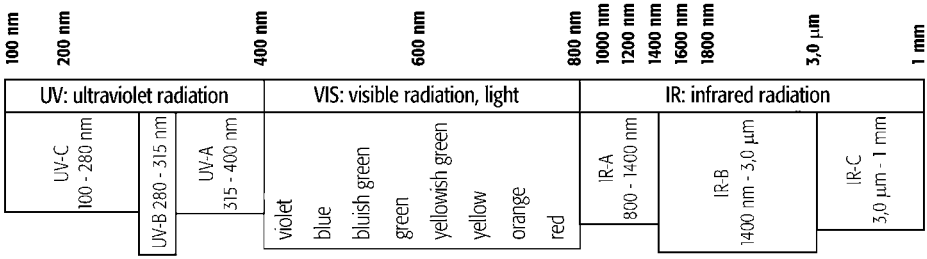
3.8 Probes for Measurement of Optical Variables

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

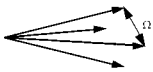
The quotient from the radiation capacity passing through (striking) a plane in a certain direction and the product of the passed solid angle and the projection of the plane to a plane surface, which is perpendicular to the examined direction. The radiancy is used for the evaluation of aperture radiators.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

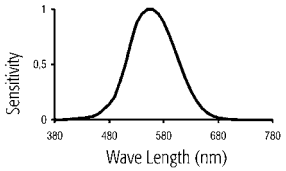
Lighting Engineering				Radiation Physics		
Variable	Symbol	Unit		Variable	Symbol	Unit
Light Flux	Φ_v	lm=cd·sr		Radiation Capacity	Φ_e	W
Luminous Intensity	I_v	cd		Radiant Intensity	I_e	W/sr
Luminance	L_v	cd/m		Radiancy	L_e	W/sr.m
Illuminance	E_v	lx=lm/m		Intensity of Irradiation	E_e	W/m
Light Quantity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

Spectral Valuation Function

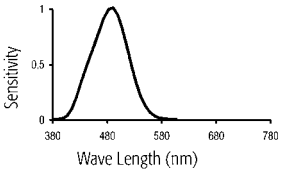
The relative spectral sensitivity of the human eye is specified with different functions for the light-adapted eye (photopic vision) or for the dark-adapted eye (scotopic vision). Due to the individual differences this data can only be considered for average values but is sufficient for most technical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

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(l), 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'(l) and can, with regard to the practical use, only be rarely found.



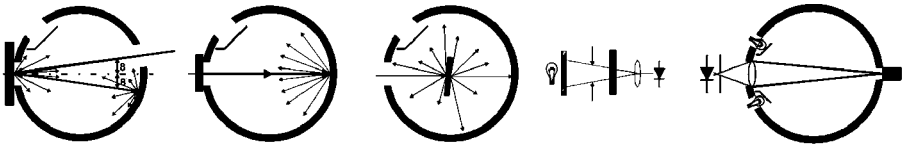
Photopic Action Function V(λ)
for photopic vision (rods, >10cd/m²)



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

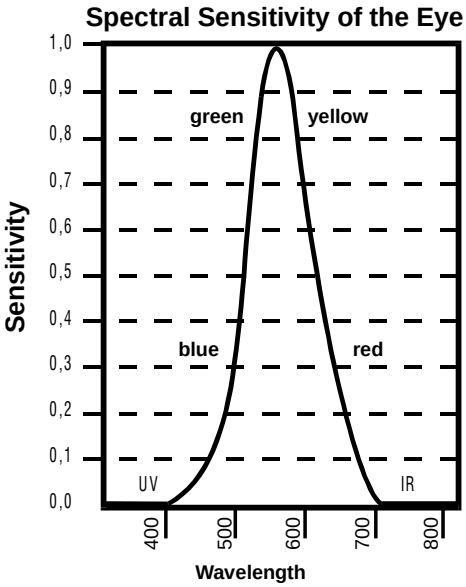
A detailed description of the metrological realisation would be beyond the scope of this catalogue.

