



# RaZON<sup>+</sup>

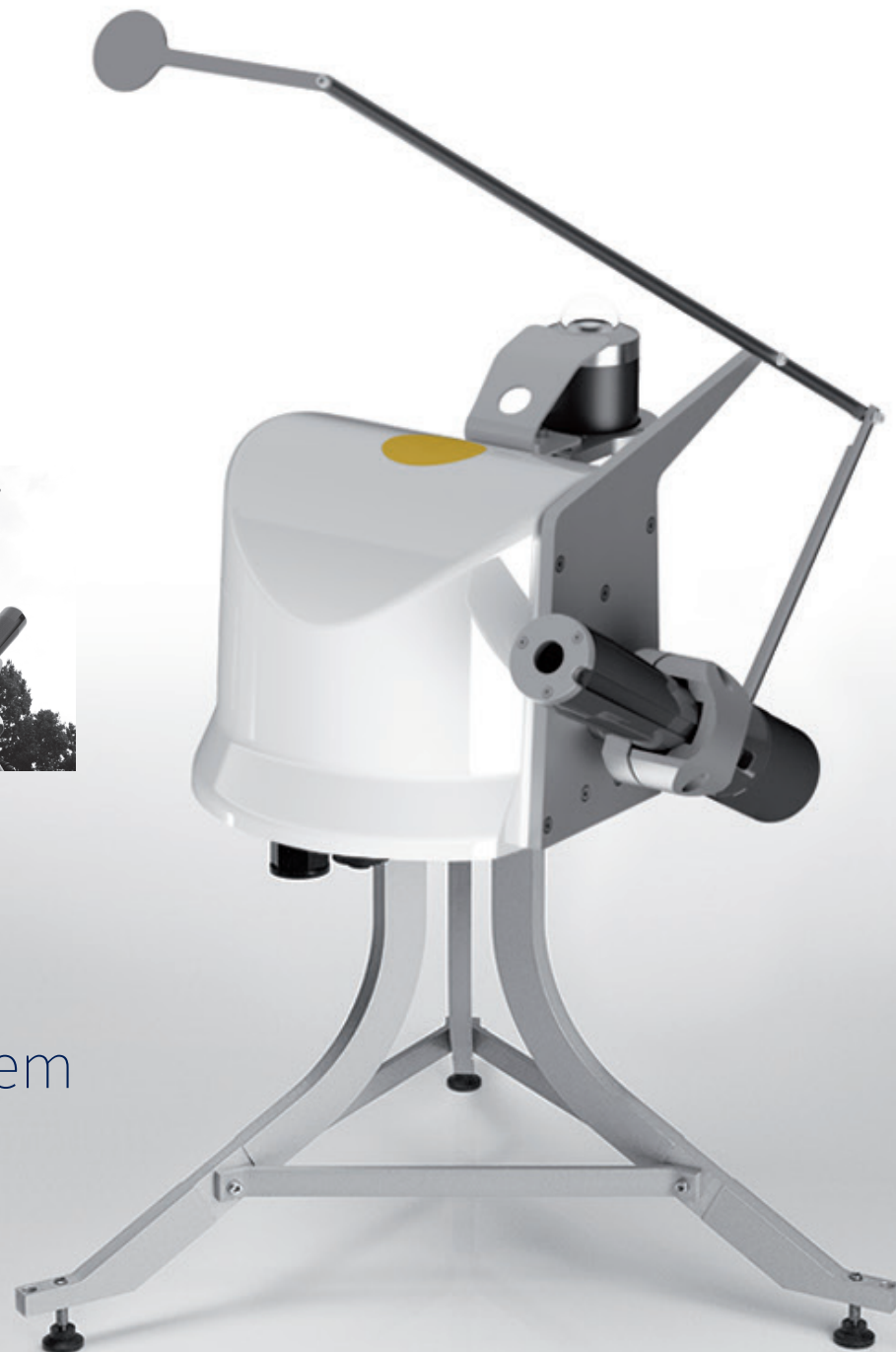
## ALL-IN-ONE Solar Monitoring System

DNI measurement with impressive accuracy

ALL-IN-ONE system including a pyrheliometer, pyranometer and data logger

Designed for remote locations and resistant to soiling

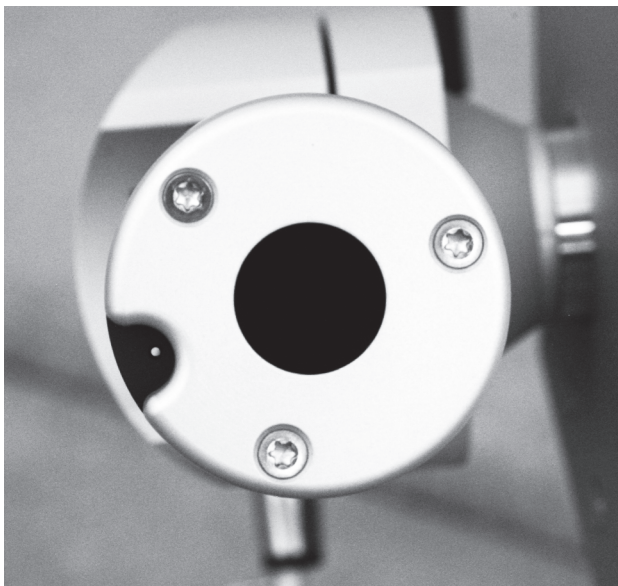
User-friendly from installation to operation, to maintenance



There are several ways to acquire solar radiation data. The most accurate, of course, is to measure it with high quality instrumentation. Global horizontal irradiance (GHI) and diffuse horizontal irradiance (DHI) are measured with pyranometers. Measuring direct normal irradiance (DNI) requires a pyrheliometer to be accurately pointed at the sun throughout the day. An automatic sun tracking device is used that also shades the DHI pyranometer from the direct sun.

Meteorologists regularly make high quality measurements using pyrheliometers mounted on sun trackers. In mature solar energy markets around the world, especially in Concentrating Solar Power (CSP) and Concentrating Photovoltaic (CPV) systems, direct solar irradiance measurement has become part of the daily operating and monitoring routine.

Performance ratio and efficiency of plants are key inputs for investors, operation and maintenance parties and other stakeholders. They need to know the exact ratio of power generated to the solar energy available on site. Local, accurate and real time solar irradiance measurements are a necessity; not only for daily operation but also to indicate the fundamental value of a plant and to inform decisions for future investments.



