

Application Note

Using the RC18 PV Reference Cell
with the Campbell Scientific
MeteoPV Data Logger



Document Number 880088 Rev. A, December 2020



www.atonometrics.com

Copyright © 2020 Atonometrics, Inc. All rights reserved.

Table of Contents

1	Overview	2
2	Set RC18 Communication Parameters	3
3	Connect the Devices.....	5
4	Configure the MeteoPV	7
5	View the Measurements	10
6	Query the MeteoPV via Modbus TCP	11

1 Overview

This application note provides a guide on how to use the Atonometrics RC18 PV Reference Cell with the Campbell Scientific MeteoPV datalogger.

The application note describes an example in which two RC18 reference cells are connected to a MeteoPV. Adapt these instructions as needed for your setup.

For more information on the **RC18**, consult the RC18 User Guide, available from the Atonometrics website (document 880058). For more information on the **MeteoPV**, consult MeteoPV documentation provided by Campbell Scientific.

To follow the instructions and example in this guide, you will need:

- RC18 and accessories
 - 1 or 2 RC18 reference cells (PN 810226-XX)
 - 1 RC18 M12-to-bare-wires cable (830256-XXX)
 - Configuration kit for RC18 (PN 810235-01)
 - RC18 configuration software (PN 500078)
 - For using two RC18's as in example in this application note:
 - Bus box for RC18 (PN 810242-06)
 - 2 RC18 M12-M12 cables (830260-XXX)
- MeteoPV and accessories
 - MeteoPV
 - 9-30 V power supply
 - MeteoPV power cable
 - USB to Micro USB cable
- PC with USB and Ethernet ports
- Ethernet cable (RJ45)

2 Set RC18 Communication Parameters

Before setting up the RC18s with the MeteoPV, we must connect to each RC18 one-by-one using the Atonometrics RC18 configuration software and configuration kit to confirm the devices are working, ensure all communication settings are configured as needed, and record settings for later setup in MeteoPV.

Connect the RC18 to your PC through a USB port using the Configuration Kit described in the RC18 User Guide. See the section titled “Configuring” and follow the instructions there.

Following the instructions from the RC18 User Guide, open the RC18 configuration software. Select the COM port that your RC18 is plugged into, and press “Find:”

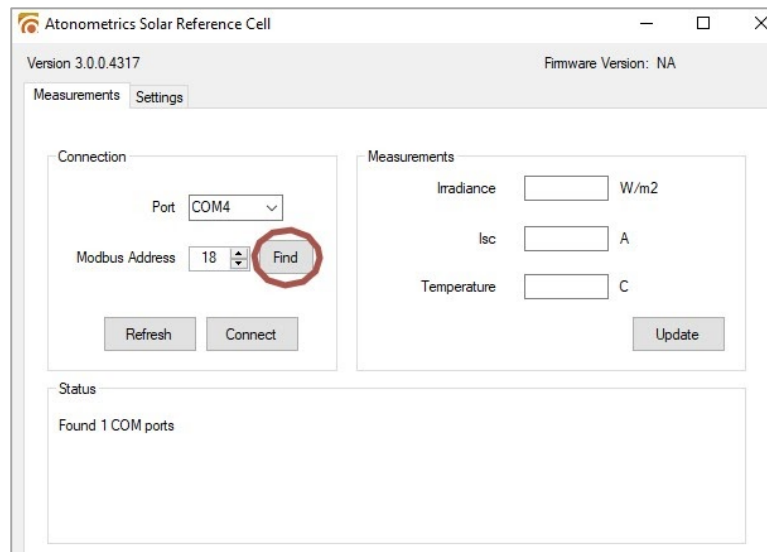


Figure 2-1: RC18 configuration software main screen

Note: Your computer may have multiple COM ports. If you are unsure which one is connected to the RC18, try disconnecting the RC18 configuration kit, checking the COM ports list, then reconnecting the configuration kit and checking the COM ports list again.

Note: RC18 units are shipped from Atonometrics with a default Modbus Address and Data Format. The default address of 18 is shown when the configuration software starts. When using the Find button, the software will detect the RC18 at its actual address and communication settings.

