load Filter⁴ – Loads a file with the format *.FLT (filter file). These files contain the transmission data for optional filters which can be attached to the free beam detector head. The software uses this information along with the wavelength selected to calculate the actual optical power entering the system. Up to 5 filter files can be loaded at one time. Once loaded, each filter file can be activated or deactivated via the check box for that filter. Note that a correct measurement will only be made, if the corresponding filter is physically connected to the detector head.

Delete Filter⁴ – Deletes a filter file from the presently loaded selection list.

No Filter⁴ – Deselects all filters without removing them from the presently loaded selection list. In this case, all filters must be removed from the detector head to have a correct measurement.

Help: **Info** – Shows information about this programme.

OPM Info – Shows information on the present instruments connected, including their models and serial numbers as well as their firmware versions and the dates of manufacture.

⁴ We offer calibrated neutral density filters mounted in a filter holder which can be screwed onto the front end of the OPM150 detector head. Each filter is delivered with a calibration file which can be read into the OPM150 graphical software. In this manner, the calibration of the full system is guaranteed.

ND-Filter, reflecting type
ND-Filter, reflecting type

OD1: Transmission = 10%
OD2: Transmission = 1%

Order code 30.070.00007
Order code 30.070.00008

Please note that reflecting type ND filters cannot be cascaded.

10.2 The Tool Bar

The tool bar allows for quick access to the most important functions.

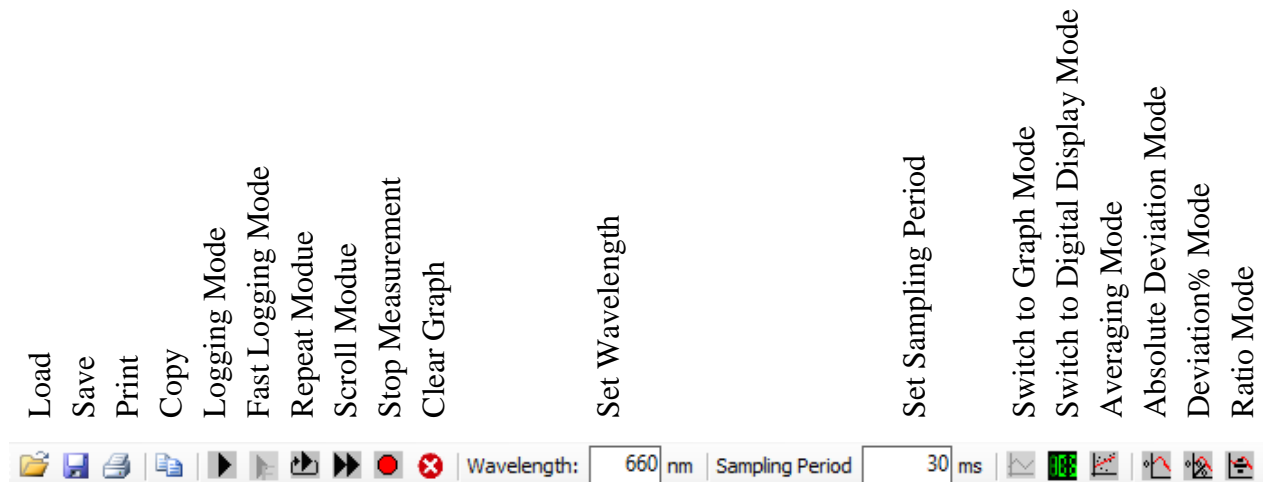









Figure 7: The Tool Bar


The file handling functions (Load , Save , Print  and Copy ) are identical to the corresponding sub menus in the pull-down menus.

To the right of these are buttons to control the data acquisition.

Logging Mode:  Starts a measurement in logging mode. All data since the last use of the “Clear Graph” function are displayed in one continuous graph. This mode is useful for observing long term effects.

Fast Logging Mode:  In this mode the data is sampled at the maximum speed of the OPM150 (> 600 samples per second). The auto gain is temporarily deactivated during the operation of this mode. Note that this mode of operation is only available when only one OPM150 unit is activated upon starting the software. When two channels are activated, this mode of operation is greyed out and cannot be activated.

Repeat Mode:  Starts a measurement in repeat mode. The graph frame displays data until the frame is full. Then the graph is immediately cleared of data and begins to fill again. The length of the data set which will fill the graph is selected in the field “Graph width (Repeat and Scroll mode)” of the “Preferences” menu (see „10.4 Preferences “ pg. 35). Note that the repeat mode emulates the function of a standard oscilloscope. Note further that the data are not stored in repeat mode. Thus, when switching to logging or scroll mode, the data acquisition begins anew.

Scroll Mode:  Starts a measurement in scroll mode. The graph frame displays data until the frame is full. Then the graph remains full showing only the last portion of data recorded. The graph “sweeps” along with the data acquisition. The length of the data set which will fill the graph is selected in the field “Graph width (Repeat and Scroll mode)” of the “Preferences” menu (see „10.4 Preferences “ pg. 35). Since the data are in fact stored, switching from scroll mode to logging mode is possible

without data loss. When switching from logging mode to scroll mode, the graph resets (the previous data is lost).

Stop:



Stops a measurement. The measurement may be restarted with no loss of data in the logging and fast logging modes. Restarting with repeat or scroll mode results in a complete loss of data and a new start of data acquisition.

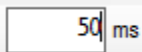
Clear Graph:



Clears all data in the present graph. If this button is selected during data acquisition, the data are cleared but the acquisition process is not halted.

In addition, there are input fields for the sampling period in ms, as well as buttons to select the mode of display (digital and graph modes).

Sampling Period:



The period between two samples can be selected and displayed. This is also accessible in the “Preferences” frame of the „Edit“ pull-down menu.

Graph:



This is the default display mode when the programme starts. The measurement results are displayed graphically:
Y-axis = measured values; X-axis = sample number.

Digital Display:



The last measured values are displayed in a large digital display.

Averaging Mode:



This function serves to reduce noise or fluctuations in the signal. When activated, the software calculates the average of the selected number of measurements before displaying this value. The update rate is unaffected since this is a “sliding average”: for the calculation of the next point, the “oldest” measurement datum is replaced by the “newest”. The number of measurements for averaging can be set in the “Preferences” frame of the “Edit” pull down menu. Note that although the graph update rate is unaffected, the response time of the measurement system is slowed according to the amount of averaging selected. The “Averaging Mode” icon is framed in a red box when activated.

