Cell Wash™ Automated Reference Cell Wash System

User Guide

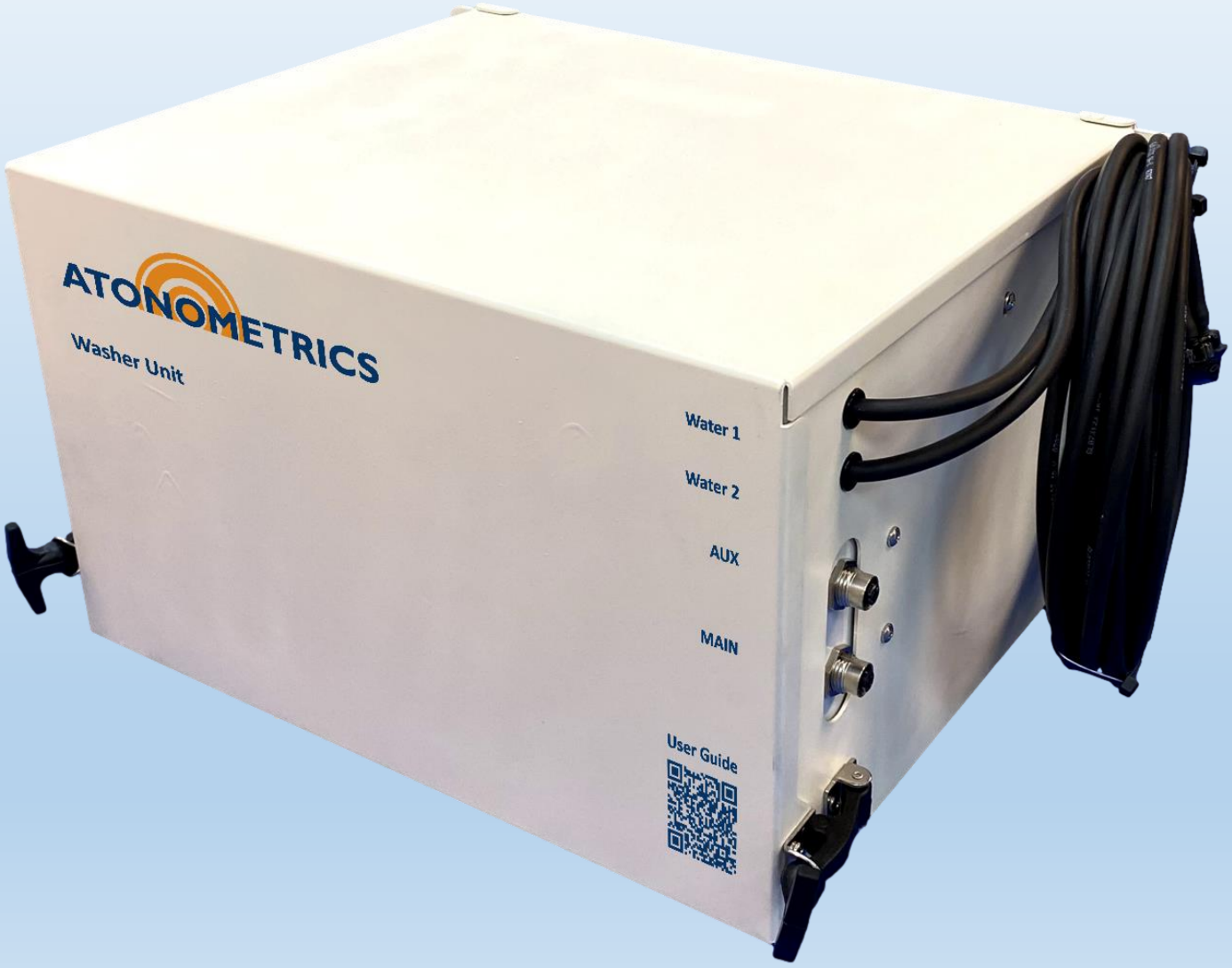

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Table of Contents

1 Product Overview 3
2 Safety 4
3 Device Configurations 5
4 Installation Overview 6
5 Installation of System Configuration C1 8
5.1 Configuring System Equipment 8
5.2 Add Water to the System 16
5.3 Complete Installation 19
6 Other Device Configurations 22
6.1 C2 Configuration 23
6.2 R1 Configuration 24
6.3 R2 Configuration 25
7 Mounting 26
7.1 Location 26
7.2 Water 26
7.3 Dimensions 27
8 Wiring 28
9 Support 30
10 Modbus Registers 32

1 Product Overview

The Cell Wash™ Automated Reference Cell Wash System, shown in **Figure 1-1**, washes Atonometrics RC22™ PV reference cells on a regular schedule.

The Cell Wash system can be used as a standalone soiling measurement system to measure clean and soiled reference cells for comparison and soiling analysis, for example as shown in **Figure 1-2**.

It can also work as an accessory to the Atonometrics RDE300i™ PV Module Measurement System as part of a more complete module performance and/or soiling measurement system.

Cell Wash can be used for both monofacial and bifacial PV systems.

Communication to your data logger or SCADA system is via Modbus RTU (RS485).

For more details on using Cell Wash as an accessory to RDE300i, see additional information on support.atonometrics.com, including the Ordering Guide (880100) which shows details of possible system configurations.

Patents may apply. See www.atonometrics.com/patents.

Figure 1-1: Cell Wash™ Features

Figure 1-2: A washed and soiled reference cell pair for soiling measurement

2 Safety

WARNING: **Follow directions:** Operate this equipment only as directed in these instructions.

