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HD 32.1 THERMAL MICROCLIMATE INSTRUMENT FOR STUDYING, MEASURING AND CONTROLLING THE MICROCLIMATE



The Thermal Microclimate **HD32.1** instrument is manufactured by Delta Ohm Srl and it allows studying, measuring and controlling the Microclimate in the workplace, in compliance with the following standards:

UNI EN ISO 7726: Ergonomics of the thermal environment
- Instruments for measuring physical quantities.

UNI EN ISO 7730: Moderate Thermal Environments - Determination of the PMV and PPD indices and specification of the condition for thermal comfort.

UNI EN ISO 27243: Hot environments. Estimation of the heat stress on working man, based on the WBGT Index (Wet bulb Globe temperature).

UNI EN ISO 7933: Ergonomics of the thermal environment
- Analytical determination and interpretation of heat stress using calculation of the predicted heat strain.

UNI ENV ISO 11079: Evaluation of cold environments - Determination of required clothing insulation (IREQ).

UNI EN ISO 8996: Ergonomics of the thermal environment
- Determination of metabolic rate.

Thanks to specific software:

**Moderate Environments,
Hot environments,**

Cold environments and Discomfort,

as well as specific probes, the instrument can perform the following measurements:

- Globe temperature
- Natural wet bulb temperature
- Ambient temperature
- Atmospheric pressure
- Relative Humidity
- Air velocity
- Air temperature at the height of the head (1,7m subject standing; 1,1m subject sitting).
- Air temperature at the height of the abdomen (1,1 m subject standing; 0,6m subject sitting).
- Air temperature at the height of the ankles (0,1 m).
- Temperature at the floor level.
- Net radiation temperature.
- Net radiation.
- Radiant temperature asymmetry.
- Illuminance, luminance, PAR, irradiance.

According to measurements performed, HD32.1, together with its software, calculates the following parameters:

- t_r : Mean radiant temperature
- **PMV** : Predicted Mean Vote
- **PPD** : Predicted Percentage Dissatisfied
- **DR** : Draught Rating
- t_o : Operative temperature
- t_{eq} : Equivalent temperature
- **WBGT_{Indoor}** : Wet bulb Globe temperature
- **WBGT_{Outdoor}** : Wet bulb Globe temperature in the presence of radiation
- **SW_p** : Sweat rate
- E_p : Predicted evaporative heat flow
- **PHS** : Tre - Water loss - Dlimtre - Dlimloss95
- **IREQ** : Required clothing insulation
- **DLE** : Duration Limit Exposure
- **RT** : Recovery time
- **WCI** : Wind chill index

- **PD_v** : Percentage Dissatisfied due to vertical temperature difference (head-ankles)
- **PD_f** : Percentage Dissatisfied due to floor temperature
- **PD_Δ** : Percentage Dissatisfied due to radiant asymmetry

To calculate the following indices is necessary to measure RH and air temperature and insert the measured values of the tables "Index of discomfort"

- **IS** : Scharlau index
- **DI** : Tom index
- **THI** : Thermohygrometric Index
- **RSI** : Relative Strain Index
- **SSI** : New Summer Simmer Index
- **HI** : Hot index
- **H** : Humidex index
- **Teq** : Equivalent Temperature index

For the calculation of the FLD is necessary to measure light (luxmeter Sonda LP PHOT 471).

You need the program "HD32.1 prog.C"

- **FLD** : Average daylight factor



Three operating programs are already uploaded on the instrument and they can be used according to the analysis:

HD32.1 A operating program: Analysis of the Microclimate in moderate, hot and cold environments.

HD32.1 B operating program: Analysis of Discomfort in moderate environments.

HD32.1 C operating program: Measurement of Physical Quantities for general purposes.

The HD32.1 together with C operating program turns into a multifunction datalogger instrument displaying maximum, minimum and average values. By connecting SICRAM probes, the instrument allows measuring temperature, temperature and relative humidity, air velocity, flow, light (with photometric/radiometric probes).

