

## Digital Radiometer RMD Pro



Radiometer RMD / RMD Pro

Radiometric UV sensors

The RMD radiometer is one of the latest developments from Opsytec Dr. Gröbel GmbH. This easy-to-use radiometer is based on more than 30 years of experience in all areas of irradiation and illuminance measurement. It features a wide dynamic range and extremely low noise. For this purpose, the sensor already contains a multi-stage amplification, an extremely precise analog-to-digital converter and a temperature sensor. The memory contained in the sensor contains all sensor identifications and the calibration history.

This allows several ultraviolet sensors and visible sensors to be used on the Radiometer RMD. A wide range of sensors is available for a wide variety of production and control processes. Two sensors can be read out simultaneously. Sensors for the evaluation of erythema-weighted radiation and multi-channel sensors are also available. The measurement data are clearly displayed on the graphic display.

The newly developed diffuser achieves a very good cosine correction with excellent lateral uniformity. The radiation to be measured is distributed evenly over several channels, so that, for example, the simultaneous determination of UVA irradiance and illuminance is possible.

Compared to the predecessor RM-22, the RMD features a significantly higher resolution of 24 bit, an extended measuring range of up to 7 orders of magnitude, multi-channel sensors and the simplified operation.

The measured values can be stored in the RMD Pro and output via USB. With the corresponding software, the RMD can be controlled from the PC. The RMD records measurement data for up to 100 days at a time. The RMD radiometer is available in two versions - as RMD Pro with all functions and as more economical RMD.

### Applications:

- Measurement of UV LEDs & UV light sources
- NDT, material testing
- Monitoring of UV irradiation systems
- Measurement of job security
- Measurement of Heff and HUVA
- Multi-channel measurements
- Applications with high dynamics
- Data logging

## TECHNICAL DATA RMD PRO

<b>Sensor connectors</b>	2, fully digital	<b>Power supply</b>	internal Li-Ion battery, USB 230 V plug-in power supply
<b>PC interface</b>	USB 2.0	<b>Internal memory</b>	8 GB
<b>Display</b>	graphical, 128 x 64 px	<b>Sampling rate</b>	adjustable: 1 s - 15 min
<b>Display output</b>	1 + 2 channels Irradiance + Dose Min/Max Irradiance	<b>Recording time</b>	> 2400 h
<b>Dimensions</b>	160 x 85 x 35 mm	<b>Operation temperature</b>	0 to 60 °C
<b>Weight</b>	250 g	<b>Storage temperature</b>	-20 to 60 °C
		<b>Humidity</b>	< 80% non-condensing

The RMD can be subsequently upgraded with the Pro functions. For this purpose, please order upgrade kit article number 814403.

You can perform the upgrade yourself. It is not necessary to send in the device. We would be pleased to perform the upgrade during the annual recalibration.

## FUNCTIONS IN DETAIL

	RMD	RMD Pro
<b>Irradiance measurement</b>	✓	✓
<b>Dose measurement</b>	✓	✓
<b>2 digital sensors can be connected</b>		✓
<b>Integrated temperature sensor</b>	✓	✓
<b>Languages: German / English</b>	✓	✓
<b>Internal memory</b>	-	8 GB
<b>Recording measurements</b>	-	✓
<b>Real time clock</b>	-	✓
<b>USB connection</b>	-	✓
<b>Remote control from PC</b>	-	✓
<b>PC software</b>	-	✓
<b>Measurement data evaluation MIN/MAX</b>	-	✓
<b>Easy firmware upgrades</b>	✓	✓

## ONE MEASURING INSTRUMENT - MANY POSSIBILITIES

Our radiometric sensors are long-term stable, robust and suitable for many applications. For some applications we recommend our other sensor series, e.g. when

the maximum overall height is limited or for high temperatures. These sensors can be connected to the RMD & RMD Pro:



