



**PVMET-330**

**User's Guide**

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Rev. 2

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## **Introduction**

The PVmet-330 weather station is a compact and economical solution for third-party agricultural weather monitoring. It measures ambient air temperature, relative humidity, barometric pressure, wind speed and direction and is capable of measuring rainfall, soil or other peripheral temperature and global irradiance. The PVmet-330 uses a 2-wire half duplex RS-485 serial port for Modbus RTU communication with a host.

## **Installing the Weather Station**

It is suggested that the system be operated at ground level to make sure that all components are working properly prior to installation.

If any of the components are damaged or malfunctioning upon receipt, RainWise should be contacted.

## **Site Requirements and Considerations**

Ambient air temperature, global irradiance, and wind speed and direction can be affected by obstructions and local topography. Each site is different and presents challenges in its own unique way. Any object, in excess of 10° above the horizontal plane, must not block the global irradiance sensor. The PVMET-330 sensor assembly, which contains the ambient air temperature and wind speed and direction sensor, should be no closer than 10 times any obstruction's height and should be placed away from any dark, heat-absorbing surface.

When roof-mounting the sensor assembly, the unit should be mounted toward an edge of the roof preferably on the prevailing wind side of the building and should be at least 2-1/2 feet above the roofline. Avoid locating the station near any heat sources such as chimneys or vents.

## **Installation**

### **Weather Station**

Mount the support mast securely to a support structure. This may be done by using the Mono-Mount, which is sold as an accessory to the PVMET-330. The mast may also be attached to a support structure using U-Bolts. Do not tighten the support structure to the PVMET-330 unit, as directional orientation will be required.

Rotate the assembled unit until the electronics enclosure faces TRUE SOUTH or TRUE NORTH if you are in the northern or southern hemisphere, respectively. Secure the support mast to the assembly. Rotation is prevented by lining up the two holes in each mast. At this point the entire unit should be secured to the support structure.

It is crucial that the device be oriented as precisely as possible. The wind direction measurement is directly related to this positioning.

### **Anemometer**

The anemometer is directly attached to the top of the sensor assembly. For correct wind direction operation, the PVmet-330 must be oriented correctly.

By default the PVmet-330 is configured for operation in the Northern hemisphere. This only requires that the irradiance sensor faces due South. If the PVmet-330 is going to be used in the Southern hemisphere it must be mounted with the irradiance sensor facing North. In addition, the hemisphere jumper inside the PVmet-330 must be changed from Northern to Southern as shown in the image be in the wiring section.

### **Wiring**

To enter the enclosure with a cable, the front cover must first be removed. Remove the four Philips head screws from the back of the enclosure. Once the lid is removed, the circuit board is exposed. The inside of the enclosure will appear as below.

### **Connecting RS-485**

The PVMET-330 is supplied with a half duplex RS-485 serial port.

Wiring connections are made using the 4-pin screw terminal inside of the PVMET-330 electronics enclosure. Cable is not supplied with the unit. The RS-485 lines can be terminated with a 120 ohm resistor. This can be enabled by moving the termination jumper, located inside the unit, to the "ON" position. This requires removing the enclosure cover. To do this, remove the 4 screws on the bottom side of the unit.

## RS-485 Terminals

A (-):	Negative RS-485
B (+):	Positive RS-485
GND:	Signal/Power Ground
+VDC:	External 10-30VDC Supply

RS-485 is rated to 4,000 feet (1,200 m) at 90 kbps. The RS-485 port on the PVMET-330 is surge protected but not isolated.

## **Connecting the Power Supply**

The weather station can either be powered from its own battery and solar panel or from an external power source (depending on model). For systems running with external power, a cable connection must be made between the RS-485 interface board and the motherboard. A cable is provided and should already be connected to J2 on the RS-485 board. To switch to external power disconnect the solar panel cable and connect the power cable in its place. The system will then be powered via the solar panel input connector. These connections will already be made if the system is ordered without the solar power option.

The power supply input is nominally rated for 24VDC but can accept a voltage in the range of 10 to 30VDC. The inputs are reverse polarity, surge, overvoltage and over current protected. The power supply is not isolated.

When replacing the cover, make sure that all installed cables are pinched by the black foam on the bottom of the enclosure. This will enable a weather tight seal.

## MODBUS RTU

These weather stations are equipped with a RS-485 communications port that supports a subset of Modbus RTU commands. Two board rates are supported 9600 and 19,200. Only 4X Holding registers are supported. The register map that follows describes each register. These stations are read only.

## COMMUNICATIONS

Baud: Switch 5 selects the baud rate. ON=19200, OFF=9600 (default).