TECHNICAL SPECIFICATIONS

Instrument

Dimensions (Length x Width x Height) 220x180x50 mm
Weight 1100 g (with batteries)
Materials ABS, Polycarbonate and Aluminium
Display Backlit, dot matrix 128x64 dots, visible area 56x38mm

Operative conditions

Operative temperature -5 ... 50°C
Storage temperature -25 ... 65°C
Operative Relative Humidity 0 ... 90% RH non condensing

Protection class IP64

Instrument uncertainty

± 1 digit @ 20°C

Power supply

Mains adapter (code SWD10) 12Vdc/1A
Batteries Four 1.5V batteries size C-BABY
Autonomy With temperature and RH probes
200 hours with 7800mAh alkaline batteries
With hotwire probe @ 5m/s:
100 hours with 7800mAh alkaline batteries
Power absorbed (instrument off) < 20μA

Security of stored data

Unlimited

Connections

Input for probes with SICRAM module 8 male 8-pole DIN 45326 connectors

RS232C Serial interface

Type Galvanically isolated RS232C
Baud rate Configurable between 1200 and 38400 baud
Data Bit 8
Parity None
Stop Bit 1
Flow control Xon/Xoff
Serial cable length Max 15m

USB Interface

Type 1.1 - 2.0 galvanically isolated

EMC standards

Safety EN61000-4-2, EN61010-1 level 3
Electrostatic discharge EN61000-4-2 level 3
Electrical Fast Transients EN61000-4-4 level 3, EN61000-4-5 level 3
Voltage variations EN61000-4-11
Electromagnetic interference susceptibility IEC1000-4-3
Electromagnetic interference emission EN55020 class B

The following table indicates the instrument memory capacity

| Memory interval | Memory capacity | Memory interval | Memory capacity |
|-----------------|------------------------------------|-----------------|-----------------------------|
| 15 seconds | 22 hours | 10 minutes | 875 hours (about 36 days) |
| 30 seconds | 43 hours | 15 minutes | 1312 hours (about 54 days) |
| 1 minute | 87 hours (about 3 days and a half) | 20 minutes | 1750 hours (about 72 days) |
| 2 minutes | 175 hours (about 7 days) | 30 minutes | 2625 hours (about 109 days) |
| 5 minutes | 437 hours (about 18 days) | 1 hour | 5250 hours (about 218 days) |

The following table explains how to use the operating programs and the different software applications available. A series of probes specially designed for different applications completes the instrument.

Delta Ohm is SIT Centre no. 124. Therefore, it can calibrate the probes employed and issue their SIT certificates..

| DeltaLog10 Software | Operating program | Main calculated indices | | Environments | Standard |
|-----------------------------------|-------------------|--|--|-----------------|-------------------------------------|
| DeltaLog10 BASIC | A Prog. | t_a t_r PMV PPD DR t_0 IS DI THI RSI SSI HI H T_{eq} | Air temperature Mean radiant temperature Predicted mean vote Predicted Percentage Dissatisfied Draught rating Operative temperature Scharlau index Tom index Thermohygrometric Index Relative Strain Index New Summer Simmer Index Hot index Humidex index Teq : Equivalent Temperature index | Moderate | UNI EN ISO 7730 |
| DeltaLog10 Hot environments | A Prog | WBGT SW_p E_p PHS | Wet bulb globe temperature Sweat rate Predicted evaporative heat flow Predicted Heat Strain Model | Severe hot | UNI EN ISO 27243 UNI EN ISO 7933 |
| DeltaLog10 Cold Environments | A Prog | IREQ DLE RT WCI | Required clothing insulation Duration limit exposure Recovery time Wind chill index | Severe cold | UNI EN ISO 11079 |
| DeltaLog10 Analysis of Discomfort | B Prog | PD_v PD_t PD_Δ | Percentage Dissatisfied due to vertical temperature difference (head-ankles). Percentage Dissatisfied due to floor temperature Percentage Dissatisfied due to radiant asymmetry | Moderate | UNI EN ISO 7730 |
| DeltaLog10 BASIC | C Prog. | t_a RH-t V_{a-t} Lux cd/m^2 $\mu W/m^2$ W/m^2 $\mu mol/m^2s$ | Air temperature Humidity-temperature Air velocity, temperature and flow Illuminance Luminance Irradiance Irradiance PAR | General purpose | |

