QUANTUM-PHOTO RADIOMETER AND THERMOMETER - DATALOGGER DO 9721

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 recognises the probes connected, whether they be illuminance, irradiance, luminance or temperature probes, and can display 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** is able to take illuminance measurements in lux and in fcd (foot-candle), irradiance measurements in W/m^2, in $\mu W/cm^2$ e in $\mu mol/m^2s$, luminance measurements in cd/m^2 and temperature measurements in °C or °F.

The instrument's Data Logger function enables it to store up to 30,000 readings. The sampling period is variable from 1 second to 12 hours.

The data acquired may later be transferred 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 must be chosen to suit the specific application; see the section on accessories.
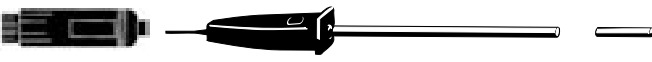
INSTRUMENT TECHNICAL DATA

Inputs / type of measurement 2:	photometric / radiometric or temperature
Connector	DIN 45326 8-pole
Measuring range	
Photometric measurements	0...200.000 lux
	0...20.000 fcd
	0...2.000.000 cd/m^2
Radiometric measurements	0...2000 W/m^2
	0...200.000 $\mu W/cm^2$
	0...200.000 $\mu mol/m^2s$
Q energy	depends on the active measurements unit
Integration time	19 hours, 59 minutes, 59 seconds
No. conversions per second	2
Working temperature	-5...+50°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

Probe types	Measuring range	Spectral range	Calibration uncertainty	Uncertainty f_2
LP 9021 PHOT	0.1÷200000 LUX	CIE N°69 Class C	<4%	<3%
LP 9021 RAD	1 mW/m^2÷2000 W/m^2	450÷950 nm	<5%	<6%
LP 9021 PAR	0.1 $\mu mol/m^2s$÷20000 $\mu mol/m^2s$	400÷700 nm	<5%	<6%
LP 9021 UVA	1 mW/m^2÷2000 W/m^2	315÷400 nm	<5%	<6%
LP 9021 UVB	1 mW/m^2÷2000 W/m^2	280÷315 nm	<5%	<6%
LP 9021 UVC	1 mW/m^2÷2000 W/m^2	200÷280 nm	<5%	<6%
LP 9021 LUM6	1÷2 x 10^6 cd/m^2	CIE (error <8%)	<5%	===
LP 9021 ERY	$0.1 \cdot 10^{-3}$ W_{eff}/m^2 2000 W_{eff}/m^2	250 mm÷400 mm	<15%	===

ACCURACY INSTRUMENT			
	at 25°C +/-	from -5°C up to 50°C +/-	Measuring range +/-
Basic accuracy instrument	0.1% + 1 digit	0.2% + 1 digit	
Temperature measurement instrument + 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	200 ... -50°C 50 ... +200°C +200 ... +650°C

TEMPERATURE PROBES				
CODE	Description	Drawing	τ Sec..	Temp/°C
TP 870	Immersion probe Ø 3 x 230 mm		3"A	-50/+400
TP 870/P	Penetration probe Ø 4 x 150 mm		3"A	-50/+400
TP 870/C	Surface probe Ø 4 x 230 mm		12"C	-50/+400
TP 870/A	Air probe Ø 4 x 230 mm		3"B	-50/+250

A) Time constant in water at 100°C / **B)** Time constant observed with metal surface at 200°C / **C)** Time constant in air at 100°C
Note: The time constant is the time needed to respond to 63% of the temperature changes.

LP 9021 PHOT

LP 9021 LUM6

LP 9021 PAR

LP 9021 RAD

LP 9021 UVA

LP 9021 UVB

LP 9021 UVC

LP BL

ORDER CODES

DO 9721K: Basic instrument kit, diplomatic carrying case, instrument, CP RS232C serial connecting cable, 9V battery.

LP 9021 PHOT: Photometric probe for measuring light, **ILLUMINANCE**, photopic filter complying with CIE, 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: Radiometric probe for measuring **IRRADIANCE** in the region of PAR radiations (Photosynthetically Active Radiation); it works in the field of the chlorophyll process following a special response curve.

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 9021 LUM6: Probe for measuring **LUMINANCE**, measuring range from 1 to 1999 x 103 candles/ m2. Measuring angle 6°. CIE filter for correction of the response according to the human eye.

