

## F-712.PM1 Optical Power Meter

Optical Power Meter for 400-1550 nm Wavelength Range, to 1 mA Input Current, 20 kHz Signal Bandwidth, Logarithmic Output  $\pm 5$  V, Benchtop Device, including Power Adapter



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## About this Document

### Objective and Target Group of this User Manual

This user manual contains the required information on the intended use of the F-712.PM1 optical power meter.

Basic knowledge on measuring optical power is assumed.

The latest versions of the relevant user manuals for your system are available on our website for download.

## Downloading Manuals

### INFORMATION

If a manual is missing or problems occur with downloading:

- Contact our customer service department (p. 13).

### INFORMATION

For products that are supplied with software (CD in the scope of delivery), access to the manuals is protected by a password. Protected manuals are only displayed on the website after entering the password.

The password is included on the CD of the product.

#### For products with CD: Identify the password

1. Insert the product CD into the PC drive.
2. Switch to the Manuals directory on the CD.
3. In the Manuals directory, open the Release News (file including *releasenews* in the file name).
4. Find the user name and the password in the section "User login for software download" in the Release News.

#### Downloading Manuals

1. Open the website **www.pi.ws**.
2. If access to the manuals is protected by a password:
  - a) Click **Login**.
  - b) Log in with the user name and password.
3. Click **Search**.
4. Enter the product number up to the period (e.g., P-882) or the product family (e.g., PICMA® Bender) into the search field.
5. Click **Start search** or press the **Enter** key.

6. Open the corresponding product detail page in the list of search results:
  - a) If necessary: Scroll down the list.
  - b) If necessary: Click **Load more results** at the bottom of the list.
  - c) Click the corresponding product in the list.
7. Scroll down to the **Downloads** section on the product detail page.  
The manuals are shown under **Documentation**.
8. Click the desired manual and save it to the hard disk of your PC or to a data storage medium.

## Safety

### Intended Use

The F-712.PM1 optical power meter is a laboratory device as defined by DIN EN 61010-1. The power meter is designed for indoor use and use in a clean environment within the specified operating temperature range.

The power meter is intended for stationary use to measure optical power. The power meter does **not** protect the user against radiation hazards from the objects being measured.

If the power meter is subject to mandatory calibration within the scope of its use, it is recommended to recalibrate the optical sensor module annually.

### General Safety Precautions

The operator is responsible for correct installation and operation of the power meter.

- Pay attention to both the safety instructions in this user manual and the general safety precautions. Otherwise, proper function and operational safety of the power meter **cannot** be ensured.
- Use the power meter only for its intended purpose and according to the technical data specified.
- After unpacking and before starting up each time, check the power meter for mechanical damage and loose parts.
- If there is any indication that safe operation is **not** possible, switch the power meter off and protect it against unintentional operation by a third party. Possible indications:
  - The power meter is damaged
  - Loose parts on the power meter (inside or outside)
  - Power meter does not function

- To ensure safe operation of the power meter, avoid the following situations:
  - Storing outside or in a humid environment or other unfavorable conditions
  - Excess load while transporting, e.g., due to improper packaging
  - Operating in a dangerous environment (explosive gases, vapors, dust etc.)
- Avoid contamination of the optical input of the power meter.
  - Seal the optical input with the protective cap supplied if an optical signal is not connected and before cleaning the power meter.

## Organizational Measures

### User Manual

- Always keep this user manual available when using the power meter. The latest versions of the user manuals are available on our website (p. 3) for download.
- Add all information from the manufacturer such as supplements or technical notes to the user manual.
- If you give the power meter to other users, also include this user manual as well as all other relevant information provided by the manufacturer.
- Only use the device on the basis of the complete user manual. Missing information due to an incomplete user manual can result in damage to equipment.
- Only install and operate the power meter after you have read and understood this user manual.

### Personnel Qualification and Instruction

The power meter may only be installed, started up, operated, maintained, and cleaned by authorized and appropriately qualified personnel. Persons who are in charge of using the power meter for measuring must be familiar with the accident prevention regulations applicable to their area.