Table of probes for HD32.1 A operating program: Microclimatic Analysis

| | |
|-----------------|--|
| TP3207 | Dry bulb temperature probe. |
| TP3275 | Globe temperature probe Ø 150mm (alternatively TP3276). |
| TP3276 | Globe temperature probe Ø 50mm (alternatively TP3275). |
| AP3203 | Omnidirectional hotwire probe. |
| HP3201 | Natural wet bulb temperature probe. |
| HP3217 | Combined temperature and relative humidity probe. |
| HP3217DM | Two-sensor probe for measuring natural wet bulb temperature and dry bulb temperature (alternatively: HP3201 and TP3207). |



The following table lists all the necessary probes for determining the microclimatic indices.
The following indices are obtained by using the **DeltaLog10 BASIC** software:
Each line shows the combination of probes to use for calculating the indices

| | TP3207 | TP3275 | TP3276 | AP3203 | HP3201 | HH3217 | HP3217DM |
|---|--------|--------|--------|--------|--------|--------|----------|
| t_a : Air temperature.. | x | | | | | | |
| | | | | | | | x |
| | | | | | | x | |
| t_r : Mean radiant temperature | x | x | | x | | | |
| | x | | x | x | | | |
| | | x | | x | | | x |
| | | | x | x | | | x |
| | | x | | x | | x | |
| PMV : Predicted mean vote. PPD : Predicted Percentage Dissatisfied | | | x | x | | x | |
| | x | x | | x | | x | |
| | x | | x | x | | x | |
| | | x | | x | | x | x |
| | | x | | x | | x | |
| DR : Draught rating. | x | | | x | | | |
| | | | | x | | | x |
| | | | | x | | x | |
| T_o : Operative temperature.. | x | x | | x | | | |
| | x | | x | x | | | |
| | | x | | x | | | x |
| | | | x | x | | | x |
| | | x | | x | | x | |
| T_{eq} : Equivalent temperature. (necessary for measuring: atmospheric pressure) | | | x | x | | x | |
| | x | | | | | x | |
| | | | | | | x | x |
| IS : Scharlau index DI : Tom index THI : Thermohygrometric Index RSI : Relative Strain Index SSI : New Summer Simmer Index HI : Hot index H : Humidex index Teq : Equivalent Temperature index | | | | | | x | |
| | | | | | | x | |
| | | | | | | x | |
| | | | | | | x | |
| | | | | | | x | |
| | | | | | | x | |
| | | | | | | x | |
| | | | | | | x | |



The following indices are obtained by using the **DeltaLog10 Cold Environments** software:
Each line shows the combination of probes to use for calculating the indices

| | | TP3207 | TP3275 | TP3276 | AP3203 | HP3201 | HH3217 | HP3217DM |
|-----|--|--------|--------|--------|--------|--------|--------|----------|
| (1) | IREQ : Required clothing insulation DLE : Duration limit exposure RT : Recovery time WCI : Wind chill index | x | x | | x | | x | |
| | | x | | x | x | | x | |
| | | | x | | x | | x | x |
| | | | | x | x | | x | x |
| | | | x | | x | | x | |
| | | | | | x | | x | |
| | | x | | | x | | | |
| | | | | | x | | | x |

(1) Using IREQ, DLE, RT, WCI it is possible to calculate:

- Ratio of surface area of the clothed body to the surface area of the nude body
- Mean skin temperature
- Fraction of wet skin
- Total convective heat conduction
- Total radiative heat conduction
- Partial water pressure at ambient temperature
- Surface temperature of clothing
- Evaporative resistance of limiting layer and clothing
- Heat exchange by evaporation
- Respiratory heat exchange by convection and evaporation
- Heat exchange by radiation
- Heat exchange by convection
- Duration limit exposure
- Required clothing insulation
- Intrinsic clothing insulation



The following indices are obtained by using the **DeltaLog10 Hot Environments software**:
Each line shows the combination of probes to use for calculating the indices

| | | TP3207 | TP3275 | TP3276 | AP3203 | HP3201 | HH3217 | HP3217DM |
|--|---|--------|--------|--------|--------|--------|--------|----------|
| WBGT Indoor: Wet bulb globe temperature | | | x | | | x | | |
| SWp: Ep: | Sweat rate Predicted evaporative heat flow | x | x | | | x | | |
| | | x | | x | | x | | |
| | | | x | | | x | | x |
| | | | | x | | x | | x |
| | | | x | | | x | x | |
| PHS | (2) | x | x | | x | | x | |
| | T _{re} | x | | x | x | | x | |
| | Water loss | | x | | x | | x | x |
| | D _{lim tre} | | | x | x | | x | x |
| | D _{limloss50} | | x | | x | | x | |
| | D _{limloss95} | | | x | x | | x | |

