

- ◇ Two Channel Bench-top Optometer for Laboratory, Quality Control and Production
- ◇ Universal Use in Any Light & Optical Radiation Measurement Application
- ◇ Calibration Data Connector for faultless Detector Exchange
- ◇ Measurement of DC, AC and Flash Signals
- ◇ Signal Range from 0.1 pA to 2 mA
- ◇ Adjustable Integration Time, 100  $\mu$ s to 6 s
- ◇ CW, Flash Energy, Dose, Data-Logger, RS232, IEEE488 Operation Mode
- ◇ Analog Output
- ◇ Optional Window Software



**Associated Parts / Service:**

Chapter Detector Heads  
Chapter Integrating Spheres  
Chapter Calibration

The P-2000 Optometer is an efficient dual-channel instrument designed for multipurpose use in any photometric, radiometric, transmittance, reflectance, absorbance application.

It offers many high-level technical features combined with a brilliant display and several different measurement modes.

These functions and the possibility of remote control operation by two different interfaces enable the P-2000 for the universal laboratory use as well as for process control integration.

**Calibration data connector:**

An unique feature of the P-2000 is its detector head calibration data connector. All data pertaining to a detector including the model and serial number are stored in the coupler. When connected to the meter, this data is automatically transmitted and the system is ready to go. This guarantees faultless handling of the instrument when used with any number of different detector heads as it is usual in laboratory use.

**Large dynamic range:**

The P-2000's wide signal range of

0.1 pA to 2 mA covers the dynamic range of most current semiconductor photodiodes for nearly unrestricted use in any light measurement application.

**2 Signal Channel**

The two signal channels do allow the connection and parallel operation of two detectors. This allows the use of the P-2000 in application with extended wavelength laser power measurements, dual wavelength-band measurements, attenuation measurements with variable reference e.g.

**Variable measurement time:**

Each channel of the P-2000 offers a fast signal input with 2 to 10 ms slew-rate (gain depending). The fast sample rate of 100 $\mu$ s allows the use of the P-2000 as a fast single channel data logger. The integration time is adjustable by average calculation of up to 6 sec. This is another key feature for individual application set-up's.

**Precise measurements:**  
The P-2000 offers a high linear 12bit ADC input with 8 manually or automatically selected gain ranges. The max. error within this large dynamic range 0.2 %.

**Remote control:**

A bi-directional RS232 serial interface and the IEEE488 interface allow external remote control operation. Optional Windows based software is available for a quick turn-key solution via the RS232 interface. The complete command set supplied in the meters manual allows the user to develop his own program.

**Process integrating:**

In combination with the optional available relay switch board the P-2000 is the right tool for process control with low-ok-high indication. The menu controlled set-up of the limiting values is simple.

**Multiple applications:**

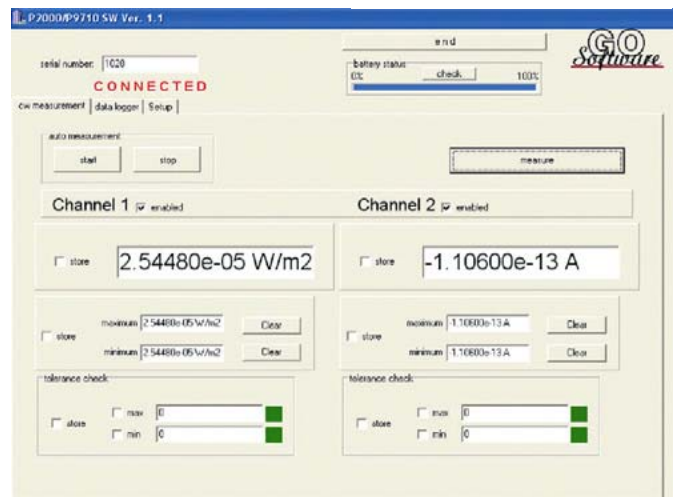
The P-2000 can be combined with most of GO's detector heads for photometric and radiometric measurement quantities.

**Many functional modes:**

The unit's many functional modes of operation includes CW, dose, pulse-energy, data-logger measurements and many more. If the sixteen different operation modes should not include the one of your need we do offer custom design modifications.

**Re-Calibration**

For re-calibration by calibration labs or within industrial processes the factory programmed calibration factors can be changed with the OS CAL software via the RS232 interface. The IEEE488 interface allows external remote control.