Periodic concentration from the user is required when handling the power meter during the measuring task. For this reason, the power meter should not be used in environments that themselves require the uninterrupted attention of the user. Instruction of the user must include any possible risks.




## Product Description

### Manufacturer Information and Product Labeling

Gigahertz-Optik GmbH ([www.gigahertz-optik.com](http://www.gigahertz-optik.com), [info@gigahertz-optik.com](mailto:info@gigahertz-optik.com)) is the manufacturer of the F-712.PM1 optical power meter.



Figure 1: Product labeling: Type plate (left) and calibration label (right) on the bottom of the power meter

Category	Value	Meaning
Type:	PM16	Product name of the manufacturer
GO item number:	15305524	Item number of the manufacturer
PI item number:	F-712.PM1	Product name from PI
Input:	DC 12 to 24 V (± 10%)	Operating voltage
Current:	200 mA	Current consumption (max.)
-	<a href="http://www.gigahertz-optik.com">www.gigahertz-optik.com</a>	Manufacturer's address (website)
-		CE conformity mark
-		Old equipment disposal (p. 17)
SN	36942	Serial number (example), individual for each power meter
-	1740794-01-WERK-2017	Calibration mark
Recal:	2018-06	Recommended time for recalibration (example)
-		Serial number as bar code (example)

## Features and Applications

The F-712.PM1 optical power meter can convert an optical signal into a voltage signal in high resolution and with an extremely high bandwidth. The design of the optical input enables measuring of the optical signal independent of the position of the optical fiber in the connector.

The power meter also has a current input. For example, a photodiode can be connected to this input to convert the diode current into a logarithmic voltage signal.

Switching between the inputs is done via a pushbutton. An LED lights up when the current input is activated.

The large wavelength range of the power meter enables working in both the visible and infrared range without switching. Thanks to the precision, logarithmic output signal, the power meter is ideally suited to fast, fully automatic optical alignment systems.

## Product View

### Front Panel



Figure 2: Front panel of the F-712.PM1

Labeling	Type	Function
<b>ANALOG OUT</b>	BNC	Analog output signal, logarithmic
<b>INPUT SELECT</b>	Pushbutton	Switching between the current and optical input
<b>STATUS</b>	LED Green/off	Indicator for the selected input: <ul style="list-style-type: none"> <li>▪ Continuously green: Current input is enabled</li> <li>▪ Permanently off when the power meter is connected to the supply voltage: Optical input is enabled</li> </ul> Error indication during switch-on: <ul style="list-style-type: none"> <li>▪ Slow flashing, 3x: No error</li> <li>▪ Fast flashing 15x: Error → contact the customer service department (p. 13)</li> </ul>
<b>CURRENT IN</b> ⚠	BNC	Current input; maximum input current: 1 mA
<b>FIBER IN</b> ⚠	LWL connector, types: FC/PC, FC/APC	Optical input; maximum input power at 1550 nm: 85 mW

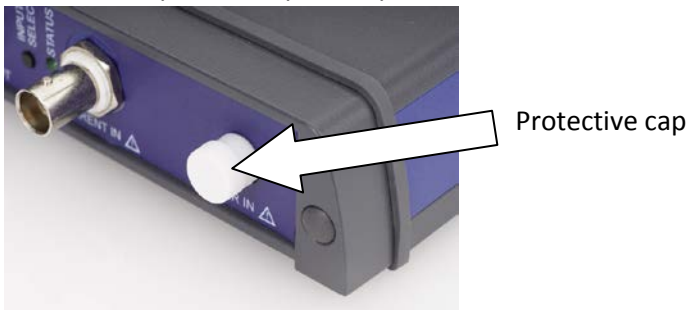
## Rear Panel



Figure 3: Rear panel of the F-712.PM1

Labeling	Type	Function
SPI	HD Sub-D 15 (f)	Both interfaces are <b>not</b> available for operation of the power meter.
	USB	
<b>POWER</b> 12 to 24 V DC	Phoenix connector, MC1,5/3-STF	Connection for the supply voltage Pin assignment, see p. 16.

