Product Catalogue

SOLAR RADIATION & PHOTONIC SENSORS

EKO INSTRUMENTS CO., LTD.

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EKO INSTRUMENTS

Established in Tokyo in 1927, EKO Instruments began with the distribution of instruments for the Japanese meteorological and environmental market. In the 50's the company started the development and production of its own solar radiation sensors.

We now offer a unique range of high precision broad band and spectral radiometers as well as various I-V measurement devices for the evaluation of photovoltaic components, systems, and energy plants.

EKO Instruments is also a center of competence offering know-how and customized services for the photovoltaic industry and in instrumental meteorology on an outstanding scientific level.

"A center of competence within the photovoltaic industry and instrumental meteorology"

Our international customers benefit from smart instrument synergies and innovative services which persistently improve and optimize the efficiency and quality of their photovoltaic systems and meteorological research.

Through its worldwide distribution network and regional offices, EKO has become a global player known for the durability and precision of its instruments which comply with the highest international quality standards.

OUR SOLAR RADIATION & PHOTONIC SENSORS RANGE

In this product catalogue you will find:

Other more specific sensors like UV radiometers, pyrgeometers or albedometers are available upon request. Don't hesitate to contact us for more information.

MS-56 PYRHELIOMETER (DNI SENSOR)

MS-56 mounted on Sun tracker STR-21G

The world's fastest response time

Perfectly suitable for the evaluation of Concentrated Photovoltaic (CPV) and Concentrated Solar Panel (CSP) systems.

The ISO First class pyrheliometer "MS-56" is a high quality DNI (Direct Normal Incidence) solar radiation sensor.

It is perfectly suitable to be used as a reference instrument for precise and accurate direct solar irradiance measurements and routine operation on a Sun tracker.

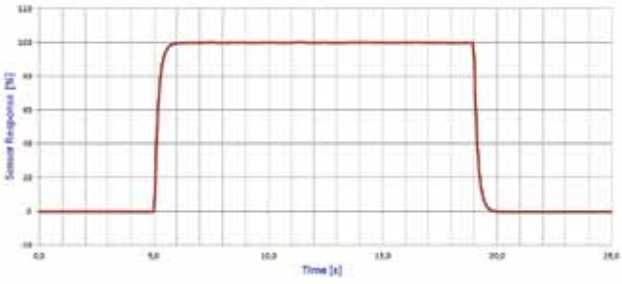
- Less than one second response time
- Accurate temperature compensation
- Thermally balanced detector
- Dual body temperature sensor
- Low power 12V / 0,5W window heater
- Compact, light weight, stylish design

Specifications

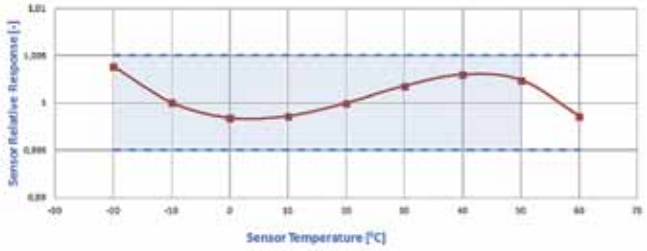
	MS-56
ISO 9060 classification	First Class
Response time 95%	< 1 s
Zero offset - Thermal radiation (200W/m²)	0 W/m²
Zero offset - Temperature change (5K/hr)	< 1 W/m²
Non-stability (change/year)	< 0.5 %
Non-linearity (at 1000W/m²)	< 0.5 %
Directional response (at 1000W/m²)	N/A
Spectral selectivity (0.35-1.5μm)	< 1 %
Temp. response (-20°C to 50°C band)	< 0.5 %
Tilt response (at 1000W/m²)	< 0.2 %
Sensitivity (μV/W/m²)	6 - 10
Impedance (Ω)	Approx. 5000
Operating temperature, °C	- 40 to +80
Wavelength range (> 50% transmittance)	200 to 4000 nm

Specifications are subject to change without further notice

Response time



Temperature dependency



PYRANOMETERS

The MS-Pyranometer series

Measuring global radiation and a lot more

EKO Pyranometers measure the total hemispherical solar radiant energy, a fundamental quantity in almost all weather-related phenomena of the Earth's climate system. EKO pyranometers are predominantly used in photovoltaic and solar thermal applications as well as for meteorological and climatological studies. They can also be used for plant ecology studies, material durability tests, etc.