Deviation Mode:



This function serves to indicate the deviation of the measured values from a reference value. When activated, the OPM150 units sample the momentary values. Thereafter, the Y-axis indicates the difference between the present value of each channel and the value registered at the moment of activation of this mode. Note that the selected units are used for this calculation. Therefore, in dBm display mode, the calculation is $Chx(dBm) - Refx(dBm)$ and not the dBm value of $Chx(W) - Refx(W)$. The “Deviation Mode” icon is framed in a red box when activated. The red frame around the icon pulsates during the reference value measurement period. Wait until the pulsation stops before taking measurement data.

Deviation% Mode:



This function serves to indicate the deviation of the measured values from a reference value. When activated, the OPM150 units sample the momentary values. Thereafter, the Y-axis indicates the %-difference between the present value of each channel and the value registered at the moment of activation of this mode. This function is not available

when the Y-Axis units are set to dBm. In this case, the button is greyed out and will not react to clicking with the mouse. The “Deviation% Mode” icon is framed in a red box when activated. The red frame around the icon pulsates during the reference value measurement period. Wait until the pulsation stops before taking measurement data.

Ratio Mode:



This function serves to indicate the ratio of the measured values compared to a reference value. When activated, the OPM150 units sample the momentary values. Thereafter, the Y-axis indicates the ratio of the present value of each channel to the value registered at the moment of activation of this mode. This function is not available when the Y-Axis units are set to dBm. In this case, the button is greyed out and will not react to clicking with the mouse. The red frame around the icon pulsates during the reference value measurement period. Wait until the pulsation stops before taking measurement data.

10.3 The Status Bar

The most important status information is displayed here.



Figure 8: The Status Bar

Connection status: Indicates whether OPM150 instruments are connected, and all relevant connection parameters could be set properly. If a connection error occurs, the fault is indicated here and highlighted with a red virtual indicator lamp.

The programme will only function if the virtual indicator lamp is green and the status “OPM150 connected” appears. Disconnection will also be recognized and indicated during a running measurement.

Filter selections: Indicates which filters are presently in active use.

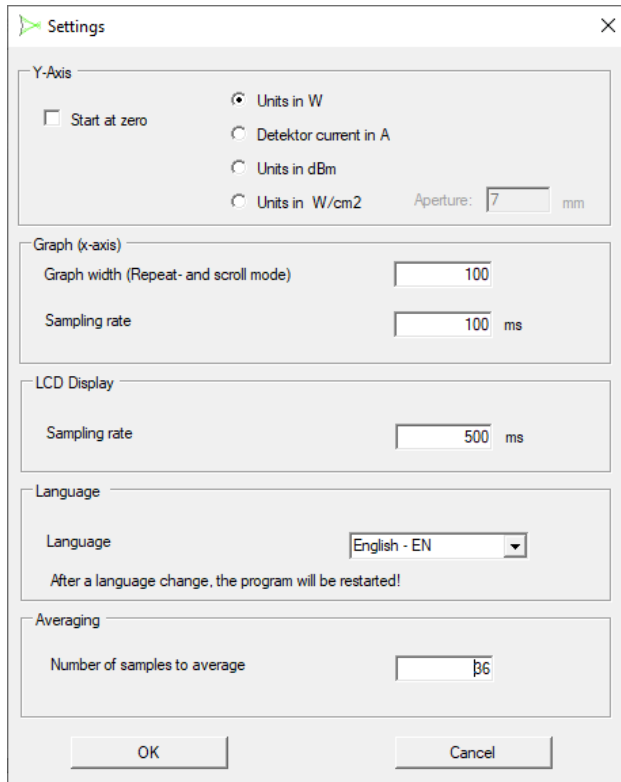
Gain selections: Indicates the presently selected gains for each channel. In autogain mode the momentarily selected gain is displayed.

Sampling rate: Indicates the momentary true sampling rate [samples/sec].

Amplifier level: For optimal signal to noise ratio, as with any measurement instrument, the OPM150 should not be used in the extreme lower range of its output. If the unit is used in the extreme upper range of output, clipping may occur. A coloured sliding graph bar is used to inform the user of the present amplifier output level (which is not directly visible in the measurement data). If the gain is fixed (not autogain) and the output is too high or too low, the colour of the bar changes from blue to red as a warning that the gain selection is not optimal. The autogain mode will always drive the unit in the optimum gain setting. If two units are being run at the same time, the left slider corresponds to Channel 1 and the right slider corresponds to Channel 2.

10.4 Preferences

In addition to the settings in the tool bar, there are several which will not be required during normal operation and will usually be set once when first setting up the instrument. These settings are found in the pull-down menu “Edit” under “Preferences”. The following window then appears:



Y-Axis: **Start at zero** – When using automatic Y-axis scaling, the lower limit of the Y-axis will lie just under the smallest measurement value. Activating this check box will force the lower limit to be fixed at zero. This function is also available via the context menu (right mouse click) within the graph frame.

Units in W– The Y-axis is scaled to show the optical power of the beam being measured in units of W.

Detector current in A– The Y-axis is scaled to show the electrical current from the detector head in units of A.

Units in dBm– The Y-axis is scaled to show the optical power of the beam being measured in units of dBm. In this logarithmic scale, 0dBm = 1mW.

Units in W/cm²– The Y-axis is scaled to show the optical power density of the beam being measured in units of W/cm². When this option is selected, the input field “Aperture” is activated. The aperture diameter of the detector head being used must be entered here. Note: the detector is not designed to be able to measure optical power density directly. The assumption here is that the beam being measured is larger than the aperture and that the optical power density is constant over the area of the aperture.

- Graph (x-axis): **Graph width** – Sets the width of the graph for use in “Repeat” and “Scroll” modes.
- Sampling period**– Sets the sampling period of the graphical display in units of ms. This function is also available in the tool bar.
- LCD Display: **Sampling period**– Sets the sampling period of the “LCD display” in units of ms. Note: this function is not available in the tool bar.
- Language: **Language** – Select the language of operation via this pull-down menu. Available languages are English, German and Chinese. The software will automatically restart when a new language is selected.
- Averaging: **Number of samples to average** – Sets the number of data points which will be used for calculation of the average value when using averaging mode. See “10.2 The Tool Bar”, pg. “31” for details.

10.5 Data Formats

10.5.1 The *TZA Format

The software uses two formats for saving data. The programme specific format *.TZA uses ASCII characters. The file header contains the date, various information on the setup as well as the units of the data values. The measurement samples are separated by semicolons.