P-2000 Applications

Because of its multiple functional modes and high-level specifications, the bench-top meter P-2000 is the right instrument for laboratory and process applications.

GO's wide range of detector heads enables the P-2000 to be used in many different photometric and radiometric applications. Its two signal channels extend

the application range by attenuation, transmission and reflectance measurements. The following page offers typical P-2000 application's. Our **Guide to**

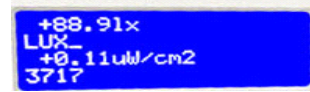
**Light Measurement's** available in our catalogue and website offers additional tutorial and application notes.

**Universal Light Meter**

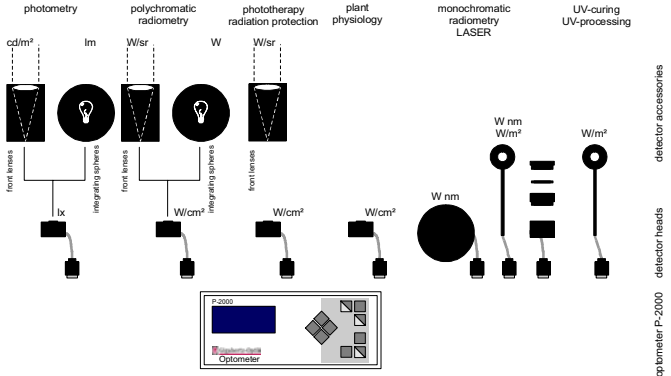
Even in the computer dominated world instruments with large size, brilliant display needs to exist. The reasons are all the applications where the operator needs the direct feedback to his operation and all the stand-alone set-ups.

But it's not only the brilliant blue back-lighted display. It's the combination of high-grade specifications with safe and universal handling which had made the P-2000's to the right choice for many laboratories and production facilities. The calibration data connector for

**Optometer P-2000**



example ensures that you will never forget the up-date of the meter, if you change to an other detector head. You can also use the meter while one of the detector heads is out for re-calibration. New detector heads, purchased years later than the meter are just plugged in and work. Multiple operation function modes ensure highest flexibility in the use of the P-2000. And last not least



**Photostability Testing**

The current ICH (International Conference for Harmonization) guidelines specify that drug and drug products must be photo-tested to ensure that exposure to light does not cause photochemical degradation of the product or packaging. The product under test must receive a **measured** dose of both UV-A (200 watt-hours per square meter) and Visible (1.2 million lux-hours) optical radiation exposure. This requires both radiometric and photometric measurements in terms of illuminance in lux and UV-A (315 to 400 nm) irradiance in W/m² multiplied by exposure time in hours. With UV-3717-2 and VL-3701-2

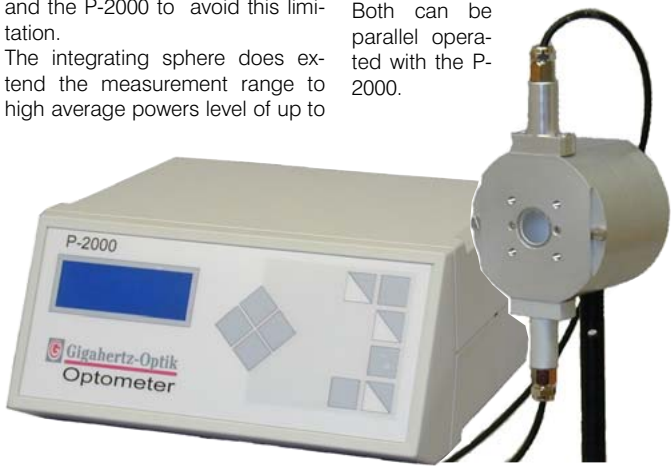


Gigahertz-Optik offers a UV-A irradiance and photometric illuminance detector head which fulfills the requirements for the evaluation of the UV-A and photometric exposure in photostability testing application. The P-2000 is the effective meter to operate both detectors in parallel mode.