The measurement technology of those sensors is based on a thermopile detector which has a flat spectral response and a hemispherical field-of-view. Therefore, pyranometers are also called global broad-band sensors. They measure global horizontal irradiance (GHI), diffuse horizontal irradiance (DHI) and global tilted irradiance (GTI).

Products

MS-802

ISO 9060 Secondary Standard

As an ISO secondary standard pyranometer, the MS-802 is the ultimate reference sensor to measure global broad-band radiation with high precision. It is used as a standard in PV research and climatological studies around the world.

Double-dome construction is adopted to improve the accuracy of the measurement and to minimize unwanted thermal offsets.

A ventilation unit can be added to the MS-802 to reduce the deposition of dust, dew, frost, snow etc. (Model MS-802F)

MS-402 / MS-410

ISO 9060 First Class

The ISO First Class pyranometers MS-402 and MS-410 are perfectly suited for the sampling of 10 minute averaged solar radiative fluxes in horizontal or tilted measurement configurations.

The two high-quality glass domes protect the detector efficiently from negative thermal effects. The MS-402 is the only temperature-compensated first class pyranometer on the market.

A ventilation unit can be added to the MS-402 to reduce the deposition of dust, dew, frost, snow etc. (Model MS-402F)

MS-602

ISO 9060 Second Class

Within the MS-series the MS-602 pyranometer is the smallest true thermopile pyranometer. It is the most economical solution for global solar radiation measurements, capturing the full solar spectrum.

MS-602 meets the ISO Second Class performance criteria. However its excellent temperature dependency characteristics can only be found on higher class pyranometers.

This radiation sensor is used in many meteorological networks and professional small-scale PV sites where the measurement of solar radiation matters.

MS-802 pyranometer mounted on top of an STR-22G Sun tracker. The shading ball is used for the measurement of diffuse radiation.

ISO 9060 compliant

ISO 9060 classifies pyranometers into three categories : Secondary Standard, First Class and Second Class. The characteristics of each class are defined by temperature dependency, non-linearity, response time and other criteria.

Specifications

	MS-802 /MS-802F	MS-402 /MS-402F	MS-410	MS-602
ISO 9060 classification	Secondary Standard	First Class	First Class	Second Class
Response time 95% (sec)	< 5	< 8	< 18	< 17
Zero offset - Thermal radiation (200W/m²)	+ 6 W/m²	+ 6 W/m²	+ 6 W/m²	+ 10 W/m²
Zero offset - Temperature change (5K/hr)	< 2 W/m²	< 2 W/m²	< 2 W/m²	< 6 W/m²
Non-stability (change/year)	< 0.5 %	< 0.5 %	< 1.5 %	< 1.7 %
Non-linearity (at 1000W/m²)	< 0.2 %	< 0.2 %	< 1 %	< 1.5 %
Directional response (at 1000W/m²)	< 10 W/m²	< 20 W/m²	< 20 W/m²	< 25 W/m²
Spectral selectivity (0.35-1.5μm)	<1 %	<1 %	<1 %	<1 %
Temp. response (for 50°C band)	< 1 %	< 1 %	< 2 %	< 2 %
Tilt response (at 1000W/m²)	< 0.2 %	< 0.2 %	< 2 %	< 2 %
Nominal Sensitivity (μV/W/m²)	7	7	7	7
Nominal Impedance (Ω)	500	500	20 - 140	20 - 140
Operating temperature range (°C)	- 40 to +80	- 40 to +80	- 40 to +80	- 40 to +80
Wavelength range in nm (> 50% transmittance)	305 to 2800	305 to 2800	305 to 2800	305 to 2800

Specifications are subject to change without further notice

SPECTRORADIOMETERS

MS-700 and MS-700 DNI

The reference instruments for spectral solar irradiance measurements

The grating technology used in all EKO spectroradiometers allows to measure the spectrum instantaneously, avoiding artifacts caused by changing radiation levels during the measurement, for example due to passing clouds. Thanks to the many EKO accessories the spectroradiometers can be used for the measurement of horizontal, tilted, diffuse, and direct spectral solar radiation.