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' rooms casualty	100 - 150 lux 500 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, combined 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.

3.8.2 Optical Probes for Indoor Applications

Design

The probe heads consist of an anodized aluminium housing. The system is dustproof and protected against dripping water. Therefore, the sensors are especially suitable for indoor measurements.

Handling

Contamination or scratching of the measurement surface (diffusor) must, under any circumstances, be absolutely avoided.

Never open the sensor, otherwise, the calibration of the sensor cannot be guaranteed.

Calibration

Our optical sensors are factory-calibrated. The calibration values are stored and locked as correction values in the ALMEMO® connector plug.

The calibration values must **not** be changed.

Dark Correction

A possible occurence of a dark signal should be subsequently corrected by a dark correction using the function BASE VALUE.

The following procedure must be followed:

1. Set the locking mode to '4'.
2. Place the sensor in a dark room.
   (Radiation/illumination intensity = '0')
3. Perform the zero point correction.
   (Press keys INPUT, DELETE)
4. Re-set the locking mode to '5'.

The operating instructions of the measuring instrument should also be followed when entering programming values.

3.8.2.1 Lux Probe

For illumination measurements the ALMEMO® sensor range provides the Lux Probe FL A613-VL.

The total measuring range is 0 to 260000 lux. The connector has been programmed with 2 channels with different resolutions for the variable lux.

Channel	Meas. Variable	Resol.	Dim	Range	Factor	Exp.
1st channel	illumination 0 to 26000 lux	1	LX	D260	-	2
2nd channel	illumination 0 to 260.00 klux	0.01	kL	D260	-	0

Measuring Principle

The measuring principle is based on a Si diode with correction filter and diffusor for adaptation to the cosine characteristics (illumination measurement). The photoelectric current is measured via two shunt resistors.

Spectral Adaptation

The spectral adaptation is approximated to the photometric valuation function v_λ. The measuring fault caused by mismatching is less than 5% with respect to sunlight (D65).

Technical Data

Low resolution channel:	0 to 260.00 klux
High resolution channel:	0 to 26000 lux
Supply voltage:	+5V
Output voltage:	approx. 10 µV/lux
Impedance:	1kΩ
Accuracy:	base accuracy 5% (of measured value) accuracy of calibration 5% (at 24°C and approx. 3300 lux)
Temperature coefficient:	0.2%/°C
Operating temperature:	0 to 60°C
Storage temperature:	-10 to +80°C
Humidity range:	10 to 90% (non-condensing)
Housing:	black anodized aluminium
Operating environment/sealing:	IP62
Dimensions:	diameter 37mm, height 19.5mm

3.8.2.2 UV Probe

For measurement of the radiation intensity the ALMEMO® sensor range provides the UV Probe FL A613-UV. The total measuring range is 0 to 54 W/m². The connector has been programmed with 2 channels with different resolutions for the variable radiation intensity.

Channel	Meas. Variable	Resol.	Dim	Range	Factor	Exp.
1st channel	radiation intensity 0 to 26.000 W/m²	0.001	Wm	D260	-	-1
2nd channel	radiation intensity 0 to 87.00 W/m²	0.01	Wm	D2.6	-	2

Measuring Principle

The measuring principle is based on a GaP diode with a correction filter for filtering the UV range and a diffusor for adapting to the cosine characteristics (radiation intensity measurement). The photoelectric current is converted into a voltage signal by means of an integrated transimpedance amplifier.

Spectral Evaluation

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

Technical Data

Low resolution channel:	0 to 87.00 W/m²
High resolution channel:	0 to 26.000 W/m²
Supply voltage:	+5V
Output voltage:	approx. 3 mV / W/m²
Accuracy:	base accuracy 5% (of measured value) accuracy of calibration 5% (at 24°C and approx. 0.500W/m²)
Detection limit:	approx. 0.2 mW/m² 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% (non-condensing)
Operating environment:	IP62
Dimensions:	diameter 37 mm, height 19.5 mm

3.8.3 Optical Probes for Outdoor Applications

Design

The probe heads consist of an anodized aluminium housing with a plastic dome that is transparent to ultraviolet light. The system is protected against rain water and water spray. Furthermore, a drying agent prevents the dome from inside misting. The sensors are, therefore, especially suitable for outdoor measurements.

