

Датчики (зонды) радиометрические-фотометрические DELTA OHM серии LP9021

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LP 9021



D09721 QUANTUM PHOTO-RADIOMETER AND THERMOMETER DATA-LOGGER

The **DO 9721** quantum photo-radiometer and thermometer data logger has been designed for measuring illuminance, irradiance, luminance and temperature. The instrument has two inputs, A and B, and automatically detects the sensors, whether illuminance, irradiance, luminance or temperature and can provide a view of the difference between the two inputs. As the probes are interchangeable, it is possible to choose the most suitable combination for all applications without having to recalibrate the instrument. The **DO 9721** can take illuminance measurements in lux and in fcd (foot-candle), irradiance measurements in W/m^2 , in $\mu W/cm^2$ and in $\mu mol \cdot m^{-2} \cdot s^{-1}$, luminance measurements in cd/m^2 and temperature measurements in $^{\circ}C$ or $^{\circ}F$.

With the data logger function the instrument stores up to 30,000 readings with selectable sampling interval from 1 second to 12 hours.

The data acquired can then be downloaded to a Personal Computer or a printer by means of the opto-insulated serial line RS232C. For each value stored the date and time of acquisition are indicated; each acquisition block is ended with a report which provides the maximum, minimum and mean values. With the Serial Output function it is possible to obtain the instantaneous values measured by the instrument at the output of the serial line RS232C, in order to send them to a printer or a computer. Other functions such as Hold (which blocks the display), Rel (for taking relative measurements), Record (for storing the maximum, minimum and mean values) and Q (integration in time of the measurements with alarm threshold) further enrich the instrument's performance. Thanks to its versatility and to its storage capacity, the instrument is suitable for a wide variety of applications, both in the field and in the laboratory.

PROBE CONNECTION

The instrument **DO 9721** has two circular DIN 45326 8-pole connectors (A and B) which allow the connection of Delta OHM probes for measuring temperature, type TP 870, and probes for measuring the photometric and radiometric intensity, type LP 9021. The probe model should be chosen according to the specific

application.

INSTRUMENT TECHNICAL DATA

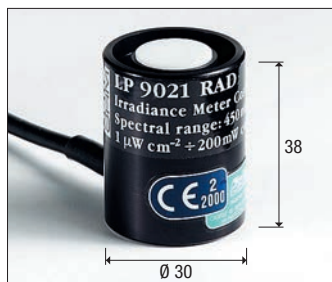
| | |
|------------------------------|---|
| Inputs / type of measurement | 2: photometric / radiometric or temperature |
| Connector | DIN 45326 8-pole |
| Measuring range | |
| Photometric measurements | 0.1...200.000 lux 1...20.000 fcd 1...2.000.000 cd/m^2 |
| Radiometric measurements | $1 \cdot 10^{-3} \dots 2000 W/m^2$ $0.1 \dots 200.000 \mu W/cm^2$ $0.1 \dots 200.000 \mu mol \cdot m^{-2} \cdot s^{-1}$ |
| Q energy | depends on the active measurements unit |
| Integration time | 19 hours, 59 minutes, 59 seconds |
| No. conversions per second | 2 |
| Working temperature | $-5 \dots +50^{\circ}C$ |
| Working relative humidity | 0...90% R.H. (no condensation) |
| Serial output | RS232C 300...19200 baud (galvanically insulated) |
| Display | Double LCD 12.5 mm |
| Functions | Auto power off / Autorange / Hold / Record Maximum / Minimum / Mean / Relative A-B / Energy |
| Memory | 512kB (FLASH) corr. to 30,000 measurements |
| Power supply | 9Vdc alkaline battery |
| Autonomy | Approx. 30 hours (continuous duty) |
| Weight / dimensions | 320 gr. / 215x73x38 mm |

ORDERING CODES

DO 9721: Instrument, user's manual, carrying case, DeltaLog1 software downloadable from Delta OHM website, 9V battery. **Probes and cables must be ordered separately.**



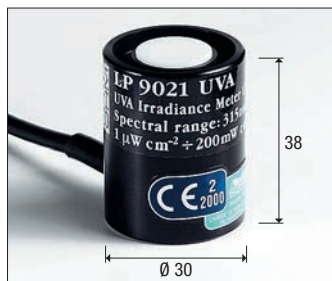
LP 9021 PHOT: Photometric probe for measuring **ILLUMINANCE**; photopic filter in compliance with CIE n° 69 - UNI 11142, diffuser for correction according to the cosine law.