Products

MS-700

The MS-700 spectroradiometer is the true working horse among the EKO spectroradiometers. During more than 10 years, this spectral radiometer has proven to be stable, reliable, and accurate. While conserving the stable and reliable hardware, PC software and calibration methods have been improved permanently.

The MS-700 can be controlled through serial communication interfaces either with the included PC software or using a set of serial commands, the latter allowing to integrate the sensor easily in corporate measurement systems using specific data collection procedures.

MS-700 DNI

Being aware of the requirements in concentrated photovoltaics, EKO Instruments developed a unique system for the measurement of the direct spectral solar irradiance: the MS-700 DNI.

The GPS Sun tracker based system with the MS-700 spectroradiometer features a precision collimator tube designed according to the DNI-related WMO and ISO norms. While the GPS Sun tracker operates autonomously, the MS-700 DNI can either be controlled by the PC software or a programmable data logger.

Advanced control and analysis PC software included

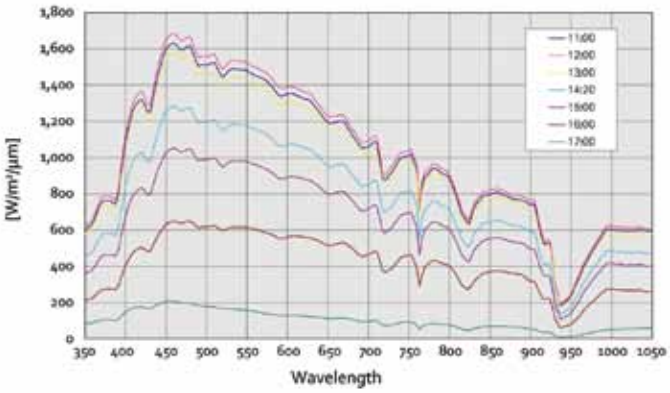
MS-701

The MS-701 UV spectroradiometer is specifically designed to measure the UV-A and UV-B spectral radiation. The high-quality calibration using 1000W Tungsten Halogen lamps enables the use of this radiometer for all kinds of UV-related measurement applications. Apart form the spectral measurement range, the same features as for the MS-700 apply to this UV spectroradiometer.

MS-710 / MS-712

The unique EKO spectroradiometers MS-710 and MS-712 are used as a set to cover the spectral measurement range from 350nm up to 1700nm (VIS and NIR). Each spectral radiometer is controlled and operated by an integrated PC software which combines the individual spectral data into one full spectrum.

The MS-710/MS-712-radiometer set, called "WISER", can be used as global spectroradiometer as well as for the measurement of the direct spectral solar irradiance. For direct spectral radiation measurements, EKO provides a special heavy-duty tracker and collimator tubes, similar to the MS-700 DNI.



The visible solar spectrum as seen by an MS-700

- Suitable for permanent outdoor usage
- Excellent long-term stability
- Excellent cosine response due to integrated diffusor and optics
- Low temperature dependency
- Fully controllable by data logger
- High quality calibration (NIST traceable)

Specifications

	MS-701	MS-700 / MS-700 DNI	MS-710	MS-712
Wavelength range (nm)	300 - 400	350 to 1050	350 - 950	900 - 1700
Detector array (pixels)	Si /256	Si /256	Si /1024	InGaAs /512
Spectral Resolution (data file)	1 / 5 nm	1 / 5 nm	1 / 5 nm	10 nm
Optical Resolution (measurement)	10 nm	10 nm	5 nm	7 nm
Wavelength accuracy	< 0.3 nm	< 0.3 nm	< 0.3 nm	<1.5 nm
Stray light	0.15%	0.15%	-	-
Directional response (0 - 80 °)	< 7%	< 7%	< 7%	< 7%
Aperture (MS-700 DNI)	5 °	5 °	-	-
Temp. response (-10°C to 40°C)	± 1 %	± 1 %	± 1 %	± 1 %
Control Temperature	25 °C	25 °C	25 °C	5 °C
Operating temperature range (°C)	- 10 to +40	- 10 to +40	- 10 to +40	-10 to +40
Cable length (Max. 30m optional)	10m	10 m	10m	10 m
Communication	RS-422 / RS-232			
Supply voltage of control unit	AC100-240V, 50/60Hz, 50VA / 12 VDC			

Specifications are subject to change without further notice

STR SUN TRACKING SYSTEMS

The STR-22G Sun tracker

Precise tracking, accurate measurement

The compact STR Sun trackers are perfectly suited to support all kinds of measurement sensors for measuring global, diffuse and direct radiation.

