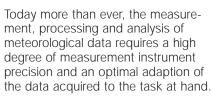


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Enercorp is pleased to support and sell these fine meteorological instruments designed and built by Thies Clima in Germany.











Glossary



Albedo The diffuse or reflected radiation, which, e.g., returns to the space "Albedo of the

whole earth"

cos-Correction Compensation of cos-error.

cos-Error Deviation of transmitter sensitivity from ideal dependency of direction.

The sensitivity of sensor is depending with the cos-function in ideal manner from

the direction.

Direct Radiation The part of radiation falling in from the direction of the sun.

Global Radiation The sum of direct solar radiation and diffuse radiation. The spectral range extends

within the short-wave range, 0.3 μm to 3 μm

Infrared Radiation Radiation above the visible radiation in the spectral range > 0.76 μm.

Long-wave Radiation Radiation in the spectral range above 3 μm.

Net Radiation or Radiation Balance (long-wave) Difference between short-wave global radiation and long-wave atmospheric counter radiation on the one hand and short-wave reflection radiation and long-wave

temperature radiation of the earth on the other hand.

PAR The photosynthetic active radiation in the spectral range 0.4–0.7 μm.

It is a fundamental factor for the growth of plants (forming of chlorophyll).

Pyranometer Instrument for the measurement of the global radiation.

Pyrradiometer Instrument for the measurement of radiation balance in the total spectrum of the solar

radiation.

Radiation Balance or Net Radiation

(short-wave)

Difference between the infalling global radiation and the reflecting radiation of the ground.

Short-wave Radiation Radiation in the spectral range below 3 µm

Sky Radiation

Diffuse Radiation

Radiation which is diffused by air particles on its way through the atmosphere

and which reaches the earth's surface.

Solar Constant Radiation which can be measured at the upper limit of the atmosphere: 1.37 kW/m².

Solar Radiation Radiation coming directly from the sun.

Nearly exclusively with wave lengths up to 3 μm

Sunshine Duration Period in which the solar radiation exceeds the threshold >120 W/m².

UV-Radiation The ultraviolet radiation below the visible radiation in the spectral range < 0.36 μm.

UVA Radiation The long-wave UV-radiation in the spectral range $> 0.313 \,\mu m$. It is essential for the

strengthening of the human immunity system and is responsible for the sun tan of the

skin.

UVB Radiation The short-wave UV-radiation in the spectral range < 0.313 μm. It is dangerous for irre-

versible damages of the human skin (cancer of the skin).

Visible Radiation The light perceived by the human eye in the spectral range of 0.36 - 0.76 μm.



Model Brief Description

Order No.

Technical Data

Sunshine



Sunshine Recorder

acc. to Campbell-Stokes

Registers the sunshine duration for one entire day. A cut glass sphere focuses the sun's ravs and leave an image line on the strip chart.

The length of the image line corresponds to the duration of sunshine.

The shipment includes the following strip charts 140 sheets for summer 140 sheets for winter 100 sheets for spring and autumn

Recording charts for: 7.1400.10.000 7.1405.10.000

7.1400.10.000

North. and southern hemisphere, latitude, 0 - 40 °

7.1405.10.000

North, and southern hemisphere,

latitude, 25 - 60°

Measuring value sunshine duration Degree of latitude adjustable Recording period

1 day per strip chart Dimensions 205 x 185 x 145 mm 5 kg

Weight

205210 205213



Sunshine Indicator SDE

Instrument to measure the global radiation and the sunshine duration.

The threshold of sunshine duration is stated by the German Weather Service (DWD) with 120 W/m². The sensor delivers a digital Yes-/No-information for the sunshine duration and a voltage as information for the global radiation. The measurement is cos-corrected. Delivery includes calibration certificate

7.1420.00.000

Measuring range Spectral range Max. spectr. sensitivity. Ambient temp. Linearity Cos-correction Absolute error Signal output Operating voltage Sunshine duration signal Threshold

Diffusor Cable **Dimensions**

Weight

0 - ca. 1300 W/m² 0.38 μm - 1.1 μm 0.78 um

-30°C - +60 °C < 1 % error f2 < 3% < ± 5 % 0 - 5 V (global rad.) 10 V - 18 V DC

4.5 V - 5.0 V yes no V - 0.6 V 120 W/m², adjustable

PTFE 5 m long

Ø 80 mm, 82 mm high

0.3 kg

Brightness



Brightness Transmitter

The instrument serves for the acquisition of the daylight intensity, and is adapted to the sensitivity of the human eye. The linearized electrical output signal can be used for the control of shading devices, heating systems, and irrigation plants.

