3.8 Probes for Measurement of Optical Variables

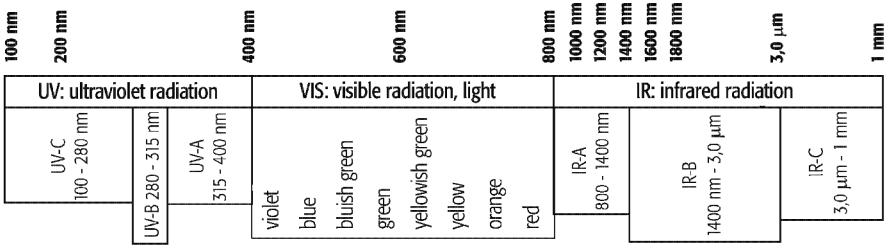
3.8.1 Basic Principles

What is ´Optical Radiation´?

Optical radiation covers the wavelength range from 100nm to 1mm of the electromagnetic radiation spectrum.

It must be considered that, with regard to the range limits, they do not preset a sharp separation, which is compulsory for all applications.

The detection of optical radiation can, for example, be measured by means of radiometric, photometric, photobiological or plant-physiological measurable variables.



Definition of Photometric and Radiometric Measurable Variables

Photometry

Limited to the range of the optical spectrum (light) that is visible to the human eye. Photometric measurable variables include: Light flux, illuminance, luminance and luminous intensity. The main characteristics of photometry is the evaluation of the brightness perception by the spectral luminosity function of the eye for photopic vision or, in rare cases, for scotopic vision (DIN 5031). Radiation detectors for photometric measuring tasks must, therefore, provide one of these spectral response characteristics.

Light Flux

The luminous power of a light source (lamp, LED etc.). As lamps do not generally emit a completely parallel luminous beam, the light flux measurement is performed by using measurement geometries, which detect the light flux independent from its geometric distribution. In most cases Ulbricht globe photometers or goniometers will be used.

Luminous Intensity

The part of a light flux, which radiates in one specific direction. The luminous intensity is an important variable for calculating the efficiency and quality of lighting equipment.The measurement is performed by detectors with a defined field of view and placed at distances that allow to consider the light source as a point light source.

Luminance

The brightness sensation provided by an illuminated or luminous surface to

the eye. In many cases the luminance data will provide significantly better information regarding the quality of a light than the illuminance. For measuring the luminance, measuring heads with a defined measuring field angle are used.

Illuminance

The light flux of one or several light sources striking a certain surface horizontally or vertically. In case of a non-parallel incidence (which is the typical case in practical photometry) a cosine diffusor must be used as measurement geometries.

Radiometry

Metrological evaluation of optical radiation using the radiometric variables "Radiation Capacity", "Radiant Intensity", "Radiancy" and "Intensity of Irradiation". The main characteristic of radiometry is the wavelength-independent examination of the intensity of radiation. This is the significant difference between radiometry and actively weighted measurable variables, such as variables used in photometry, photobiology, plant physiology etc.

Radiation Capacity

The overall power provided by radiation.

Radiant Intensity

The quotient from the radiation capacity emitted by the light source into a certain direction and the solid angle being covered. The radiant intensity is used for the measurement of the geometric distribution of the radiation capacity.

Radiancy

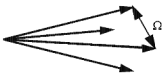
The quotient from the radiation capacity passing through (striking) a plane in a certain direction and the product of the passed solid angle and the projection of the plane to a plane surface, which is perpendicular to the examined direction. The radiancy is used for the evaluation of aperture radiators. Steradian or telescopic adapters can be used as measurement geometries.

Intensity of Irradiation

The quotient of the radiation capacity striking a plane and the illuminated plane. For measuring the intensity of irradiation the spacial examination of the incident radiation is very important; therefore, a cosine-corrected field view function has been preset.

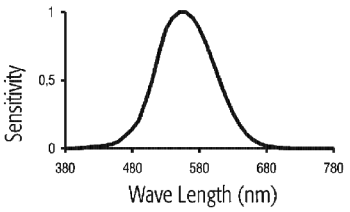
Comparison of Optical Variables

Every photometric variable corresponds to a radiometric variable and involves the same interrelationships between them. The variables can be distinguished by their index v (visual) and index e (energetic).

Lighting Engineering				Radiation Physics		
Variable	Symbol	Unit		Variable	Symbol	Unit
Light Flux	Φ_v	lm=cd·sr		Radiation Capacity	Φ_e	W
Luminous Intensity	I_v	cd		Radiant Intensity	I_e	W/sr
Luminance	L_v	cd/m		Radiancy	L_e	W/sr.m
Illuminance	E_v	lx=lm/m		Intensity of Irradiation	E_e	W/m
Light Quantity	Q_v	lm · s		Radiation Energy	Q_e	Ws
Lumination	H_v	lx.s		Radiation	H_e	Ws/m

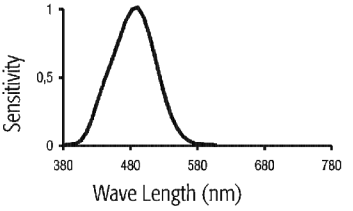
Spectral Valuation Function

The relative spectral sensitivity of the human eye is specified with different functions for the light-adapted eye (photopic vision) or for the dark-adapted eye (scotopic vision). Due to the individual differences this data can only be considered for average values but is sufficient for most technical purposes. The detailed data of the spectral sensitivity curve are given in table format in the DIN 5031 standard.



Photopic Action Function V(λ)
for photopic vision (rods, >10cd/m²)

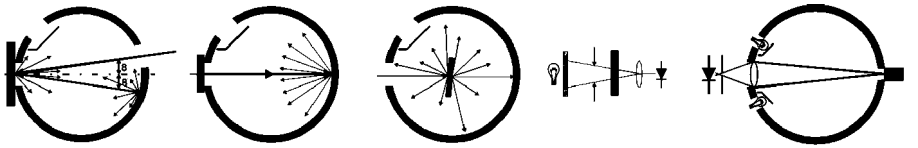
The two different spectral action functions result from the different "sensor types" of the eye.
The relative luminous efficiency for photopic vision (rods, > 10cd/m²) is described with the function V(λ), which is the function used in most cases. The spectral luminous efficiency for the scotopic vision (cones, < 0.001cd/m²) is described with the function V'(λ) and can, with regard to the practical use, only be rarely found.



Scotopic Action Function V(λ)
für scotopic vision (cones > 0,001cd/m²)

Determination of Photometric Characteristic Factors

The metrological evaluation of the properties of materials regarding their reflection, transmission and absorption, as well as the stray light of objectives, is based on internationally accepted recommendations. These mainly include the CIE 130-1998 "Practical methods for the measurements of reflectance and transmittance", DIN 5036 Part 3 "Radiometric and photometric characteristics of materials", DIN 67507 "Light transmission factor of glazing", DIN 58186 "Stray light determination of optically image-forming systems".



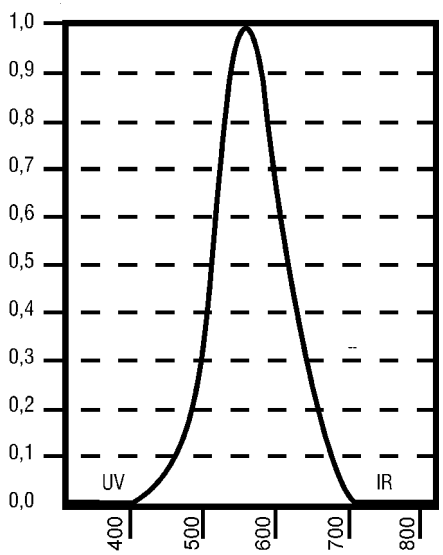
Degree of Reflection Transmission Factor Absorption Factor Light Transmission Grade Stray Light

A detailed description of the metrological realisation would be beyond the scope of this catalogue.
Please do not hesitate to contact us, the ALMEMO® system will also provide a solution for your measuring task in this field.

A large part of the human sense impression is of an optical nature. Light is the only visible part of the electromagnetic spectrum. The human eye perceives different wavelengths of the light as colours. The spectral response of the eye, with regard to different colours, depends on the wavelength. Furthermore, the human system is also influenced by ultraviolet radiation in a short-wave range and the infrared radiation in a long-wave range of the electromagnetic spectrum.