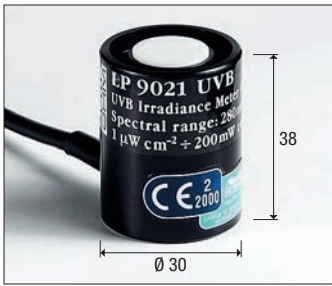
LP 9021 RAD: Radiometric probe for measuring the **IRRADIANCE** of artificial light sources, irradiance of the sun.



LP 9021 PAR: Quantum-radiometric probe for measuring the **PHOTONS FLOW** in the chlorophyll field PAR (photosynthetically Active Radiation 400nm...700nm), $\mu mol \cdot m^{-2} \cdot s^{-1}$ measure, cosine correction diffuser.



LP 9021 UVA: Radiometric probe for measuring **IRRADIANCE** in the ultraviolet field. Suitable for measuring radiation in the ultraviolet region A.



LP 9021 UVB: Radiometric probe for measuring **IRRADIANCE** in the ultraviolet field. Suitable for measuring radiation in the ultraviolet region **B**.



LP 9021 UVC: Radiometric probe for measuring **IRRADIANCE** in the ultraviolet field. Suitable for measuring radiation in the ultraviolet region **C**.

- LP BL:** Stand for supporting and levelling probes, except for LP 9021 LUM2.
- TP 870.0:** Immersion temperature probe, Pt100 sensor, diam. 3x230 mm, measuring range -50...+250°C.
- TP 870C.0:** Contact temperature probe, Pt100 sensor, diam. 4x230 mm, measuring range -50...+250°C.
- TP 870P.0:** Penetration temperature probe, Pt100 sensor, diam. 4x150 mm, measuring range -50...+250°C.
- TP 870A.0:** Air temperature probe, Pt100 sensor, diam. 4x230 mm, measuring range -50...+250°C.
- C.205:** Serial connection cable with USB connector for PC and Sub-D 9-pole connector for the instrument. The cable has a built-in USB/RS232 converter and connects the instrument **DO 9721** directly to the USB port of the PC.
- 9CPRS232:** Sub D 9-pole Female/Female RS232 null-modem cable for **DO 9721**.