## Scope of Delivery

Order number	Quantity	Components
F-712.PM1	1	Optical power meter
-	1	Protective cap for the optical input 
-	1	Adapter cable for the power adapter connection; barrel connector to Phoenix connector
C-501.24050H	1	Wide-range-input power supply 24 V DC / 50 W
3763	1	Power cord
000012566	2	Measuring cable, BNC/BNC, RG58, black, 2 m
000012567	2	Adapter, BNC/BNC, 1 x connector, 2 x socket, T-branch
MP165E	1	User manual for the power meter (this document)
-	1	Calibration certificate



## Unpacking

1. Unpack the power meter carefully.
2. Compare the contents with the items listed in the contract and the packing list.
3. Inspect the contents for signs of damage. If there is any sign of damage or missing parts, contact PI immediately.
4. Keep all packaging materials in case the product needs to be returned.

## Connecting the Power Adapter to the Power Meter

### Requirements

- ✓ The power cord is **not** connected to the power socket.

### Tools and accessories

- Included 24 V wide-range-input power supply (for line voltages between 100 and 240 VAC at 50 or 60 Hz)
- Alternative: Sufficiently dimensioned power adapter
- Included adapter cable for the power adapter connection; barrel connector to Phoenix connector
- Alternative: Sufficiently dimensioned adapter
- Included power cord
- Alternative: Sufficiently dimensioned power cord

### Connecting the power adapter to the power meter

- Connect the Phoenix connector of the adapter cable to the **POWER 12 to 24 V DC** input of the power meter. Use the integrated screws to secure the connection against accidental disconnection.



- Connect the barrel connector of the adapter cable to the barrel connector socket of the power adapter.
- Connect the power cord to the power adapter.

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## Startup and Operation

### General Notes for Startup and Operation

Unsuitable ambient conditions, condensation, and contamination of the optical input as well as unsuitable handling can impair safe operation of the power meter and lead to significant deviations of the measured values.

- Adhere to the specified ambient conditions (p. 15).
- If the power meter is moved from a cold to a warm environment, start it up only after the temperature of the power meter has adapted itself to the ambient temperature.
- Avoid contamination of the optical input of the power meter.
  - Seal the optical input with the protective cap supplied if an optical signal is not connected.
- Do **not** operate the power meter in areas with high magnetic, electromagnetic, and electrostatic fields.
- Protect the power meter against direct sunlight and humidity.

### Switching the Power Meter on

#### Requirements

- ✓ You have read and understood the general notes on startup and operation.
- ✓ The power adapter was properly connected to the power meter (p. 9).

#### Switching the power meter on

- Connect the power cord of the power adapter with the power socket.

## Calculating the Radiant Power and the Input Current

The radiant power of the optical signal measured and the input current can be calculated from the output voltage of the power meter.

$$\frac{\text{Radiant Power}}{W} = E * 10^{\left(\frac{U-c}{m}\right)}$$

$$\frac{\text{Input Current}}{A} = 10^{\left(\frac{U-c}{m}\right)}$$

➤ Use the following:

U	Output voltage U (ANALOG OUT) / V
c	Intercept / V, see calibration certificate (value for logarithmic output signal, page 5)
m	Slope / V/A, see calibration certificate (value for logarithmic output signal, page 5)
E	Spectral responsivity / W/(A*nm) If the optical input of the power meter is used: See calibration certificate (pages 6 and 7). If the current input of the power meter is used with a photodiode, refer to the spectral responsivity in the documentation of this photodiode.

## Maintenance

### Recalibrating the Power Meter

If the power meter is subject to mandatory calibration within the scope of its use, it is recommended to recalibrate the optical sensor module annually.

- For recalibration, contact the customer service department (p. 13).