Radiometric sensors - universal use



XT sensors - for high irradiances and temperatures



FLT - perfect for the PLC connection and monitoring



UV probes - for bad accessible areas

## TECHNICAL DATA SENSORS

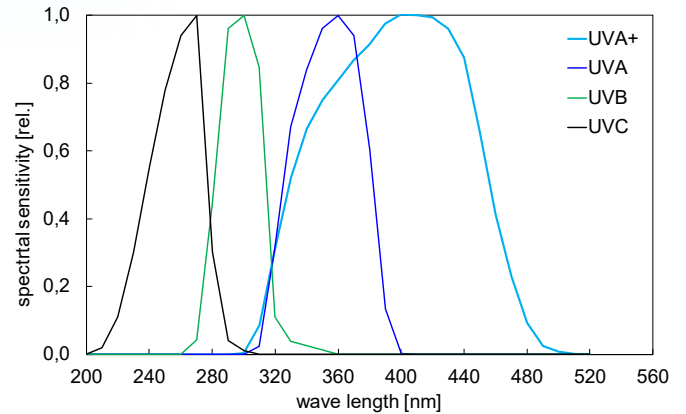
<b>Spectral range</b>	UVA, UVA+, UVBB
<b>Measurement range, typ.</b>	0 - 10 W/cm <sup>2</sup>
<b>Resolution</b>	0,001 μW/cm <sup>2</sup>
<b>Spectral range</b>	UVB, UVC, VISB, VISBG
<b>Measurement range, typ.</b>	0 - 1 W/cm <sup>2</sup>
<b>Resolution</b>	0,001 μW/cm <sup>2</sup>
<b>Spectral range</b>	UVC (for occupational safety detection), erythema+UVA
<b>Measurement range, typ.</b>	0 - 10 mW/cm <sup>2</sup>
<b>Resolution</b>	0,001 μW/cm <sup>2</sup>
<b>Dose range</b>	0 - 100 MJ/cm <sup>2</sup>
<b>Illumination meas. range</b>	0 - 500.000 lx
<b>Resolution</b>	0,001 lux
<b>Dynamic range</b>	up to 10 <sup>7</sup>
<b>AD conversion</b>	24 bit
<b>Temperature sensor</b>	integrated
<b>Dimensions</b>	Ø 40 mm, h 35 mm
<b>Optical area</b>	Ø 6 mm
<b>Weight</b>	160 g
<b>Connecting cable</b>	1,8 m
<b>Operation temperature</b>	0 to 40 °C
<b>Storage temperature</b>	-20 to 60 °C
<b>Humidity</b>	< 80% non-condensing

## SENSOR SPECTRAL RANGES

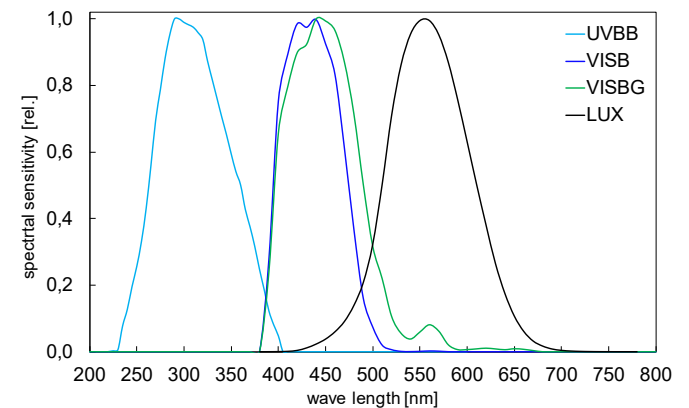
<b>UVC</b>	200 - 280 nm
<b>UVB</b>	280 - 315 nm
<b>UVA</b>	315 - 400 nm
<b>UVA+</b>	330 - 455 nm
<b>UVBB (broad-band)</b>	230 - 400 nm
<b>VISB</b>	400 - 480 nm
<b>VISBG</b>	400 - 570 nm
<b>LUX</b>	380 - 780 nm, V(λ)
<b>NDT (365 nm + LUX)</b>	315 - 400 nm, 380 - 780 nm
<b>Erythema + UVA</b>	200 - 400 nm, Ery(λ)

## TYPICAL TECHNICAL DATA

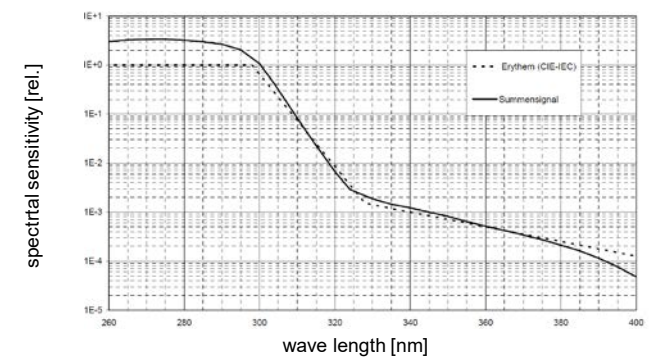
<b>Calibration uncertainty</b>	4,5 - 7,0% (k=2)
<b>Linearity error</b>	< 1%
<b>Ageing / year</b>	< 3%



Spectral sensitivity UVA+, UVA, UVB and UVC sensors



Spectral sensitivity UVBB, VISB, VISBG and VISL sensors



Spectral sensitivity erythema sensor

The specified measuring ranges are our recommended measuring ranges. These can be adapted to customer requirements. Please ask us for this or specify it when ordering.