(2)

T_{re} : Predicted rectal Temperature

D_{lim tre} : Maximum allowable exposure duration for heat storage

D_{limloss50} : Maximum allowable exposure duration for water loss, standard subject

D_{limloss95} : Maximum allowable exposure duration for water loss, 95% of the working population

Table of probes for HD32.1 B operating program: Analysis of Discomfort

- TP3227K** Temperature probe composed of 2 independent probes, temperature of the head and abdomen.
TP3227PC Temperature probe composed of 2 independent probes, temperature of the ankles and the floor.
TP3207P Temperature probe Pt100 sensor, floor temperature..
TP3207TR Probe for measuring radiant temperature (net-radiometer)

The following table lists all the necessary probe for determining the microclimatic indices.
The following indices are obtained by using the **DeltaLog10 Analysis of Discomfort software**

Each line shows the combination of probes to use for calculating the indices

| | | TP3227K | TP3227PC | TP3207P | AP3207TR | LP471Phot |
|------------------------|---|---------|----------|---------|----------|-----------|
| PD_v: | Percentage Dissatisfied with vertical temperature difference (head-ankles). | x | | x | | |
| PD_f: | Percentage Dissatisfied with floor temperature. | | x | | | |
| | | | | x | | |
| PD_Δ: | Percentage Dissatisfied with radiant asymmetry. | | | | x | |
| FLD: | Average daylight factor For the calculation of the FLD is necessary to measure light (luxmeter Sonda LP PHOT 471). | | | | | x |

ORDERING CODES

HD32.1 Kit basic: It is composed of HD32.1 instrument, A operating program: Analysis of the Microclimate, four 1.5V alkaline batteries size C-BABY, instruction manual.

DeltaLog10 Basic Moderate Environments Software (for operating systems from Windows 98 to Windows XP).

DeltaLog10 Hot Environments Software:

The use of this software requires the complete HD32.1 Kit basic.

DeltaLog10 Cold Environments Software:

The use of this software requires the complete HD32.1 Kit basic.

DeltaLog10 Analysis of Discomfort Software:

The use of this software requires the B operating program: Analysis of discomfort and the complete HD32.1 Kit basic.

DeltaLog10 Physical Quantities Software: The use of this software requires the C operating program: Physical quantities and the complete HD32.1 Kit basic.

Probes, holder, case and cables must be ordered separately.

Accessories:

VTRAP32: Tripod equipped with 6-input head and 4 probe holders code HD3218K

9CPRS232: Connection cable 9 - pole Sub-D female connector for RS232C.

CP22: USB 2.0 connection cable connector type A - connector type B.

BAG32: Carrying case for the HD32 and its accessories.

SWD10: 100-240Vac/12Vdc-1A Stabilized mains power supply.

HD3218K: Probe shaft

AM32: Two-clamp shaft for two probes

AQC: 200cc. distilled water and 3 braids for HP3201 or HP3217DM probes.

Delta Ohm metrological laboratories are accredited by SIT in Temperature, Humidity, Pressure, Photometry/Radiometry, Acoustics and Air velocity. Probes can be supplied with SIT calibration certificate on request.

Probes for operating programs:

A: Microclimatic Analysis

B: Analysis of Discomfort

TP3207: Temperature probe, Pt100 sensor. Probe stem Ø 14mm, length 140 mm. Cable length 2 metres. Equipped with SICRAM module.

Used for calculating the following indices: IREQ,WCI, DLE, RT, PMV, PPD, WBGT, SR. Used for calculating Mean radiant temperature.

TP3275: Globe temperature probe, Pt100 sensor, globe Ø 150 mm. Stem Ø 14 mm, length 110 mm. Cable length 2 metres. Equipped with SICRAM module.

Used for measuring: Mean radiant temperature, WBGT.

TP3276: Globe temperature probe, Pt100 sensor, globe Ø 50 mm. Stem Ø 8 mm, length 110 mm. Cable length 2 metres. Equipped with SICRAM module.

Used for measuring: Mean radiant temperature, WBGT..