An example of the file structure is as follows:

```
Date and time :28.01.2025 08:41:19
Detektor(1): S10339
Detektor(2): S10340
Wavelength: 520nm
Sampling rate: 240ms
Filter Channel1: No Filter;
Filter Channel2: No Filter;
Unit: nW
16890;10230;17070;10200;17130;10050;17250;10020;17310;9960;
```

Note that when two channels are active, the data occur in pairs. The odd data correspond to channel 1 and the even data correspond to channel 2. For example, in the data set above the correlation is as follows:

Channel 1 **Channel 2**

16890;10230;17070;10200;17130;10050;17250;10020;17310;9960;

10.5.2 The *CSV Format

The *.CSV format is useful for data export or for use with other programmes. These files can be loaded directly into spread sheet programmes such as Excel. The file header is identical to that of the *.TZA files.

Date and time :28.01.2025 11:24:08

Detektor(1): S10340

Detektor(2): S10339

Wavelength: 520nm

Sampling rate: 100ms

Filter Channel1: No Filter;

Filter Channel2: No Filter;

Unit: nW

0;64590;122820

1;64590;122820

2;64590;122820

3;64590;122820

4;64590;122820

5;64590;122820

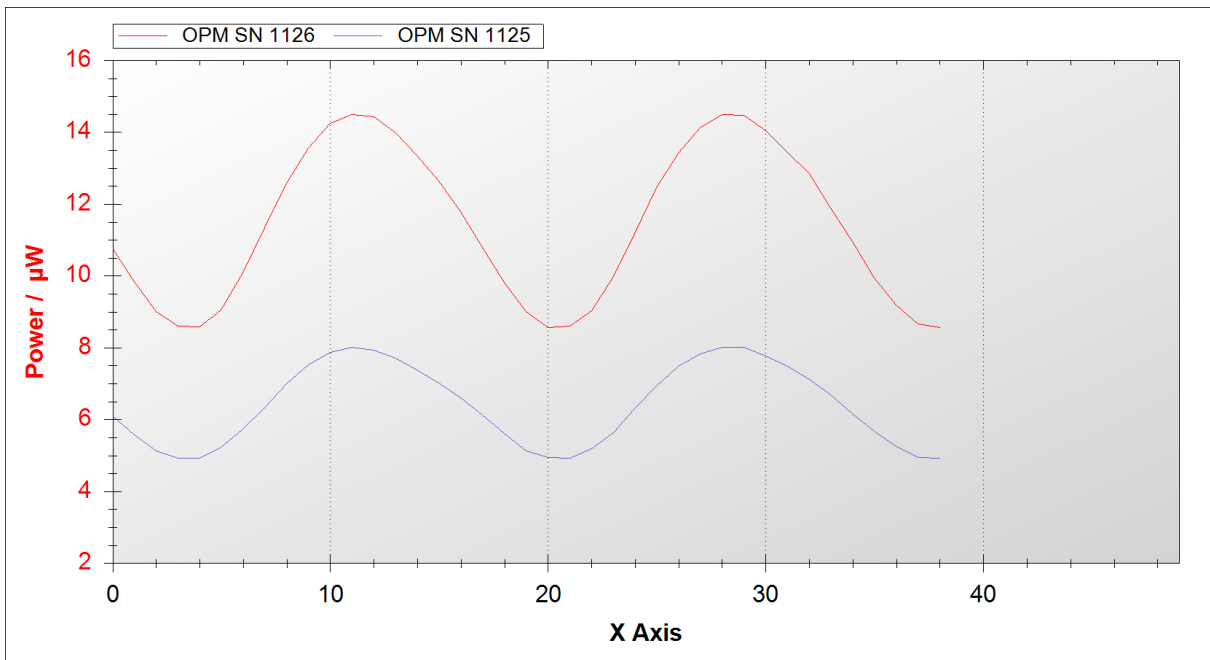
6;64650;122820

7;64650;122820

8;64650;122820

10.6 The Graph

The graph mode is the default mode which will appear when starting the programme. The X-axis represents the sample number of a measurement sequence, the Y-axis represents the measured power or current as selected in the preferences menu. The units automatically adjust to the level being measured. The legend at top left indicates the colour coding of the traces in the graph. The serial numbers correspond to the base units being sampled.



A dynamic zoom can be activated by clicking in the graph window and dragging a box to the size of the desired zoom. If the automatic rescaling is activated, the next measurement will rescale the window to its previous representation. Therefore, if the zoom is to be kept active, the automatic rescaling must be deactivated first (context menu) or the measurement stopped.

If the cursor is moved over a given sample in the graph, an information box will appear with the name of the relevant detector head as well as the sample value:

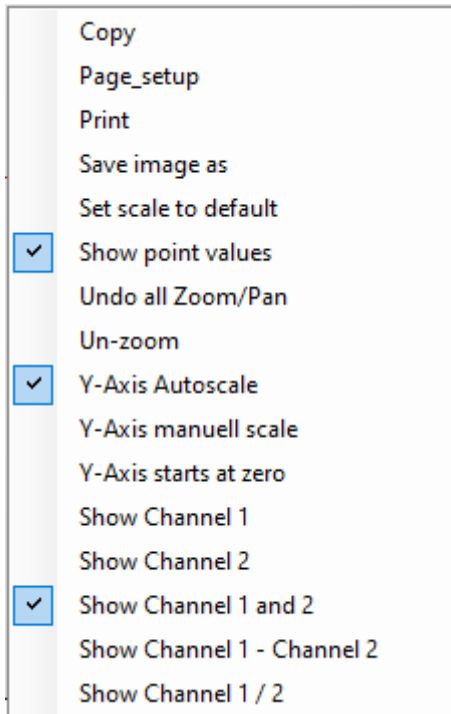
OPM SN 1126 is 52,95µW at Point No. 466,0

This option can be activated and deactivated using the context menu:

Show Point Values

10.6.1 The Context Menu

The context menu is opened by a right click within the graph frame.



