

X9<sub>3</sub> Hand-held Laser Power and Laser Stray-light Meter

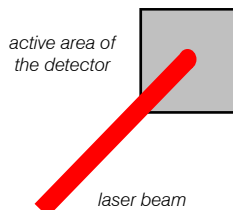
- © Hand-held Single Channel Laser Power Meter
- © Low Profile Detector - 100 mW max.
- © Compact Integrating Sphere Detector - 500 mW max.
- © 7 mm dia. Aperture Laser Stray-light Detector
- © Wavelength Range from 400 to 1100 nm
- © Simple Wavelength Selection
- © CW Snapshot Hold Function
- © Peak Hold Function
- © Economical Price
- © Battery Operation
- © RS232 Interface

**Laser Power Measurement**

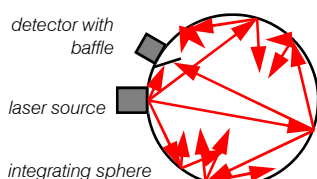
Lasers with low to medium power levels in the wavelength range from 400 to 1100 nm are well established in metrology applications. To quantify laser power three different measurement geometries exist.

**Collimated Lasers**

Lasers with quasi-parallel light bundles are typically measured using a flat-field detector with an active area larger than the laser beam diameter. There is some measurement error risk with flat field detectors due to polarization effects, re-reflection from the detector surface or windows and misalignment of the beam on the detector.

**Non-collimated Lasers**

Lasers with divergent light bundles (beams), such as laser diode array bars, are difficult to measure with a flat-field detector because of the different angles of incidence. The power output of these lasers is typically measured with detectors combined with an integrating sphere independent of the angle of



incidence.

Due to its unique design and the multiple reflections produced, integrating spheres offer:

- High attenuation permitting higher power measurements
- Reduction of polarization effects inaccuracies as found with flat-field detectors
- Flexibility with less aiming problems since sphere port diameter can be enlarged by increasing the sphere diameter to allow measurement of larger diameter beams

**Laser Stray-light**

Although very useful, laser radiation can pose a health risk to the human eye. Even stray-light from lasers may be hazardous due to the typically high power levels found. The EN 60825 standard describes the risk and measurement methods for risk classification. Laser stray-light can be assessed with the use of a detector head with a 7 mm dia. free aperture to mimic the open pupil.

**X9<sub>3</sub> Meter**

Besides its precise measurement capability the X9<sub>3</sub> meter's most outstanding feature is its easy handling. To measure, the user simply switches on the meter and selects the wavelength corresponding to the laser wavelength. The LCD characters are 9 mm high for easy viewing. The X9<sub>3</sub> is a compact handheld battery operated instrument.

**LP-9901 Flat Field Detector**

A 7 mm diameter aperture makes this low profile design detector useful for laser power and laser stray-light measurement over a useful wavelength range from 400 to 1100 nm.

The wavelength dependent laser power measurement range is 1  $\mu$ W to 100 mW with 0.02 resolution at 633 nm.

The wavelength dependent laser stray-light measurement range is 2.5  $\mu$ W/cm<sup>2</sup> to 250 mW/cm<sup>2</sup> with 0.05  $\mu$ W/cm<sup>2</sup> resolution at 633 nm.

**LP-9910 Sphere Detector**

With a free measurement aperture of 12.7 (0.5 in.) and an acceptance angle of  $\pm 45^\circ$  this detector is well suited to measure collimated and non-collimated radiation beams from lasers, laser diodes, laser diodes with lens attachments and narrow beam diverging light emitting diodes. Its high precision Si-photodiode with a compact 50 mm diameter integrating sphere offers a useful wavelength range from 400 to 1100 nm with a power range from 0.5 W to 100 mW with 0.01  $\mu$ W resolution at 633 nm.

**Traceable Calibration**

Calibration is traceable to the

ISO EN 17025 accredited part of Gigahertz-Optik's Calibration Laboratory for Optical Radiation Quantities.

**Custom Label:**

All meters in the X9 family are ready made for custom design and labeling. Customization may include the meter front panel, function/mode set-up, detector heads, manuals and calibration certificates. Contact the factory for details and applications assistance.

**Operation**

The X9<sub>3</sub> is simple to operate. To measure, connect the detector and switch on the meter.

**CW Measurement**

CW mode is used to measure continuous DC or AC signals.

**Power/Stray-light Meas.**

Laser power in mW must be selected if the laser beam under fills the detectors area.

Laser stray-light in mW/cm<sup>2</sup> must be selected if the laser beam over fills the detectors area.

**Auto/Manual Gain Ranging**

Select manual ranging when the power range in production control applications stays at the same level to avoid time delays in auto-ranging mode.

**Peak Hold Measurement**

Peak Hold mode is used to search for "hot-spots" light intensities. The peak intensity measured is frozen on the display.

**Stop/Run Function**

Current reading can be 'frozen' by pressing 'stop' button.