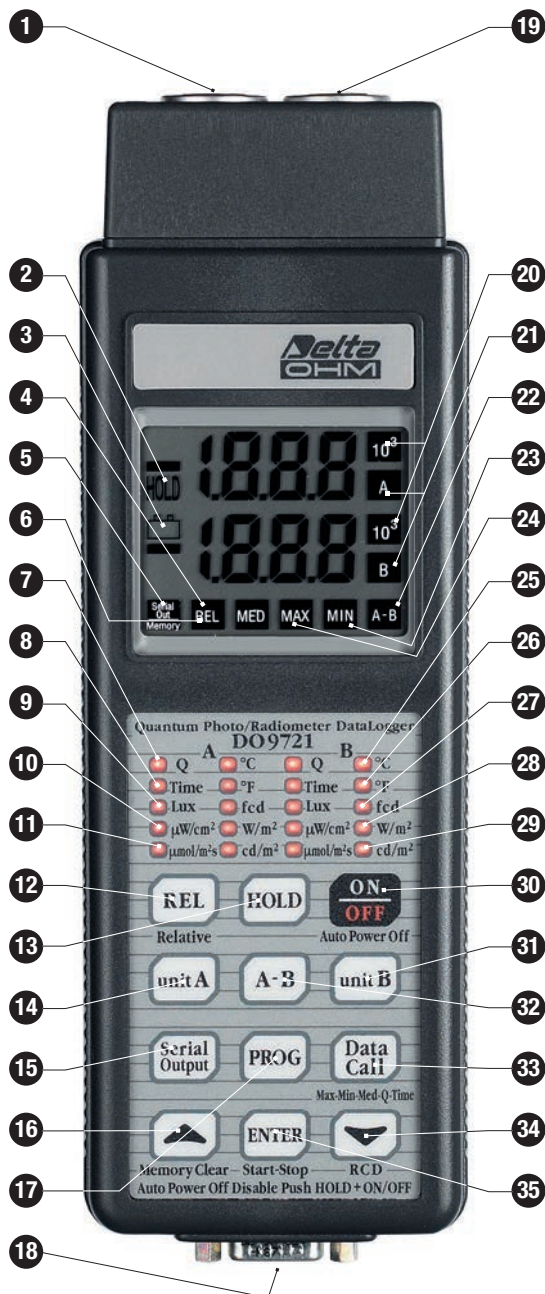
LP BL

| Probe Model | Measuring range | Spectral measuring range | Calibration uncertainty |
|--------------|---|--------------------------|-------------------------|
| LP 9021 PHOT | 0.1 ... 200000 lux | CIE N°69 Class C | <4% |
| LP 9021 RAD | 1mW/m ² ... 2000 W/m ² | 450 ... 950nm | <5% |
| LP 9021 PAR | 0.1 μmol m ⁻² s ⁻¹ ... 20000 μmol m ⁻² s ⁻¹ | 400 ... 700nm | <5% |
| LP 9021 UVA | 1 mW/m ² ... 2000 W/m ² | 315 ... 400nm | <5% |
| LP 9021 UVB | 1 mW/m ² ... 2000 W/m ² | 280 ... 315nm | <5% |
| LP 9021 UVC | 1 mW/m ² ... 2000 W/m ² | 200 ... 280nm | <5% |
| LP 9021 LUM2 | 1 ... 2 · 10 ⁶ cd/m ² | CIE N°69 Class C | <5% |

| INSTRUMENT UNCERTAINTY | | | |
|--|-----------------------|---|--|
| | at 25°C +/- | from -5°C to 50°C +/- | Measuring range +/- |
| Instrument base uncertainty | 0.1% ... 1 digit | 0.2% ... 1 digit | |
| Temperature measure of instrument with probe | 0.6°C 0.4°C 2°C | 0.6°C + 0.01°C/°C 0.4°C + 0.01°C/°C 2°C + 0.01°C/°C | -50 ... +50°C +50 ... +200°C +200 ... +400°C |

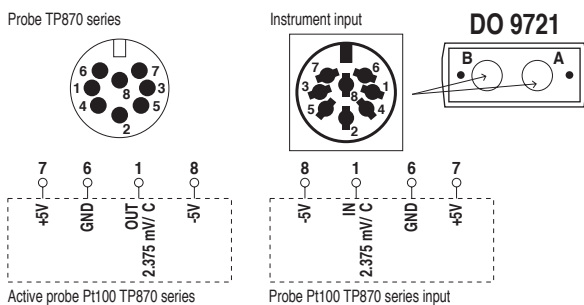
| TEMPERATURE PROBES OF THE SERIES TP870 | | | | |
|--|--------------------------------|---------|-----------------|----------|
| Code | Description | Drawing | τ Sec. | Temp/°C |
| TP 870.0 | Immersion probe ø 3 x 230 mm | | 3 ^A | -50/+250 |
| TP 870P.0 | Penetration probe ø 4 x 150 mm | | 3 ^A | -50/+250 |
| TP 870C.0 | Contact probe ø 4 x 230 mm | | 12 ^C | -50/+250 |
| TP 870A.0 | Air probe ø 4 x 230 mm | | 3 ^B | -50/+250 |

A) Time constant in water at 100 ° C / B) Time constant detected in contact with metal surface at 200 ° C / C) Time constant in air at 100 ° C.
Notes: Time constant to respond to the 63% of the temperature variation.