WARNING: **Inspect before using:** Inspect the equipment and note any damage or defects, including in wiring. Do not use the equipment if damaged or defective.

WARNING: **Qualified personnel only:** The product should only be installed and serviced by trained and qualified personnel.

WARNING: **Follow standard safety precautions:** When connecting this equipment to power sources, follow standard electrical safety precautions. Also, note that equipment in PV power plants may produce hazardous voltages. Follow all standard safety precautions applicable to the work environment.

3 Device Configurations

Cell Wash may be configured to support different system types and applications. Configurations are listed in **Table 3-1**.

System diagrams and wiring information for these systems, including those integrating with RDE300i, are provided in the Ordering Guide (880100) at support.atonometrics.com.

Set the Device Configuration using the Cell Wash Configuration Manager software as explained in Section 5.1.4 (Configure Cell Wash).

Table 3-1: Device Configurations

Device Configuration	RC22s in System	How it Works	Applications
C1	2	• Two front-side PV reference cells. One cell is automatically washed	• Reference cell irradiance measurements with automatic washing • Soiling Ratio measurements
C2	4	• Two front-side PV reference cells. One cell is automatically washed • Two rear-side PV reference cells. One cell is automatically washed	• Bifacial reference cell irradiance measurements with automatic washing • Bifacial Soiling Ratio measurements
R1	1	• Used together with RDE300i • One front-side PV reference cell, automatically washed by Cell Wash unit • RDE300i uses washed cell as reference for module performance measurements	• Soiling power loss measurements including effects of non-uniform soiling and module coatings and frames • Module performance and degradation
R2	3	• As above, for a bifacial system, with two additional PV reference cells on the rear side	• As above, for bifacial systems

4 Installation Overview

The following is an overview of the steps to install your Cell Wash unit. More details are given in the sections below.

- Configure the system equipment following instructions in Section 5 (Installation of System Configuration C1).
  - Set the communication settings of your RC22s.
  - Configure the Cell Wash unit.
    - If your system will not be in configuration C1, look at Section 6 (Other Device Configurations) for configuration settings.
  - Connect the RC22s to verify the RC22 and Cell Wash configuration.
  - If your system includes an RDE300i, configure it following instructions in the RDE300i User Guide (880093) after completing the setup of Cell Wash. It can be mounted after confirming system configuration.
- Open the Cell Wash enclosure and connect the battery wires to the enclosed battery.

Note: The battery does not provide power to the Cell Wash control board. For Cell Wash to function properly, **both** main input power must be provided by the user **and** the battery must be connected.

Note: The battery will slowly discharge over long periods of storage, so it may need to recharge before washing will occur. Connect the battery and power the Cell Wash unit to charge the battery.

WARNING: **Observe polarity markings for battery connection.** Do not short the battery. The battery can produce high currents.

- Connect the nozzle(s) to the washed RC22(s). Instructions are listed in Section 5.2.1 (Connect Nozzle Bracket Kit to Washed RC22).
- Mount the Cell Wash unit per Section 5.2.2 (Mount the Cell Wash Unit).
- Add distilled water to the water tank.
  - Note that water will not be detected until the tank is filled above the water sensor, which is located under the internal electronics enclosure.
  - Make sure the water tank lid is closed after filling to prevent evaporation.

Note: Use only distilled water to avoid cloudy deposits on the reference cells.

- Prime the pumps using the “Test Pump” button(s) on the Wash Settings tab of the Configuration Manager.
  - **Ensure the nozzle(s) are pointed to wash the surface of the RC22 unit(s).** Make any adjustments to the nozzle as needed.
  - After this point, the nozzles should remain above the tank to avoid siphoning water from the tank.

- Mount the RC22 unit(s) per Section 5.3.1 (Mounting the RC22 Reference Cells).
- Normalize the irradiance measurements of the system per Section 5.3.2 (Normalizing RC22 Irradiance Measurements).
- Disconnect the Configuration Kit and install power and communication cables per Section 8 (Wiring).
- Provide power to the unit, then check that the indicator LED is flashing.
    - Inside the Cell Wash enclosure there is an electronics enclosure. The indicator LED is on the bottom surface of this internal enclosure, facing downwards.
- Close the Cell Wash enclosure. Installation is complete.

5 Installation of System Configuration C1

5.1 Configuring System Equipment

Figure 5-1 shows the system diagram of configuration C1. This configuration is used for basic soiling measurement. Each of these pieces of equipment need to be configured before installation.