Once the RC18 is found, note its Address, Baud Rate, and Data format which appear on the Find dialogue:

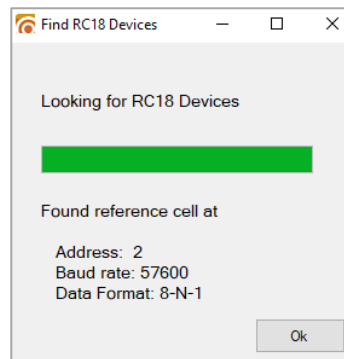


Figure 2-2: RC18 configuration software Find dialog

Click “OK.”

Verify that the RC18 is working properly by pressing the “Update” button when the sensor is under different light levels. In an office environment, the irradiance measurement will typically read 0. If the sensor is under a desk lamp, the irradiance measurement will typically be in the range 20-100 W/m²:

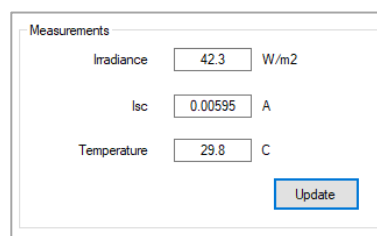


Figure 2-3: RC18 configuration software measurement test

Now use the RC18 configuration software to set the RC18 Modbus Address, Baud Rate, and Data Format as desired for use with the MeteoPV. Apply these settings to the device.

Repeat for each additional RC18.

Wiring ▾			
CSI Wire Color	Manufacturer's Wire Color	Station Terminal	Function
Blue	Purple (Pin 8)	A-	RS-485 A/A' [-]
White/Blue	White (Pin 7)	B+	RS-485 B/B' [+]
White/Brown	Pink (Pin 1)	12V	12 VDC
Brown	Black (Pin 2)	G	Power Ground
Orange	-	G	Power Ground
Green	-	G	Power Ground
White/Orange	-	NC	No Function
White/Green	-	NC	No Function

Figure 3-2: MeteoPV software wiring directions for RC18 hookup

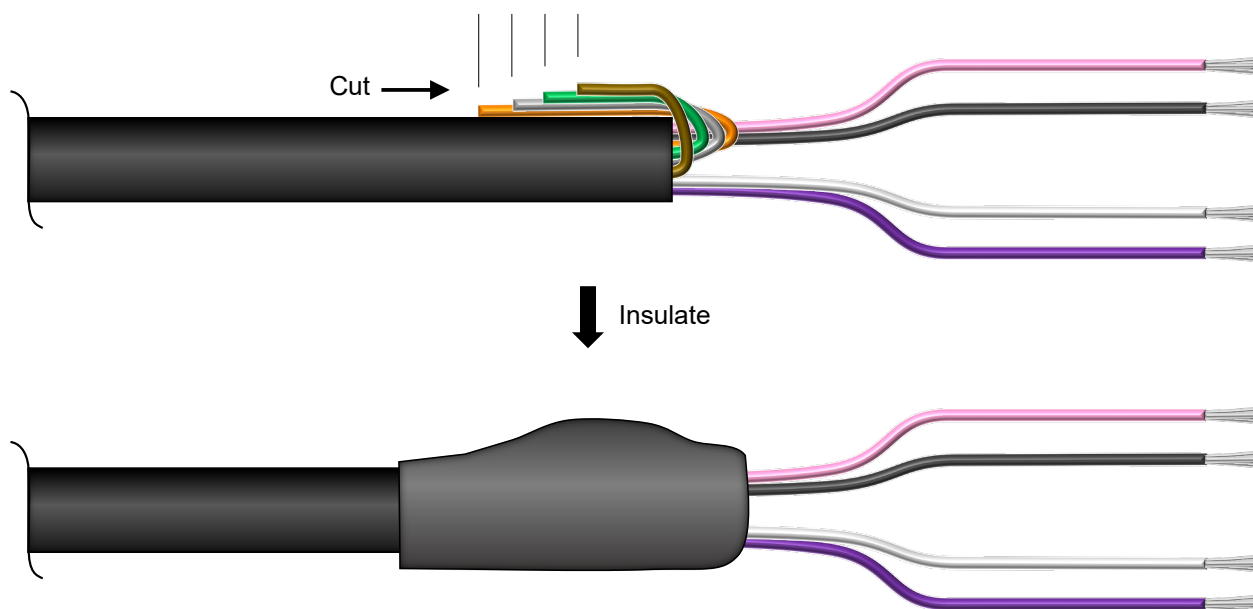


Figure 3-3: Protect unused wires from accidental contact

4 Configure the MeteoPV

After all wiring is complete and the MeteoPV is powered on, it is time to configure the MeteoPV using the MeteoPV web interface.