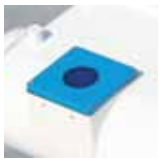
Two independent tracking modes

The position of the Sun can either be determined by tracking it with the Sun-sensor or calculating its position using a solar algorithm. Based on this information, the STR will automatically compensate any misalignment between the measured and the calculated position.

Positioning function

While the STR-series Sun trackers are working without any intervention, they can also be fully controlled through an open command protocol. This allows to point the tracker manually to any hemispherical position by using a PC or programmable data logger.

Easy set-up



Thanks to the embedded GPS receiver, the tracker position and time information is obtained automatically. The integrated Sun-sensor allows easy set-up and leveling (+/- 15 degree acceptance angle).

Durable compact drive

High precision, maximum torque, small size and durability are the most valuable assets offered by the harmonic drives used inside the STR Sun trackers. Due to their high working efficiency, the motors are relatively small and use little power.

- The STR-21G and 22G Sun trackers come with a small tripod for easy and stable installation. Adjustable pyrheliometer mount with fine-tuning alignment jig is included. Various other mounting tools are available to install MS pyranometers or other types of pyrheliometers.
- The new heavy-duty STR Sun tracker STR-32G is capable to support up to 60kg of instrumentation without compromising the high tracking accuracy. This GPS Sun tracker is designed to support EKO's spectral measurement solutions.
- EKO Instruments high precision STR Sun tracker models STR-21G (single arm), STR-22G (dual arm) and STR-32G (high torque dual arm) provide high tracking reliability, enhanced functionalities with fully automated operation through a built-in GPS receiver

An MS-56 pyrheliometer and an MS-700 DNI sensor mounted on an STR-22G

Solar Measurement Configurations

Direct Normal Incidence (DNI)

A compact measurement system based on STR-21G Sun tracker and ISO 9060 first class pyrheliometer MS-56.

Diffuse Radiation (DHI)

STR-22G Sun tracker, shading ball MB-121 and pyranometer MS-802 measuring diffuse radiation (DHI). MS-56 pyrheliometer simultaneously measures the DNI.

Spectral Direct Normal Incidence Irradiance

STR-21G Sun tracker with MS-700 DNI which provide direct spectral irradiance in the range 350-1050 nm.

STR-32G high torque Sun tracker and MS-710/712 spectroradiometers with collimating tube provide direct spectral irradiance in the range 350 - 1700 nm.

Specifications	STR-21G single arm	STR-22G double arm	STR-32G double arm
Motor	Stepping motor		
Driving technology	Harmonic Drive		
Pointing accuracy	< 0.01° (Solar Elevation: 0 to 87°)		
Angle resolution	0.009°	0.009°	0.0036°
Rotation angle	Elevation-angle(-15° to +95°) Azimuth-angle(0° to +/-180°)		
Torque	12 Nm	24 (12+12) Nm	60 (30 +30) Nm
Payload	7kg balanced	15kg balanced	60kg balanced
Tracking mode	Sun-sensor mode and Calculation mode		
Tracking accuracy of Sun-sensor mode	+/- 0.01°		
Sun-sensor field of view	+/- 15°		
Environmental Protection	IP65		
Temperature range	From -30 to +50°C		
Communication	RS-232C, 9600bps, 8N1		
Power requirement	AC100 to 240V, 50/60Hz, 50W		AC100 to 240V, 50/60Hz, 50W
	DC18 to 30V, 20W for DC optional Sun Tracker		
Dimension	430(W) x 380(D) x 440(H) mm		430(W) x 380(D) x 250(H) mm
Weight	14.5 kg	15.5 kg	15 kg

Specifications are subject to change without further notice

MS-093 SUNSHINE DURATION SENSOR

Reliable sunshine duration data

The MS-093 is a high-quality sunshine duration meter. The unique measurement concept with the rotating mirror and the broadband sensor truly measures the broad-band direct solar radiation, without interference of the diffuse radiation.

The sensor uses a rotating mirror which reflects once per revolution the direct beam onto a pyro-electric detector. By using this method the MS-093 can measure the real broad-band direct radiation.