Illumination:

People are used to daylight illumination. This can be approximately 5000 on a dull winter day while approximately 100,000 lux are reached on a sunny summer day. In contrast, only between 100 and 1000 lux are reached with artificial illumination. Sufficient light is an essential factor for the well-being of people. Symptoms of tiredness, caused by insufficient light, do not generally occur at the eye but affect the whole body. The standard DIN 5035/2, therefore, contains illumination standard values for health protection at working places. These are legally bound in the guideline ASR 7/3 and it is imperative that this is observed.
The following nominal illuminations are valid for inside:



Offices:	office rooms working places for editing/drawing	300 lux 750 lux
Factories:	visual action in production processes	1000 lux
Hotels:	recreation rooms, front desk, cashier	200 lux
Shops:	front side of shop display windows	1500 - 2500 lux
Hospitals:	patients' roomscasualty	100 - 150 lux500 lux
Schools:	lecture halls, gymnasiums	300 lux

Irradiation Intensity:
For the radiometric radiation the term irradiation intensity is used instead of the term illumination (only for visible light, photometry).

Global Radiation:
The global radiation is a measuring variable that is especially important for environmental research and that represents the entire diffuse and direct sun radiation that strikes the surface of the earth. The spectral range covers wavelengths from the short-wave range, at 300nm (UV-B) to the long-wave range, at 5000nm (IR).

UVA Radiation:
The long-wave UV radiation (more than 313nm) reaches the surface of the earth almost unfiltered and tans the human skin and strengthens the immune system. In solariums the biological effect of the UVA spectrum is used, com-

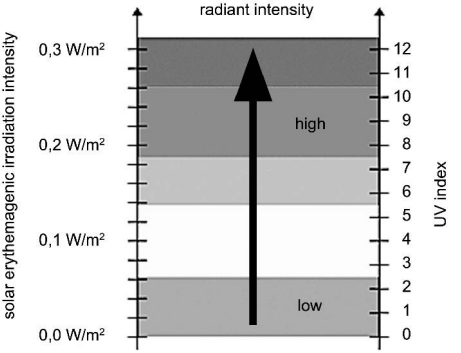
bined with other spectral ranges, as a trigger for the direct pigmentation (melanin colouring). Damages to the connective tissue and premature skin ageing are promoted by too much UVA radiation.

UVB Radiation:
The short-wave UV range (less than 313 nm) can cause irreversible damages. All spectral characteristic functions that can have unfavourable effects on the human skin are summarised in the CIE recommendation. This recommendation is described in DIN 5050 and regarded as guideline. A popular measure for the 'sunburn sensitivity' is, for example, the UV index 'UVI' provided by the German weather service. The measuring results provide, directly or in comparison with other spectral ranges, information that is of medical or biological relevance.

UV index
The UV index is an internationally specified measurable variable. The erythemagenic component (i.e. the type and level causing sunburn) in the UV irradiance E(λ) incidental on a horizontal surface is integrated in duly weighted form in the erythema reference $s_{er}(\lambda)$ defined by the CIE (Commission Internationale de l'Eclairage).

$$E_{CIE} = \int s_{er}(\lambda) \cdot E(\lambda)\, d\lambda$$

This quantity is further divided by 25 mW/m² to obtain a dimensionless variable, namely the UV index.
The UV index is used in assessing the risks of exposure and the need to issue public health warnings; one takes the highest 30-minute average per day.
The harmful component in irradiance depends very much on wavelength; the weighting in ser(λ) takes due account of this.



Irradiance, physical units

0.0001 W/m²	0.00001 mW/cm²	0.01 µW/cm²
0.001 W/m²	0.000.1 mW/cm²	0.1 µW/cm²
0.01 W/m²	0.001 mW/cm²	1 µW/cm²
0.1 W/m²	0.01 mW/cm²	10 µW/cm²
1 W/m²	0.1 mW/cm²	100 µW/cm²
10 W/m²	1 mW/cm²	1000 µW/cm²
100 W/m²	10 mW/cm²	10000 µW/cm²
1000 W/m²	100 mW/cm²	100000 µW/cm²
10000 W/m²	1000 mW/cm²	1000000 µW/cm²

W/m² = Watts per square meter, mW/cm² = Milliwatts per square centimeter,
µW/cm² = Microwatts per square centimeter

3.8.2 Optical probes for indoor applications

ALMEMO® optical probes for indoor applications
The ALMEMO® range of sensors includes probes for various spectral ranges.

- Illuminance (V-lambda)
- UV-A, UV-B, UV-C
- Global radiation
- IR
- Quantum (photosynthesis)

These probes comprise a robust anodized aluminum housing with a built-in plug on the side for the ALMEMO® connecting cable. The radiation probes are suitable for indoor applications. Variants protected against damp are available as an option (not for UV probes).

Handling

The measuring surface (diffuser) must never be dirtied or scratched. The sensor must never be opened. If this instruction is ignored correct calibration can no longer be guaranteed.

Calibration

Our optical sensors are calibrated before leaving our factory. The calibration values are stored and locked as automatic correction values in the ALMEMO® connector.

These calibration values must not be altered.

Dark correction

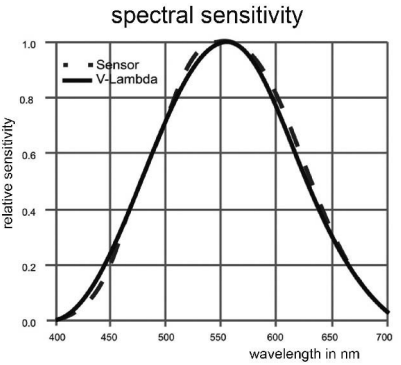
In the event of a dark signal occurring the sensor should be corrected again by means of a dark adjustment in the function BASE VALUE.
To do this, proceed as follows :

1 Set the locking mode to "4".
2 Place the sensor into a dark room (radiation, illuminance = "0").
3 Perform zero-point adjustment. (Press keys ENTER, DELETE)
4. Set the locking mode back to "5".

When entering programming values please comply with the operating instructions for your measuring instrument.

3.8.2.1 Illuminance probe FLA 623 VL (Lux probe)

- Measuring the illuminance (V-lambda radiation)
- For evaluating lighting conditions, e.g. in the workplace
- The sensor complies with device class B as per DIN 5032.



V-lambda radiation describes the spectral range of visible light; this corresponds to the sensitivity of the human eye. The measured value is the level of perceived brightness.
The wavelength range starts at the end of UV at approx. 400 nm and goes up to the beginning of IR at approx. 720 nm - with the working maximum at around 550 nm.

ALMEMO® illuminance probe FLA 623 VL

For direct connection to ALMEMO® devices the illuminance probe is provided as standard with a plug-in ALMEMO® connecting cable (length 2 meters, options for 5 and 10 meters).
Important parameters, e.g. measuring range, scaling, and physical units, are stored in the ALMEMO® plug on the connecting cable; the sensor's output voltage (0 to 2 V) can thus be displayed via 2 measuring channels with different resolutions as illuminance in lx (lux) and in klx (kilolux).

Measuring channel	ALMEMO® measuring range	Resolution
Channel 1	Illuminance 0 to approx. 20000 lx	1 lx
Channel 2	Illuminance 0 to approx. 170.00 klx	0.01 klx

Type / Order no.	Standard accessories
FLA623VL	including factory test certificate

Options	Order no.
ALMEMO® connecting cable, Length = 5 meters	OA9623L05
ALMEMO® connecting cable, Length = 10 meters	OA9623L10
Probe, protected against damp Diffuser, opal glass (instead of PTFE), silicone-sealed	OA9623W

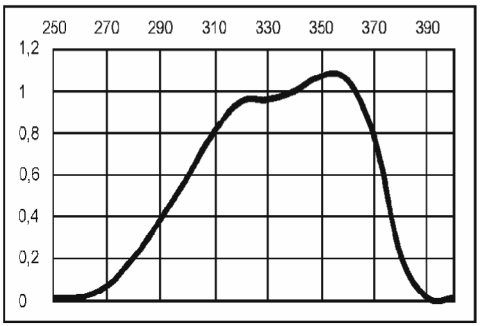
Technical data

Spectral sensitivity	380 to 720 nm, maximum approx. 555 nm
Diffuser	PTFE
Cosine correction	Error f2 <3 %
Linearity	<1 %
Absolute error	<5 %
V-lambda adaptation	<3 %
Nominal temperature	+22 °C ±2 K
Operating temperature	-20 to +60 °C
Signal output	0 to 2 V
Duty cycle	<1 second
Power supply	via ALMEMO® plug (5 to 15 VDC)
Electrical connections	Built-in plug on the side
Connecting cable	Plug-in PVC cable with ALMEMO® plug
Housing	Aluminum, black, anodized
Fixture	2 screws M2 in base plate
Dimensions	Ø 33 mm, height approx. 29 mm
Weight	approx. 50 g (without cable)

3.8.2.2 UV probe FLA 613 UV

Measuring principle

The measuring principle is based on a GaP diode (gallium phosphide) with a correction filter for filtering the UV range and a diffuser for adapting to the cosine characteristic (to measure irradiance). The photo-electric current is converted by means of an integrated transimpedance amplifier into a voltage signal.