**RaZON<sup>+</sup>** is an innovative ALL-IN-ONE solar monitoring system with integrated pyrheliometer, shaded pyranometer, digital data processing, GPS receiver and data logger. It measures DNI from the sun and DHI from the sky and, knowing the sun position, calculates GHI that matches secondary standard value. From the DNI measurements sunshine duration is calculated much more accurately than any sunshine duration sensor on the market.

Measurements are acquired every second and averaged over one minute. The integrated data logger presents the stored averages as DNI, DHI and GHI irradiance measurements in W/m<sup>2</sup>; sunshine duration in hours and energy in kWh/m<sup>2</sup>.

**RaZON<sup>+</sup>** outperforms all rotating shadow band and shadow mask systems on the market, none of which actually measure DNI. **RaZON<sup>+</sup>** provides a complete set of solar radiation data, accurately, affordably and in accordance with ISO 9060:1990.

The pyranometer and pyrheliometer are Smart sensors connected via Modbus® to the **RaZON<sup>+</sup>** Smart sun tracker. There will be a future update to connect further Smart devices. Ethernet and RS-485 ports provide all the necessary interfaces and data formats for communication with industrial data acquisition and control systems.

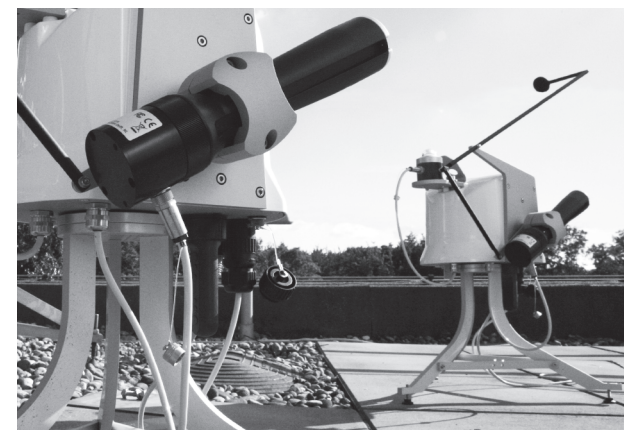
### New and innovative sensor technology

New Smart pyrheliometer with anti-soiling design

ISO 9060

New Smart pyranometer with quartz diffuser technology

For **RaZON<sup>+</sup>** Kipp & Zonen has designed an innovative pyrheliometer that resists soiling and a shaded pyranometer with a quartz diffuser that is optimized for DHI measurements. These new Smart sensors with digital signal processing and temperature correction have a very fast response time, meet the requirements of ISO 9060 and are integrated parts of the **RaZON<sup>+</sup>**. Built-in data processing and data logging make it a complete turn-key system for solar radiation monitoring. This is the first all-in-one system to measure DNI accurately and affordably.