Data bits: 8

Parity: None

Stop Bits: 1

Maximum Poll Rate: 5 Hz (Extended periods of rapid polling will drain the battery)

## SCALING

Parameters are reported as integers. In order to maintain resolution some values are scaled up. The scale factor shown indicate how the value should be scaled. “-1” indicates that the value should be multiplied by  $10^{-1}$  or simply divided by 10. Rainfall is an exception; this parameter reports the number of tips of the tipping bucket rain gauge. Typically, the gauge is calibrated to 0.254mm (0.01”) per tip. This counter resets on a reboot and will roll over at 65536 counts.

## UNSUPPORTED FIELDS

The register map reserves registers for all combinations of sensors supported by the Rainwise stations. Not all will be available on any one system. Sensors/fields that are not supported will contain the value 0x8000. Some fields require the purchase of additional sensors. The values reported by fields that don't have valid sensors installed should be ignored.

## POWER MANAGEMENT

The weather station will enter a low power mode when the RS-485 bus is quiet. The station will wake on any activity and will remain awake drawing full power for 3 seconds after the last activity on the bus. When using the weather station with its own solar power the bus should remain inactive for the majority of the time. Suggested polling rates are between 1 and 5 minutes. The battery voltage can be monitored to assess the station health. Readings below 6 volts indicate a low battery. 5.8 volts is considered critical.

If the station is supplied with auxiliary power the above is not applicable and the station can be polled as often as desired.

MODBUS MAP

Holding Register	Item	Type	Units	Scale Factor	Contents
0	Manufacturer	uint16	N/A		"RW" (0x5257)
1	Model	uint16	N/A		"S0"=MK-III, "S1"=AgroMet, "S2"=PVmet
2	Version	uint16	N/A		0x0170, "01" Map Version, "70" Firmware Version
3	Air Temperature	int16	Degrees C	-1	Measured
4	Humidity	int16	%	1	Measured
5	Pressure	int16	hPa	-1	Measured
6	Wind Speed	int16	m/s	-1	Measured
7	Wind Direction	int16	Degrees	1	Measured
8	Wind Speed 5min Avg	int16	m/s	-1	Measured
9	Wind Direction 5 min Avg	int16	Degrees	1	Measured
10	Wind Gust (5 min)	int16	m/s	-1	Measured
11	Wind Gust Direction	int16	Degrees	1	Measured
12	Rainfall	int16	Counter	1	Measured
13	B.O.M Temperature 1	int16	Degrees C	-1	Measured
14	B.O.M Temperature 2	int16	Degrees C	-1	Measured
15	-	-	-	-	-
16	-	-	-	-	-
17	-	-	-	-	-
18	Solar Irradiance - Global	int16	W/m2	1	Measured
19	Solar Irradiance – P.O.A	int16	W/m2	1	Measured
20	-	-	-	-	-
21	-	-	-	-	-
22	Battery Voltage	int16	Volts	-2	Measured



## Changing the Modbus Device Address

The Modbus device can be changed using the dipswitches 1 & 2 with the default position set to device address 60.

Modbus Address	Switch 1	Switch 2
60	0	0
61	1	0
62	0	1
63	1	1

## Changing the Baud Rate

The baud rate can be set to either 9600 or 19200. The default baud rate is 9600. Changing dipswitch 5 to the ON position will change the baud rate to 19200.

## **Minimum System Requirements**

The PVMET-330 is equipped with an RS-485 serial port.

### **RS-485**

Baud rate:	9600/19,200 bps
Parity:	None
Data bits:	8
Stop bits:	1
Flow Control:	None
Interface mode:	2-Wire Half Duplex

### **Software**

The PVMET-330 is designed to work with an RS-485 compliant host. A terminal emulator program is required to change settings.

## **Material Specifications**

### **Sensor Assembly:**

RoHS Compliant	
Mast:	Polyvinyl Chloride
Heat Shields:	Acrylonitrile Butadiene Styrene
Insulation Sensor Bracket:	Delrin
Hardware:	Stainless Steel and Nylon Locknut
Foam Gasket:	Vinyl and Acrylic

### **Enclosure:**

RoHS Compliant	
IP65 Rated Outdoor Enclosures	
UL 94 V-2	
Body:	Polycarbonate

### **Pyranometer Sensor:**

RoHS Compliant	
Body:	Anodized Aluminum with Cast Acrylic Lens
Cable:	Santoprene Jacket

### **Ambient Air Temperature Sensor:**

RoHS Compliant

### **Electronics:**

RoHS Compliant

### **Physical:**

Packaged Weight:	7 lbs
Packaged Dimensions:	6cm x 20.3cm x 20.3cm (10.25" x 8" x 8")