Copy	A picture of the graph is stored to the PC's temporary storage. It may be copied into other programmes for documentation purposes.
Page Setup	Page setup for printing.
Print...	Opens the print control window for output to a printer.
Save Image As...	Saves a picture of the graph to a file. There are six file formats to choose from.
Set Scale to Default	Resets the graph axes to their default values.
Show Point Values	Activates or deactivates the mouse-over pop-up box with the sample data information.
Undo all Zoom/Pan	Resets all zoom and pan settings.
Un-zoom	Resets the last zoom and pan setting.
Y-Axis Autoscale	Activates automatic rescaling of the Y-axis (unless the „Y-Axis starts at zero“ option is activated).
Y-Axis manual scale	Opens an input box in which the upper and lower limits of the Y-axis can be manually fixed. This deactivates the autoscaling.

Y-Axis starts at zero	Fixes the lower limit of the Y-axis to zero. This setting remains active in autoscaling mode, in which case only the upper limit is automatically rescaled.
Show Channel 1	Displays data for channel 1 only, even if channel 2 is active.
Show Channel 2	Displays data for channel 2 only, even if channel 1 is active.
Show Channel 1 and 2	Displays data for channel 1 and channel 2.
Show Channel 1 – Channel 2	Displays the mathematical difference between the two channels. Note that the selected units are used for this calculation. Therefore, in dBm display mode, the calculation is $\text{Ch1(dBm)} - \text{C2(dBm)}$ and not the dBm value of $\text{Ch1(W)} - \text{Ch2(W)}$.
Show Channel 1 / 2	Displays the mathematical ratio of the two channels. Note that the selected units are used for this calculation. Therefore, in dBm display mode, the calculation is $\text{Ch1(dBm)} / \text{C2(dBm)}$.

10.7 The SDK Package

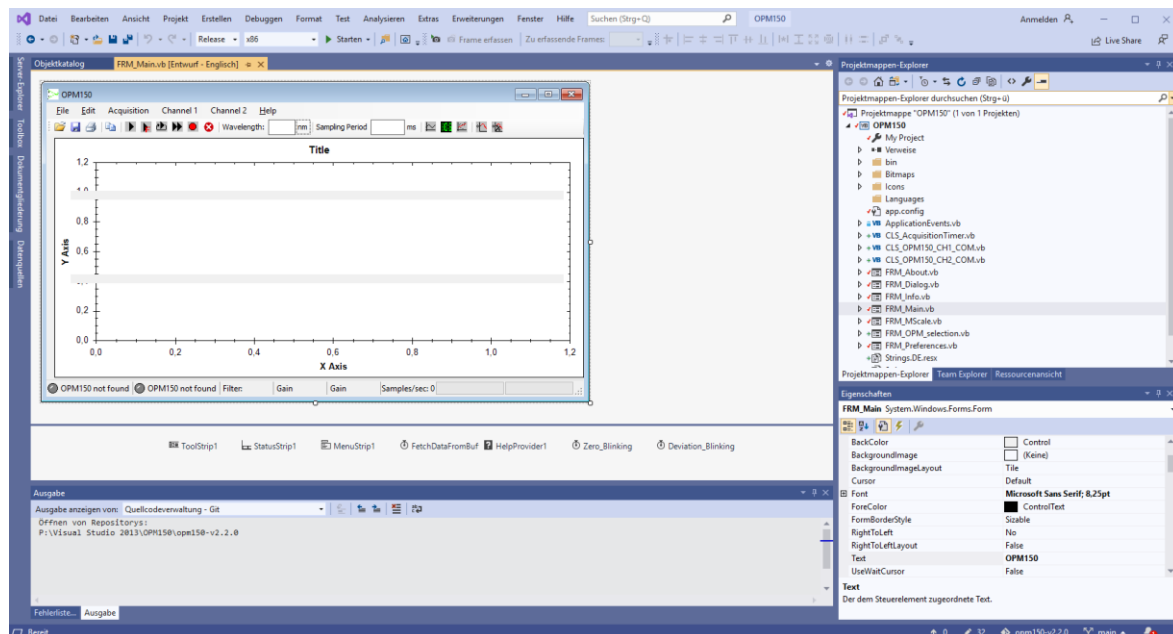
The OPM150 comes with a software development kit (SDK package) to ease integration of the instrument into OEM projects. This package includes:

- the source code of the application programme (written in Microsoft VB.net version 2019)
- python library
- LabVIEW® VI example.

The SDK package is found on the data storage device delivered with the instrument.

10.8 Source Code of the Application Programme

The project file OPM150.sln is stored on the data storage device delivered with the instrument. This file contains all the necessary window files, modules, classes, graph and icon files as well as the necessary compiling settings. This file may be loaded into the software development environment.



All enclosed files are shown in the project explorer (lower left window). The folder structure is the same as is found on the storage media delivered with the instrument.

The graph in the main window is generated by embedding the file Graph.dll in the output. For more information, see Hinweis.txt.

The programme comprises 7 windows which contain the source code. There are further modules responsible for the following features:

® „LabVIEW“ is a registered trade mark of the National Instruments Corporation.

CLS_OPM150_CHx_COM: This class controls communication with the OPM150 via the driver libraries. The data is pre-processed before sending and after receiving. To ensure efficient use of the PC's resources, the send and receive routines are in their own thread. Each channel has its own class.

CLS_AcquisitionTimer: The data acquisition is controlled by the precision timer in this class.