### Cleaning the Power Meter

The power meter contains electrostatically sensitive components that can be damaged by short circuits or flashovers if cleaning fluids penetrate the housing. Liquids or moisture intruding into the optical input of the power meter can lead to significant deviations of the measured values.

- Before cleaning, disconnect the power meter from the power adapter by pulling the power plug.
- Before cleaning the power meter, seal the optical input with the protective cap supplied.
- Prevent cleaning fluid from penetrating the case.
- When necessary, clean the surfaces of the power meter housing with a cloth that is dampened with a mild, residue-free cleanser or disinfectant.
- Do **not** use aggressive cleaning agents.

## Troubleshooting

Problem	Solution
Significant deviations of the measured values compared to previous measurements	➤ Inspect the optical input for contamination
	➤ Switch the power meter off and on again and repeat measuring
Power meter does not switch on	➤ Check the power adapter connection

If the problem that occurred with your system is not listed in the table above or cannot be solved as described, contact the customer service department (p. 13).

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## Customer Service Department

Contact your PI representative or send us an email (<mailto:service@pi.de>).

- If you have questions concerning your system, have the following information ready:
  - Product and serial numbers of all products in the system
  - Firmware version of the controller (if present)
  - Version of the driver or the software (if present)
  - Operating system on the PC (if present)
- If possible: Take photographs or make videos of your system that can be sent to our customer service department if requested.

The latest versions of the user manuals are available on our website (p. 3) for download.

## Technical Data

### Data Table

Optical input	F-712.PM1	Unit	Tolerance
Wavelength range	400 to 1550 <sup>(1)</sup>	nm	
Connectors	FC/PC, FC/APC		
Polarization dependence	None		
Minimum input power at 1550 nm	85	nW	
Maximum input power at 1550 nm	85	mW	
Average noise at 1550 nm	<10	nW	
<b>Current input</b>			
Connectors	BNC		
Minimum input current	0	mA	
Maximum input current	1	mA	
Average noise	<120	pA	
<b>Output</b>			
Connectors	BNC		
Output signal	Analog, logarithmic		
Voltage range	-5 to 5	V	typ.
Bandwidth (3dB)	20	kHz	
Logarithmic increase	1	V/10 dB	
Output voltage at 85 mW, 1550 nm	≈ +5 <sup>(2)</sup>	V	
Output voltage at 85 nW, 1550 nm	≈ -1.2 <sup>(2)</sup>	V	
Output voltage at 1 mA input current	+5	V	
<b>Miscellaneous</b>			
Operating voltage	12 to 24	V	
Power consumption	2.4	W	
Overall mass (without power adapter and adapter cable)	0.6	kg	

(1) See "Responsivity" for a typical course of responsivity (p. 15). Individual calibration certificate with the exact distribution of responsivity in the scope of delivery.

(2) Individual calibration certificate in the scope of delivery.

See "Calculating the Radiant Power and the Input Current" for exact calculation of the radiant power (p. 11).

## Responsivity

The figure below shows the typical responsivity curve. Refer to the calibration certificate (in the scope of delivery) for the exact responsivity distribution of your power meter.