Spectral evaluation

Spectral evaluation covers the spectral range 250 to 400 nm (20% of peak sensitivity). Peak wavelength is 366 nm. Calibration is carried out in W/m2 at 366 nm.

ALMEMO® UV probe FLA 613 UV

For direct connection to ALMEMO® devices the UV probe is provided as standard with an ALMEMO® connecting cable (length 1.5 meters). Important parameters, e.g. measuring range, scaling, and physical units, are stored in the ALMEMO® plug on the connecting cable; the sensor's output voltage (ca. 3 mV / W/m²) can thus be displayed via 2 measuring channels with different resolutions as UV irradiance in W/m².

Measuring channel	ALMEMO® measuring range	Resolution
Channel 1	Irradiance 0 to 26.000 W/m^2	0.1 W/m^2
Channel 2	Irradiance 0 to 87.00 W/m^2	0.01 W/m^2

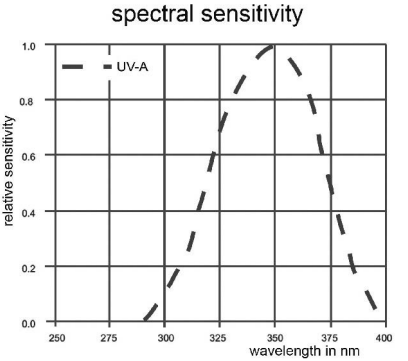
Type / Order no.	Standard accessories
FLA613UV	including factory calibration certificate

Technical data

Spectral sensitivity	250 to 400 nm maximum approx. 366 nm
Supply voltage	+5 V
Output voltage	approx. 3 mV / W/m^2
Accuracy	5% of measured value
Accuracy of calibration	5% (at +24 °C and approx. 0.500 W/m²)
Detection limit	approx. 0.2 mW/m^2 at 366 nm
Temperature coefficient	0.2% / °C
Operating temperature	0 to +60 °C
Storage temperature	-10 to +80 °C
Humidity range	10 to 90% RH (non-condensing)
Protection class	IP62
Dimensions	Ø 37 mm, height 19.5 mm, diffuser 15 mm

3.8.2.3 UV-A probe FLA 623 UVA

- This probe measures irradiance in the UV-A range.
- It measures long-wave UV radiation (bronzing effect on human skin).
- Its spectral sensitivity is weighted according to global solar radiation.



ALMEMO® UV-A probe FLA 623 UVA

For direct connection to ALMEMO® devices the UV-A probe is provided as standard with a plug-in ALMEMO® connecting cable (length 2 meters, options for 5 and 10 meters). Important parameters, e.g. measuring range, scaling, and physical units, are stored in the ALMEMO® plug on the connecting cable; the sensor's output voltage (0 to 2 V) is thus displayed as UV-A irradiance in W/m².

Measuring channel	ALMEMO® measuring range	Resolution
Channel 1	Irradiance 0 to approx. 50 W/m²	0.01 W/m²

Type / Order no.	Standard accessories
FLA623UVA	including factory test certificate

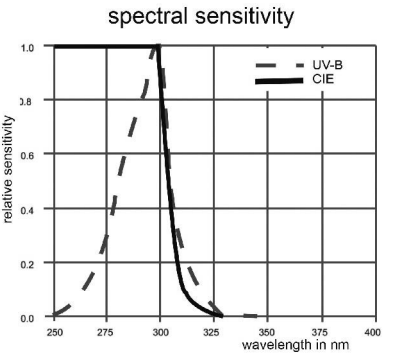
Options	Order no.
ALMEMO® connecting cable, length = 5 meters	OA9623L05
ALMEMO® connecting cable, length = 10 meters	OA9623L10

Technical data

Spectral sensitivity	250 to 400 nm, maximum approx. 335 nm
Diffuser	PTFE
Cosine correction	Error f2 <3 %
Linearity	< 1 %
Absolute error	< 10 %
Nominal temperature	+22 °C ±2 K
Operating temperature	-20 to +60 °C
Signal output	0 to 2 V
Duty cycle	<1 second
Power supply	via ALMEMO® plug 5 to 15 VDC
Electrical connection	Built-in plug, on the side
Connecting cable	Plug-in PVC cable with ALMEMO® plug
Housing	Aluminum, black, anodized
Fixture	2 screws M2 in base plate
Dimensions	Ø 33 mm, height approx. 29 mm
Weight	approx. 50 g (without cable)

3.8.2.4 UV-B probe FLA 623 UVB

- This probe measures irradiance in the UV-B range.
- It measures short-wave UV-B radiation.
- Its spectral sensitivity is weighted according to the erythemagenic component in global solar radiation (causing sunburn) as per CIE recommendation (Commission Internationale de l'Eclairage).
  The UV index can be calculated.



ALMEMO® UV-B probe FLA 623 UVB
For direct connection to ALMEMO® devices the UV-B probe is provided as standard with a plug-in ALMEMO® connecting cable (length 2 meters, options for 5 and 10 meters). Important parameters, e.g. measuring range, scaling, and physical units, are stored in the ALMEMO® plug on the connecting cable; the sensor's output voltage (0 to 2 V) is thus displayed as UV-B irradiance in W/m².

Measuring channel	ALMEMO® measuring range	Resolution
Channel 1	Irradiance 0 to approx. 5 W/m²	0.001 W/m²

Type / Order no.	Standard accessories
FLA623UVB	including factory test certificate

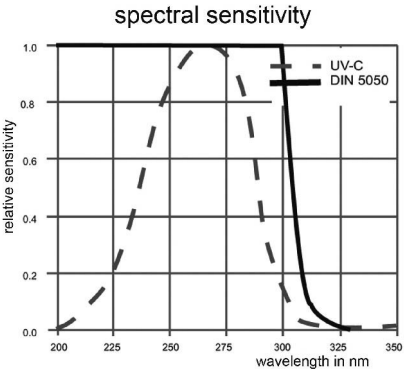
Options	Order no.
ALMEMO® connecting cable, length = 5 meters	OA9623L05
ALMEMO® connecting cable, length = 10 meters	OA9623L10

Technical data

Spectral sensitivity	265 to 315 nm maximum approx. 297 nm
Diffuser	PTFE
Cosine correction	Error f2 <3 %
Linearity	< 1 %
Absolute error	< 10 %
Nominal temperature	+22 °C ±2 K
Operating temperature	-20 to +60 °C
Signal output	0 to 2 V
Duty cycle	<1 second
Power supply	via ALMEMO® plug 5 to 15 VDC
Electrical connections	Built-in plug, on the side
Connecting cable	Plug-in PVC cable with ALMEMO® plug
Housing	Aluminum, black, anodized
Fixture	2 screws M2 in base plate
Dimensions	Ø 33 mm, height approx. 29 mm
Weight	approx. 50 g (without cable)

3.8.2.5 UV-C probe FLA 623 UVC

- This probe measures irradiance in the UV-C range
- It measures UV-C radiation (e.g. Hg line at 256 nm).
- This probe can be used inter alia in water disinfection units.



ALMEMO® UV-C probe FLA 623 UVC

For direct connection to ALMEMO® devices the UV-C probe is provided as standard with a plug-in ALMEMO® connecting cable (length 2 meters, options for 5 and 10 meters). Important parameters, e.g. measuring range, scaling, and physical units, are stored in the ALMEMO® plug on the connecting cable; the sensor's output voltage (0 to 2 V) is thus displayed as UV-C irradiance in mW/m².