7.1414.10.xxx 7.1414.12.xxx 7.1414.15.xxx 7.1414.22.xxx .040 .041 .061

Measuring range

0 - 100 000 lux 5 000 lux 0 -

Electrical output

Accuracy Spectral range Half angle Operating voltage

Protection **Dimensions** Weight

0 - 20 000 lux

2 000 lux $0 - 20 \text{ mA } (600 \Omega)$ 4 - 20 mA (600 Ω)

0 - 10 V (max. 10 mA) \pm 3 % of mr. 0.350 - 0.775 μm ± 55 degree 24 V AC/DC IP 65 80 x 82 x 65 mm 0.15 kg

Model Brief

Order No.

Technical Data

Brightness Transmitter

independent of the direction

The measuring transmitter adapted to the sensitivity of the human eye serves for the acquisition of the total ambient brightness. The measuring range and the electrical output can be set through internal code-switches. The standardized output of the measuring value allows the connection to available control systems.

7.1414.51.

Measuring range

Electrical output 2

Electrical output

programmable

Accuracy Half angle Operating voltage

Ambient temp. Protection Cable Dimensions Weight see output 1
only 0 - 1000 lux
± 5 % of mr.
180 degree
15 - 36 V DC
15 - 26 V AC
- 30 - + 70 °C

- 30 - + 70 °C IP 65 5 m long Ø 70 x 73 mm 0.4 ka



Global Radition

Pyranometer CM 11

WMO-recommended measured value transmitter to determine global radiation. It is also used as a reference instrument due to its measurement precision. Easy to adjust horizontally owing to its adjustable feet and a level. The protective label can be easily removed.

The instrument is "secondary standard" according to WMO and ISO 9060.

Delivery includes calibration certificate.

7.1415.01.000

Measuring range Sensitivity Spectral range Non-linearity Impedance Response time Sensor type Ambient. temp. Cable Dimensions Weight $\begin{array}{l} 0 - 1400 \text{ W/m}^2 \\ 4 - 6 \ \mu\text{V/Wm}^{-2} \\ 0.305 - 2.8 \ \mu\text{m} \\ \pm 0.6 \ \% < 1000 \ \text{W/m}^2 \\ 700 - 1500 \ \Omega \\ 1/e \ 4s \ ; 99 \ \% \ 24s \\ 100 \ \text{Thermocouples} \\ - 40 - + 80 \ ^{\circ}\text{C} \\ 10 \ \text{m long} \\ \varnothing \ 150 \ x \ 92 \ \text{mm} \\ 0.85 \ \text{kg} \end{array}$



Pyranometer CM 6B

The instrument can be used also as Albedometer. Easy to adjust horizontally owing to its adjustable feet and a level. The protective label can be easily removed.

The instrument is "first class" according to WMO and ISO 9060.

Delivery includes calibration certificate.

7.1415.02.000

Measuring range Sensitivity Spectral range Non-linearity Impedance Response time Sensor type Ambient. temp. Cable Dimensions Weight 0 - 1400 W/m² 9 - 15 μ V/Wm⁻² 0.305 - 2.8 μ m \pm 1.5 % (< 1000 W/m²) 70 - 100 Ω 1/e 5 s; 99 % 55s 64 Thermocouples - 40 - + 80 °C 10 m long Ø 150 x 92 mm 0.85 kg



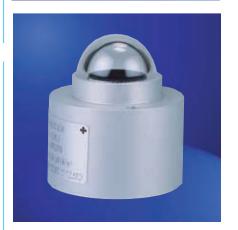
Pyranometer CM 3

Measuring value transmitter for the determination of the global radiation. The instrument can be used also as Albedometer. The instrument is "second class" according to WMO and ISO 9060.

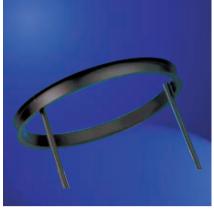
Delivery includes calibration certificate.