The MS-093 is unique in its kind and different from other dedicated sunshine duration sensors, which are based on an indirect measurement principle (using photodiodes with a limited spectral range).

- Very precise under all measurement conditions
- Measurement uncertainty: less than 10 minutes per day
- Pyroelectric detector (300 nm - 2800 nm
- Economic solution to precisely measure sunshine hours
- Measures sunshine hours with direct solar radiation > 120 W/m2

The MS-093 Sunshine duration sensor

Specifications MS-093	
Output	100 pulses/hour
Declination error	±5% (within latitude ±23.5°)
Temperature dependency	±5% / °C(within -20 to +40°C)
Non-linearity	< 2.5%
Threshold value	120 W/m2
Detector type	Pyroelectric detector (spectral response 0.3 - 2.5 μm)
Integration error	less than 10 min/day (clear days)
Operating temperature	-20 to +40°C
Power requirements	12 VDC, 400mA
Options:	
Power supply	100 ~ 240 VAC / 12 VDC / 200 x 140 x 80 mm / 2.5 kg
Heater	100 ~ 240 VAC @ 50W/ Control thermostat / heater switches < 0°C
Blower Fan	100 ~ 240 VAC @ 16W

Specifications are subject to change without further notice

SMALL SENSORS: ML-020 SERIES

Small sensors, great performance

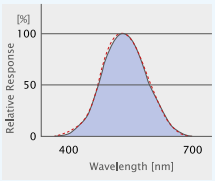
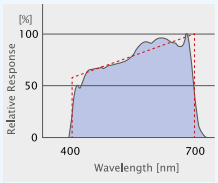
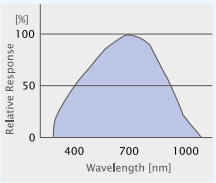
The ML-020 small sensors are used as multi-purpose, cost-effective radiometers in the fields of photovoltaics, horticulture, agriculture, building automation and industry. Three different types of sensors with dedicated sensitivities are available.

levelling plate

EKO ML-020 small sensors accurately match the spectral sensitivities of photovoltaic modules, the human eye and plant leaves. Sensors have an optical-quality glass dome, minimizing soiling of the diffusor and optimizing the cosine response of the sensors.

The superior cosine-response, temperature stability characteristics and compact design make the ML-020VM an interesting replacement for reference cells in photovoltaic applications.

- Specific spectral responses
- Low temperature dependency
- Fast response time
- Small and lightweight
- Optimized cosine response and glass dome
- Weather proof

Specifications	ML-020 S-O	ML-020 S-I	ML-020P	ML-020VM
Spectral response			Photosynthetically Photon Flux Density 400 - 700 nm	Solar Irradiance (300 to 1100nm)
Measuring range	~ 150,000	~ 30,000	~ 3000	~ 1.4
Unit	lx	lx	µmol•s-1•m-2	kW/m²
Output	~30mV	~30mV	~10mV	~ 10mV
Internal resistance	280Ω	1.3kΩ	160Ω	10Ω
Temperature response (-10 to +50)	0.4%	0.4%	1.1%	0.5%
Directional response (at 30/60/80 deg)			1 / 1.5 / 17 %	
Output cable			5m, standard	
Spectral responsivity				
	Luxmeter ML-020S-I, ML-020S-O		Photon sensor ML-020P	Pyranometer ML-020VM

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Sensors and systems

It is the aim of EKO Instruments to help its customers to get ahead by developing turnkey research solutions and services for the photovoltaic and meteorological markets. With our high level of know-how and latest technologies used in the photovoltaic measurement equipment and solar radiation sensors we aim to extend your solar research capabilities in functionality, accuracy and quality. EKO Instruments' unique Solar Monitoring Station (SMS) is considered a reference in PV to collect high-quality solar irradiance data on site.

EKO's commitment to the photovoltaic industry

The principle of all PC performance investigations is to relate the input energy, which is the solar radiative flux, to the output energy, which is the electrical power produced by the photovoltaic cells, modules, or installations. To do so, with EKO's I-V tracers in combination with the high precision solar sensors, users are enabled to evaluate PV systems according to the latest international standards.

Contact us for more information

ISO 9001 ISO 14001

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