Our calibrations are available as factory and ISO 17025 calibrations and are traceable to PTB standards. IP65 sensors, further measuring and spectral ranges available. Just ask us!



## PART NUMBERS

Radiometer RMD Pro	814400
Radiometer RMD	814401
RMD sensor UVC	814410
RMD sensor UVB	814420
RMD sensor UVA	814430
RMD sensor UVA+	814445
RMD sensor UVBB	814412
RMD sensor VISB	814440
RMD sensor VISBG	814450
RMD sensor LUX	814461
NDT-Sensor (365 nm + LUX)	814491
Erythem + UVA sensor	814470
ISO 17025 Calibration	17025
Transport case	921001

## SCOPE OF DELIVERY

RMD Radiometer, power supply, USB cable, manual + selected sensor; for Pro also SD card, PC software

We calibrate traceable to PTB and deliver with factory calibration certificates, optionally with ISO 17025 calibration certificates.

## APPLICATION NOTES

One watt of visible light corresponds to approximately  $10^{19}$  photons. This large number of photons is the basis for the application of light and UV radiation as the surface interaction of the photons is usually limited to a few  $\text{nm}^2$ .

The scope of our UV sensors is just as varied, ranging from process monitoring, risk assessment, and job security to medical applications of UV lamps and UV LEDs. The following notes should assist in the selection of suitable sensors.

For **process monitoring** and dose control, the spectral range of the sensor depends basically on the UV application or usually the photoinitiator. UV spotlight sources such as the HP-120i reach irradiance in the range of a few  $\text{W}/\text{cm}^2$ . This is lower outside the spots or at a greater distance. The sensor should provide a wide measuring range of 0-2000  $\text{mW}/\text{cm}^2$  or more.

**Low-pressure UV lamps and UVC amalgam lamps** usually reach irradiances of less than 100  $\text{mW}/\text{cm}^2$  in the irradiation level.

The emission of **UV LEDs** occurs, for example, at 365, 385, 395, or 405 nm. A UVA+ sensor has been developed to measure UV LEDs. The latter has a wider spectral range. Measurements of UV LEDs in the area of the filter edge should be avoided since the smallest changes of temperature and charge fluctuations can cause high measurement errors.

For **risk assessments and occupational or job safety**, DIN EN 14255-1:2005 regulates the measurement and assessment of personal exposure to artificial optical radiation. DIN 14255-1 itself contains no limits. Limits are given in directive 2006/25/EC „Artificial Optical Radiation.“

The sensors must be sufficiently sensitive for the measurements. To achieve this, select a sensor (e.g., UVA, UVB) with a measuring range 0 - 2  $\text{mW}/\text{cm}^2$ . In accordance with 2006/25/EC directive, the UVA radiation limit is  $10^4 \text{ J}/\text{m}^2$  for an 8h working day. This corresponds to continuous irradiance of 0.035  $\text{mW}/\text{cm}^2$ . The maximum irradiance may be higher for short-term work, for example:

Scope of work: Daily cleaning

Duration: 10 min

Exposure dose:  $H_{\text{UVA}} = 10^4 \text{ J}/\text{m}^2$

Irradiance: 1.68  $\text{mW}/\text{cm}^2$

**Tip:** UV systems should be designed so that the irradiance relative to the duration of the activity does not exceed the exposure dose. In general, installations should be checked if they continuously irradiate the worker with more than 1-2  $\text{mW}/\text{cm}^2$ .

For **medical applications**, process safety and the calibration in the foreground are of most importance. Our sensors are durable and can be individually recalibrated. Repair and spare parts service is available for many years. Take advantage of our many years of experience as a calibration laboratory.

**Applications with different UV lamps** can be reproducibly measured with our radiometer sensors. A measurement of all spectral ranges at the same time is also possible (e.g., with the UVpad).