7.1415.03.000

Measuring range Sensitivity Spectral range Non-linearity Impedance Response time Sensor type Ambient. temp. Cable Dimensions Weight 0 - 1400 W/m² 10 - 35 μV/Wm⁻² 0.305 - 2.8 μm \pm 2,5 % (< 1000 W/m²) 79 - 200 Ω 18 s at 95 % 64 Thermocouples - 40 - + 80 °C 5 m long Ø 55 x 60 mm 0.35 kg







Model Brief

Shadow Ring CM 121

Serves for shading the Pyranometer from direct solar radiation. By that, an exact measurement of the diffuse sky radiation is possible.

Suitable sensors: Pyranometer CM 11 or Pyranometer CM 6B

Order No.

Technical Data

7.1415.01.121

Material anodized aluminium Height (max.) 800 mm Ring outer Ø 620 mm Ring width 55 mm Rina width / Rina 0.185 radius ratio Weight, incl. CM 11 5.8 kg



Pyranometer SP-Lite

Electrical measuring instrument to measure the global radiation. The sensor element consists of a silicium-photodiode; it delivers a voltage signal in direct pro-portion to the radiation. Delivery includes calibration certificate.

Pyranometer GSM 3.3 Electrical measuring instrument to measure the global radiation.

The measurement is cos-corrected.

Delivery includes calibration certificate.

7.1415.08.000

Measuring range 0 - 2000 W/m² Measuring element Silicium diode Spectral range 0.4 - 1.1 μm . Sensitivity 100 μV/Wm⁻² Cos-error < 10 % Temperature error ± 0.15 % / °C - 30 - + 70 °C Ambient temp. Response time < 1 s Impedance 50 Ω Cable 3 m long **Dimensions** Ø 54 x 34 mm Weight 0.15 kg

Measuring range Electrical output

.051 7.1415.09⁰61× .040 .041 .051

.040 .041

.061

7.1415.09.xxx

0 - 1300 W/m² 0 - 20 mA

4 - 20 mA 0 - 5 V 0 - 10 V 0.4 - 1.1 μm Spectral range Max. spectr. 0.78 μm sensitivity Cos-correction error f2 < 3 %

Linearity < 1 % Abs. error < 10 % Diffuser PTFE Dome **PMMA** - 30 - + 60 °C 10 - 18 VDC Ambient temp. Operating voltage Cable 5 m long Ø 80 x 95 mm Dimensions Weight 0.3 kg

Net Radiation Transmitter

Suitable for measuring radiation balance consists of two identical thermocouple elements. The upper plate measures global radiation, the lower one measures the reflected radiation from the surface. The interior is dried by means of silica gel. The instrument is "first class"

according to WMO

Delivery includes calibration certificate.

7.1415.10.000

Measuring range Sensitivity Spectral range Impedance Response time Linearity Dome Sensor type Ambient temp. Cable **Dimensions** Weight

0 - 1500 W/m² approx. 15 μV/Wm-2 $0.3 - >30 \mu m$ approx. 5 Ω 25 s at 95 % ± 2 % (0.5 - 1330 W/m²) Lupolene Thermocouples - 40 - + 60 °C 10 m long

127 x 50 x 35 mm 0.35 kg



Model Brief

Order No.

Technical Data

Pyrradiometer

For measurement of the total radiation balance, global radiation and reflected radiation. The measuring values of the global and the reflected radiation are put out separately.
The instrument is "first class"

according to WMO.

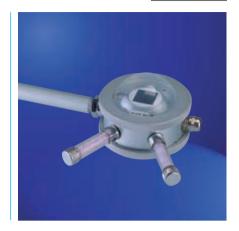
Delivery includes calibration certificate

7.1415.20.000

Measuring range Sensitivity Spectral range Impedance Linearity Response time

Sensor type Ambient temp. Cable **Dimensions** Weiaht

0 - 1500 W/m² approx. 15 μ V/Wm⁻² $0.3 - > 60 \, \mu m$ approx. 190 Ω/Sensor < 2 % (0.5 - 1330 W/m²) 25 s at 95 % 45 s at 99 % Thermocouples - 40 - + 60 °C 5 m long Ø 90 x 88 mm 1.25 ka



Albedometer CM 7B

To measure the short-wave radiation balance, global radiation and reflection radiation. Albedo could be calculated from this measured values. The instrument consists of two identical Pyrradiometers. The upper measures the global radiation, the lower the reflection radiation of the ground. The Pyrradiometers have separate outputs. The interior is dried by means of silica gel. Delivery includes calibration certificate.