Calibration

Our optical sensors are factory-calibrated. The calibration values are stored and locked as correction values in the ALMEMO® connector plug.

The calibration values must **not** be changed.

Handling and Installation

The plastic dome is very sensitive to shock and scratches. The installation must be carried out with the utmost care.

Damages that are caused by improper handling, as well as glass breakage, are not covered by warranty terms and conditions.
Never open the sensor, otherwise, the calibration of the sensor cannot be guaranteed and the warranty claim will be void.

The probe head is screwed to a suitable fixture (e.g. aluminium box profile) with two M4 screws. If possible, it should be exactly horizontally aligned. The mounting location should be chosen so a diurnal sun radiation of the probe head is possible. The probe head must have an unobstructed horizon in all directions. Mounting the probe head near houses or trees can invalidate the measured value.

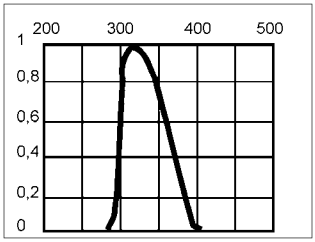
Maintenance

The electronical/optical component of the probe head is maintenance-free but it should be regularly calibrated. The plastic dome and the housing should, depending on the mounting location, or at least twice per year, be cleaned with a soft damp cloth or, for more severe contamination, with clean water and dish washing agent, if necessary.

NEVER use liquid cleaning agents containing scouring powder additions or solvents for the external cleaning.

3.8.3.1 UVA Probe

For measuring the UVA radiation the ALMEMO® sensor range provides the probe head FL A613-UVA. The probe head detects the UVA radiation (globally evaluated 315nm - 400nm).



Meas. Variable	Meas. Range	Resol.	Dim	Range	Factor	Exp
UVB radiation	0 - 3.000 mW/cm²	1 µW/cm²	Wm	D2.6	-	-

Application

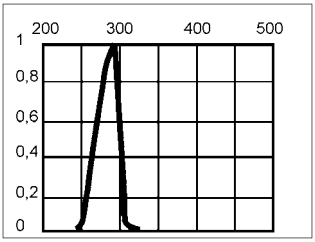
The measuring results provide, in comparison with other spectral ranges, information that is of medical or biological relevance. The probe head is used in medical and biological research, weather information and forecast systems, climatology, agriculture and for general public information.

Technical Data

Measuring range UVB	0 - approx. 3 mW/cm²
Spectr. sensitivity	310nm to 400nm
Max. spectral sensitivity	335nm
Operating temperature	-20°C - +60°C
Signal output	0V - 2V
Supply voltage	+5V - +15V
Fixture	two M4 screws in base plate
Cable run	downwards
Housing	anodized aluminium
Diffusor	PTFE
Dome	PMMA (transparent to ultraviolet light)
Cosine correction	error f2 < 3%
Linearity	< 1%
Absolute error	< 10%
Residual voltage (E=0)	< 10mV
Weight	approx. 300g

3.8.3.2 UVB Probe

For measuring the UVB radiation the ALMEMO® sensor range provides the probe head FL A613-UVB. The relative spectral sensitivity of the sensor has been especially adapted to the erythema curve according to DIN 5050. The erythema sensor reliably detects the skin irritating components of this spectral range.



Meas.Variable	Meas. Range	Resol.	Dim	Range	Factor	Exp
UVB radiation	0 - 50.00 µW/cm²	0.01 µW/cm²	Wm	D2.6	-	-

Application

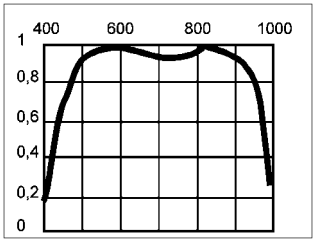
The measuring results provide immediate information that is of medical or biological relevance for this spectral range. The probe head is used in medical and biological research, weather information and forecast systems, climatology and for general public information.