TP3227K: Temperature probe composed of 2 independent probes, Pt100 sensor. Stem diameter Ø 14 mm, length 500 mm. Cable length 2 metres. Equipped with double SICRAM module and TP3227.2 extension shaft Ø 14 mm, length 450 mm.

Used for measuring local discomfort due to vertical thermal gradient. It can be used for studying subjects sitting or standing. The height of one probe can be regulated.

TP3227PC: Temperature probe composed of 2 independent probes, Pt100 sensor, one for measuring floor temperature (diameter Ø 70 mm, height 30 mm), the other for measuring temperature at the height of the ankles (diameter Ø 3 mm, height 100 mm). Cable length 2 metres. Equipped with double SICRAM module.

Used for measuring local discomfort due to vertical thermal gradient.

TP3207P: Temperature probe, Pt100 sensor, for measuring floor temperature (diameter Ø 70 mm, height 30 mm). Cable length 2 metres. Equipped with SICRAM module.

Used for measuring local discomfort due to vertical thermal gradient.

TP3207TR: Probe for measuring radiant temperature. Probe stem Ø 16 mm, length 250 mm. Cable length 2 metres. Equipped with SICRAM module.

Used for the evaluation of dissatisfied people due to radiant asymmetry.

AP3203: Omnidirectional hotwire probe. Measuring range: air velocity 0÷5 m/s, temperature 0÷100 °C. Probe stem Ø 14 mm, length 110 mm. Cable length 2 metres. Equipped with SICRAM module.

Used for calculating the following indices: IREQ,WCI, DLE, RT, PMV, PPD, SR. Used for calculating Mean radiant temperature.

HP3201: Natural wet bulb probe. Pt100 sensor. Probe stem Ø 14 mm, length 110 mm. Cable length 2 metres. Equipped with SICRAM module, spare braid and 50cc. distilled water.

Used for measuring: WBGT.

HP3217: Combined temperature and relative humidity probe. Capacitive RH sensor, Pt100 temperature sensor. Probe stem Ø 14 mm, length 110 mm. Cable length 2 metres. Equipped with SICRAM module.

Used for calculating the following indices: IREQ,WCI, DLE, RT, PMV, PPD, SR.

HP3217DM: Double natural wet bulb probe and temperature probe (dry bulb). Probe stem Ø 14 mm, length 110 mm. Cable length 2 metres. Equipped with double SICRAM module, spare braid and 50cc. distilled water.

Probes for C operating program: physical quantities

Temperature probes equipped with SICRAM module

TP472I: Immersion probe, Pt100 sensor. Stem Ø 3 mm, length 300 mm. Cable length 2 metres.

TP472I.0: Immersion probe, Pt100 sensor. Stem Ø 3 mm, length 230 mm. Cable length 2 metres.

TP473P.0: Pointed probe, Pt100 sensor. Stem Ø4 mm, length 150 mm. Cable length 2 metres.

TP474C.0: Contact probe, Pt100 sensor. Stem Ø4 mm, length 230 mm, contact surface Ø 5 mm. Cable length 2 metres.

TP475A.0: Air probe, Pt100 sensor. Stem Ø4 mm, length 230 mm. Cable length 2 metres.

TP472I.5: Immersion probe, Pt100 sensor. Stem Ø 6 mm, length 500 mm. Cable length 2 metres.

TP472I.10: Immersion probe, Pt100 sensor. Stem Ø 6 mm, length 1000 mm. Cable length 2 metres..

Combined Relative Humidity and Temperature probes equipped with SICRAMmodule

HP472AC: Combined %RH and Temperature probe, dimensions Ø 26x170 mm. Connection cable 2 metres.

HP473AC: Combined %RH and Temperature probe. Handle dimensions Ø 26x130 mm, probe Ø 14x110 mm. Connection cable 2 metres.

HP474AC: Combined %RH and Temperature probe. Handle dimensions Ø 26x130mm, probe Ø 14x210 mm. Connection cable 2 metres.

HP475AC: Combined %RH and Temperature probe. Connection cable 2 metres. Handle Ø 26x110 mm. Stainless steel stem Ø 12x560 mm. Point Ø 13.5x75 mm.

HP475AC.1: Combined %RH and Temperature probe. Stainless steel stem Ø14x500mm with 20µm sintered stainless steel filter. Handle 80 mm. Connection cable 2 metres.