7.1415.15.000

Measuring range Sensitivity Spectral range . Impedance Linearity Response time Sensor type Cable Dimensions Weight

0 - 2000 W/m² 9 - 15 μ V/Wm⁻² 0.3 - 2.8 μm 70 - 100 Ω ±1.5% (< 1000 W/m²) 1/e 4 s; 55 s at 99% Thermocouples 10 m long Ø 150 x 115 mm 1.9 kg



Net Radiometer NR Lite

The instrument serves to measure the net radiation and the proportion between the solar radiation and the infrared radiation far away.

The output signal is in proportion to the net radiation and can be interpreted as radiation energy, which is absorbed from the earth's surface.

7.1415.40.000

Measuring range Sensitivity Spectral range Response time Sensor type Ambient temp. Cable **Dimensions** Support Arm Weight

- 200 - + 1500 W/m² 10 μV/Wm⁻² 0.2 - 100 μm 20 s Thermocouples - 30 - + 70 °C 3 m lona Ø 80 mm Ø 16 x 400 mm 0.26 kg



UV Radiation

UVAB Sensor S

The sensor acquires the radiations UV-A and UV-B independently from each other. The separately stated measuring results give direct information about the medically and biologically relevant correlation of these radiation fields.

Mounting / Adjustment Device (not shown) To align the UVAB Sensor S horizontally.

7.1416.00.000

Measuring range Spectral range UV-A Measuring range

Spectral range Electrical output Linearity Ambient temp. Operating voltage Heating Cable / Connector

Dimensions

Weight

7.1416.01.000

UV-B

0.28 - 0.315 μm 0 - 42.7 W/m² 0.315 - 0.4 μm 2 x 0 - 3 V

< 0.2 % -25 °C - + 50 °C 6 - 32 V DC, 12 mA 7 - 18 V DC, 8 W 1 Connector Ø 122 x 127 mm 1.2 kg

0 - 1.25 W /m²







Model Brief Description

UVAB Sensor E 1.1

The sensor acquires the radiations UV-A and UV-B independently from each other. The measuring results correspond to the erythem-curve acc. to DIN 5050. They give direct information about the medically and biologically relevant correlation of these radiation fields.

The measurement is coscorrected

Delivery includes calibration certificate.

Order No.

Technical Data

7.1416.10.040 .051 .061

Electrical output

4 - 20 mA 0-5 V 0 - 10 V

0 - 20 mA

UV-B

Measuring range Spectral range max. sensitivity

UV-A

Measuring range Spectral range max. sensitivity

Operating voltage Ambient temp. Switch on time Switch off time Cos-correction Linearity

Absolute error Temp. coeff. Cable Dimensions Weight

 $0 - 0.5 \text{ W/m}^2$ 0.265 - 0.315 μm 0.297 μm

0 - 30 W/m² 0.310 - 0.400 μm $0.335~\mu m$

10 -18 V DC / 250 μA - 30 °C - + 60 °C

< 12 s error f2 < 1,5 % < 1% < ± 10 %

< 0,2 % /K 5 m long, connector Ø 80 x 82 mm 0.3 kg



UVB Sensor E 1.c

Measuring transmitter for shortwave radiation, which can cause irreversible damages of the human skin.

The relative spectral sensitivity of the sensor is especially suited to the ervthem-curve acc. to DIN 5050. This sensor determines exactly the skin-damaging components of the spectral range.

Delivery includes calibration certificate.

7.1416.20.040 .051 .061

Electrical output

0 - 20 mA 4 - 20 mA 0-5 V 0 - 10 V

Measuring range 0 - ca. 0.5 W /m² Spectral range 0.265 - 0.315 μm Max. spectr. 0.297 μm sensitivity Ambient temp. -30 °C - + 60 °C

Switch on time < 1 s Switch off time < 12 s Cos-correction error f2 < 3 % Linearity < 1% < 10 % Absolute error Operating voltage 10 - 18 V DC 5 m long Cable Dimensions Ø 36 x 90 mm Weight 0.3 kg





Sensor PAR 5.3

With the PAR-sensor the photochemical growth processes of outdoor- and greenhouseplants can be optimized. The sensitivity corresponds to the optimal degree of effect of chlorophyll. The measuring results make it possible to assess reliably the developmental conditions of the plants.