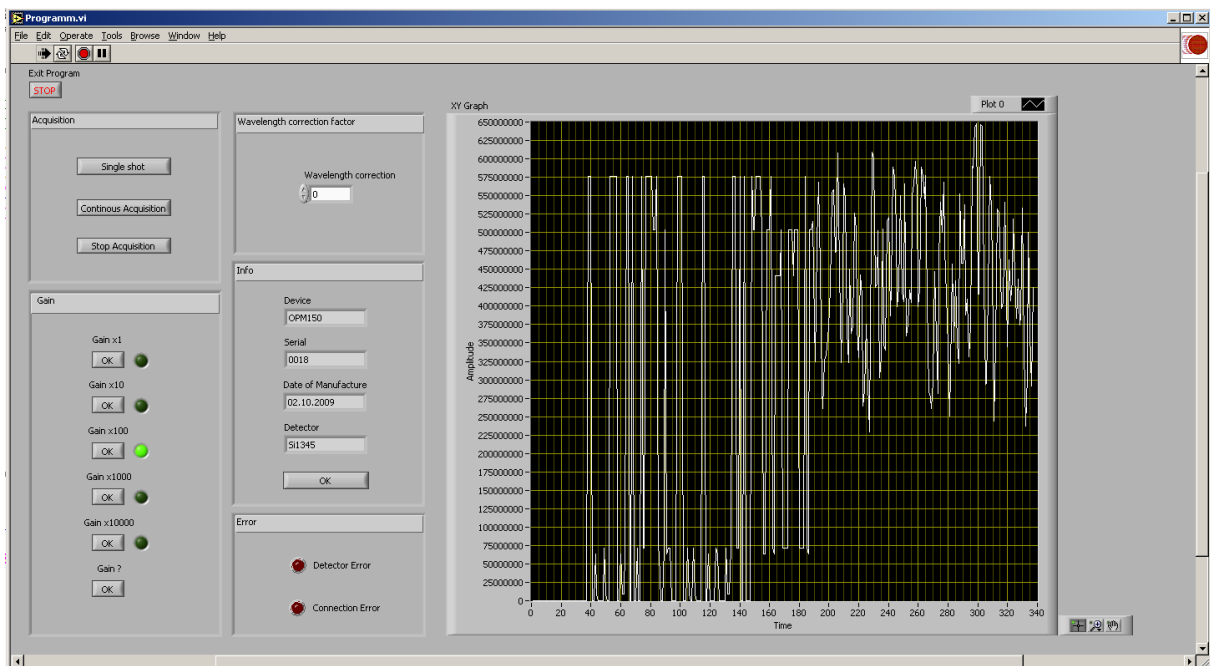
Strings.XX.resx: Governs the language settings. The vocabulary is stored in strings which are called as required.

Further details are contained in the comments in the source code.

10.9 Demo Programm in Labview

A LabVIEW demonstration VI is supplied with the instrument to ease integration into LabVIEW environments. The programme is found in the folder \SDK\Labview. All relevant sub-VIs are in the subfolder libraries.

Please note that this is a demonstration programme only and is not intended to replace the fully functional main application software. The VI is capable of measuring, setting gain, wavelength correction and display of error messages. Instrument information can also be read out and displayed.



The programme diagramme contains a loop for receiving and calculating data as well as a loop for sending commands.

Both loops are executed until the “Stop” button is pressed. If the programme is stopped via the pull-down menu or the tool bar, then the USB port will not be freed for other applications. In this case, the USB cable must be removed from the PC (or the OPM150) and then reconnected.

11 Communication with the OPM150

To communicate with the OPM150, the driver can be integrated directly into an existing project. Two examples have been given in the description of the SDK package.

A simpler method is by designating a COM-port. The driver can generate a virtual port in the control panel. One disadvantage of this method is the fact that the PC will designate a port number according to the free ports available. Then the user must use this port number in the programme code, otherwise communication will not be possible.

11.1 Communication Protocol

The communication parameters for the OPM150 are:

Baud rate: 115200 Bits/s

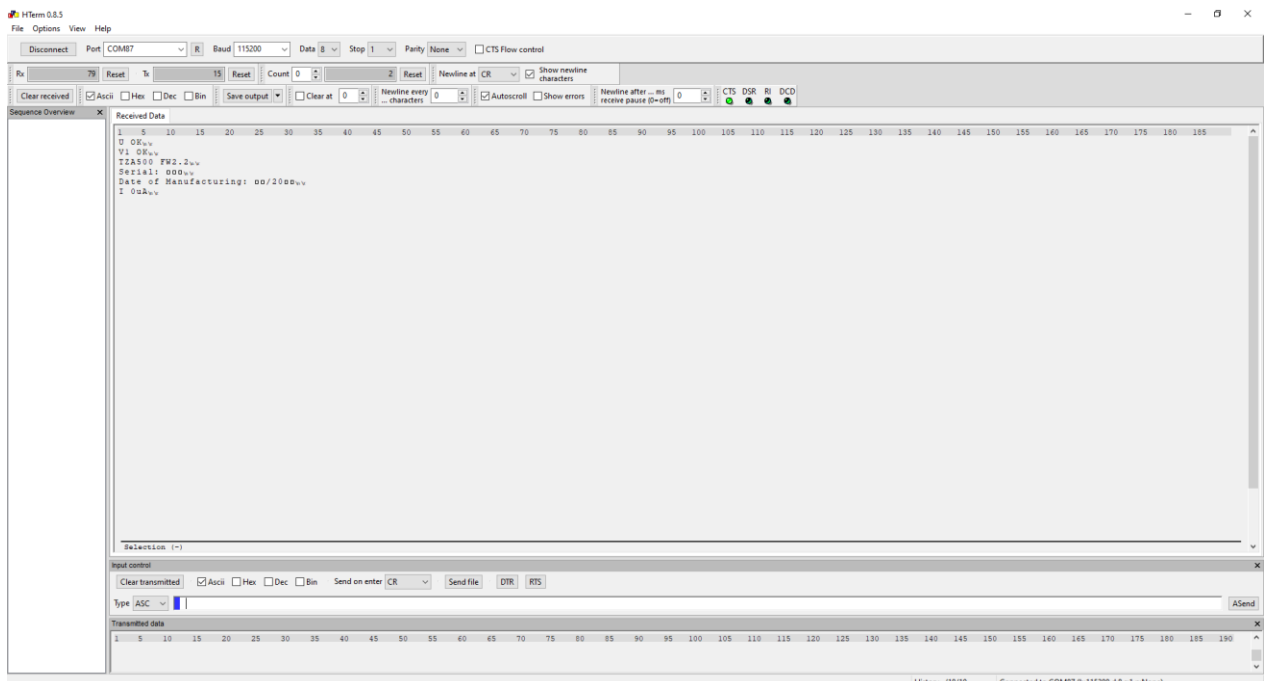
Data bits: 8

Stop bits: 1

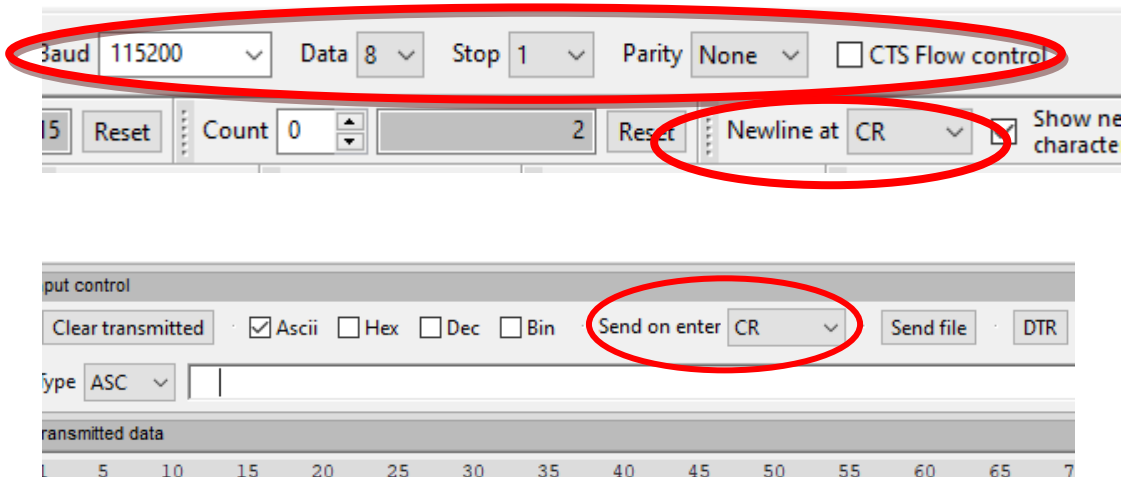
Parity: none

Flow control: none

The communication uses ASCII-characters. As an example, communication via the programme Hterm (www.der-hammer.info) can be realized. Active VCP is necessary for this communication (see “Activating the VCP-Option” in the software installation manual).



The communication parameters must match the following:



There will now be an indication in the main frame that the communication is active. This can be tested by typing \$I (“dollar” and capital “i”, this is the code to request information about the instrument). The OPM150 will respond with a message similar to the following:

OPM150

Serial: 1126

Date of Manufacturing: 2.11.2024

Detector: S10340 250nm - 1000nm

The commands “\$E” (single measurement sample) and “\$P” (continuous measurement at maximum sampling rate $\approx 600\text{S/s}$) generate measurement data. The output is in the form $I10\mu\text{A}$. These values represent the current measured by the detector head. To convert to optical power, the detector calibration value for a given wavelength can be requested using “Lxxxx” whereby xxxx is the wavelength required. For example, the command L0350 will call the calibration value for 350nm. The instrument response (KFx.xxx) is the calibration value in A/W .

Furthermore, the serial number of the head indicates if the head is an integrating sphere, and which multiplier must be used in that case. Integrating spheres are denoted with “U”, “V”, “W” or “X”. The next number indicates the power multiplier as 10^x . For example, a detector with serial number U50001 has a power multiplier of $10^5=100\,000$.

For example, from the response KF0.654 with a measured value of $10\mu\text{A}$ and serial number U50001, the optical power can be calculated as follows:

$$\text{Optical power} = 10^5 \cdot \frac{10\mu\text{A}}{0.654 \frac{\text{A}}{\text{W}}} = 1.53\text{W}$$

11.2 Command Structure

Note: each byte must be sent individually with a delay of at least 10ms!

11.2.1 Info

\$I Information about the system, serial number and date of manufacture.

Response: <Instrument> e.g. OPM150
Serial: <serial number.>
Date of Manufacturing: <date of manufacture>
Detector: <detector type, serial number. and wavelength range>
e.g. S10001 190nm – 950nm
In the case of “U”, “V”, “W”, “X”: the detector is an integrating sphere. The next number is the power multiplier in the form 10^x (see details in previous section).

11.2.2 Data output

\$P : Polling mode. The measurement takes place continuously at approximately 600 S/s. Sending „\$“ ends the measurement.

\$E : Single measurement mode. One single data sample is measured.

Response: I<value><units in nA/uA> e.g. I3uA means a current of 3µA.

11.2.3 Gain

V1 gain 1V/mA
V2 gain 10V/mA
V3 gain 100V/mA
V4 gain 1000V/mA
V5 gain 10000V/mA

Response: V<gain> OK

V? Request present gain status

Response: V<gain> e.g. V1

11.2.4 Wavelength dependant calibration value

Lxxxx : Wavelength in nm.

Response: KF: <calibration value> (Note: the units of the calibration value is A/W).

11.2.5 Messages

DET ERR Defective or missing optical head.

DET OK A valid optical head was detected.

PWR ERR The USB port cannot provide enough current to supply the OPM150. Please do not use passive or non-powered USB hubs.

PWR OK The power supply was reinstated.

11.2.6 Internal Averaging

An internal averaging function is available for direct USB communication. This feature is not accessible via the graphical user interface. The graphical user interface (GUI) has its own averaging function which calculates a sliding average of the data downloaded to the computer. For details on the averaging function of the GUI, see 10.2 „The Tool Bar“ pg 31ff.

Note that when the internal averaging function is activated, the relative timing between two channels will be disturbed and so they are no longer well synchronized to each other. This means that measurements involving both channels (Ch1 – Ch2 and Ch1 / Ch2) will be inaccurate during transitional periods whereas as long as both signals are static, the measurement will be correct.

A user defined number of samples are averaged internally before downloading to the control computer. The sampling time (integration time) is 10 μ s followed by 52 μ s delay for internal computations.

The number of samples resets to the default value of 1 at each restart of the OPM150.

NXXXXX

XXXXX = number of samples for averaging

Range of validity: 00001 - 16000

Five digits must be uploaded. Unused digits must be filled with zeros, as shown in the range of validity.

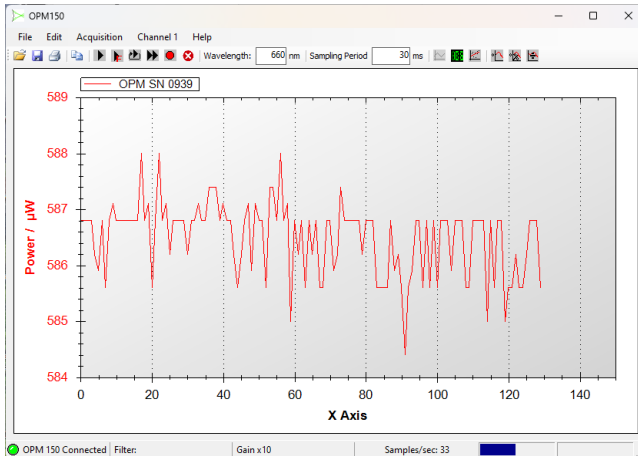
Response:
N OK



12 Application Examples

12.1 Laser Power Stability

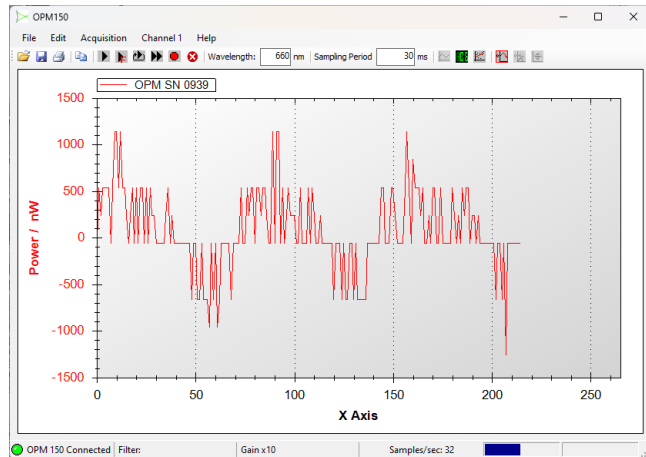
To measure the power stability of a laser, use either the “Deviation” or “Deviation%” mode.