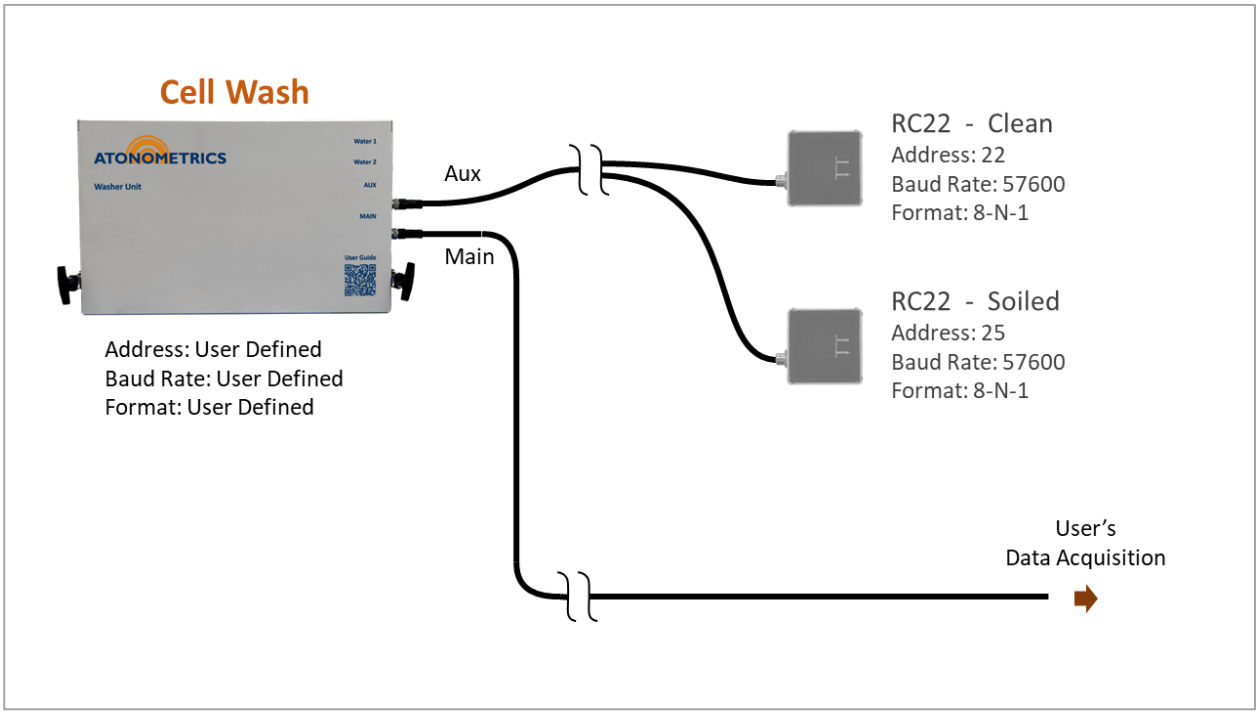

Figure 5-1: Configuration C1

5.1.1 Documentation

You will need the latest versions of the following software and documentation:

- This document, the Cell Wash User Guide (880104)
- Cell Wash Configuration Manager (500113)
- RC22 User Guide (880095)
- RC22 Configuration Manager (500099)
- Ordering Guide (880100), which contains wiring diagrams for each system configuration

All of these, along with installation instructions, can be found at support.atonometrics.com.

Atonometrics configuration manager software allows you to connect to your device, set communication and other configuration settings, and test system status. The software runs on a Windows PC.

5.1.2 Configuration Kit

The Configuration Kit (810276), sold separately, allows you to conveniently power your Atonometrics equipment, perform configuration, and test communication and system status. The main kit contents are shown in **Figure 5-2**.

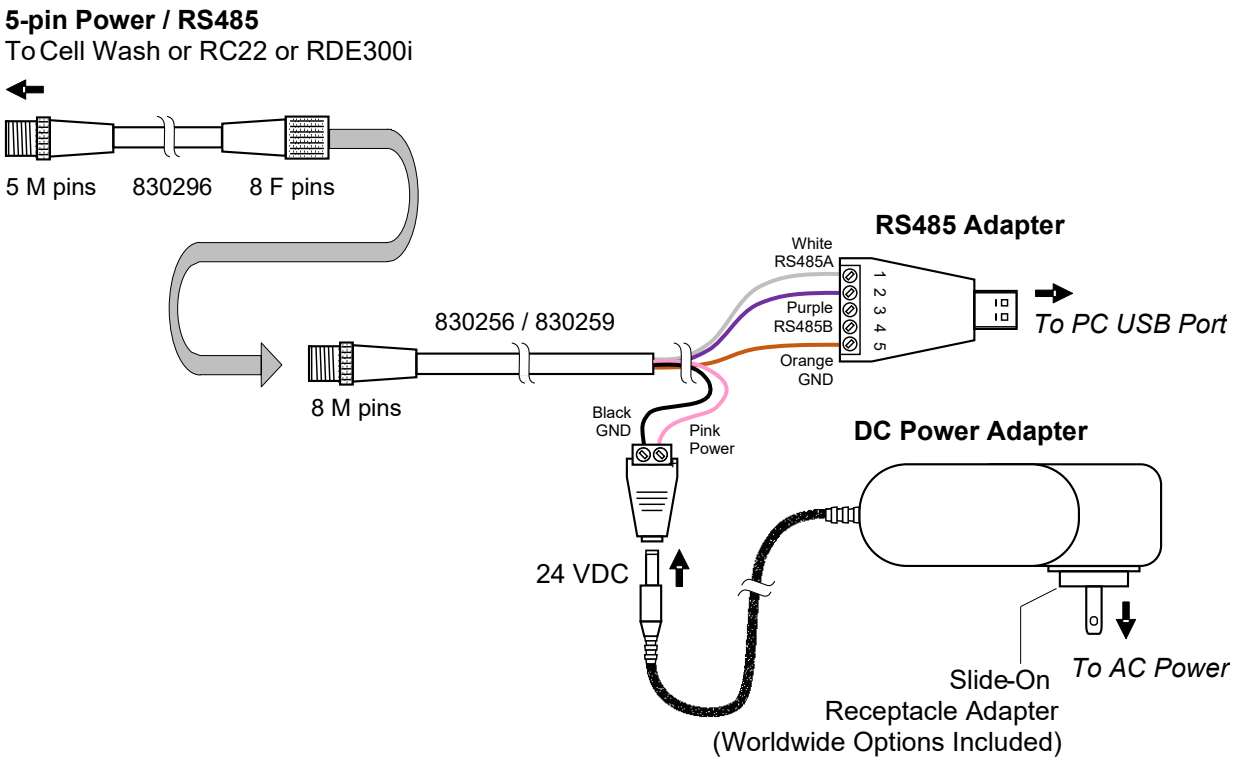

Figure 5-2: Configuration Kit (810276, sold separately)

To assemble and install the kit for use with your Windows PC:

- Assemble the power/RS485 cable and connect to the Main input on your Cell Wash
- Connect the RS485 adapter cable to your PC's USB port.
- Allow Windows to detect the USB adapter and automatically install its driver.
- Select the included AC power receptacle adapter appropriate for your region and install it on the AC-DC power adapter. Connect the power adapter to AC power.

