PVmet™ Weather Station

Comprehensive Environmental Monitoring Solution

The RainWise PVmet™ family of weather stations offers a powerful add-on to any solar plant monitoring system. Featuring accurate sensors and standard communication integration, the PVmet™ is an economical addition to insure the highest PV panel output.

The **PVmet™-150** is our **Precision Utility** Grade model for users who require the highest caliber sensors for exceptionally accurate data. The **PVmet™-150** uses a precise second-class thermopile pyranometer allowing for dependably bankable data and is mounted on a tilting bracket to provide global or plane-of-array measurements. The **PVmet™-150** is available with ISO 9060:1990 and WMO second-class, first class and secondary standard pyranometers. These well-designed and affordable stations are sturdy, compact and simple to install.

Features

- Adjustable Solar Irradiance Sensor for Global or Plane-of-Array Monitoring
- 1 or 2 x Back-of-PV Panel Temp Sensor(s)
- Ambient Air Temperature Sensor

- Modbus RS-485 Communication
- Ethernet Modbus TCP Option Available
- SunSpec Certified

- Additional Irradiance Sensor Option
- Available with Private Labeling for OEM

Sensors & Options

Ambient Air Temperature.

Housed in a passive solar shield.

Global Irradiance or Plane-of-Array Irradiance.

The irradiance sensor is adjustable and can be set to provide global irradiance (when horizontal) or plane -of-array irradiance when installed to match the PV panel angle.

Back-of-Module Temperature.
These sensors are attached to the back of the PV panel using thermal conductive adhesive tape. They provide accurate panel temperatures, an important parameter for efficiency monitoring. One sensor is shipped with each system. The **PVmet™-150** supports two sensors. The second may be purchased separately.

Communications

The **PVmet™-150** has a single, 2-wire, half duplex, RS-485 port. Termination can be enabled or disabled using a jumper located near the RS-485 screw terminals.

By default the **PVmet™-150** is configured to operate as a Modbus slave at address 60. The Modbus register layout is compatible with SunSpec protocol. A simplified register set is located at address 200 for those that do not wish to use the SunSpec data format.

For users that wish to change settings, a configuration mode is provided. A simple terminal emulator application such as HyperTerminal is required to make changes.

Installation

The ***PV*MET-150**'s compact, lightweight design makes installation quick and easy. Various mounting options are available, including the RainWise Mono Mount. The ***PV*MET-150** is supplied with a detachable mast section that can bolt to an existing structure.

All electrical connections are made using screw terminals. Standard sensors are factory installed.
As a user/installer the only connections required are power, communications and external BOM sensors. Removing the front cover accesses the connections. The cover is secured with 4 screws.

Customization

The firmware in the **PVmet™-150** can be updated through the RS-485 port using a simple PC application. This feature ensures that the **PVmet™-150** can be kept up to date with the latest available firmware. In addition, RainWise can provide certain OEM firmware customization. This includes register configuration, specific defaults and protocols.

The **PVmet™-150** can also be customized to support customer specific sensors. This service is only available to volume OEM customers.

Specifications

PVmet™ – 150

Power Requirements
10 to 30 VDC at 50mA

Operating Environment

Temperature:	- 40° to 80°C (- 40° to 176°F)
Relative Humidity:	0-100%, Condensing

Irradiance Sensor (Eko, Kipp & Zonen CMP 3)

IS0 9060:1990 Classification	Second Class
Sensor Range:	0 to 2000 W/m^2
Accuracy:	+/-5%
Spectral Range:	285 ~ 2800 nm
Response Time to 95%	< 18 s
Response Time to 63%:	< 6 s
Non-Linearity (0~1000 W/m^2):	< 1%
Non-Stability (Change/Yr):	< 1%
Cosine Response 45°:	+/-1%
Cosine Response 75°:	+/-5%
Operational Temperature:	-25° to 55°C (-13° to 131°F)
Resolution:	1 W/m^2

Ambient Air Temperature Sensor

Range:	- 40° to 80°C (- 40° to 176°F)
Accuracy:	+/- 0.3°C (.54°F)
Thermal Time Constant	30 sec.
Resolution:	0.1°C

Back of Module (BOM) Temperature Sensors:

Range:	- 40° to 80°C(- 40° to 176°F)
Accuracy:	+/- 0.3°C (.54°F)
Thermal Time Constant:	270 sec.
Cable Length:	7.62m (25 ft)
Resolution:	0.1°C