Measuring channel	ALMEMO® measuring range	Resolution
Channel 1	Irradiance 0 to approx. 1990 mW/m²	0,1 W/m²

Type / Order no.	Standard accessories
FLA623UVC	including factory test certificate

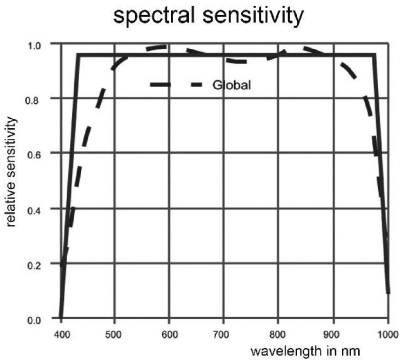
Options	Order no.
ALMEMO® connecting cable, length = 5 meters	OA9623L05
ALMEMO® connecting cable, length = 10 meters	OA9623L10

Technical data

Spectral sensitivity	220 to 280 nm maximum approx. 265 nm
Diffuser	PTFE
Cosine correction	Error f2 <3 %
Linearity	< 1 %
Absolute error	< 10 %
Nominal temperature	+22 °C ±2 K
Operating temperature	-20 to +60 °C
Signal output	0 to 2 V
Duty cycle	<1 second
Power supply	via ALMEMO® plug 5 to 15 VDC
Electrical connections	Built-in plug, on the side
Connecting cable	Plug-in PVC cable with ALMEMO® plug
Housing	Aluminum, black, anodized
Fixture	2 screws M2 in base plate
Dimensions	Ø 33 mm, height approx. 29 mm
Weight	approx. 50 g (without cable)

3.8.2.6 Global radiation probe FLA 623 GS

- This probe measures irradiance in the solar spectrum in the visible range and in the short-wave IR range.
- It measures global radiation (comprising both direct and diffused solar radiation).



ALMEMO® global radiation probe FLA 623 GS

For direct connection to ALMEMO® devices the global radiation probe is provided as standard with a plug-in ALMEMO® connecting cable (length 2 meters, options for 5 and 10 meters). Important parameters, e.g. measuring range, scaling, and physical units, are stored in the ALMEMO® plug on the connecting cable; the sensor's output voltage (0 to 2 V) is thus displayed as global radiation in W/m².

Measuring channel	ALMEMO® measuring range	Resolution
Channel 1	Global radiation 0 to approx. 1300 W/m²	0,1 W/m²

Type / Order no.	Standard accessories
FLA623GS	including factory test certificate

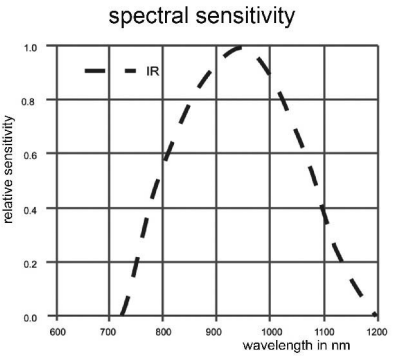
Options	Order no.
ALMEMO® connecting cable, length = 5 meters	OA9623L05
ALMEMO® connecting cable, length = 10 meters	OA9623L10
Probe, protected against damp Diffuser, opal glass (instead of PTFE), silicone-sealed	OA9623W

Technical data

Spectral sensitivity	400 to 1100 nm, maximum approx. 780 nm
Diffuser	PTFE
Cosine correction	Error f2 <3 %
Linearity	< 1 %
Absolute error	< 10 %
Nominal temperature	+22 °C ±2 K
Operating temperature	-20 to +60 °C
Signal output	0 to 2 V
Duty cycle	<1 second
Power supply	via ALMEMO® plug 5 to 15 VDC
Electrical connections	Built-in plug, on the side
Connecting cable	Plug-in PVC cable with ALMEMO® plug
Housing	Aluminum, black, anodized
Fixture	2 screws M2 in base plate
Dimensions	Ø 33 mm, height approx. 29 mm
Weight	approx. 50 g (without cable)

3.8.2.7 Infra-red probe FLA 623 IR

- This probe measures irradiance in the solar spectrum in the short-wave IR range (excluding the visible range).
- Global radiation comprises both direct and diffused solar radiation.



ALMEMO® infra-red probe FLA 623 IR

For direct connection to ALMEMO® devices the IR probe is provided as standard with a plug-in ALMEMO® connecting cable (length 2 meters, options for 5 and 10 meters). Important parameters, e.g. measuring range, scaling, and physical units, are stored in the ALMEMO® plug on the connecting cable; the sensor's output voltage (0 to 2 V) is thus displayed as IR radiation in W/m².

Measuring channel	ALMEMO® measuring range	Resolution
Channel 1	Infrared radiation 0 to approx. 400 W/m^2	0.01 W/m²

Type / Order no.	Standard accessories
FLA623IR	including factory test certificate

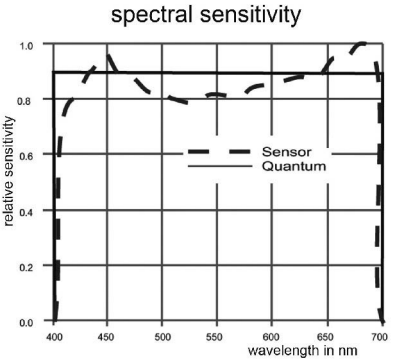
Options	Order no.
ALMEMO® connecting cable, length = 5 meters	OA9623L05
ALMEMO® connecting cable, length = 10 meters	OA9623L10
Probe, protected against damp Diffuser, opal glass (instead of PTFE), silicone-sealed	OA9623W

Technical data

Spectral sensitivity	800 to 1100 nm, maximum approx. 950 nm
Diffuser	PTFE
Cosine correction	Error f2 <3 %
Linearity	< 1 %
Absolute error	< 10 %
Nominal temperature	+22 °C ±2 K
Operating temperature	-20 to +60 °C
Signal output	0 to 2 V
Duty cycle	<1 second
Power supply	via ALMEMO® plug 5 to 15 VDC
Electrical connections	Built-in plug, on the side
Connecting cable	Plug-in PVC cable with ALMEMO® plug
Housing	Aluminum, black, anodized
Fixture	2 screws M2 in base plate
Dimensions	Ø 33 mm, height approx. 29 mm
Weight	approx. 50 g (without cable)

3.8.2.8 Quantum probe FLA 623 PS

- This probe measures the visible light absorbed by the chlorophyll in plants in the course of photosynthesis.
- It measures the photosynthetically active radiation (PAR) in the spectral range specified.
- It is used to assess the conditions in which plants develop in open field and greenhouse cultivation.



ALMEMO® quantum probe FLA 623 PS
For direct connection to ALMEMO® devices the quantum probe is provided as standard with a plug-in ALMEMO® connecting cable (length 2 meters, options for 5 and 10 meters). Important parameters, e.g. measuring range, scaling, and physical units, are stored in the ALMEMO® plug on the connecting cable; the sensor's output voltage (0 to 2 V) is thus displayed as ?*? photosynthetically active radiation (PAR) in µmol/m²s.

Measuring channel	ALMEMO® measuring range	Resolution
Channel 1	Photosynthetically active radiation (PAR) 0 to approx. 3000 µmol/m²s	0.1 µmol/m²s

Type / Order no.	Standard accessories
FLA623PS	including factory test certificate

Options	Order no.
ALMEMO® connecting cable, length = 5 meters	OA9623L05
ALMEMO® connecting cable, length = 10 meters	OA9623L10
Probe, protected against damp Diffuser, opal glass (instead of PTFE), silicone-sealed	OA9623W

Technical data

Spectral sensitivity	380 to 720 nm maximum approx. 420 and 700 nm
Diffuser	PTFE
Cosine correction	Error f2 <3 %
Linearity	< 1 %
Absolute error	< 10 %
Nominal temperature	+22 °C ±2 K
Operating temperature	-20 to +60 °C
Signal output	0 to 2 V
Duty cycle	<1 second
Power supply	via ALMEMO® plug 5 to 15 VDC
Electrical connections	Built-in plug, on the side
Connecting cable	Plug-in PVC cable with ALMEMO® plug
Housing	Aluminum, black, anodized
Fixture	2 screws M2 in base plate
Dimensions	Ø 33 mm, height approx. 29 mm
Weight	approx. 50 g (without cable)

3.8.3 Optical probes for outdoor applications

Variants
The ALMEMO® range of sensors includes probes for various spectral ranges.

- Illuminance (V-lambda)
- UV-A, UV-B
- Global radiation

These probes comprise an anodized aluminum housing, with UV-transparent plastic dome. The system is protected against rain and splashing water. It also contains a desiccant to prevent condensation forming on the inside of the dome.

Uses
These probes are specially designed for measuring operations outdoors :

- medical, biological, and climate research
- meteorological information and weather forecasting
- agriculture
- general public information systems

Setting up and using
The plastic dome is highly sensitive as regards impact and scratches. When mounting these probes in position extreme caution is required.

The terms of warranty do not cover breakage of glass parts nor any damage attributable to careless or unworkmanlike handling. The sensor must never be opened. If this instruction is ignored correct calibration can no longer be guaranteed and the terms of warranty cease to apply.