Note: Older configuration kits shipped with a 12V DC power adapter. These power adapters will not work with Cell Wash. Check that your DC power adapter provides 24V.

Note: The 810276 Configuration Kit supports multiple products. It may include some accessories that are not required for your Cell Wash unit and are not shown here.

Note: Configuration Kits are optional. You may duplicate their functions with your own supplied equipment and cables if desired.

Note: For more information on the 810276 Configuration Kit, or to find software drivers, visit the 801276 configuration kit page on support.atonometrics.com.

5.1.3 Configure RC22 Units

RC22 units must be set to specific addresses per Cell Wash system configuration. Cell Wash uses the configured addresses to identify each RC22 unit and its position (i.e. front/ rear side, soiled/cleaned).

Use the RC22 Configuration Manager (500099) and the Configuration Kit (or equivalent equipment) to set the RC22 units to the communication parameters in **Table 5-1**.

Reference the RC22 User Guide (880095) for more detailed instructions on RC22 configuration.

Table 5-1: RC22 Communication Settings for C1 System Configuration

RC22 unit	Address	Baud Rate	Data Format
Front Side Clean Cell	22	57600	8-N-1
Front Side Soiled Cell	25	57600	8-N-1

5.1.4 Configure Cell Wash

5.1.4.1 Connect to Cell Wash

Connect the Cell Wash to the Configuration Kit (or equivalent equipment) as described above in Section 5.1.2 (Configuration Kit) and ensure the kit is powered. You can verify the Cell Wash is powered by the flashing LED on the bottom of the internal electronics enclosure.

Launch the Cell Wash Configuration Manager Software on your PC.

From Cell Wash Configuration Manager, use the Connect tab shown in **Figure 5-3** to connect to your Cell Wash unit.

Select your PC's COM port corresponding to the USB/RS485 adapter of the Configuration Kit.

If the Modbus communication settings of your Cell Wash are unknown, Scan for the Cell Wash using the Find button. The software will attempt to discover your Cell Wash address, baud rate, and data format.

If your Modbus communication settings are known, you may enter these in the Connect Manually box and press the Connect button.

Note: To determine the COM port of your RS485 adapter, check the COM ports drop down box with and without the adapter connected to your PC, using the Refresh button to update the list after connecting/disconnecting the adapter from the PC.

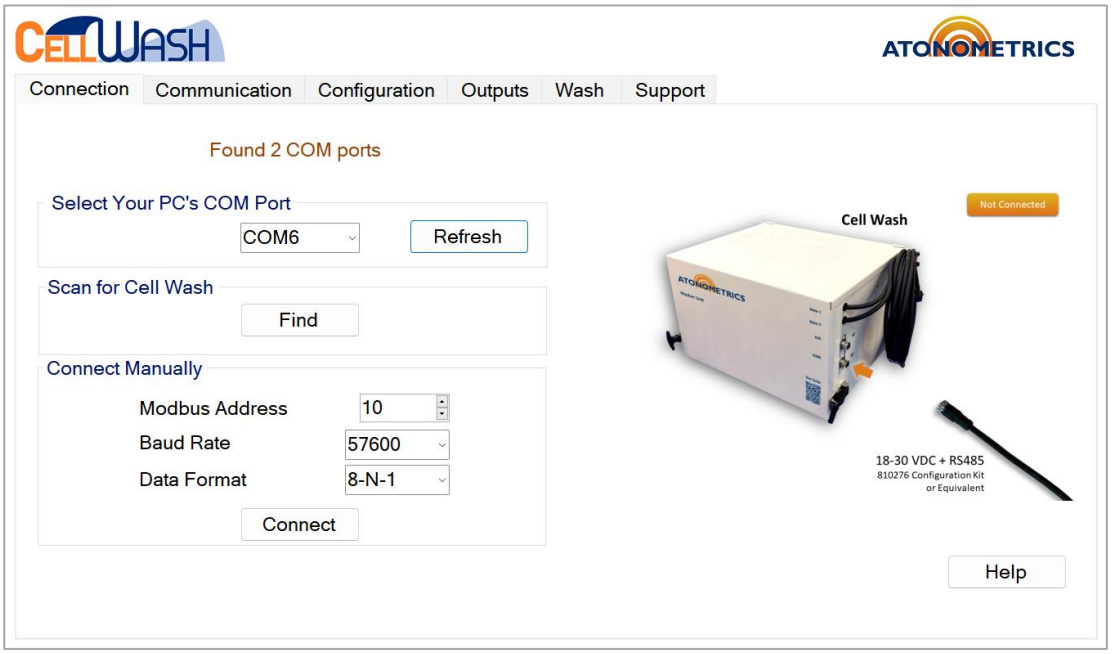

Figure 5-3: Connecting with Cell Wash Configuration Manager Software

Once your Cell Wash unit is connected, the software will display the Connected status as shown in **Figure 5-4**.