Technical Data

Measuring range UVB	0 to approx. 50 µW/cm²
Spectr. sensitivity	265nm to 315nm
Max. spectral sensitivity	297nm
Operating temperature	-20°C to +60°C
Signal output	0V to 2V
Supply voltage	+5V to +15V
Fixture	two M4 screws in base plate
Cable run	downwards
Housing	anodized aluminium
Diffusor	PTFE
Dome	PMMA (transparent to ultraviolet light)
Cosine correction	error f2 < 3%
Linearity	< 1%
Absolute error	< 10%
Residual voltage (E=0)	< 50mV
Weight	approx. 300g

3.8.3.3 Global Radiation Probe

For measuring the global radiation the ALMEMO® sensor range provides the probe head FL A613-GS. It detects almost 90% of the solar spectrum from 400nm to 1100nm and covers UV, VIS and a part of the IR range.



Meas. Variable	Meas. Range	Resol.	Dim	Range	Factor	Exp
Global radiation	0 - 1200 W/m²	1 W/m²	Wm	D2.6	-	4

Application

The measuring results provide, in comparison with other spectral ranges, information that is of medical or biological relevance. The probe head is used in medical and biological research, weather information and forecast systems, climatology, agriculture and for general public information.

Technical Data

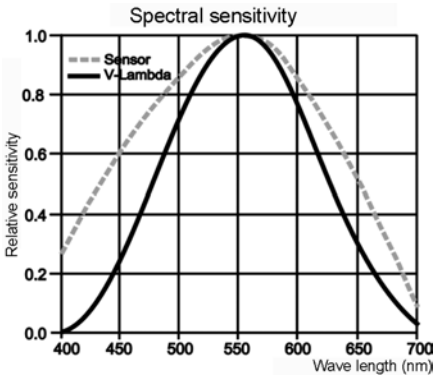
Measuring range Global	0 to approx. 1200 W/m²
Spectr. sensitivity	400 nm to 1100 nm
Max. spectral sensitivity	780 nm
Operating temperature	-20°C to +60°C
Signal output	0V to 2V
Supply voltage	+5V to +15V
Fixture	two M4 screws in base plate
Cable run	downwards
Housing	anodized aluminium
Diffusor	PTFE
Dome	PMMA
Cosine correction	error f2 < 3%
Linearity	< 1%
Absolute error	< 10%
Residual voltage (E=0)	< 10mV
Weight	approx. 300g

3.8.3.4 Lux Probe (Radiation Intensity Probe Head)

The V Lambda radiation covers the spectral range of the visible light and corresponds to the sensitivity of the human eye. The measured value is a measure for the brightness sensation.The wavelength range starts at the end of the UV range, at approx. 400nm, and ends at the beginning of the IR range, at approx.720nm. The maximum sensitivity is reached at 550nm.
The radiation intensity that has been determined in W/m^2 can be directly converted into the illuminance "LUX". Measurements in this range are very important for work place design and lighting projects.

Radiation Intensity Probe Head FL A613 VLM

V Lambda sensors are used in medical biological research, weather information and forecast systems, climate research, agriculture, the automotive industry and for measurements of the artificial illumination. The spectral sensitivity of the receiver almost equals that of the human eye.



Technical Data

Measuring range	0 to 170 kLux (approx. 250W/m²)
Spectral sensitivity	360nm to 760nm
Maximum spectral sensitivity	550nm
Operating temperature	-20°C to +60°C
Signal output	0V to 2V
Power supply	+5V to +15V
Fastening	2 screws M4, in base plate
Cable routing	downwards
Housing	anodised aluminium
Diffuser	PTFE
Dome	PMMA
Cos correction	error f2 < 3%
Linearity	< 1%
Absolute error	< 10%
Residual voltage (E=0)	< 10mV
Weight	approx. 300g