HP477DC: Combined sword %RH and Temperature probe. Connection cable 2 metres. Handle Ø 26x110 mm. Probe stem 18x4 mm, length 520 mm.

Combined Air velocity and Temperature probes equipped with SICRAM module

Hotwire

AP471 S1: Hotwire telescopic probe, measuring range: 0...40m/s. Cable length 2 metres.

AP471 S2: Omnidirectional hotwire telescopic probe, measuring range: 0...5m/s. Cable length 2 metres.

AP471 S3: Hotwire telescopic probe with tip easy to shape, measuring range: 0...40m/s. Cable length 2 metres

AP471 S4: Omnidirectional hotwire telescopic probe with base, measuring range: 0...5m/s. Cable length 2 metres.

AP471 S5: Omnidirectional hotwire telescopic probe, measuring range: 0...5m/s. Cable length 2 metres.

Vane

AP472 S1L Vane probe with thermocouple K, Ø 100mm. Speed 0.6 to 20m/s; temperature -25 to 80°C. Cable length 2 metres.

AP472 S1H Vane probe with thermocouple K, Ø 100mm. Speed 10 to 30m/s; temperature -25 to 80°C. Cable length 2 metres.

AP472 S2: Vane probe, Ø60mm. Measuring range: 0.25...20m/s. Cable length 2 metres.

AP472 S4L: Vane probe, Ø 16mm. Speed 0.6 to 20m/s. Cable length 2 metres.

AP472 S4LT: Vane probe, Ø 16mm. Speed 0.6 to 20m/s. Temperature -30 to 120°C with thermocouple K sensor (*). Cable length 2 metres.

AP472 S4H: Vane probe, Ø 16mm. Speed 10 to 50m/s. Cable length 2 metres.

AP472 S4HT: Vane probe, Ø 16mm. Speed 10 to 50m/s. Temperature -30 to 120°C with thermocouple K sensor (*). Cable length 2 metres.

(*) The temperature limit refers to the probe head, where the vane and temperature sensors are located, and not to the handle, cable and telescopic shaft that can withstand up to the maximum temperature of 80°C.

Photometric/radiometric probes for measuring Light equipped with SICRAM module

LP 471 PHOT: Photometric probe for measuring ILLUMINANCE equipped with SICRAM module, spectral response in agreement with standard photopic vision, diffuser for cosine correction. Measuring range: 0.01 lux...200x10³ lux.

LP 471 LUM 2: Photometric probe for measuring LUMINANCE equipped with SICRAM module, spectral response in agreement with standard photopic vision, vision angle 2°. Measuring range: 0.1 cd/m²...2000x10³ cd/m².

LP 471 PAR: Quantum radiometric probe for measuring the photon flow in the chlorophyll range PAR (photosynthetically Active Radiation 400 nm...700 nm) equipped with SICRAM module, measurement in µmol/m²s, diffuser for cosine correction. Measuring range 0.01µmol/m²s...10x10³µmol/m²s

LP 471 RAD: Radiometric probe for measuring IRRADIANCE equipped with SICRAM module in the 400 nm...1050 nm spectral range, diffuser for cosine correction. Measuring range: 0.1x10⁻³W/m²...2000 W/m².

LP 471 UVA: Radiometric probe for measuring IRRADIANCE equipped with SICRAM module in the 315 nm...400 nm UVA spectral range, peak 360 nm, quartz diffuser for cosine correction.

Measuring range: 0.1x10⁻³W/m²...2000 W/m².

LP 471 UVB: Radiometric probe for measuring IRRADIANCE equipped with SICRAM module in the 280 nm...315 nm UVB spectral range, peak 305 nm, quartz diffuser for cosine correction.

Measuring range: 0.1x10⁻³W/m²...2000 W/m².

LP 471 UVC: Radiometric probe for measuring IRRADIANCE equipped with SICRAM module in the 220 nm...280 nm UVC spectral range, peak 260 nm, quartz diffuser for cosine correction.

Measuring range: 0.1x10⁻³W/m²...2000 W/m².

LP 471 ERY: Radiometric probe for measuring TOTAL EFFECTIVE IRRADIANCE (Weff/m²) according to the UV action curve (CEI EN 60335-2-27) equipped with SICRAM module. Spectral range: 250 nm...400 nm, quartz diffuser for cosine correction.

Measuring range: 0.1x10⁻³Weff/m²...2000 Weff/m².