RS-485/422 Serial Port

Mode:	2-Wire Half Duplex
Connector:	4-Position Screw Terminal (A(-), B(+), Signal and Earth Ground)
Max Speed:	9600 Baud
Termination:	120 ohms (Internal Jumper Enable)

Materials
Polyvinyl Chloride, Acrylonitrile Butadiene Styrene, Stainless Steel, Anodized Aluminum, Lexan®, Delrin

Electronics:
Lead-free RoHS Compliant

Physical:

Packaged Dimensions:	6 cm x 20.3 cm x 20.3 cm (10.25” x 8” x 8”)
Packaged Weight:	0.8 kg (1 lb. 12oz.)

Warranty
2 Years

RainWise® Inc.
Professional Weather Instruments

PVmet™ SERIES

The PV **PRO**MOUNT is compact, light-weight, corrosion resistant and ships fully-assembled ready to install

PV **PRO**MOUNT

Features

- Adjusts for global and plane-of-array
- Annodized aluminum construction
- Stainless steel hardware
- Lightweight
- Fully-assembled, easy to install

The RainWise PV **PRO**MOUNT accepts the following pyranometers:

EKO

MS-40
MS-60
MS-80
MS-80A
MS-80M
MS-402
MS-602
MS-802
MS-410
ML-01

EKO's broad-band pyranometer product line includes instruments of all ISO classes, ranging from the second class MS-40, via the first class MS-60, up to the top class secondary standard MS-80

KIPP & ZONEN SINCE 1830

CMP-3
SMP-3
CMP-6
SMP-6
CMP-10
SMP-10
CMP-11
SMP-11
CMP-21
SMP-21
CMP-22
SMP-22

Kipp & Zonen solar instruments are relied upon by meteorological networks all over the world and are widely used in climate research, hydrology, agriculture, water resource management, materials testing, renewable energy and public health applications

Hukseflux Thermal Sensors

SPECSHEET **PV PRO**MOUNT

Manufacturer	RainWise Inc.
Weight:	1.3 lbs/.6 kg
Length:	15.75 in/40 cm
Construction:	Aluminum/annodized
Hardware:	Stainless steel

Best In Industry **2 Year Warranty** Fully Assembled

RoHS Compliant

EKO Beyond Accuracy.

MS-40 Pyranometer

Technical Specifications

ISO 9060:2018 Class C (Second class)

Sub-category "Spectrally flat"

Analog output

ISO 17025 certified calibration

Optional ventilator MV-01

The MS-40 is an ISO 9060:2018 Class C pyranometer which is based on the EKO's universal sensor platform. It is the most cost effective irradiance sensor to measure Solar irradiance accross the full Solar spectrum. It can be used for agro meteorological networks and professional small scale PV sites where solar radiation is taken seriously. The MS-40A and MS-40M provide a digital output (4-20mA or Modbus 485 RTU). The MS-40/40A/40M can be used with the optional MV-01 ventilator / heater or can be combined with the optional mounting kit for albedo measurements.

The MS-40 pyranometers are manufactured in a consistent way followed by strict quality inspection and performance evaluation. EKO provides a unique calibration compliant to the international standards defined by ISO/IEC17025/9847.

The sensor has a 5 year warranty with a 2 year re-calibration interval recommended and it is no longer necessary to change the desiccant.

EKO Beyond Accuracy.

	MS-40
ISO 9060:2018	Class C
ISO 9060:1990	Second Class
Sub-category "Spectrally flat"	Compliant
Sub-category "Fast response"	Not compliant
Output	Analog (mV)
Response time 95%	< 18 Sec.
Zero off-set a) 200W/m²	+/- 12 W/m²
Zero off-set b) 5K/hr	+/- 5 W/m²
Complete zero off-set c)	+/- 17 W/m²
Non-stability change/1 year	+/- 1.5 %
Non-linearity at 1000W/m²	+/- 1 %
Directional response at 1000W/m²	+/- 20 W/m²
Spectral error	+/- 0.2 %
Temperature response -10°C to 40°C	+/- 3 %
Temperature response -20°C to 50°C	+/- 3 %
Tilt response at 1000W/m²	+/- 1 %
Sensitivity	Approx. 10 µV/W/m²
Impedance	100 Ω
Operating temperature range	-40 - 80 °C
Irradiance range	0 - 2000 W/m²
Wavelength range	285 - 3000 nm
Ingress protection IP	67
Cable length	10 m