3.8.4 Optical Probes According To DIN Quality Class B

3.8.4.1 Luminance Probe Head Type FLA603LDM2

Type:
Luminance probe head with 1° field of view and external sighting device, DIN quality class B, with ALMEMO® connecting cable 2m long, incl. factory calibration certificate, calibration in cd/m2

- Luminance measuring head, equipped with achromatically corrected, low stray light optics and high quality V(λ) detector according to DIN class B.
- The external sighting device allows, at a working distance of 1m, to exactly locate the measuring point, therefore, it is particularly suitable for evaluating the luminance for service and constancy tests.
- Three measuring channels with different sensitivities.

Typical Applications:

Luminescent surfaces such as colour monitors, alphanumerical displays, sign plates and light panels, and reflective surfaces, such as walls and equipment at work places, projecting screens, traffic and sign plates, guided paths and roadway lines.

Technical Data

Measuring range	0.04cd/m^2 to 8333 cd/m^2
Smallest resolution	10 mcd/m^2
Field of view	1°
Sensitivity	approx. 30pA / (cd/m^2)
Spectral adaptation	approx. to photometric valuat. function V(λ) for photopic vision, class B, better than 6%
Operating distance	1m
Nominal temperature	24°C ±2K
Operating/storage temperature	0 to 60°C / -10 to +80°C
Humidity range	10 to 90 % non-condensing
Measuring surface	21 x 21mm at 1m operating distance
Meets standards	IEC 61223-2-5, DIN 5032-T.7
Dimensions	length 150mm, Ø 30mm

3.8.4.2 Light Flux Probe Head Type FLA603LSM4

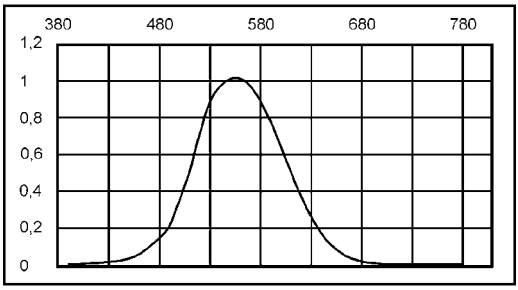
Type

Light flux measuring head with Ulbricht globe photometer, including ALMEMO® connecting cable 2m long

DIN quality class B, incl. factory calibration certificate,calibration in lm.

- High quality measuring head, DIN class B for light flux measurement with Ulbricht globe photometer.
- Perfect coating of the globe with BaSO4 for diffuse reflectivity and spectrally neutral reflection quality.

- Suitable for cold light sources, and lamps with high colour temperature and almost monochromatic radiation (as in LEDs).
- Examples for applications: Endoscopes, fiber optic bunches, light emitting diodes.



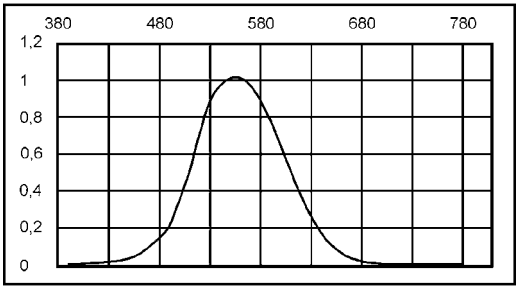
Technical Data

Measuring range	0.0002 lm to 50 lm
Smallest resolution	0,001 lm
Sensitivity	20 nA/lm
Acceptance angle	up to 90 °
Accuracy	DIN quality class B
Nominal temperature	24°C ±2K
Operating/storage temperature	0 to 60°C / -10 to +80°C
Humidity range	10 to 90 % non-condensing
Operating temperature	max. 100 °C inside globe
Inner diameter of globe	50 mm
Test opening	12,7 mm

3.8.4.3 Lux Probe Head Type FLA603VLx

Type:
Lux probe head, DIN quality class B with ALMEMO® connecting cable 2m long, incl. factory calibration certificate with calibration in lx
for indoor lighting (3 measuring channels)
Order No. FLA603VL2
for ambient light (2 measuring channels)
Order No. FLA603VL4

- High quality probe head for determining the density of light in lighting engineering or in sunlight and any place where DIN standards recommend the use of a class B luxmeter.
- Spectral adaptation approximated to the photometric valuation function V(λ) for photopic vision, class B, better than 6%.
- Different measuring channels with different sensitivities.