Delivery includes calibration certificate.

7.1418.00.040 .041 .051 .061

Electrical output

Measuring range

Spectral range

Max. spektr.

0 - 20 mA 4 - 20 mA 0-5 V

0 - 10 V 0 - 250 W/m² $0.38 - 0.7 \mu m$ 0.42 and 0.6 μm

sensitivity Switch on time < 1 sSwitch off time < 12 s Cos-Correction error f2 < 3% Linearity < 1 % Abs. error < 10 % Ambient temp. - 30 °C - + 60 °C Operating voltage

Cable Dimensions Weight

+ 9 V - +24 V DC +14 V - +24 V DC max. 750 μA 5 m long Ø 80 x 95 mm 0.3 kg

Model Brief

Technical Data

- 9 -

Heat Flux

Heat Flux Plate

Measures the temperature balance through a surface. Consists of 250 Cu-CuNi thermocouples between two stainless steel plates.

Delivery includes calibration certificate.

7.1417.00.000

Sensitivity Impedance Accuracy Time response Temp. Coeff. Cable Dimensions Weight

200 μV/mW/cm² 20 Ω ±5% 30 s in air (95 %) 0.2 % / °C 4 m Iona 48 x 33 x 6 mm

0.22 kg

Transducer

Measuring Transducer SH

Radiation - Brightness

This measuring transducer is usually connected to radiation or brightness transmitters. This allows the control of connected recording or display instrument. The electrical input is individually adjusted to correspond to that of the transmitter. The wall mounting case is designed for mounting to a plane wall, the PC-board is designed for insertion into a 19" board

7.1084.xx.xxx 7.1184.xx.xxx .00.xxx .10.xxx .040

.041

.061

Measuring range

Model Electrical output

0 - 1300 W/m² -300 - 1000 W/m² Wall mounting case PC-board 0 - 20 mA

4 - 20 mA 0 - 10 V

Electrical Input Ambient temp. Operating voltage Protection

Dimensions

Weight

mV, acc. to the sensor 0 - 40 °C 230 V / 50 Hz IP 65 (wmc) 200 x 120 x 75 mm (wmc) 170 x 100 x 30 mm (pcb)

0.65 kg resp. 0.25 kg



Preamplifier

The instrument serves to convert the small measuring value signals of the radiation sensor into a standardized signal, which can be transmitted also over a long distance afterwards.

7.1415.00.100

Electrical input

Electrical output

Operating voltage

Ambient temp.

Protection

Dimensions

Cable

Weight

mV, individually adjusted to the corresponded sensor 0 - 5 V (0 - 1250 W/m²) - 30 - + 50 °C

6 - 18 V DC IP 65 3 m long 58 x 35 x 64 mm 0.18 kg



Digital Displays

Digital Indicator S for Installation

Flat-section indicator for connection to available radiation data transmitters or measuring transducer.

The measured value is indicated digitally with red LED digits.

Designed for installation in switch panels or front panels. The background of the indicator is black to facilitate reading. 7.1044.10.xxx 7.1044.11.xxx .040 .041