LP 9021 ERY: Radiometric probe for **TOTAL EFFECTIVE IRRADIANCE** (W_{eff}/m^2) according to the UV action curve (CEI EN 60335-2-27) complete with SICRAM module. Spectral range: 250 nm…400 nm, quartz diffuser for cosine correction. Measurement range: $0.1 \cdot 10^{-3} W_{eff}$ /m^2 … 2000 W_{eff} /m^2.
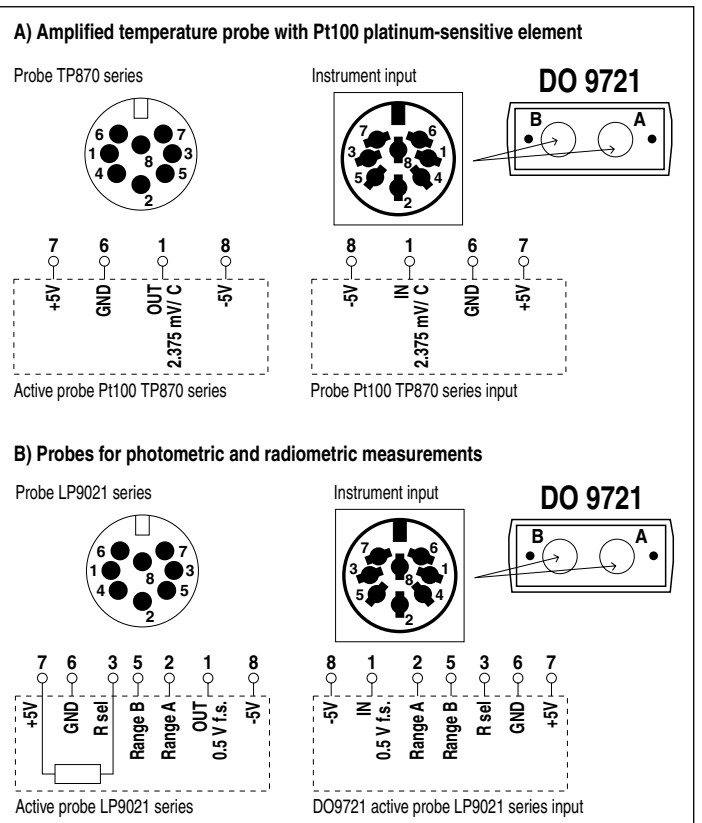
LP BL: Stand for supporting and levelling probes, eccept for LP 9021 LUM6.
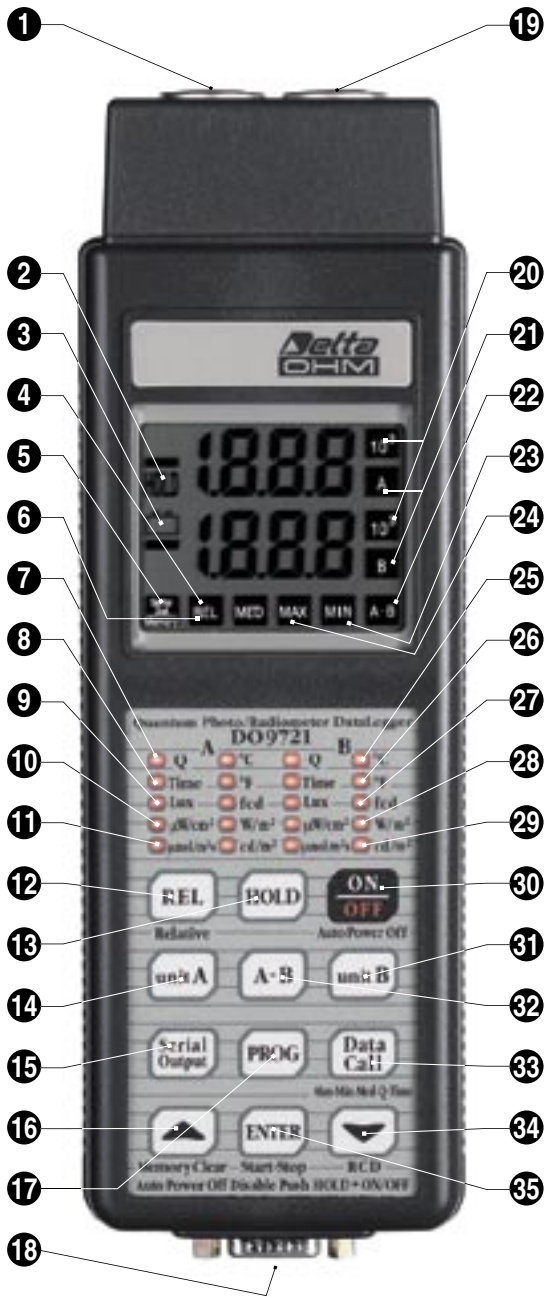
TP 870: Immersion temperature probe, Pt100 sensor, diam. 3x230 mm, measuring range -50...+400°C.

TP 870/C: Contact temperature probe, Pt100 sensor, diam. 4x230 mm, measuring range -50...+400°C.

TP 870/P: Penetration temperature probe, Pt100 sensor, diam. 4x150 mm, measuring range -50...+400°C.

TP 870/A: Air temperature probe, Pt100 sensor, diam. 4x230 mm, measuring range -50...+250°C.

A) Amplified temperature probe with Pt100 platinum-sensitive element

Probe TP870 series

Instrument input

DO 9721

B   A

7	6	1	8
+5V	GND	OUT 2.375 mV/ C	-5V

Active probe Pt100 TP870 series

8	1	6	7
-5V	IN 2.375 mV/ C	GND	+5V

Probe Pt100 TP870 series input

B) Probes for photometric and radiometric measurements

Probe LP9021 series

Instrument input

DO 9721

B   A

7	6	3	5	2	1	8
+5V	GND	R sel	Range B	Range A	OUT 0.5 V f.s.	-5V

Active probe LP9021 series

8	1	2	5	3	6	7
-5V	IN 0.5 V f.s.	Range A	Range B	R sel	GND	+5V

DO9721 active probe LP9021 series input

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. µW/cm2: the led indicates that the measurement is in µW/cm2.
11. µmol/m2s: the led indicates that the measurement is in µmol m–2 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 103: indicates multiplication factor 103 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/m2: the led indicates that the measurement is in W/m2.
29. cd/m2: the led indicates that the measurement is in cd/m2.
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.