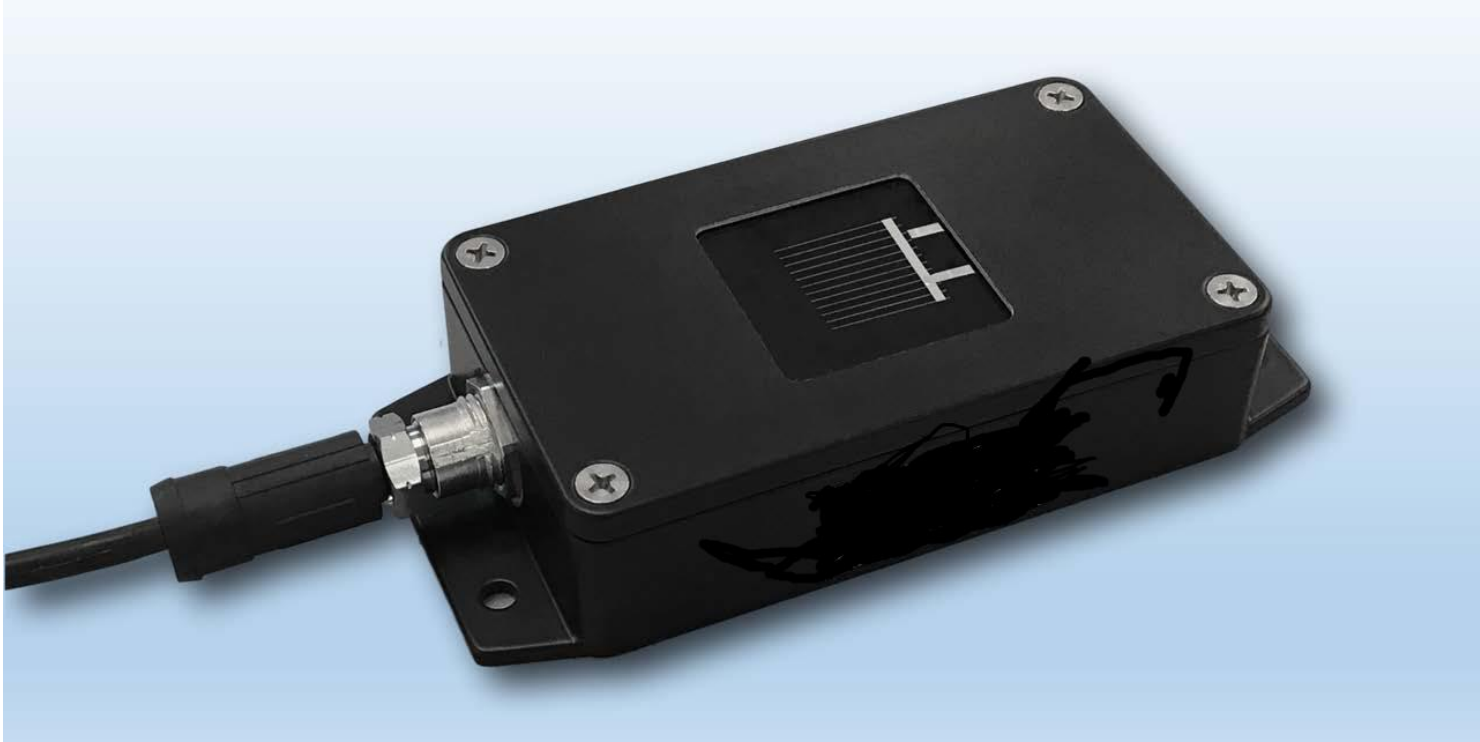
Options	MS-40
Cable length	20 / 30 / 50 m
Ventilation unit	MV-01
Albedo mounting kit	MS-albedo Kit

Specifications are subject to change without further notice.