The probe must be screwed by means of two M4 screws onto a suitable fixture (e.g. aluminum box section). It should be aligned as closely as possible in a horizontal position. As regards location the probe should be exposed to direct sunlight as far as possible all day long. Around the probe the horizon must be as free as possible in all directions. Setting up the probe in the vicinity of buildings or trees may falsify measured values.

Calibration
Our optical sensors are calibrated before leaving our factory. The calibration values are stored and locked as automatic correction values in the ALMEMO® connector.

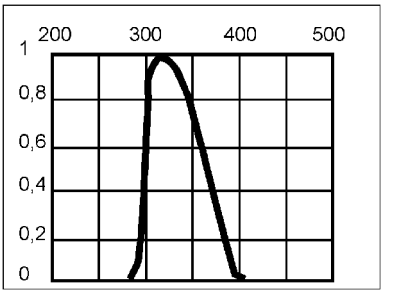
These calibration values must not be altered.

Routine servicing and maintenance

The electronics and optics part of the probe is maintenance-free but should be recalibrated at regular intervals. The plastic dome and the housing should be cleaned - depending on conditions on site - at least twice per year with a soft, moist cloth - or in the event of more severe soiling by means of clear water, if necessary with a little washing-up liquid.

Liquid cleansing agents containing abrasive or scouring additives or solvents must NEVER be used to clean the outside surfaces.

3.8.3.1 UV-A probe FLA 613 UVA



- This probe measures irradiance in the UV-A range.
- Its global weighting is for 315 to 400 nm.

ALMEMO® UV-A probe FLA 613 UVA

For direct connection to ALMEMO® devices the UV-A probe is provided as standard with a plug-in ALMEMO® connecting cable (length approx. 1.5 meters, other lengths available on request). Important parameters, e.g. measuring range, scaling, and physical units, are stored in the ALMEMO® plug on the connecting cable; the sensor's output voltage (0 to 2 V) is thus displayed as UV-A irradiance in µW/cm².

Measuring channel	ALMEMO® measuring range	Resolution
Channel 1	Irradiance 0 to approx. 3 mW/cm²	1 µW/cm²

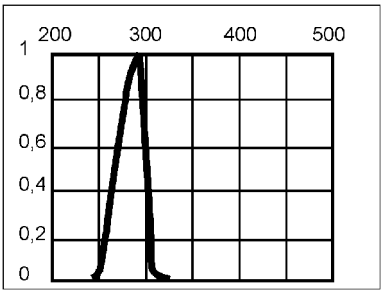
Type / Order no.	Standard accessories
FLA613UVA	including test report

Technical data

Spectral sensitivity	310 to 400 nm
Maximum spectral sensitivity	335 nm
Signal output	0 to 2 V
Power supply	+5 to +15 V via ALMEMO® plug
Fixture	2 screws M4 in base plate
Cable routing	downwards
Housing	anodized aluminum
Diffuser	PTFE
Dome	PMMA (transparent to UV)
Cosine correction	Error f2 <3%
Linearity	< 1%
Absolute error	< 10%
Residual voltage	(E = 0) <10 mV
Nominal temperature	+22 ±2 °C
Operating temperature	–20 to +60 °C
Dimensions	Housing height 55 mm, Dome Ø 80 mm, height 40 mm
Weight	approx. 300 g

3.8.3.2 UV-B probe FLA 613 UVB

- This probe measures irradiance in the UV-B range.
- The sensor's relative spectral sensitivity is specially adapted to the erythema curve as per DIN 5050.
- The erythema sensor measures those components in this spectral range likely to cause damage to the human skin.



ALMEMO® UV-B probe FLA 613 UVB

For direct connection to ALMEMO® devices the UV-B probe is provided as standard with a plug-in ALMEMO® connecting cable (length approx. 1.5 meters, other lengths available on request). Important parameters, e.g. measuring range, scaling, and physical units, are stored in the ALMEMO® plug on the connecting cable; the sensor's output voltage (0 to 2 V) is thus displayed as UV-B irradiance in µW/cm².

Measuring channel	ALMEMO® measuring range	Resolution
Channel 1	Irradiance 0 to approx. 50 µW/cm²	0.01 µW/cm²

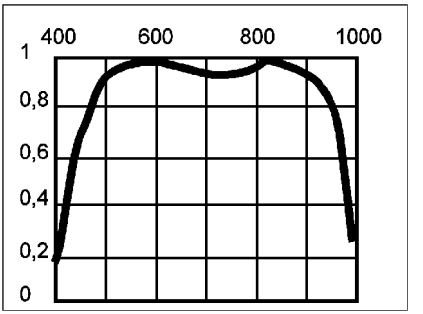
Type / Order no.	Standard accessories
FLA613UVB	including test report

Technical data

Spectral sensitivity	265 to 315 nm
Maximum spectral sensitivity	297 nm
Operating temperature	-20 to +60 °C
Signal output	0 to 2 V
Power supply	+5 to +15 V via ALMEMO® plug
Fixture	2 screws M4 in base plate
Cable routing	downwards
Housing	anodized aluminum
Diffuser	PTFE
Dome	PMMA (transparent to UV)
Cosine correction	Error f2 <3%
Linearity	< 1%
Absolute error	< 10%
Residual voltage	(E = 0) <10 mV
Nominal temperature	+22 ±2 °C
Operating temperature	–20 to +60 °C
Dimensions	Housing height 55 mm Dome Ø 80 mm, height 40 mm
Weight	approx. 300 g

3.8.3.3 Global radiation probe FLA 613 GS

- This probe measures irradiance in the solar spectrum.
- It detects approx. 90 percent of the solar spectrum in the range 400 to 1100 nm, i.e. in the range of visible light and part of the short-wave IR range.
- It measures global radiation (comprising both direct and diffused solar radiation).



ALMEMO® global radiation probe FLA 613 GS
For direct connection to ALMEMO® devices the global radiation probe is provided as standard with a plug-in ALMEMO® connecting cable (length 1.5 meters, option for 5 meters). Important parameters, e.g. measuring range, scaling, and physical units, are stored in the ALMEMO® plug on the connecting cable; the sensor's output voltage (0 to 2 V) is thus displayed as global radiation in W/m².

Measuring channel	ALMEMO® measuring range	Resolution
Channel 1	Irradiance 0 to approx. 1200 W/cm²	1 W/cm^2

Type / Order no.	Standard accessories
FLA613GS	including test report

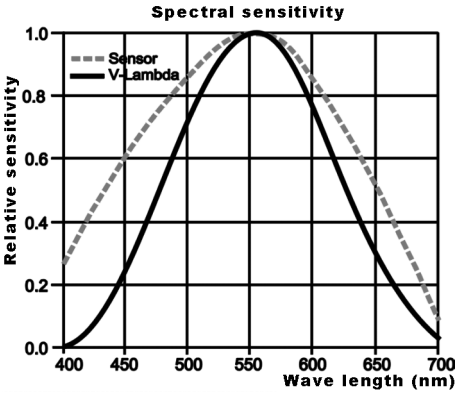
Options	Order no.
ALMEMO® connecting cable, length = 5 meters	OA9613K05

Spectral sensitivity	400 to 1100 nm
Maximum spectral sensitivity	780 nm
Signal output	0 to 2 V
Power supply	+5 to +15 V via ALMEMO® plug
Fixture	2 screws M4 in base plate
Cable routing	downwards
Housing	anodized aluminum
Diffuser	PTFE
Dome	PMMA (polymethyl methacrylate, acrylic)
Cosine correction	Error f2 <3%
Linearity	< 1%
Absolute error	< 10 %
Residual voltage	(E = 0) <10 mV

Nominal temperature	+22 ±2 °C
Operating temperature	–20 to +60 °C
Dimensions	Housing height 55 mm, Dome Ø 80 mm, height 40 mm
Weight	approx. 300 g

3.8.3.4 Irradiance probe FLA 613 VLM

- V-lambda sensors are used in numerous sectors - in medical and biological research, in climate research. in meteorological information and weather forecasting, in agriculture, in the automotive industry, and for measuring artificial lighting. The spectral sensitivity of the receiver corresponds approximately to that of the human eye.



V lambda radiation describes the spectral range of visible light; this corresponds to the sensitivity of the human eye. The measured value is the level of perceived brightness.
The wavelength range starts at the end of UV at approx. 400 nm and goes up to the beginning of IR at approx. 720 nm - with the working maximum at around 550 nm.
Irradiance measured in W/m2 can be converted directly into illuminance in "lux". Measurement in this range plays a very important role in workplace design and organization and in lighting projects.