Figure 5-4: Cell Wash connected

5.1.4.2 Setting Communication Parameters

Cell Wash default Modbus serial communication parameters are Address = 10, Baud Rate = 57600, and Data Format = 8-N-1 (8 data bits, no parity, 1 stop bit).

To update the communication parameters, use the Communication tab of Cell Wash Configuration Manager, shown in **Figure 5-5**.

Enter your new parameters in the Update Modbus Settings box and press Apply to transmit these to the unit.

Addresses from 1 to 247 are allowed.

Supported baud rates are 9600, 19200, 38400, and 57600.

Supported data formats are 8-N-1, 8-N-2, 8-E-1, and 8-O-1.

Note: If Cell Wash is being used as an accessory to RDE300i, Modbus communication parameters must be left at the factory defaults and may not be changed by the user. See the RDE300i User Guide (880093) for more information.

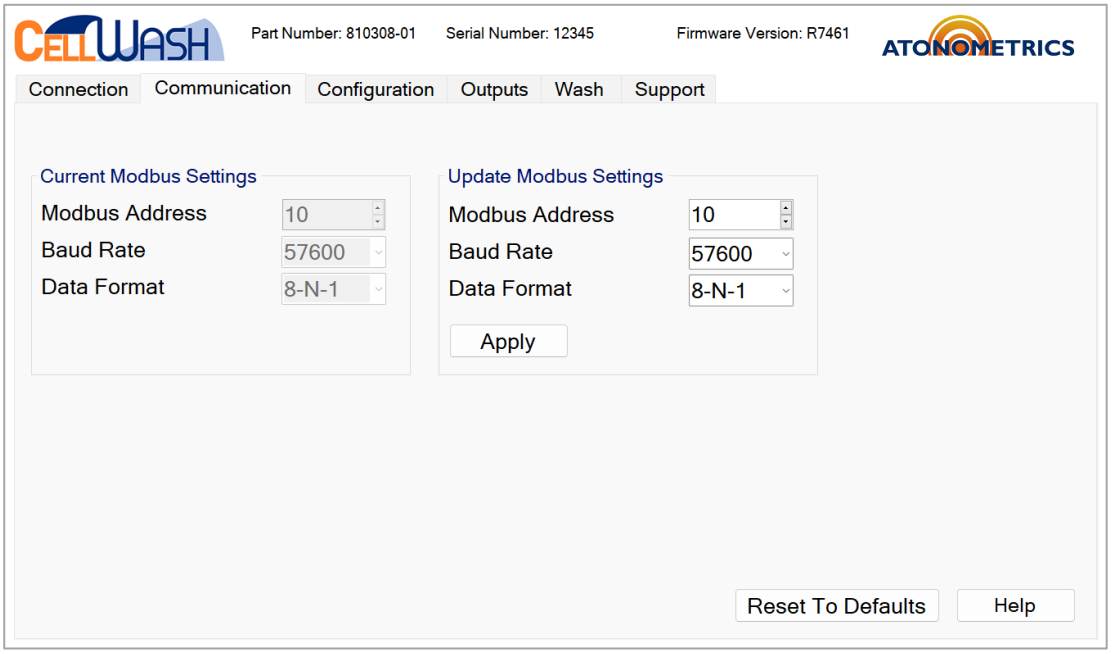

Figure 5-5: Setting communication parameters

5.1.4.3 Set Cell Wash System Configuration to C1

The System tab of the Configuration Manager software contains a drop-down to set device configuration. The diagram displayed below the drop-down provides visual confirmation of the configuration operation and illustrates the RC22(s) on the Aux network.

Select “C1 (2 reference cells)” from the Choose Device Configuration drop-down in the Configure tab of Cell Wash Configuration Manager, as shown in **Figure 5-6**, and press Apply.