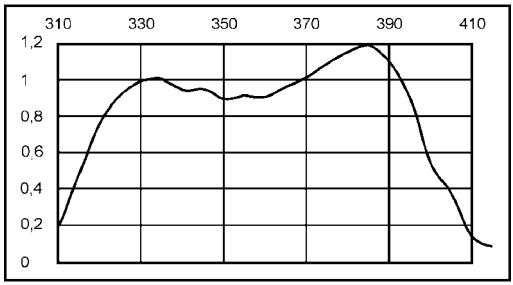
Technical Data

Measuring range	FLA603VL2: 0.05 lx to 12500 lx FLA603VL4: 1 lx to 250000 lx
Smallest resolution	FLA603VL2: 0.01 lx FLA603VL4: 1 lx
Sensitivity	approx. 20 pA/lx
Spectral adaptation	approx. to photometric valuat. function V(λ) for photopic vision, class B, better than 6%
Maximum cos deviation	class B, <3%
Cos diffuser	Ø 7 mm
Nominal temperature	24°C ±2K
Operating/storage temperature	0 to 60°C / -10 to +80°C
Humidity range	10 to 90% non-condensing
Dimensions	Ø 37mm, height 20mm

3.8.4.4 UVA Probe Head Type FLA603UV 12/14

Type:
Probe head for measuring UVA radiation intensity
with ALMEMO® connecting cable 2m long
incl. factory calibration certificate with calibration in mW/cm2
for examinations in industrial medicine
Order No. FLA603UV12
for measurements in industrial plants
Order No. FLA603UV14

- High quality probe head for precise determination of UVA radiation in the wavelength range from 315 to 400nm.
- Measurement geometries with cosine diffusor instead of simple diffusing screen for highest quality requirements.
- Three measuring channels with different sensitivities.



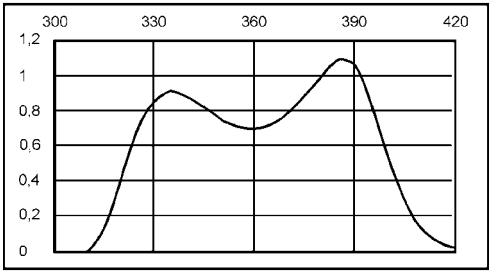
Technical Data

Measuring range	FLA603UV12: 0.00002 to 5mW/cm^2 FLA603UV14: 0.0004 to 100mW/cm^2
Smallest resolution	FLA603UV12: 20nW/cm^2 FLA603UV14: 100nW/cm^2
Sensitivity	approx. 50nA/(mW/cm^2)
Spectral sensitivity	315 to 400nm
Max. cos deviation	< 5%
Cos diffuser	Ø 15mm
Nominal temperature	24°C ±2K
Operating/storage temperature	0 to 60°C/-10 to +80°C
Humidity range	10 to 90% non-condensing
Dimensions	Ø 37mm, height 32mm

3.8.4.5 UVA Probe Head Type FLA603UV 22/24

Type:
Probe head for measuring UVA radiation intensity with ALMEMO® connecting cable 2m long, incl. factory calibration certificate with calibration in mW/cm2
for examinations in
medical therapy Order No. FLA603UV22
for industrial measurements of the
UV radiation hardening Order No. FLA603UV24

- High quality probe head for precise determination of UVA radiation in the wavelength range from 320 to 400nm.
- Measurement geometries with cosine diffusor instead of simple diffusing screen for highest quality requirements.
- Three measuring channels with different sensitivities.