1. Start a measurement and turn on the laser.

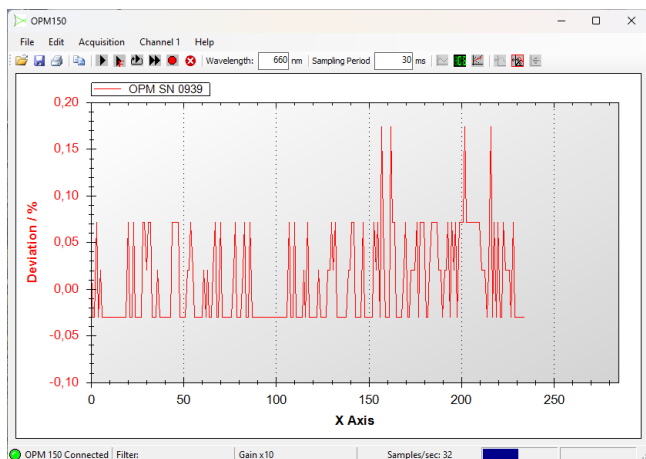


2. Take a reference measurement by clicking either the  (deviation mode) or the  (deviation% mode) button. Thereafter the graph will display the deviation of the laser output power with respect to the power at the time of referencing.

Example result in Deviation mode:



Example result in Deviation% mode:

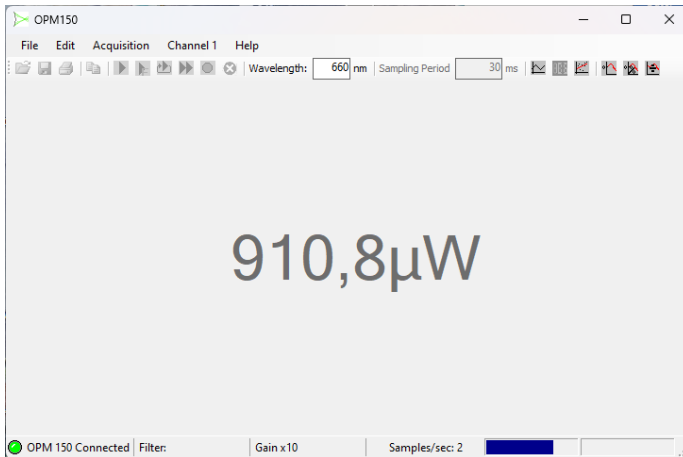



12.2 Beamsplitter Splitting Ratio

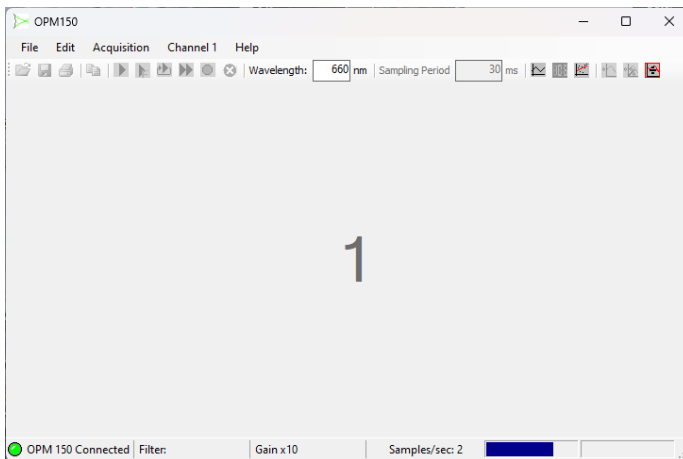
12.2.1 Measurement with one detector

To measure the splitting ratio of a beamsplitter using a single detector, use the “Ratio” mode.

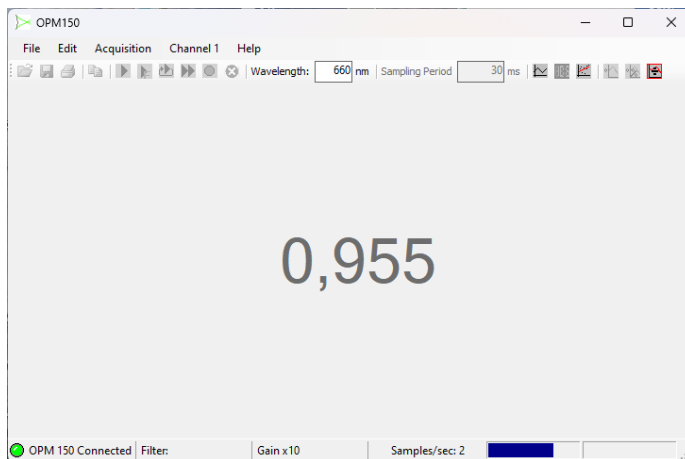
1. Start a measurement of the laser power in graph or digital display mode and allow the laser to reach thermal stability for constant power output. If necessary, use the “Averaging” mode to reduce the high frequency noise of the laser.