**Extended Wavelength Range Laser Power Meter**

Semiconductor photodiodes offer low noise and high sensitivity, but are limited in the spectral sensitivity range and in high power detection. Two photodiode, such as a silicon and InGaAs one, can be combined with an integrating sphere and the P-2000 to avoid this limitation. The integrating sphere does extend the measurement range to high average powers level of up to

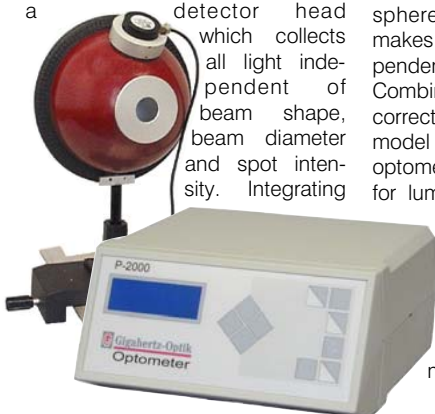
few-hundred Watt and peak powers up to the kWatt range. The sphere's integration function does allow the parallel use of two diodes in the same beam which will extend the wavelength range from 350 to 1750 nm without the need to replace the detector. Both can be parallel operated with the P-2000.



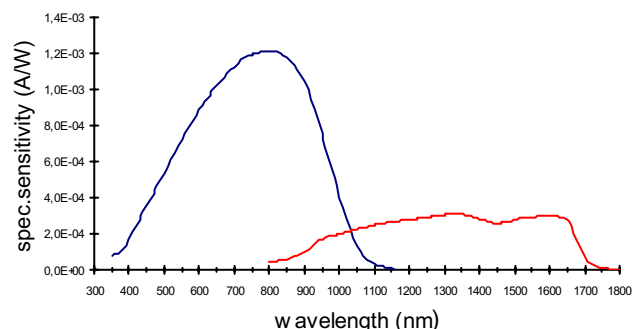
**Luminous flux Meter for Light-guides, Endoscopes & LED's**

Spot sources are light sources, which emit directional in one axis. Typically the light beam has a convergent or focused shape. The measurement of the luminous flux in lm of such light sources requires a detector head which collects all light independent of beam shape, beam diameter and spot intensity. Integrating

sphere based photometric detectors are a practical choice for this application. Different sphere diameter offer flexible selection of the measurement port diameter and max. power level. The spheres integrating function makes the measurement independent from the beam shape. Combined with a photometric corrected detector head, such as model VL-3701 and the P-2000 optometer a precise instrument for luminous intensity measurement is given. Calibration standard lamps and software is offered for recalibration by the end-user in the case of frequent use of the instrument.



LP-9930, Si and InGaAs



**Operation Functional Modes**

Because of its unique electronic design and its powerful micro-processor the P-2000 optometer is more than just a simple instrument for light intensity readings. Sixteen different operation function modes in combination with a variable measurement parameter set-up function makes the P-2000 to one of the most flexible

meter available. Because of that it's in manual and remote control use in process control, long-time stability search, service, teaching and R&D application. This page

will show the available function at the dead-line of this catalog. If you do not find your function mode pls. ask for up-dates and custom modification.

**CW Measurement (Ch1 or Ch2 or Ch1&2)**

CW mode is used to measure continuous DC or AC signals with the selected integration time from 100 μs to 6s. Beside the measurement value and measurement

quantity the connected detector/selected wavelength is shown in the lower line of the display. Manual and auto-ranging operation.

**Ratio relative (%), log. (dB), factor (Ref. Ch1 or Ch2)**

Measurement of the ratio between a reference value and the actual measurement value. Displayed as

relative ration (%) or logarithm ratio/attenuation (dB or dBm) or ratio factor.

**CW Offset (Ch1 or Ch2 or Ch1&2)**

A constant offset value, such as given by ambient light, can be

subtracted from the CW measurement value.

**Reference (Ch1 or Ch2)**

The reference value is used for ratio measurements.

stored as reference value.

The ref. value can be set to 1 with the selected quantity such us 1 W, 1 A.

A manual entered value can be used as reference.

The reference value '1.000 mW' can be used to measure the attenuation in dBm.

**CW Minimum or CW Maximum (Ch1 or Ch2 or Ch1&2)**

Together with the measurement value the min. or max. value reached during the measurement

period is displayed. during a measurement period (erased by pressing 'reset' button).

**Hold (Ch1 & Ch2)**

Beside the actual measurement value a current reading can be

'frozen' by pressing 'reset' button.

**Peak Minimum or Maximum, Peak to Peak (Ch1 or Ch2)**

This modes allow to analyse the signal stability within the selected integration interval e.g. flicker of light sources. The min., max. or p-p values are displayed together

with the CW average value. Only signals longer that the gain dependent slew-rate (see tabular below) can be measured.