## X9<sub>3</sub> Specifications & Ordering Information

### Specifications: X9<sub>3</sub> Meter

Signal Input	
Detector Input	Photocurrent to voltage converter amplifier with following voltage to voltage amplifier (x10). 7 decade stepped gain ranges with max. gain signal values from 200.0 $\mu$ A to 200.0 pA . Automatic range switching. 12 bit ADC with up to 14 bits at longer integration times.
Signal Processing	A/D converter with 20 ms time interval. 500 ms integration through averaging of multiple measurements.
Frequency Range	Signal conversion from 0.166 Hz to >300 MHz. .
Detector Connector	9 pin MDSM9 socket .

### Range Specifications

Range (A/V)	Max. Input Value	Slew-Rate (10 - 90%)	Error (with offset compensation) 1 year, 23°C $\pm$ 5°C $\pm$ ( % of reading + % of range),	Permitted Detector Capacitance
1x10-4	200.0 $\mu$ A	30 ms	0.2 % + 0.05 %	2 nF
1x10-5	20,00 $\mu$ A	30 ms	0.2 % + 0.05 %	2 nF
1x10-6	2,000 $\mu$ A	30 ms	0.2 % + 0.05 %	2 nF
1x10-7	200,0 A	30 ms	0.2 % + 0.05 %	10 nF
1x10-8	20,00 nA	30 ms	0.2 % + 0.05 %	10 nF
1x10-9	2,000 nA	30 ms	0.2 % + 0.05 %	10 nF
1x10-10	200,0 pA	30 ms	0.2 % + 0.05 %	10 nF

### Function

Parameter Settings	Retention of the last settings in continuous memory. 3 function buttons.
Measurement Quantity	Ampere calibrated with DKD calibrated current source. Current signal multiplied with calibration correction factor to display the radiant power in mW or the irradiance in mW/cm <sup>2</sup> . Calibration factors stored in meter.

### General

Display	6 character LCD. Character height 9 mm. Indication of appropriate measurement quantities, battery low, peak, stop
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	120 x 65 x 22 mm / 150 g (4.7 x 2.6 x 0.9 in / 0.33 lb).
Power	9 V one-piece battery. Operation time about 100 h. Operation from a AC plug-in power supply 230V/50 Hz on option, erases battery operation.

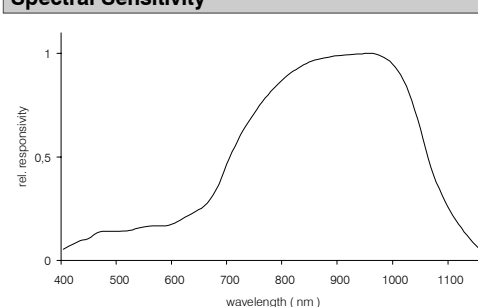
### Interface

RS232	9600 Baud, 8 8D, 1S,N. 8 pin plug Hirose, type 3260-8S1. Power supply operation recommended for remote control.
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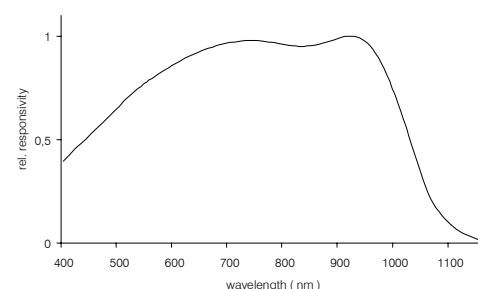
### X9<sub>3</sub> with Detector Head LP-9901 and LP-9910

X9 <sub>3</sub> with LP-9901-4	
typ. max. value*	30 mW at 900 nm, 100 mW at 633 nm
typ. max. resolution*	0.00002 mW*
wavelength range	400 – 1100 nm, calibrated in 10 nm increments
measurement aperture	7 mm diameter
dimensions	8 mm height, 37 mm diameter, handle length 100 mm
X9 <sub>3</sub> with LP-9910-4	
typ. max. value*	100 mW*
typ. max. resolution*	0.00001 mW*
wavelength range	400 – 1100 nm, calibrated in 10 nm increments and additional laser wavelength**
measurement aperture	12.7 mm diameter
dimensions	50 mm sphere diameter
*) values may vary from unit to unit **) 441, 458, 473, 476, 488, 496, 514, 532, 543, 568, 594, 612, 633, 647, 1064 nm	

### Spectral Sensitivity



LP-9901



LP-9910

### Ordering Information

X9 3	Optometer with handbook and battery. Detector calibration data stored in memory
LP-9901-4	Low-profile detector head. Calibration in mW from 400-1100 nm in 10 nm increments and calculated irradiance in mW/cm <sup>2</sup> . Calibration certificate. ITT-type connector
LP-9910-4	Integrating sphere detector head. Calibration in mW from 400-1100 nm in 10 nm increments. Calibration certificate. ITT-type connector
X9Z-01	RS232 interface cable to connect the X9 meter with 9 PIN SUB-D PC standard socket
X9Z-02	External AC power unit for the X9 meter including meter modification (cancels battery operation)
BHO-05	Hard case to carry and store the X9 3 with one LP-9901-4