On your PC, open a web browser and go to linktodevice.com.

Click on the Configuration tab and press “Add Measurement.” In the Pyranometers tab, go to “Pyranometer 1 / Campbell Scientific - CS325DM”. This is the Campbell Scientific part number for the RC18.

As shown in **Figure 4-1**, set the Modbus Address and Serial Number of your first RC18 using data recorded during the settings check described earlier in section 2, “Set RC18”. Type in your desired notes for the Sensor Description, Sensor Notes, and Measurement Name.

The screenshot shows the configuration page for a Pyranometer in the MeteoPV web interface. At the top, there is a dark grey header with a '+ Add Measurement' button and a help icon. Below this is a light grey bar with the text 'Pyranometer 1 (CS325DM)'. The main configuration area is divided into two columns. The left column contains 'Sensor Description' (with a value of 'RC18 1'), 'Modbus Address' (with a value of '1'), and a 'Wiring' dropdown menu. The right column contains 'Serial Number' (with a value of '15491') and 'Sensor Notes' (with a value of 'PN: 810226-02 c-Si reference cell'). Below these fields is a blue bar with a gear icon and the text 'Irradiance Output'. Underneath this bar is a 'Measurement Name' field with the value 'RC18_1_Irradiance'.

Pyranometer 1 (CS325DM)	
Sensor Description	Serial Number
RC18 1	15491
Modbus Address	Sensor Notes
1	PN: 810226-02 c-Si reference cell
Wiring	
Irradiance Output	
Measurement Name	
RC18_1_Irradiance	

Figure 4-1: Adding RC18 measurements to the MeteoPV configuration

In the Network tab, input the Ethernet Settings as shown in the example in **Figure 4-3**. The Ethernet IP Address you assign will be the IP address of the MeteoPV. Set the Gateway and Netmask per your Ethernet network. In order for your PC to communicate with the MeteoPV, it must be on the same subnet at an appropriate non-conflicting IP Address.

Note: For your PC to communicate with the MeteoPV, it must be on the same Ethernet subnet at a non-conflicting IP Address.

In the Network tab, input the RS-485 Settings corresponding to the RC18 communication settings recorded during the settings check described earlier in section 2, “Set RC18 Communication Parameters”.

Note: RS-485 baud rate, parity, data bits, and stop bits must match settings on the RC18.

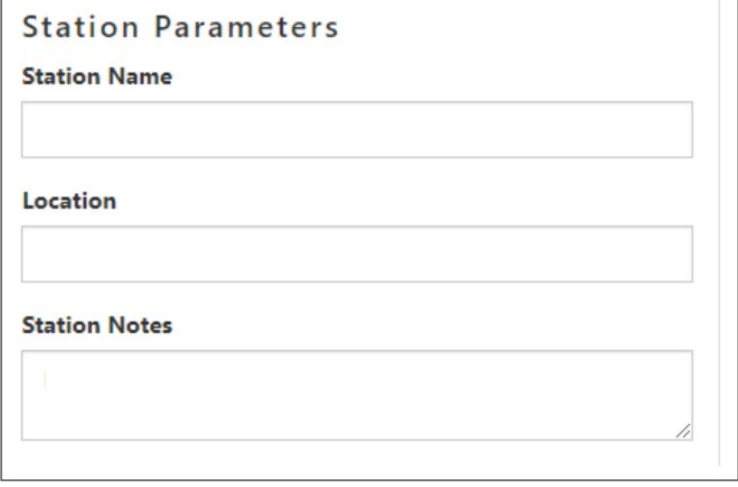
The screenshot shows the 'Network' tab selected at the top. Below it, the 'Ethernet Settings' section is active, indicated by a blue header bar with a gear icon and the text 'Device Settings'. Inside this section, there are three input fields: 'IP Address' with the value '10.244.69.102', 'Netmask' with the value '255.255.255.0', and 'Gateway' with the value '10.244.69.102'. Each field has a small information icon to its right.