ALMEMO® irradiance probe FLA 613 VLM
For direct connection to ALMEMO® devices the irradiance probe is provided as standard with a plug-in ALMEMO® connecting cable (length 1.5 meters). Important parameters, e.g. measuring range, scaling, and physical units, are stored in the ALMEMO® plug on the connecting cable; the sensor's output voltage (0 to 2 V) is thus displayed as irradiance in W/m².

Measuring channel	ALMEMO® measuring range	Resolution
Channel 1	Illuminance 0 to 170 klux	0.01 klux
Channel 2	Irradiance 0 to approx. 250 W/cm²	0.01 W/cm²

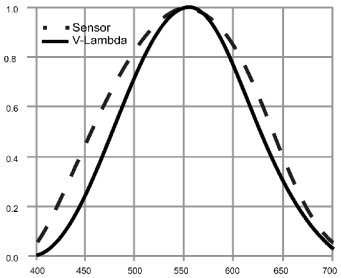
Type / Order no.	Standard accessories
FLA613VLM	including test report

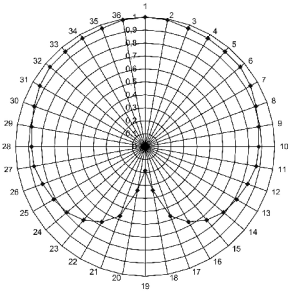
Technical data

Spectral sensitivity	360 to 760 nm
Maximum spectral sensitivity	550 nm
Signal output	0 to 2 V
Power supply	+5 to +15 V
Fixture	2 screws M4 in base plate
Cable routing	downwards
Housing	anodized aluminum
Diffuser	PTFE
Dome	PMMA
Cosine correction	Error f2 <3%
Linearity	< 1%
Absolute error	< 10 %
Residual voltage	(E = 0) <10 mV
Nominal temperature	+22 ±2 °C
Operating temperature	–20 to +60 °C
Dimensions	Housing height 55 mm Dome Ø 80 mm, height 40 mm
Weight	approx. 300 g

3.8.3.5 Illuminance probe - with spherical head FL A613 VLK

- This probe can perform measuring operations in any direction - thanks to its spherical head.
- Its housing is weather-proof aluminum; its spherical head is made from plastic.
- It is suitable for universal use, including photostability tests - in compliance with various international standards and ICH guidelines (International Conference on Harmonization).
- The probe's spectral range corresponds to the spectral sensitivity of the human eye (V-lambda radiation).





ALMEMO® illuminance probe - with spherical head FL A613 VLK
For direct connection to ALMEMO® devices the illuminance probe is provided as standard with an ALMEMO® connecting cable (length 1.5 meters). Important parameters, e.g. measuring range, scaling, and physical units, are stored in the ALMEMO® plug on the connecting cable; the sensor's output voltage (0 to 2 V) is thus displayed as illuminance in klux.

Measuring channel	ALMEMO® measuring range	Resolution
Channel 1	Illuminance 0 to 50 klux	0.01 klux

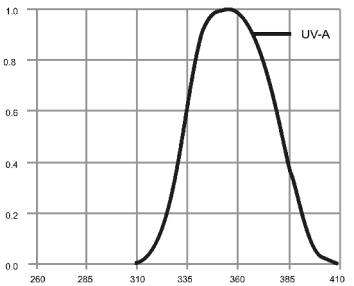
Type / Order no.	Standard accessories
FLA613VLK	including test report

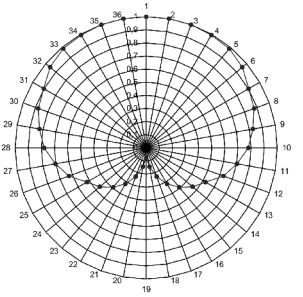
Technical data

Spectral sensitivity	360 to 760 nm
Maximum spectral sensitivity	555 nm
Signal output	0 to 2 V
Duty cycle	<1 second
Power supply	via ALMEMO® plug +5 to +15 V
Fixture	2 screws M4 in base plate
Cable routing	at side
Housing	anodized aluminum
Diffuser	Plastic
Sphere	Plastic
Directional characteristics	see diagram
Linearity	< 1%
Absolute error	< 10 %
Nominal temperature	+22 ±2 °C
Operating temperature	–20 to +60 °C
Dimensions	Sphere Ø 40 mm, Overall height76 mm
Weight	approx. 100 g

3.8.3.6 UV-A probe - with spherical head FLA 613 UVAK

- This probe can perform measuring operations in any direction - thanks to its spherical head.
- Its housing is weather-proof aluminum; its spherical head is made from plastic.
- It is suitable for universal use, including photostability tests - in compliance with various international standards and ICH guidelines (International Conference on Harmonization).
- This probe measures irradiance in the UV-A range.





ALMEMO® UV-A probe - with spherical head FLA 613 UVAK
For direct connection to ALMEMO® devices the UV-A probe is provided as standard with an ALMEMO® connecting cable (length 1.5 meters). Important parameters, e.g. measuring range, scaling, and physical units, are stored in the ALMEMO® plug on the connecting cable; the sensor's output voltage (0 to 2 V) is thus displayed as UV-A irradiance in W/m².

Measuring channel	ALMEMO® measuring range	Resolution
Channel 1	Irradiance 0 to 50 W/m²	0.01 W/cm²

Type / Order no.	Standard accessories
FLA613UVAK	including test report

Technical data

Spectral sensitivity	310 to 400 nm
Maximum spectral sensitivity	335 nm
Signal output	0 to 2 V
Duty cycle	<1 second
Power supply	via ALMEMO® plug +5 to +15 V
Fixture	2 screws M4 in base plate
Cable routing	at side
Housing	anodized aluminum
Diffuser	Plastic
Sphere	Plastic
Directional characteristics	see diagram
Linearity	< 1%
Absolute error	< 10 %
Nominal temperature	+22 ±2 °C
Operating temperature	–20 to +60 °C
Dimensions	Sphere Ø 40 mm Overall height 76 mm
Weight	approx. 100 g

3.8.4 Optical probes - with especially high resolution

3.8.4.1 Luminance probe - DIN class B FL A603 LDM2

Variants

- This luminance probe has a 1° field of view, achromatically corrected, low scatter optics, and high quality V(λ) detector as per DIN class B.
- Thanks to its external sighting piece the user can, at a working distance of 1 meter, locate the measuring point exactly; this probe is thus particularly suitable for evaluating luminance in routine servicing and consistency tests.

Uses

- Luminescent surfaces - such as color monitors, alphanumeric displays, information signs, and luminous panels
- Reflective surfaces - such as walls and fittings in the workplace, projection screens, traffic signs, road markings, and airport taxiways

ALMEMO® luminance probe FL A603 LDM2

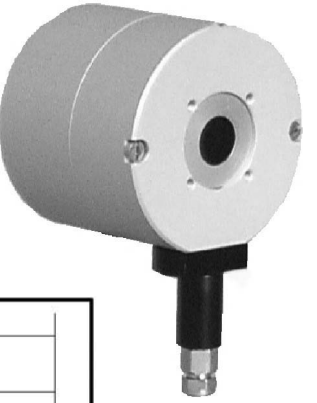
For direct connection to ALMEMO® devices the luminance probe is provided as standard with an ALMEMO® connecting cable (length approx. 1.5 meters, other lengths available on request). The measured values can be divided up onto various ALMEMO® measuring channels with different sensitivities. Important parameters, e.g. measuring range, scaling, and physical units, are stored in the ALMEMO® plug on the connecting cable; the sensor's output signal is thus displayed as luminance in candela/cm².