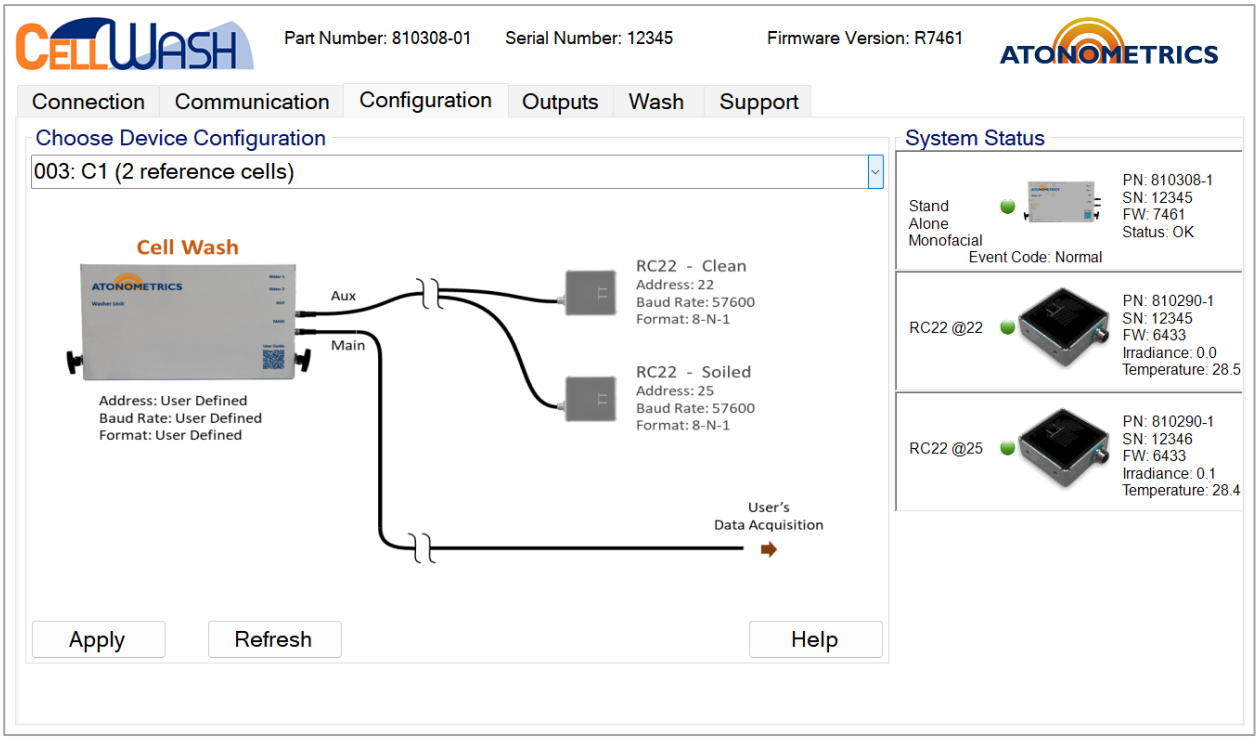

Figure 5-6: The Configuration Tab showing C1 applied

The System Status box displays the operation status of the connected Cell Wash as well as its part number, serial number, and installed firmware version. For warning and error conditions, an Event Code may be displayed.

The System Status box also displays the RC22 unit(s) on the Aux network. For each RC22, the operation status, part number, serial number, and installed firmware version are shown.

For Event Code explanations, see the Help screen or refer to help articles on support.atonometrics.com.

Note: If any Aux networked unit is not properly configured or connected, its status may be displayed with an error in the System Status box. To resolve this, connect to the RC22 according to its User Guide, configure the device to the required settings, and then reconnect the Cell Wash’s Aux port to the device or device network.

5.1.4.4 Confirming Wash Settings

Cell Wash is shipped with recommended wash settings, which will wash cells daily. (Wash duration 10 seconds, Time between washes 1 day.)

If changes are needed, the following settings are available in the Wash Tab of the Configuration Manager:

- **Wash Duration**: The length of time, in seconds, that water will be pumped to wash the clean cell(s) during each wash event.
- **Time between washes**: The number of days between washes. Depending on the setting chosen, Cell Wash will wash either every day at sunset, or every other day at sunset.

A wash will not occur if any of these conditions are present:

- Temperature is too low (water may be frozen)
- There is no water detected in the water tank
- The battery in the Cell Wash unit is disconnected

The Wash Tab also shows the status of the wash cycle. If the last wash was unsuccessful, the errors will be shown in the top right.

For initial setup and test, there is a “Test Pump” button on this tab that can be used to send a wash command to the Cell Wash unit. There is a 60 second cool-down on the pump test command to prevent pump overheating.

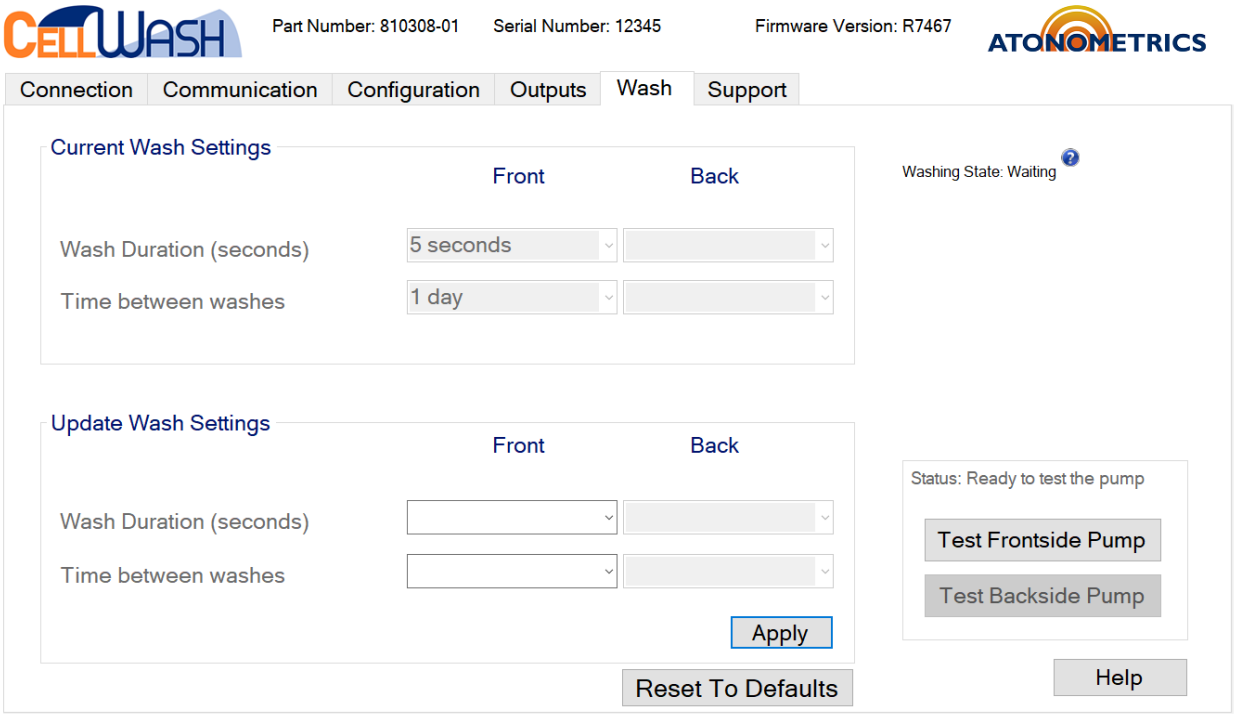

Figure 5-7: The Wash Tab with wash duration and time between washes settings

5.1.5 Validate System Configuration

Following the system wiring diagram in the Ordering Guide (document 880100), connect the RC22 units to the Cell Wash unit's Aux port.