Figure 4-2: Configuring MeteoPV Ethernet Settings

The screenshot shows the 'Network' tab selected at the top. Below it, the 'RS-485 Settings' section is active, indicated by a blue header bar with a gear icon and the text 'Device Settings'. Inside this section, there are four dropdown menus: 'RS-485 Baud Rate' set to '57600', 'RS-485 Data Bits' set to 'Eight (default)', 'RS-485 Parity' set to 'None', and 'RS-485 Stop Bits' set to 'One (default)'. Each dropdown has a small information icon to its right.

Figure 4-3: Configuring MeteoPV RS-485 Settings

In the Station Parameters (**Figure 4-4**), enter the Station Name, Location, and any Station Notes.

A screenshot of a web form titled "Station Parameters". It contains three input fields: "Station Name" (a single-line text box), "Location" (a single-line text box), and "Station Notes" (a multi-line text area with a small icon in the bottom right corner).

Station Parameters

Station Name

Location

Station Notes

Figure 4-4: Setting Station Parameters on the MeteoPV

After configuration is complete, press "Apply to Station".

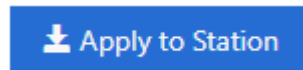


Figure 4-5: MeteoPV apply settings button

5 View the Measurements

In the Modbus Map tab of the MeteoPV software as shown in **Figure 5-1**, you can view a table of the measurements from the MeteoPV, including the irradiance measurements from the two RC18s. These will update automatically.

On the left, take note of the Modbus Register numbers for the different measurements, as shown in **Figure 5-1**. Not to be confused with the Modbus register numbers of the RC18 itself (which are documented in the RC18 User Guide), these are the registers for data fields recorded by the MeteoPV which can be read from your computer or SCADA system via Modbus TCP over the Ethernet cable.

Dashboard Configuration Historical Data Diagnostics Modbus Map				
Modbus Map				
Data types: 32-bit Float (ABCD)				
Modbus Slave ID: 1				
Register	Point	Measurement	Signal	Description
40001	1	Heartbeat	37	Heartbeat
40003	2	Supply Voltage	11.86	Supply Voltage
40021	11	RC18 1 Irradiance	0	Irradiance
40023	12	RC18 2 Irradiance	0	Irradiance
40601	301	RC18 1 Modbus Result	0	Modbus Result Code
40603	302	RC18 2 Modbus Result	0	Modbus Result Code
40801	401	RC18 1 Meta Data	-0	Short-Circuit Current
40803	402	RC18 1 Meta Data	25.22	PV Temperature
40841	421	RC18 2 Meta Data	-0	Short-Circuit Current
40843	422	RC18 2 Meta Data	25.714	PV Temperature

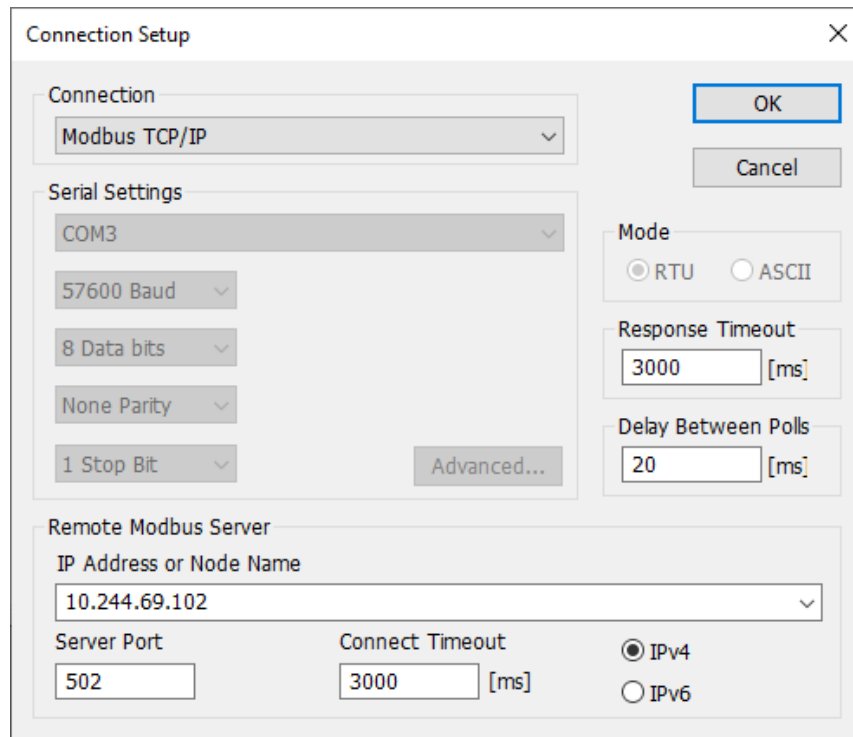
Figure 5-1: Modbus Map data view on MeteoPV software

To view tables of previously saved data, use the “Historical Data” tab of the MeteoPV software.