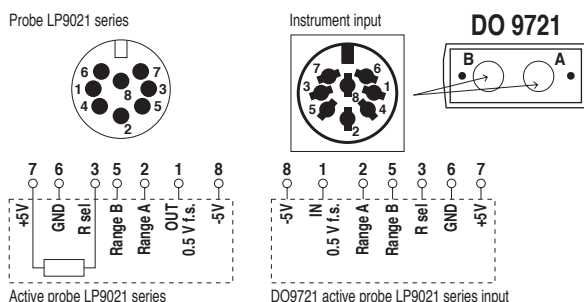


- 1 Input A, DIN 45326 8-pole connector.
- 2 HOLD symbol, the measurement refers to the moment in which the HOLD key was pressed.
- 3 Battery symbol: flashes during RECORD function, permanently lit if the battery is running low.
- 4 REL symbol, indicates that the instrument is making a relative measurement.
- 5 Serial Out/Memory. Fixed symbol: the instrument is storing. Flashing symbol: serial output is enabled.
- 6 MED symbol: the display shows the mean values found during RCD function.
- 7 Q: instrument in Q-energy function, flashes when it has reached the limit.
- 8 Time: the display indicates the integration time, if flashing it has reached the time programmed for integration.
- 9 Lux: the led indicates that the measurement is in lux.
- 10 $\mu\text{W}/\text{cm}^2$: the led indicates that the measurement is in $\mu\text{W}/\text{cm}^2$.
- 11 $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$: the led indicates that the measurement is in $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$.
- 12 REL key: shows the difference between the current value and the value stored when the REL key is pressed.
- 13 HOLD key for blocking the reading.
- 14 Unit A key: for selecting the measurement unit for input A, depending on the probe fitted. When turned to P0 mode, it sets the Q-energy and Time limits for input A.
- 15 Serial Output: activates data transmission at the RS232C serial output.
- 16 ▲ (Memory clear): increases the parameters in programming mode; when held down it erases the "RCD" memory; when pressed with P1, it erases the permanent memory.
- 17 PROG key: activates the programs P0... P1... P... of the different instrument functions.
- 18 Connector for RS232C (SUB D male 9 pole).
- 19 Input B, DIN 45326 8-pole connector.
- 20 Symbol 10^3 : indicates multiplication factor 10^3 for the respective channel.
- 21 Symbols A and B: for magnitudes Q and T indicate the channel selected.
- 22 A-B: the bottom display shows the difference between A and B. The top display shows A.
- 23 MIN symbol: the display shows the minimum values found during RCD function.
- 24 MAX symbol: the display shows the maximum values found during RCD function.
- 25 °C: the led indicates that the temperature measurement is in degrees centigrade.
- 26 °F: the led indicates that the temperature measurement is in degrees Fahrenheit.
- 27 fcd: the led indicates that the measurement is in fcd (foot-candle).
- 28 W/m^2 : the led indicates that the measurement is in W/m^2 .
- 29 cd/m^2 : the led indicates that the measurement is in cd/m^2 .
- 30 On/Off key: for switching the instrument on or off.
- 31 Unit B key: for selecting the measurement unit for input B, depending on the probe fitted. When turned to P0 mode, it sets the Q-energy and Time limits for input B.
- 32 A-B key: shows the difference between the inputs.
- 33 Data Call key (Max-Min-Med-Q-Time): recalls on the display the maximum, mean, minimum, Q and Time values of each input.
- 34 ▼ (RCD): starts and stops the RECORD function, in programming mode it decreases the parameter shown.
- 35 ENTER key: starts and stops storage, confirms the parameters set during programming.

A) Amplified temperature probe with Pt100 platinum-sensitive element



B) Probes for photometric and radiometric measurements



| | | | | |
|------------------------------------|-----------------------------------|--|---------------------------------------|---------------------------------|
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