Configuration	Ordering Guide Wiring Diagram
C1	Cell-Cell-Washer Single POA
C2	Cell-Cell-Washer Dual POA
R1	Module-Cell-Washer Monofacial
R2	Module-Cell-Washer Bifacial

Open the Cell Wash enclosure and connect the battery wires to the enclosed battery.

Note: The battery does not provide power to the Cell Wash control board. For Cell Wash to function properly, **both** main input power must be provided by the user **and** the battery must be connected.

Note: The battery will slowly discharge over long periods of storage, so it may need to recharge before washing will occur. Connect the battery and power the Cell Wash unit to charge the battery.

WARNING: **Observe polarity markings for battery connection.** Do not short the battery. The battery can produce high currents.

Connect the Cell Wash to the Configuration Kit and ensure the kit is powered.

Using the Configuration Manager, check the output data of Cell Wash.

- On the Wash tab, check that temperature is reported and no water is detected.
- On the Outputs tab, check the RC22 units are reporting irradiance and temperature.

5.2 Add Water to the System

5.2.1 Connect Nozzle Bracket Kit to Washed RC22

The Cell Wash ships with a Nozzle Bracket Kit (PN 810330). The kit contains the bracket, nozzle, nozzle adjustment tool, hose clamps, and screws. **Figure 5-8** shows the contents of the Nozzle Bracket Kit.

Figure 5-8: Nozzle Bracket Kit Contents

Attach the nozzle to the metal bracket by screwing on the plastic knob, as shown in **Figure 5-9**. Thread a hose clip onto the end of the Cell Wash hose, past the length of the nozzle intake tube. Feed the hose onto the nozzle, then use a pair of pliers to open the hose clamp and clamp the hose onto the nozzle.

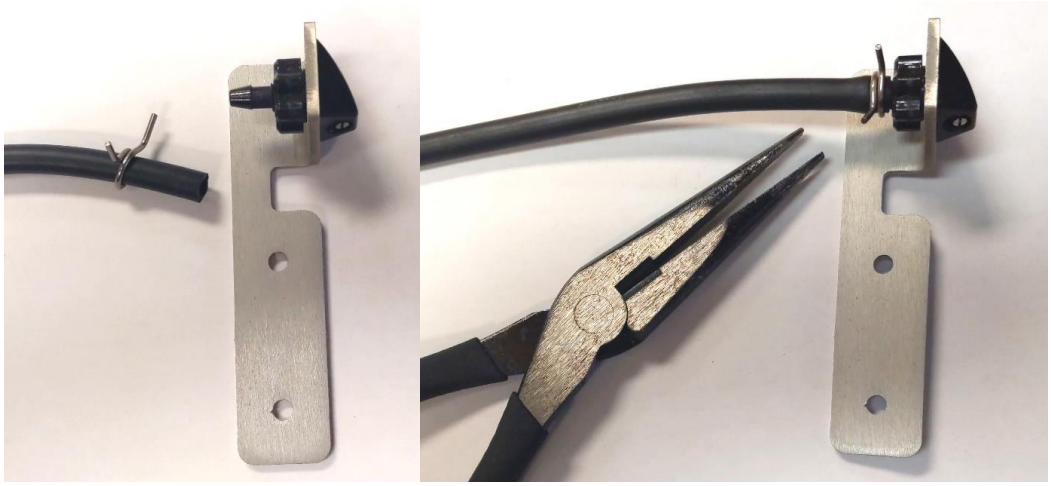

Figure 5-9: Connecting the nozzle and hose to the bracket

Depending on how the RC22 unit will be mounted, the bracket may need to be placed on either side of the RC22, as shown in **Figure 5-10**. Avoid directing the water spray towards any nearby solar modules. Use the screws included in the kit to attach the nozzle bracket.

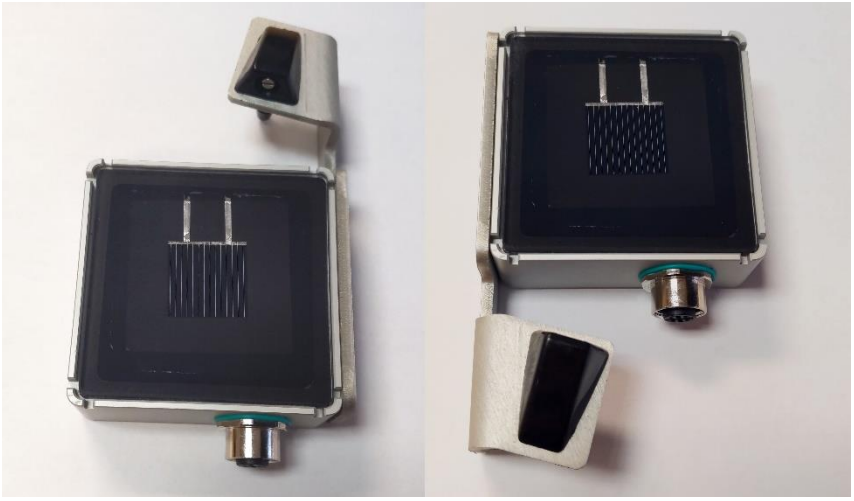

Figure 5-10: The nozzle bracket attached to the RC22 in two orientations

The small metal piece in this kit is a tool to adjust the spray direction of the nozzle. **Keep this piece** until installation is complete – you will need to adjust the spray after adding water to the system.