Type / Order no.	FLA603LDM2
Standard accessories	including factory calibration certificate in cd/m^2
ALMEMO® measuring channels	Channels 1 to 3
ALMEMO® measuring range	Luminance divided up 0.04 to 8333 cd/m^2
Resolution	Smallest resolution 10 mcd/m^2

Technical data

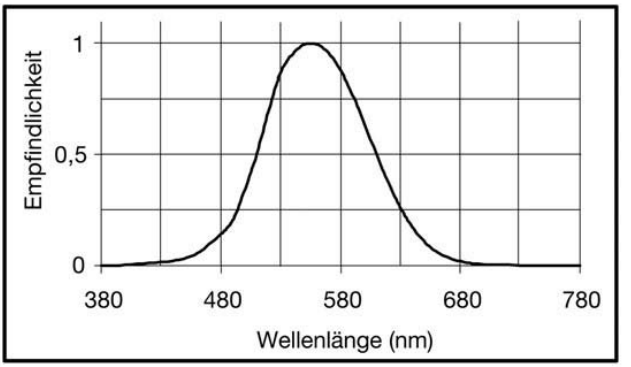
Field of view	1°
Field of view, diameter	approx. 30 mm at distance of 0.5 meters 6 approx. 40 mm at distance of 1 meter approx. 120 mm at distance of 5 meters
Sensitivity	approx. 30 pA/(cd/m^2)
Spectral adaptation	Adapted to approximately the photometric weighting of photopic (daytime) vision class B, better than 6%
Nominal temperature	+24 °C ±2 K
Operating temperature Storage temperature	0 to +60 °C -10 to +80 °C
Humidity range	10 to 90 % RH non-condensing
Measuring surface	21 x 21 mm at working distance of 1 meter
Compliance with standards	IEC 61223-2-5, DIN 5032-T.7
Dimensions	Ø 30 mm, length 150 mm

3.8.4.2 Luminous flux probe - DIN class B FLA 603 LSM4



Variants

- This high-quality probe measures luminous flux using an Ulbricht integrating sphere.
- Its interior is coated with meticulous precision with BaSO4 to ensure high diffuse reflectivity and spectrally neutral reflection.
- DIN class B



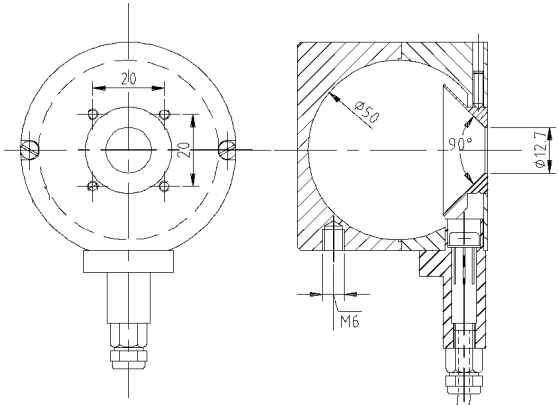
Uses

- It is suitable for cold light sources, lamps with high color temperatures, and virtually monochromatic radiation (LEDs).
- It is also used in endoscopes, optical fiber bundles, and light-emitting diodes.

ALMEMO® luminous flux probe FLA 603 LSM4

For direct connection to ALMEMO® devices the luminous flux probe is provided as standard with an ALMEMO® connecting cable (length approx. 2 meters, other lengths available on request). Important parameters, e.g. measuring range, scaling, and physical units, are stored in the ALMEMO® plug on the connecting cable; the sensor's output signal is thus displayed as luminous flux in lumen (lm).

Type / Order no.	FLA603LSM4
Standard accessories	including factory calibration certificate in lm
ALMEMO® measuring channels	Channel 1
ALMEMO® measuring range	Luminous flux 0.0002 to 50 lm
Resolution	Smallest resolution 0.001 lm



Dimensions

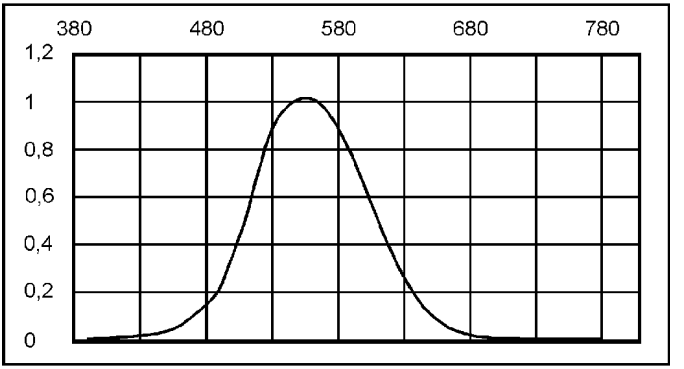
Technical data

Sensitivity	20 nA/lm
Acceptance angle	up to 90°
Accuracy	DIN class B
Nominal temperature	+24 °C ±2 K
Operating temperature Storage temperature	0 to +60 °C -10 to +80 °C
Humidity range	10 to 90 % RH non-condensing
Operating temperature	maximum 100 °C inside sphere
Inner diameter of sphere	50 mm
Measuring aperture	12.7 mm

3.8.4.3 Illuminance probe - DIN class B FLA 603 VLx

Variants

- This high-quality probe measures illuminance.
- DIN class B
- Spectral sensitivity is adapted to approximately the photometric weighting V(λ) of photopic (daytime) vision, class B, better than 5%.



Uses

- Lighting technology or in sunlight
- All applications for which DIN recommends using a class B light meter

ALMEMO® illuminance probe FLA 603 VLx

For direct connection to ALMEMO® devices the illuminance probe is provided as standard with an ALMEMO® connecting cable (length approx. 1.5 meters, other lengths available on request).

The measured values can be divided up onto various ALMEMO® measuring channels with different sensitivities. Important parameters, e.g. measuring range, scaling, and physical units, are stored in the ALMEMO® plug on the connecting cable; the sensor's output signal is thus displayed as illuminance in lux (lx).

Type / Order no.	FLA603VL2
Standard accessories	including factory calibration certificate in lx
ALMEMO® measuring channels	Channels 1 to 3
ALMEMO® measuring range	For ambient light Illuminance divided up 1 to 250000 lx
Resolution	Smallest resolution 0.01 lx

Type / Order no.	FLA603VL4
Standard accessories	including factory calibration certificate in lx
ALMEMO® measuring channels	Channels 1 to 2
ALMEMO® measuring range	For ambient light Illuminance divided up 1 to 250000 lx
Resolution	Smallest resolution 1 lx

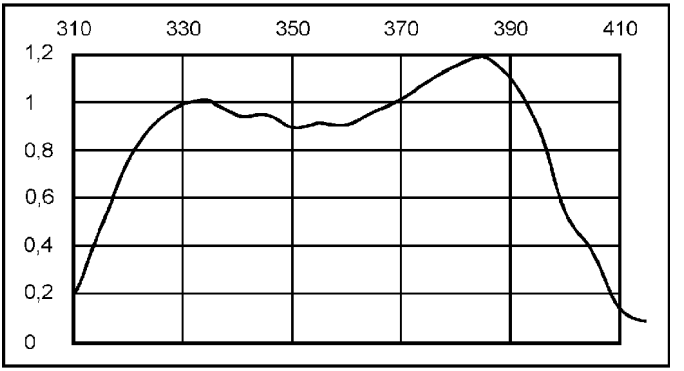
Technical data

Sensitivity	approx. 20 pA/lx
Spectral adaptation	Adapted to approximately the photometric weighting of photopic (daytime) vision class B, better than 5%
Maximum cosine deviation	class B, <3 %
Cosine diffuser	Ø 7 mm
Nominal temperature	+24 °C ±2 K
Operating temperature Storage temperature	0 to +60 °C -10 to +80 °C
Humidity range	10 to 90 % RH non-condensing
Dimensions	Ø 37 mm, height 20 mm

3.8.4.4 UV-A probe FLA603UV 12/14

Variants

- This high-quality probe measures UV-A radiation in the wavelength range 315 to 400 nm; its measured values are very precise.
- It meets the highest quality requirements - thanks to its geometry with a cosine diffuser instead of a simple diffuser screen.



Uses

- Examinations in industrial medicine FLA 603 UV12
- Measuring operations in industrial plants FLA 603 UV14

ALMEMO® UV-A probe FLA 603 UV 12/14

For direct connection to ALMEMO® devices the UV-A irradiance probe is provided as standard with an ALMEMO® connecting cable (length approx. 1.5 meters, other lengths available on request).

The measured values can be divided up onto various ALMEMO® measuring channels with different sensitivities. Important parameters, e.g. measuring range, scaling, and physical units, are stored in the ALMEMO® plug on the connecting cable; the sensor's output signal is thus displayed as irradiance in mW/cm^2.