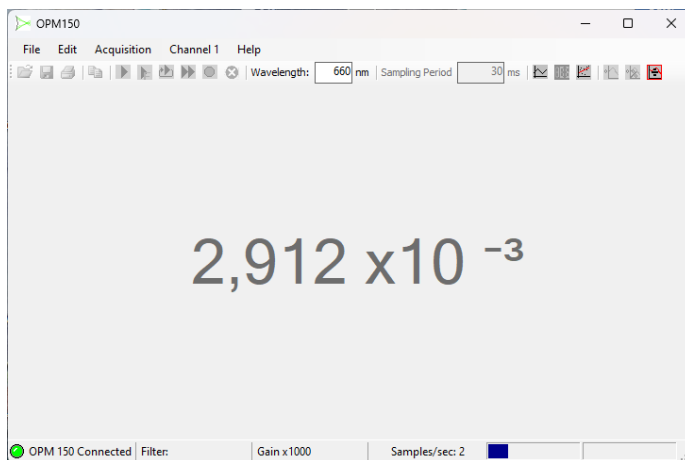
2. Click the Ratio mode button  to measure the laser power as the reference value. The red frame around the icon pulsates during the reference value measurement period. Wait until the pulsation stops before taking measurement data.
3. Thereafter the graph (or digital display) will show the ratio of the present power to the power of the full beam.



4. Insert the beamsplitter into the laser beam path and read the value of the transmittivity of the beamsplitter.



5. Place the detector head into the reflected beam path to read the value of the reflectivity of the beamsplitter.

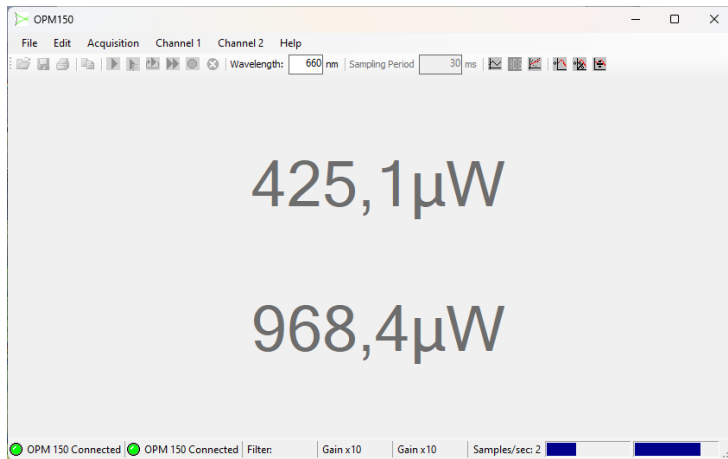


Note that beamsplitters are in general polarization dependant. A judicious choice of the polarization state of the laser beam is essential for producing meaningful results.

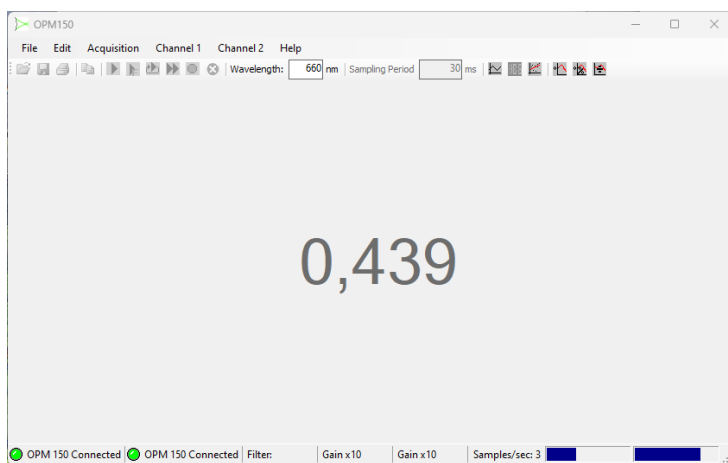
12.2.2 Measurement with two detectors

To measure the R:T ratio of a beamsplitter using two detectors, use the “Ch1 / Ch2” function of the graph or digital display mode.

1. Place the detector corresponding to channel 1 in the reflected beam path and the detector corresponding to channel 2 in the transmitted beam path.
2. Start a measurement of the laser power in graph or digital display mode and allow the laser to reach thermal stability for constant power output. If necessary, use the “Averaging” mode to reduce the high frequency noise of the laser.



3. Open the context menu of the display (“right click”) and select the display mode “Ch1 / Ch2”. The value measured is the splitting ratio R:T for the beamsplitter.



12.3 Transmittance of a Filter or Window

This measurement is identical to “12.2.1 Beamsplitter Splitting Ratio Measurement with one detector”, steps 1-4.

13 Damage

The unit may be damaged by exceeding the maximum average input power. Please read „4 Absolute Maximum Ratings”, pg. 18 for these maximum values before working with the instrument.

13.1 Troubleshooting

In the event that a measurement is not successful, the following possibilities should be analysed:

Symptom	Possible Errors	Correction
OPM connection failed	<ul style="list-style-type: none"> Unit is not connected to the USB port 	<ul style="list-style-type: none"> Connect the unit to the USB port
No output	<ul style="list-style-type: none"> Input power too low Input or output connection not correct 	<ul style="list-style-type: none"> Increase input power Ensure that the connectors are inserted correctly and locked
Output at full scale, independant of input current	<ul style="list-style-type: none"> Input power too high Gain is too high 	<ul style="list-style-type: none"> Reduce input power Reduce the gain or use auto-gain mode

In the unlikely event that you are not able to obtain a measurement in spite of these troubleshooting measures, please contact us. We will be pleased to help you solve your problem.

14 Disposal

Do not dispose of the OPM150 with the household waste. The worn out unit can be taken to an electronics and metal recycling centre for disposal. The manufacturer also accepts old units for disposal.

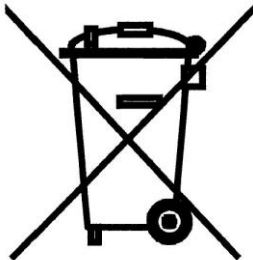


NOTICE!

Danger for the environment from improper disposal!

Dangers for the environment can arise through improper disposal.


- Never dispose of the device with the household waste.
- Take the electrical scrap or electronic components to an approved specialist company for disposal.
- In case of doubt, contact the local authorities or a special disposal company for information about the environmentally compatible disposal.



15 Type plate

The type plate is located on the back of the enclosure and includes the following information:

- Manufacturer
- Model number
- Article number
- Serial number
- Manufacturing date

		OPM150
Model-No.:		OPM150
Article-No.:		30.070.00002
Ser.-No.:		1111
Date of Manufact.:		01/25
www.artifex-engineering.com		CE

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DANGER! The OPM150 series of optical power meters may be used with lasers. Personnel who use this instrument must, therefore, be instructed in the safe use of lasers and laser beams.

Always wear the proper laser safety glasses designed for the laser in use!

Never allow the direct or reflected laser beam to impinge on the eyeball or to come into contact with the skin!

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