.061

Display range

Electrical Input

Resolution Display Operating voltage Model Protection

Dimensions Weight

0 - 1300 W/m² -300 - 1000 W/m²

0 - 20 mA 4 - 20 mA 0 - 10 V ± 1 digit

LED, red, 13 mm high 230 V / 50 Hz Switch panel installation

IP 20

96 x 48 x 104 mm

0.3 kg



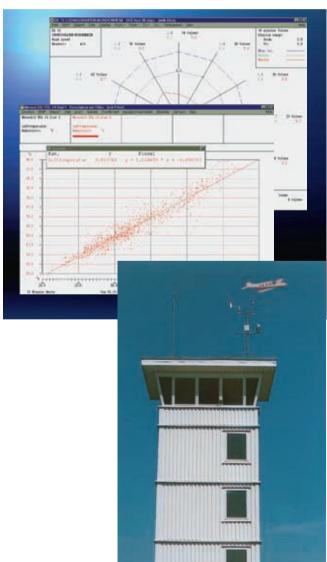
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July 2003 Part #	Radiation Instrument Prices Description	44	
		\$Cdn	\$US
7.1044.10.0XX	DIGITAL INDICATOR FOR PANEL INSTALLATION	\$966	\$724
7.1044.11.0XX	DIGITAL INDICATOR FOR PANEL INSTALLATION	\$966	\$724
7.1084.00.0XX	TRANSDUCER SH 40/41/61	\$690	\$517
7.1084.10.0XX	TRANSDUCER SH 40/41/61	\$621	\$466
7.1184.00.0XX	TRANSDUCER SH 40/41/61	\$690	\$517
7.1184.10.0XX	TRANSDUCER SH 40/41/61	\$621	\$466
7.1400.10.000	SUNSHINE RECORDER	\$2,322	\$1,742
7.1405.10.000	SUNSHINE RECORDER	\$2,322	\$1,742
7.1414.10.0XX	BRIGHTNESS TRANSMITTER 40/41/61	\$447	\$335
7.1414.12.0XX	BRIGHTNESS TRANSMITTER 40/41/61	\$447	\$335
7.1414.15.0XX	BRIGHTNESS TRANSMITTER 40/41/61	\$447	\$335
7.1414.22.0XX	BRIGHTNESS TRANSMITTER 40/41/61	\$500	\$375
7.1414.51.000	BRIGHTNESS TRANSMITTER	\$596	\$447
7.1415.00.000	RADIATION TRANSMITTER	\$3,504	\$2,628
7.1415.00.100	AMPLIFIER	\$579	\$435
7.1415.01.000	PYRANOMETER CM 11	\$4,201	\$3,151
7.1415.01.121	SHADOW RING CM 121	\$5,031	\$3,773
7.1415.01.400	SOLAR SENSOR AMPLIFIER CT24	\$878	\$658
7.1415.02.000	PYRANOMETER CM 6 B	\$2,847	\$2,135
7.1415.03.000	PYRANOMETER CM 3	\$1,342	\$1,006
7.1415.08.000	PYRANOMETER SP-Lite	\$765	\$574
7.1415.09.0XX	PYRANOMETER GSM 3.3 40/41/51/61	\$1,367	\$1,025
7.1415.10.000	RADIATION BALANCE TRANSMITTER	\$3,363	\$2,522
7.1415.20.000	PYRRADIOMETER	\$6,446	\$4,834
7.1415.25.000	ALBEDOMETER CM 7 B	\$5,663	\$4,247
7.1415.40.000	NET RADIOMETER NR LITE	\$2,483	\$1,862
7.1416.00.000	UVAB SENSOR S AB IRRADIANCE	\$13,669	\$10,251
7.1416.01.000	MOUNTING/ADJUSTMENT DEVICE	\$564	\$423
7.1416.10.0XX	UVAB SENSOR E 1.1 40/41/51/61	\$4,687	\$3,516
7.1416.20.040	UVB - SENSOR E 1.c 40/41/51/61	\$840	\$630
7.1417.00.000	HEAT FLUX PLATE	\$1,139	\$854
7.1418.00.0XX	SENSOR PAR 5.3 40/41/51/61	\$1,650	\$1,238
7.1420.00.000	SUNSHINE INDICATOR SDE	\$3,536	\$2,652
7.1421.00.000	SUNSHINE INDICATOR CSD	\$3,657	\$2,742
7.1421.00.001	SUNSHINE INDICATOR CSD HEATED	\$4,000	\$3,000
ACCESSORIES			
4.3185.00.00X	HANGER - 1 m	\$757	\$568
4.3185.01.00X	HANGER - 1 m	\$740	\$555
4.3185.02.00X	HANGER - 1 m	\$587	\$440
4.3171.30.000	TRAVERSE - COMPACT, 0,8 m	\$159	\$119
4.3171.40.000	TRAVERSE - COMPACT, 0,4 m	\$125	\$94
506347	HOLDER - COMPACT	\$88	\$66
506345	ADAPTER	\$123	\$92
205210	RECORDING CHARTS 1400/380	\$183	\$137
205213	RECORDING CHARTS 1405/380	\$183	\$137