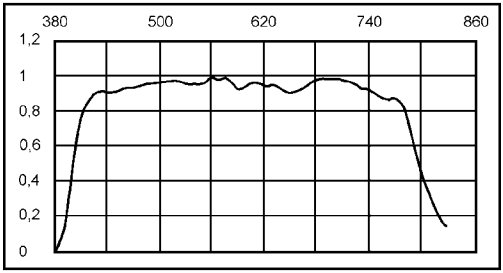
Technical Data

Measuring range	FLA603UV22: 0.00002 to 5mW/cm^2 FLA603UV24: 0.0004 to 100mW/cm^2
Smallest resolution	FLA603UV22: 10nW/cm^2 FLA603UV24: 100nW/cm^2
Sensitivity	approx. 50nA/(mW/cm^2)
Spectral sensitivity	320 to 400nm
Max. cos deviation	< 5%
Cos diffuser	Ø 15mm
Nominal temperature	24°C ±2K
Operating/storage temperature	0 to 60°C / -10 to +80°C
Humidity range	10 to 90% non-condensing
Dimensions	Ø 37mm, height 32mm

3.8.4.6 Radiometric Probe Head Type FLA603RW4

Type:
Radiometric probe head
with ALMEMO® connecting cable 2m long
incl. factory calibration certificate
with calibration in mW/cm2
for evaluation of
LED diodes and lasers Order No. FLA603RW4

- High quality radiometric probe head for precise determination of the radiation intensity in the visible wavelength range from 400 to 800nm.
- Measurement geometries with cosine diffusor instead of simple diffusing screen for highest quality requirements.
- Three measuring channels with different sensitivities.



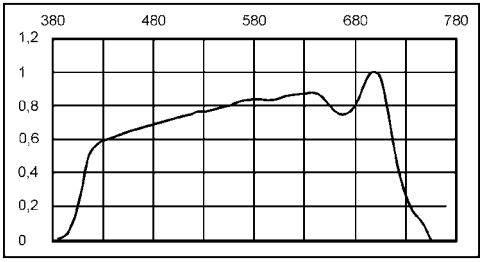
Technical Data

Measuring range	0.00004 to 10mW/cm^2
Smallest resolution	10nW/cm^2
Sensitivity	approx. 500nA/(mW/cm^2)
Spectral sensitivity	400 to 800nm
Max. cos deviation	< 5%
Cos diffuser	Ø 15mm
Operating / storage temperature	0 ... 60°C / -10 ... +80°C
Humidity range	10 ... 90% non-condensing
Dimensions	Ø 37mm, height 50mm

3.8.4.7 Photosynthesis Probe Head Type FLA603PS4 / PS5

Type:
Photosynthesis probe head with ALMEMO® connecting cable 2m long incl. factory calibration certificate with calibration in µmol/(m²*s) for the measurement of photosynthetical active intensity of irradiation.
Measuring low-level available light (e.g. dawn, dusk, artificial lighting) Order no.FLA603PS4
Measuring in greenhouses with daylight Order no.FLA603PS5
in a waterproof design with clear dome hood (see illustr.) Order no.FLA603PS4/5WG

- High quality measuring head for direct evaluation of the Photosynthetical Active Radiation (PAR) in the wavelength range from 400 to 700nm.
- Measurement geometries with cosine diffusor instead of simple diffusing screen for highest quality requirements.
- Waterproof design with clear dome hood as sealing for the diffusor.
- Three measuring channels with different sensitivities.



Technical Data

Measuring range	
FLA603PS4	0,0002 to 5 µmol/(m²*s)
FLA603PS5	0,2 µmol/(m²*s) to 100,00 mmol/(m²*s)
Smallest resolution	
FLA603PS4	0,0002 µmol/(m²*s)
FLA603PS5	0,1 µmol/(m²*s)
Sensitivity	approx. 100nA/(µmol/m²*s)
Spectral sensitivity	400 to 700 nm
Max. cos deviation	< 5%
Cos diffuser	Ø 15mm
Operating / storage temperature	0 ... 60°C / -10 ... +80°C
Humidity range	10 ... 90% non-condensing
Dimensions	Ø 37mm, height 35mm