RainWise Inc.
Professional Weather Instruments

PV Reference Cell

Digital & Analog Irradiance Sensor



Designed for PV System Monitoring

- Specifically designed for low-cost, high-accuracy solar irradiance measurements for outdoor monitoring of PV systems

No Need to Track Calibration Data

- You never have to track calibration data or reprogram data loggers or SCADA systems when you install or change out the reference cell
- Measurements are performed by a precision microcontroller circuit
- Both digital and analog outputs are internally calibrated

Cell Design

- Crystalline silicon PV cell
- Short-circuit current measured with precision 0.1 ohm shunt resistor
- Cell temperature measured with Pt100 RTD
- Automatic temperature compensation as well as optional temperature output

Digital and Analog Outputs

- Both digital and analog outputs in a single, flexible product
- Digital communication uses Modbus over RS485
- Analog outputs are user-configurable – choose from 0-1.5V, 0-10V, or 4-20mA
- Analog output options include both irradiance and temperature

Robust Mechanical Construction

- IP67-rated cast aluminum enclosure provides for protection from the elements and solid mounting

Optional Spectral Matching Filter

- Standard window is solar low-iron glass
- Optional CdTe-matching window material

Connectorized for Easy Installation

- M12 circular connector allows for easy installation, user-selectable cable lengths, and simple change-out for recalibration

Specifications

Main Data	Model name	RC18 Series
	Irradiance measurement range	0 to 1500 W/m^2
	Operating temperature	-35 to 80 °C
	Input power	8 to 28 VDC (12-28 VDC for 0-10V analog output)
	PV cell	Crystalline Si, 20 mm x 20 mm, ~135 mA @ 1 sun
	Window	Low-iron solar glass, or CdTe-matching filter
	Cell temperature measurement	-40 to 100 °C, Pt100 RTD
	Calibration data	Internally calibrated; no calibration data to manage
Digital	Communication protocol	Modbus over RS485, user-settable Modbus address
	Baud rate	Up to 57.6k
	Current consumption	typ. 8-15 mA
Analog	Analog output options	0-1.5V, 0-10V, or 4-20mA
	Analog output signals	Irradiance, Cell Temperature
	Current consumption	0-1.5V or 0-10V mode: typ. 8-15 mA 4-20mA mode: 15-55 mA
	Output impedance	0-1.5V or 0-10V mode: 2 kohm
	Internal voltage drop	4-20mA mode: Allow 3.5 V minimum
Enclosure	Material	Powder-coated cast aluminum housing
	Outdoor rating	IP67
Dimensions	Dimensions	4.53 x 2.56 x 1.18 in. / 115.1 x 65.0 x 30.0 mm
	Weight	0.6 lb / 0.3 kg
	Mounting	4 mounting holes, dia. 0.217 in. / 5.50 mm
Cable	Type	Shielded, weather resistant, UV-rated, 24 awg / 0.2 mm^2
	Cable length options	4 m, 10 m, 25 m, 50 m, 100 m
	Connector	M12 circular connector, IP67
	Pinout	Power, Ground, Data+, Data-, Analog 1 Signal, Analog 1 Ground, Analog 2 Signal, Analog 2 Ground, Shield
Measurement Specifications	Response time	0.15 s
	Electronics non-linearity	± 0.03% of range
	Repeatability	± 0.02% of range
	Temperature drift, -35 °C to 80 °C	± 0.4% at 1000 W/m^2
	Cell temperature measurement	± 1 °C
	Factory calibration of electronics	± 0.1% of reading ± 0.2% of range
	Irradiance calibration	± 1.8%, calibrated to NREL-traceable reference standard
	Overall measurement uncertainty	± 2.0% of reading ± 4 W/m^2
	Stability	0.5% / year

RainWise® Inc.
Professional Weather Instruments

PVmet™ SERIES

RainWise® Inc.

Back of Module (BOM) Temperature Sensors

Features

- All-weather, durable sensor
- Light weight
- Annodized aluminum housing
- Easy installation
- Factory tested
- Fully-assembled

About

The back of module teperature sensor is designed to attach directly to any solar panel. When placed on the center back side of thepanel, it accurately measures the temperature of the panel. The sensor is encased in an aluminum housing with self-adhesive thermal conductive tape for easy installation and precise monitoring. Each sensor is individually tested before shipping and comes with a Best-in-Industry 2 year warranty.

SPECSHEET BACK OF MODULE (BOM) Temp sensor

Manufacturer:	RainWise Inc.
Range:	- 40° to 80°C(- 40° to 176°F)
Accuracy:	+/- 0.3°C (.54°F)
Thermal Time Constant:	270 sec.
Cable Length:	7.62m (25 ft)
Resolution:	0.1°C

Best In Industry 2 Year Warranty Fully Assembled

RoHS Compliant