### Extremely low maintenance

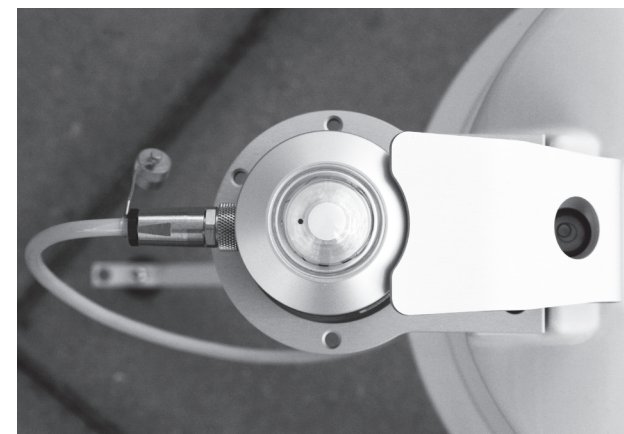
Gear Drive sun tracker with no maintenance

Integrated remote status check

New anti-soiling pyrheliometer design

Long lasting integrated desiccant

One of the important innovations in **RaZON<sup>+</sup>** is the new pyrheliometer design. The open collimator tube and the quartz diffuser minimize the effect of soiling, so less cleaning is needed. The sensors have long life internal desiccant that does not need to be regularly inspected or changed. Thanks to decades of experience with sun tracking systems, Kipp & Zonen has selected completely maintenance free gear drive components for **RaZON<sup>+</sup>**, making it reliable and robust.



## Complete solar radiation data

Accurate DNI, DHI, calculated GHI (in W/m<sup>2</sup>)   Sunshine duration   Status info  
GPS time, date and location   Sun position, zenith and azimuth

The most accurate way to measure Global Horizontal Irradiance (GHI) is by calculation from direct sun and diffuse sky radiation and the solar zenith angle. The **RaZON<sup>+</sup>** uses this method. The integrated GPS receiver provides precise time and location information to calculate the sun position and time-stamp the logged data.

## Easy on-site check via Wi-Fi

Set-up and configuration via smartphone, tablet or PC   Password protection  
Local status and sensor check   On site graphic visualization of data

**RaZON<sup>+</sup>** has an accessory Wi-Fi connection that allows set-up and configuration using any smart device. You can check status and irradiance on-site and in real-time. The state-of-the-art interactive design of the interface is user-friendly and provides a graphical overview of the logged data and system status. It is also possible to determine the uncertainty of real-time measurements for the site conditions using Kipp & Zonen's free Suncertainty app.

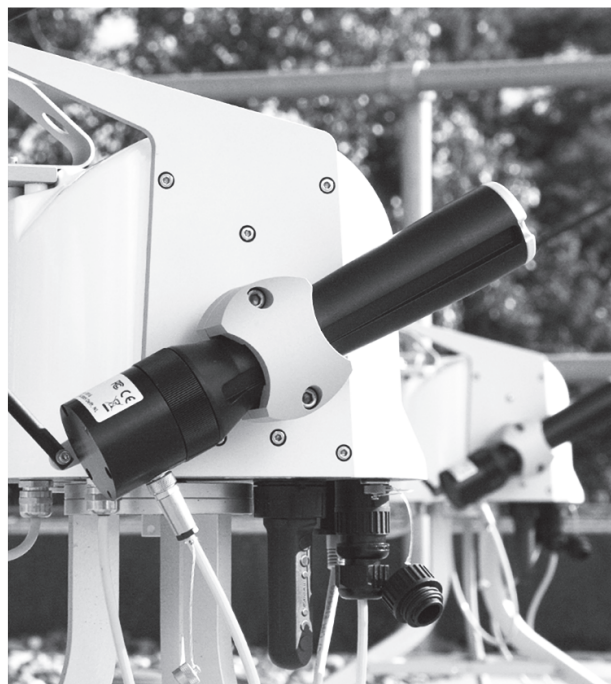
## Internal data logging with Web access

Integrated webpage   Ethernet and RS-485 Modbus<sup>®</sup> connections  
Download of logged data

**RaZON<sup>+</sup>** is the world's first ALL-IN-ONE solar monitoring system with internal logging of all relevant parameters in one data set. It is equipped with both Ethernet and RS-485 interfaces that have various communication format options. Use either, or both, to download the data. An extra Modbus<sup>®</sup> input connector is provided for future use with compatible devices. The data set consists of DNI, DHI, GHI, sunshine duration, solar energy, GPS time and location information, sun position, and system status.