## Hardware Specifications

**Power Specification:** 6V 5AH AGM Sealed Lead Acid, 0.6W Solar Panel

### Operating Environment:

Temperature: -40 ~ 70°C (-40 ~ 158°F)  
Humidity: 0 ~ 100% Condensing

### Ambient Air Temperature Sensor:

Range: -55 ~ 85°C (-67 ~ 185°F)  
Accuracy:  $\pm 0.2^\circ\text{C}$  at 25°C ( $\pm 0.4^\circ\text{F}$  at 77°F)  
Resolution: 0.056°C (0.1°F)

### Relative Humidity:

Operational Temperature: -40 ~ 70°C (-40 ~ 158°F)  
Range: 0 ~ 100%  
Accuracy:  $\pm 2\%$  for  $10 \leq \%RH \leq 90$  at 25°C (77°F)  
 $\pm 4\%$  for  $10 > \%RH > 90$  at 25°C (77°F)  
Resolution: 1%

### Barometric Pressure:

Operational Temperature: -40 ~ 85°C (-67 ~ 185°F)  
Range: 300 ~ 1100 mbar (8.86 ~ 32.49 inHg)  
Accuracy:  $\pm 0.5$  mbar between 700-1100 mbar at 25°C  
( $\pm 0.015$  inHg between 20.67 ~ 32.49 inHg. at 77°C)  
Resolution: 0.34 mbar (0.01 inHg)

### Anemometer (Reed Switch)

Operational Temperature: -40 ~ 85°C (-40 ~ 185°F)  
Anemometer Extension: Up to 15.24m (50ft)

#### Wind Direction:

Range: 0 ~ 360°  
Accuracy:  $\pm 11.25^\circ$   
Resolution: 22.5°  
Starting Threshold: 1.98 m/s (4.43 mph)

#### Wind Speed:

Range: 0 ~ 67 m/s (0 ~ 150 mph)  
Accuracy: Greater of 0.45m/s (1 mph) or 5% of Reading  
Resolution: 0.045 m/s (0.1 mph)  
Threshold: 0.65 m/s (1.45 mph)

### RainWise Liquid Precipitation:

Operational Temperature: 0 ~ 85°C (0 ~ 185°F)  
Range: 0 ~ 762 mm/hr (0 ~ 30 in/hr)  
Accuracy:  $\pm 2\%$  at 25.4 mm/hr ( $\pm 2\%$  at 1 in/hr)

Resolution: 0.254 mm (0.01 in)

**Apogee Pyranometer Sensor:**

Operational Temperature: -25 ~ 55°C (-13 ~ 131°F)

Range: 0 ~ 1750 W/m<sup>2</sup>

Accuracy: ±5%

Cosine Response 45°: ±1%

Cosine Response 75°: ±5%

Resolution: 1 W/m<sup>2</sup>

**RainWise B.O.M Temperature:**

Range: -55 ~ 85°C (-67 ~ 185°F)

Accuracy: ±0.2°C at 25°C (±0.4°F at 77°F)

Resolution: 0.056°C (0.1°F)

## **Contact Information**

RainWise Inc.  
23 Creek Circle  
Boothwyn, PA 19061 USA

Phone: (207)-288-5169

## **Warranty**

RainWise, Inc. warrants RainWise, Inc. manufactured PVMET products against defects in materials and/or workmanship for a period of two years from the date of purchase and agrees to repair or replace any defective product without charge. Equipment supplied by RainWise but not manufactured by RainWise is covered by the particular warranty of that manufacturer.

**IMPORTANT:** This warranty does not cover damages resulting from accident, misuse or abuse, lack of reasonable care, the fixing of any attachment not provided with the product or damage due to a lightning strike or power surge. RainWise, Inc. will not reimburse for take-down or installation charges. RainWise, Inc. will not pay for warranty service performed by a non-authorized repair service and will not reimburse the consumer for damage resulting from warranty service performed by a non-authorized repair service. No responsibility is assumed for any special, incidental or consequential damages.

To return a unit under this warranty, call (800) 762-5723 within the continental US or (207) 288-5169. The service department will document the need for repair/replacement and arrange such. Shipping costs from the customer to RainWise are borne by the customer, RainWise will cover return shipment. It is the customer's responsibility to see that the unit is properly packed, preferably in the original box, because damage occurring during return shipment is not covered by this warranty.

**NOTE:** No other warranty, written or oral, is authorized by RainWise, Inc. This warranty gives you specific legal rights, and you may also have other rights, which vary from state to state. Some states do not allow the exclusion of limitation of incidental or consequential damages, so the above exclusion and limitations may not apply to you.