6 Query the MeteoPV via Modbus TCP

As an example of querying data from the MeteoPV via Modbus TCP over Ethernet, we will read the registers shown in **Figure 5-1** from the PC using Modbus Poll, a PC application from Modbus Tools, available at modbustools.com. (For information about Modbus Poll software, consult documentation provided by Modbus Tools. Alternatively, use another similar software package.)

Open Modbus Poll. From the Connection tab, click Connect. Choose Modbus TCP/IP and enter the IP of your MeteoPV:



The screenshot shows the 'Connection Setup' dialog box in Modbus Poll. The 'Connection' dropdown is set to 'Modbus TCP/IP'. The 'Serial Settings' section is visible, showing 'COM3', '57600 Baud', '8 Data bits', 'None Parity', and '1 Stop Bit'. The 'Mode' section has 'RTU' selected. The 'Response Timeout' is set to '3000 [ms]' and the 'Delay Between Polls' is set to '20 [ms]'. The 'Remote Modbus Server' section shows the 'IP Address or Node Name' as '10.244.69.102', the 'Server Port' as '502', and the 'Connect Timeout' as '3000 [ms]'. The 'IPv4' radio button is selected under the network protocol options. 'OK' and 'Cancel' buttons are at the top right.

Figure 6-1: ModbusPoll, Connection Setup example

Click OK.

Then, from the Setup tab, click Read/Write Definition. Choose function code 3, Read Holding Registers. We will read the irradiance measurement from RC18 1 which, according to the Modbus Map on MeteoPV (**Figure 5-1**), is at address 40021. Type in 20 to the Address field to make the PLC address match that. The irradiance measurement is 4 bytes, or 2 words, so type in a quantity of 2 to the Quantity field.

Read/Write Definition

Slave ID: 1

Function: 03 Read Holding Registers (4x)

Address mode: ☒ Dec ☐ Hex

Address: 20 PLC address = 40021

Quantity: 2

Scan Rate: 1000 [ms]

Disable: ☐ Read/Write Disabled ☐ Disable on error

Read/Write Once

View: Rows ☒ 10 ☐ 20 ☐ 50 ☐ 100 ☐ Fit to Quantity

☐ Hide Name Columns ☐ PLC Addresses (Base 1)

☐ Address in Cell ☐ Enron/Daniel Mode

Request: RTU 01 03 00 14 00 02 84 0F

ASCII 3A 30 31 30 33 30 30 31 34 30 30 32 45 36 0D 0A

Figure 6-2: ModbusPoll, Read/Write example

Next, select the value in the table, and go to Display/32 Bit Float/Big-endian:

File Edit Connection Setup Functions Display View Window Help

Mbpol1

Tx = 31513: Err = 3647: ID = 1: F = 0

	Name	Value
0	00020	0
1		--
2		
3		
4		
5		
6		
7		
8		
9		

Display menu:

- Signed (Alt+Shift+S)
- Unsigned (Alt+Shift+U)
- Hex - ASCII (Alt+Shift+H)
- Binary
- 32 Bit signed
- 32 Bit Unsigned
- 64 Bit Signed
- 64 Bit Unsigned
- 32 Bit Float (selected)
 - Big-endian (checked)
 - Little-endian
 - Big-endian byte swap
 - Little-endian byte swap
- 64 Bit Double
- Communication...
- Real time Charting... (Alt + R)
- Link to Chart

Figure 6-3: ModbusPoll, Display example

Now, test the value in the table by shining a light over the RC18:

	Name	00020
0		44.588
1		--
2		
3		
4		
5		
6		
7		
8		
9		

Figure 6-4: ModbusPoll, Display example result

In this example the irradiance reading is low (44.588 W/m²) because the test is being performed indoors with a weak light on the RC18.