**CW Level Check (Ch1 or Ch2 or Ch1&2)**

Compares the measured CW value with stored pre-set lower and upper limit values. The actual measurement value and it's status is displayed. The limit values can be entered manually or via the

RS232. The relay board P-9710Z-02 can be remote controlled to indicate the status by external lamps or integrate the meter in process control application.

**I-Effective (Ch1 or Ch2)**

Evaluation of the effective luminous intensity of a single light flash according to the Schmidt-Clausen method. The measurement is manually started with the 'run' botton. The integration time can be selected in the menu function

'set-up/pulse measurement time'. The time constant C for daylight (0.1 s) and night time observation (0.2 s) can be selected in the menu function 'set-up/IF time constant.

**Dose (Integrated Energy) (Ch1 or Ch2 or Ch1&2)**

Measurement values are accumulated with a logger rate of 1 s and displayed a dose. The measurement can be manually started and stopped or be automatically

stopped at a max. dose measurement time (1 s to 1,000 h) or a max. dose value. The actual measurement status ca be displayed

**Pulse Energy (Ch1 or Ch2)**

Measurement of the energy of single pulses or a pulse chain within the selected measurement time. The measurement time is selected in the menu function 'set-up/pulse measurement time'. The

measurement is started with the 'run' botton. In auto-range operation 'UL/ OL" (under/over-load) is displayed if a gain change is necessary.

**Automatic Data Logger (Ch1 or Ch2 or Ch1&2)**

Up to 12,288 measurement values can be stored with a sampling rate

of 0.1 to 6000 s.

**Manually Data Logger (Ch1 or Ch2 or Ch1&2)**

Up to 150 individual data records (meas. values & parameters) can

be stored by pressing the run button.

**Pulse Offset (Ch1 or Ch2)**

A offset value, such as given by ambient light, can be subtracted from the I-Effective and Pulse Energy measurement value. 'Static Offset' does subtract a constant

value. 'Continuous Offset' does subtract the actual measured value before the pulse measurement is started. Selection in menu 'pulse offset'.

**Manual Calibration Data**

Individual calibration correction data can be manually entered.

**Remote Control**

Instrument set-up for remote control operation either for the RS232

or for the IEEE488 interface.

**Default Initiation**

Resets all parameters to the default condition.

**IEEE488 address**

Sets the address for the IEEE488 communication.

**Specification:**

Range and Uncertainty Specification				
Range (A/V)	Range max. signal	Slew-Rate (10-90%)	Error (with offset compensation) 1 year 23°C +/-5°C +/-(% of reading + % of range)	Gain (A/V) Analog Output
1 x 10 <sup>-3</sup>	2.000 mA	2 ms	0.2 % + 0.05 %	1 x 10 <sup>-3</sup>
1 x 10 <sup>-4</sup>	200.0 μA	2 ms	0.2 % + 0.05 %	1 x 10 <sup>-3</sup>
1 x 10 <sup>-5</sup>	20.00 μA	3 ms	0.2 % + 0.05 %	1 x 10 <sup>-5</sup>
1 x 10 <sup>-6</sup>	2.000 μA	3 ms	0.2 % + 0.05 %	1 x 10 <sup>-5</sup>
1 x 10 <sup>-7</sup>	200.0 nA	4 ms	0.2 % + 0.05 %	1 x 10 <sup>-7</sup>
1 x 10 <sup>-8</sup>	20.00 nA	4 ms	0.2 % + 0.05 %	1 x 10 <sup>-7</sup>
1 x 10 <sup>-9</sup>	2.000 nA	10 ms	0.2 % + 0.05 %	1 x 10 <sup>-9</sup>
1 x 10 <sup>-10</sup>	200.0 pA	10 ms	0.2 % + 0.05 %	1 x 10 <sup>-9</sup>