## PH1 Smart Pyrheliometer

The new PH1 pyrheliometer design is optimized for low maintenance. The open collimation tube minimizes soiling and dew on the quartz diffusor. The housing can easily be opened by a bayonet connection to inspect and clean the diffusor and collimation tube. PH1 has a fast detector, Smart interface with temperature correction and communicates via Modbus<sup>®</sup> with the sun tracker. Both direct radiation and status information are given every second for averaging and logging in the **RaZON<sup>+</sup>**.



## PR1 Smart Pyranometer

The new PR1 pyranometer incorporates the same fast detector and quartz diffusor technology as the PH1. PR1 is continuously shaded from the direct sun by an arm and disk on the sun tracker. Due to the new detector and quartz diffusor very good linearity and low offsets are achieved. Because the PR1 is designed specifically for the **RaZON<sup>+</sup>** it needs no bubble level or adjustable feet.



## Upgrade

**RaZON<sup>+</sup>** can be upgraded with other Kipp & Zonen Smart radiometers. SHP1 can be fitted instead of the PH1 pyrheliometer. To replace the PR1 by a SMP6, SMP10, or higher grade pyranometer, an adapter kit is available. This consists of an extension to the shading assembly arm and a pyranometer mounting plate.

## Future

**RaZON<sup>+</sup>** is designed for the future, new features and accessories are planned. It will be possible to connect additional sensors to the extra RS-485 Modbus<sup>®</sup> port; such as a plane of array (POA) pyranometer, PV panel temperature or even a compact weather station. New features will include calibration and soiling checks. Updates are implemented by uploading new firmware via the Ethernet connection. Watch the **RaZON<sup>+</sup>** web page for the latest update news.







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## Specifications RaZON<sup>+</sup>

Pointing accuracy	0.2°
Payload	Sufficient for 1 pyranometer and 1 pyrliometer
Angular velocity	30°/s
Rotation	110° zenith, 600° azimuth
Protection against over rotation	Physical limit stops
Supply voltage	20 to 30 VDC
Power	13 W
Operating temperature range	-20 °C to +50 °C
Weight	9 kg
Dimensions (WxDxH)	60x60x48 cm
Accuracy of bubble level	< 0.1°
Ingress Protection (IP) rating	65
CE/FCC compliance	Yes
RoHS	Yes
Transmission	Gear drives
Power connections	DC power
Communication interface	RS-485 Modbus® for external sensor/system RS-485 to host, Modbus® or ASCII Ethernet RJ-45 web based Modbus® TCP Wi-Fi (accessory adapter)
Data logging	1 s sampling, 1 minute average logging
GPS, location and time/date	Standard
Installation	Plug-and-play, Wi-Fi enabled device used
Functional self-test	Standard
Test/diagnostic facility	Standard via Ethernet connection
Sun tracking mode	Standard
PC system requirements	Ethernet connection, web browser
Firmware update possible	Flash memory
Maintenance	No scheduled maintenance required Annual inspection recommended
Restart after power interruption	Automatic

## Specifications PR1 Smart Pyranometer

Classification to ISO 9060:1990	Second Class
Response time (95%)	< 0.2 s
Response time (63%)	< 0.1 s
Spectral range (50% points)	310 to 2700 nm
Zero offsets	
(a) thermal radiation (at 200 W/m <sup>2</sup> )	1 W/m <sup>2</sup>
(b) temperature change (5 K/h)	1 W/m <sup>2</sup>
Non-linearity (100 to 1000 W/m <sup>2</sup> )	< 0.3%
Directional response (up to 80° with 1000 W/m <sup>2</sup> beam)	< 20 W/m <sup>2</sup>
Temperature response	< 1% (-20°C to +50°C)
Field of view	180°
Measurement range	0 to 1500 W/m <sup>2</sup>
Operating temperature range	-40 °C to +80 °C
Ingress Protection (IP) rating	67

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Non-linearity (100 to 1000 W/m <sup>2</sup> )	< 0.3%
Temperature response	< 1% (-20°C to +50°C)
Field of view	5° ±0.2°
Slope angle	1° ±0.2°
Measurement range	0 to 1500 W/m <sup>2</sup>
Operating temperature range	-40 °C to +80 °C
Ingress Protection (IP) rating	67

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