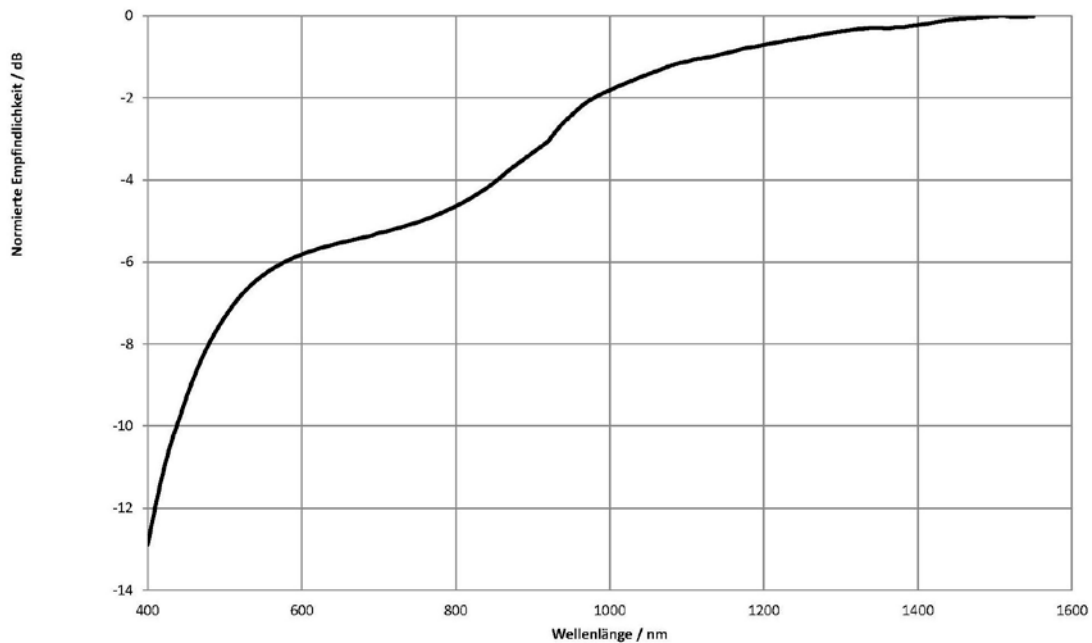





Figure 4: Typical responsivity curve depending on the wavelength

## Maximum Ratings

<b>Maximum operating voltage</b>		<b>Maximum operating frequency (unloaded)</b>		<b>Maximum power consumption</b>	
24 V DC		---		2.4 W	

## Ambient Conditions and Classifications

Area of application	For indoor use only
Maximum altitude	2000 m
Relative humidity	20 to 70 %, not condensing
Operating temperature range	5 to 40 °C
Storage temperature	-10 to 50 °C
Overvoltage category	II
Protection class	I
Degree of pollution	2
Degree of protection according to IEC 60529	IP20

## Dimensions

Dimensions in mm. Note that the decimal places are separated by a comma in the drawings.

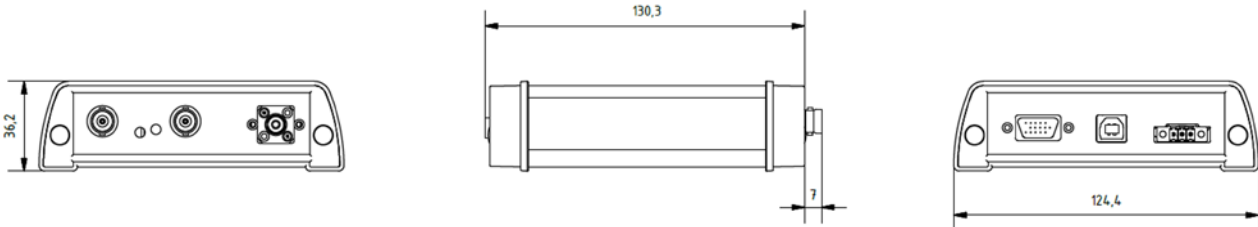


Figure 5: F-712.PM1

## Pin Assignment

### POWER 12 to 24 V DC

Phoenix Connector MC1,5/3-STF



Figure 6: Pins from left to right: 1 to 3

Pin	Function
1	12 to 24 V
2	GND
3	Wiring with GND switches the power meter off (only relevant when the adapter cable supplied is <b>not</b> used)



## Old Equipment Disposal

In accordance with EU law, electrical and electronic equipment may not be disposed of in EU member states via the municipal residual waste.

Dispose of your old equipment according to international, national, and local rules and regulations.

In order to fulfil the responsibility as the product manufacturer, Physik Instrumente (PI) GmbH & Co. KG undertakes environmentally correct disposal of all old PI equipment made available on the market after 13 August 2005 without charge.

Any old PI equipment can be sent free of charge to the following address:

Physik Instrumente (PI) GmbH & Co. KG

Auf der Roemerstrasse 1

76228 Karlsruhe, Germany