**P-2000 Specification & Ordering Information**

**Specification:**

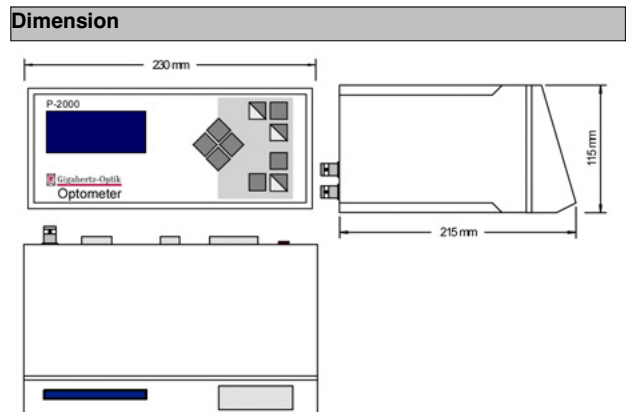
Signal Input	
Detector Input	Two photocurrent to voltage converter amplifier with following voltage to voltage amplifier (x10). 8 decade stepped gain ranges with max. gain signal values from 2.000 mA to 200.0 pA . Manual or automatic range switching. One 12 bit ADC with up to 14 bits at longer integration times.
Signal Processing	A/D converter with 100 $\mu$ s time interval. Longer integration (100 $\mu$ s to 6s) through averaging of multiple measurements.
Frequency Range	Signal conversion from 0.166 Hz (6s integration time setting) to >300 MHz.
Zero Setting	Gain independent offset subtraction of unwanted ambient light signal.
Detector Connector	9 pin DSUB-socket . Detector heads with calibration data connector (type -2).

Function	
Parameter Settings	Menu controlled parameter set-up. Retention of the last settings in continuous memory. 10 function buttons.
Measurement Quantity	Ampere calibrated with DKD calibrated current source. Current signal multiplied with calibration correction factor to display absolute photometric or radiometric quantities. Calibration data stored in calibration data connector of the detector heads manually entered into the meter storage.
Dose Measurement	Integration of the measurement signal with 1 s sampling rate. Adjustable max. measurement time from 1 s to 1000 h. Adjustable maximum dose limit value. Current status display function.
Data Logger	Storage of up to 12,288 readings. Adjustable sampling rate from 0.1 to 6000 seconds. Manual recording mode. Display of readings stored in the flash Eproms on the display or on computer using the RS232 interface and software.
Analog Output	Two, gain dependent: 0 - 200 mV or 0 - 2 V (10 k $\Omega$ internal resistance). BNC type sockets

General	
Display	LCD module, LED backlight illuminated, 4 rows x 20 character
Operating Temperature	5 to 40 °C (41 to 104 ° F) (75 % rel. H, non-condensing). Storage Temperature: 0 to 50°C (32 to 122 °F).
Dimensions/Weight	230 mm x 215 mm 115 mm / 800 g (9.1 x 8.5 x 4.5 in /1.8 lb).
Serial Port Settings	RS232 (9600 baud, 8 data bits, 1 stop bit, no parity) 5 pin cylindrical TRIAD01 connector..
Power supply	Battery or AC operation. Built-in rechargeable lead battery, 6V,0.5 Ah. Approx 6 h with display illumination. Battery charge under 8 % is displayed. Operation from AC plug-in power supply 230V/50 Hz (other values on request) with specific U/I recharge characteristic.

Interface	
RS232	9600 Baud, 8 data bit, 1 stop bit, no parity. TRIAD01 / 5 pin connector with integrated analogue output.
IEEE488	AH1, SH1, L4, T4

Detector Head / Measurement Output	
Detector Heads	All available detector heads with -2 type calibration data connector. See chapter 'detector heads' to select the detector head for your application.
Data Connector	Storage of sensor data such as detector model number, serial number, calibration data . Calibration data of integral sensitivity or spectral sensitivity with or without accessory. Selection of the calibration data or the wavelength in the menu function of the P-9710. Automatic data transfer if detector head is connected to the meter.



**Ordering Information**

P-2000-1	Optometer with gain dependent slew-rate, rechargeable battery with plug-in power supply and manual
Detector Heads	All Gigahertz-Optik detector heads with -2 type calibration data connector (example VL-3701-2)
P-2000Z-01	RS232 Interface Cable to connect P-9710 to a PC or P-2000Z-02 Relay Motherboard.
P-2000Z-02	Relay Motherboard (power supply and housing not supplied)
P-2000Z-1/2	Adapter cable to connect detector with BNC-type connectors to P-2000
P-2000Z-2/1	Adapter cable to connect detector with calibration data connector (-2) to meters with BNC-type socket input
OS-P2000	Software for remote control of the P-2000-1, including OS-CAL.
OS-CAL	Software to enter calibration data via the P-2000 meter into -2 type data connector
BHO-08	Hard -shell Case to carry and store the P-2000 with accessories
BHO-09	Hard -shell Case to carry and store the P-2000 with accessories