Type / Order no.	FLA603UV12
Standard accessories	including factory calibration certificate in mW/cm^2
ALMEMO® measuring channels	Channels 1 to 3
ALMEMO® measuring range	Irradiance divided up 0.00002 to 5 mW/cm^2
Resolution	Smallest resolution 20 nW/cm^2

Type / Order no.	FLA603UV14
Standard accessories	including factory calibration certificate in mW/cm^2
ALMEMO® measuring channels	Channels 1 to 3
ALMEMO® measuring range	Irradiance divided up 0.0004 to 100 mW/cm^2
Resolution	Smallest resolution 100 nW/cm^2

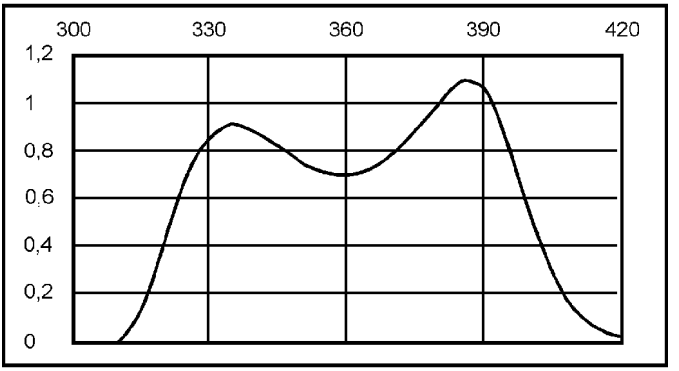
Technical data

Sensitivity	approx. 50 nA / (mW/cm^2)
Spectral sensitivity	315 to 400 nm
Maximum cosine deviation	< 5 %
Cosine diffuser	Ø 15 mm
Nominal temperature	+24 °C ±2 K
Operating temperature	0 to +60 °C
Storage temperature	-10 to +80 °C
Humidity range	10 to 90 % RH non-condensing
Dimensions	Ø 37 mm, height 32 mm

3.8.4.5 UV-A probe FLA 603 UV 22 / 24

Variants

- This high-quality probe measures UV-A radiation in the wavelength range 320 to 400 nm; its measured values are very precise.
- It meets the highest quality requirements - thanks to its geometry with a cosine diffuser instead of a simple diffuser screen.



Uses

- Examinations in medical therapy FLA 603 UV22
- Industrial measuring of UV radiation hardening FLA 603 UV24

ALMEMO® UV-A probe FLA 603 UV 22 / 24

For direct connection to ALMEMO® devices the UV-A irradiance probe is provided as standard with an ALMEMO® connecting cable (length approx. 1.5 meters, other lengths available on request).

The measured values can be divided up onto various ALMEMO® measuring channels with different sensitivities. Important parameters, e.g. measuring range, scaling, and physical units, are stored in the ALMEMO® plug on the connecting cable; the sensor's output signal is thus displayed as irradiance in mW/cm^2.

Type / Order no.	FLA603UV22
Standard accessories	including factory calibration certificate in mW/cm^2
ALMEMO® measuring channels	Channels 1 to 3
ALMEMO® measuring range	Irradiance divided up 0.00002 to 5 mW/cm^2
Resolution	Smallest resolution 20 nW/cm^2

Type / Order no.	FLA603UV24
Standard accessories	including factory calibration certificate in mW/cm^2
ALMEMO® measuring channels	Channels 1 to 3
ALMEMO® measuring range	Irradiance divided up 0.0004 to 100 mW/cm^2
Resolution	Smallest resolution 100 nW/cm^2

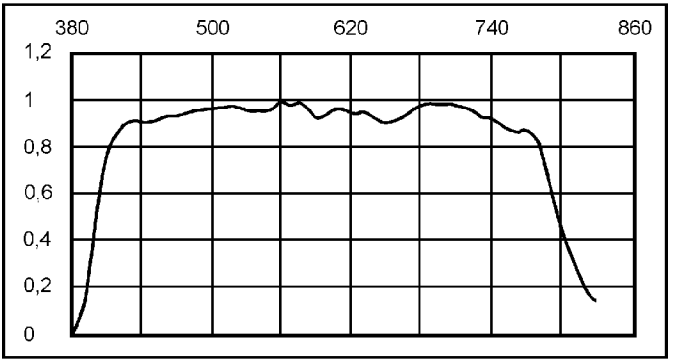
Technical data

Sensitivity	approx. 50 nA / (mW/cm^2)
Spectral sensitivity	320 to 400 nm
Maximum cosine deviation	< 5 %
Cosine diffuser	Ø 15 mm
Nominal temperature	+24 °C ±2 K
Operating temperature Storage temperature	0 to +60 °C -10 to +80 °C
Humidity range	10 to 90 % RH non-condensing
Dimensions	Ø 37 mm, height 32 mm

3.8.4.6 Radiometric probe FLA 603 RW4

Variants

- This high-quality radiometric probe measures irradiance in the visible wavelength range 400 to 800 nm; its measured values are very precise.
- It meets the highest quality requirements - thanks to its geometry with a cosine diffuser instead of a simple diffuser screen.



Uses

- Evaluation of LEDs and lasers

ALMEMO® radiometric probe FLA 603 RW4

For direct connection to ALMEMO® devices the radiometric probe is provided as standard with an ALMEMO® connecting cable (length approx. 1.5 meters, other lengths available on request).

The measured values can be divided up onto various ALMEMO® measuring channels with different sensitivities. Important parameters, e.g. measuring range, scaling, and physical units, are stored in the ALMEMO® plug on the connecting cable; the sensor's output signal is thus displayed as irradiance in mW/cm^2.

Type / Order no.	FLA603UV22
Standard accessories	including factory calibration certificate in mW/cm^2
ALMEMO® measuring channels	Channels 1 to 3
ALMEMO® measuring range	Irradiance divided up 0.00004 to 10 mW/cm^2
Resolution	Smallest resolution 10 nW/cm^2

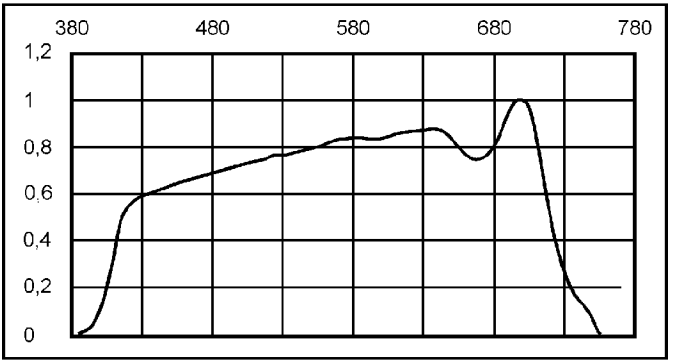
Technical data

Sensitivity	approx. 500 nA / (mW/cm^2)
Spectral sensitivity	400 to 800 nm
Maximum cosine deviation	< 5 %
Cosine diffuser	Ø 15 mm
Operating temperature Storage temperature	0 to +60 °C -10 to +80 °C
Humidity range	10 to 90% RH non-condensing
Dimensions	Ø 37 mm, height 50 mm

3.8.4.7 Photosynthesis probe FLA 603 PS4 / PS5

Variants

- This high-quality probe directly evaluates the photosynthetically active radiation (PAR) in the wavelength range 400 to 700 nm.
- It meets the highest quality requirements - thanks to its geometry with a cosine diffuser instead of a simple diffuser screen.
- The design is water-proof - thanks to the transparent quartz dome sealing the diffuser. (see Figure)



Uses

- Measuring the photosynthetically active radiation (PAR) levels
- Measuring low-level available light (e.g. dawn, dusk, artificial lighting)
  → FLA 603 PS4
- Measuring the conditions in greenhouses using daylight
  → FLA 603 PS5
- Water-proof design with transparent quartz dome (see Figure)
  → FLA 603 PS4 / 5WG

ALMEMO® photosynthesis probe FLA 603 PS4 / PS5

For direct connection to ALMEMO® devices the photosynthesis probe is provided as standard with an ALMEMO® connecting cable (length approx. 1.5 meters, other lengths available on request).

The measured values can be divided up onto various ALMEMO® measuring channels with different sensitivities. Important parameters, e.g. measuring range, scaling, and physical units, are stored in the ALMEMO® plug on the connecting cable; the sensor's output signal is thus displayed as PAR in µmol/(m²·s).

Type / Order no.	FLA603PS4
Standard accessories	including factory calibration certificate in µmol/(m^2·s)
ALMEMO® measuring channels	Channels 1 to 3
ALMEMO® measuring range	Photosynthetically active radiation (PAR) divided up 0.0002 to 5 µmol/(m^2·s)
Resolution	Smallest resolution 0.0002 µmol/(m^2·s)

Type / Order no.	FLA603PS5
Standard accessories	including factory calibration certificate in µmol/(m^2·s)
ALMEMO® measuring channels	Channels 1 to 3
ALMEMO® measuring range	Photosynthetically active radiation (PAR) divided up 0.2 µmol/(m^2·s) to 100 mmol/(m^2·s)
Resolution	Smallest resolution 0.1 µmol/(m^2·s)

Technical data

Sensitivity	approx. 100 nA/(mmol/m^2·s)
Spectral sensitivity	400 to 700 nm
Maximum cosine deviation	< 5 %
Cosine diffuser	Ø 15 mm
Operating temperature Storage temperature	0 to +60 °C -10 to +80 °C
Humidity range	10 to 90% RH non-condensing
Dimensions	Ø 37 mm, height 35 mm