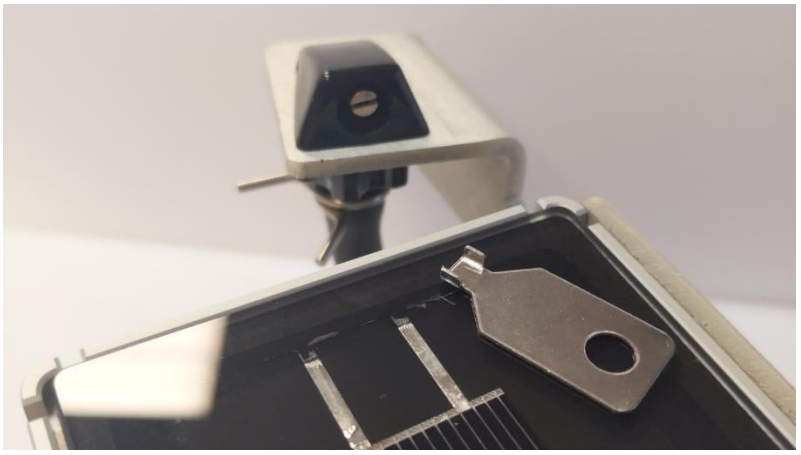

Figure 5-11: The nozzle adjustment tool and the slot for adjustment

5.2.2 Mount the Cell Wash Unit

Mount the Cell Wash unit before adding water to the tank. See Section 7 (Mounting) for dimensions and mounting requirements.

Once it is mounted, add distilled water to the water tank. Note that water will not be detected until the tank is filled above the water sensor, which is located under the internal electronics enclosure.

Make sure the water tank lid is closed after filling to prevent evaporation.

Note: Use only distilled water to avoid cloudy deposits on the reference cells.

5.2.3 Prime the Washer Pump

After distilled water has been added to the water tank, the Cell Wash Configuration Manager will show that water is detected.

Prime the pumps using the “Test Pump” button(s) on the Wash Settings tab of the Configuration Manager.

Ensure the nozzle is pointed to wash the surface of the RC22 unit. Make any adjustments to the nozzle as needed. Avoid directing any spray towards nearby solar modules. You can check alignment by pressing the “Test Pump” button again. There is a 60 second cool-down on the pump test command to prevent pump overheating.

After this point, the nozzles should remain above the tank to avoid siphoning water from the tank.

5.3 Complete Installation

5.3.1 Mounting the RC22 Reference Cells

Ensure the surfaces of the RC22s are parallel with the Plane of Array of the solar panel string.

To avoid siphoning water from the Cell Wash water tank, ensure that the washed RC22 is always higher than the water tank. Take special care for tracking systems, as the RC22 units may not be at the lowest point during installation.

When mounting the RC22s, avoid mounting them such that water is sprayed towards nearby solar modules.

Front-side RC22s are mounted to the Flat Mounting Plate (610534).

For systems on trackers, attach the Flat Mounting Plate to the Torque Tube Mounting Kit (810313).

Secure cables and tubing, while ensuring that cables and tubing have adequate service length for module motion if using a tracker.

Note: Do not compress the water tubes with cable ties or other methods of cable management.

Refer to the support article “RC22 mounting solutions” at support.atonometrics.com for more information on mounting RC22s.

5.3.2 Normalizing RC22 Irradiance Measurements

In order for Cell Wash to calculate the Performance Index (Soiling Ratio) of the RC22s, their clean measurements must be normalized against each other. Normalization is completed through the Outputs tab of the Cell Wash Configuration Manager.

Before normalization, check these items:

- **Ensure that it is a clear sunny day, preferably within 2-3 hours of local solar noon.**
- Ensure angle of incidence to the sun is small, preferably less than 35 degrees
- Clean the RC22 units thoroughly.
- Ensure the RC22 units are at the same tilt angle, preferably within 0.5 degrees. Use a handheld inclinometer to confirm. Check the tilt in both directions across each device. If necessary, remount the devices.

If the above conditions are not met, normalization may fail or result in an incorrect normalization factor being stored and used by the Cell Wash unit.

The RC22 units must be properly configured and connected to the Cell Wash unit, as detailed in Section 5.1 (Configuring System Equipment).

Connect the Cell Wash to the Configuration Kit and ensure the kit is powered.

Connect to Cell Wash in the Configuration Manager, then go to the Outputs tab.

Verify that the RC22 units are reporting irradiance and temperature as expected.

After ensuring that the listed conditions above are met, use the button labeled “Normalize.” Cell Wash will automatically calculate the Normalization Factor.

Because both RC22 units are clean, the resulting Soiling Ratio should read 1.00 (±0.02).

If the resulting soiling ratio is not 1.00 (±0.02), the procedure was not successful and must be repeated. Before trying again, check that both RC22s are clean and the sky conditions are bright and clear, per the list of requirements above.

Note: An incorrectly normalized Cell Wash unit will provide incorrect soiling readings. Ensure the normalization procedure is followed correctly.

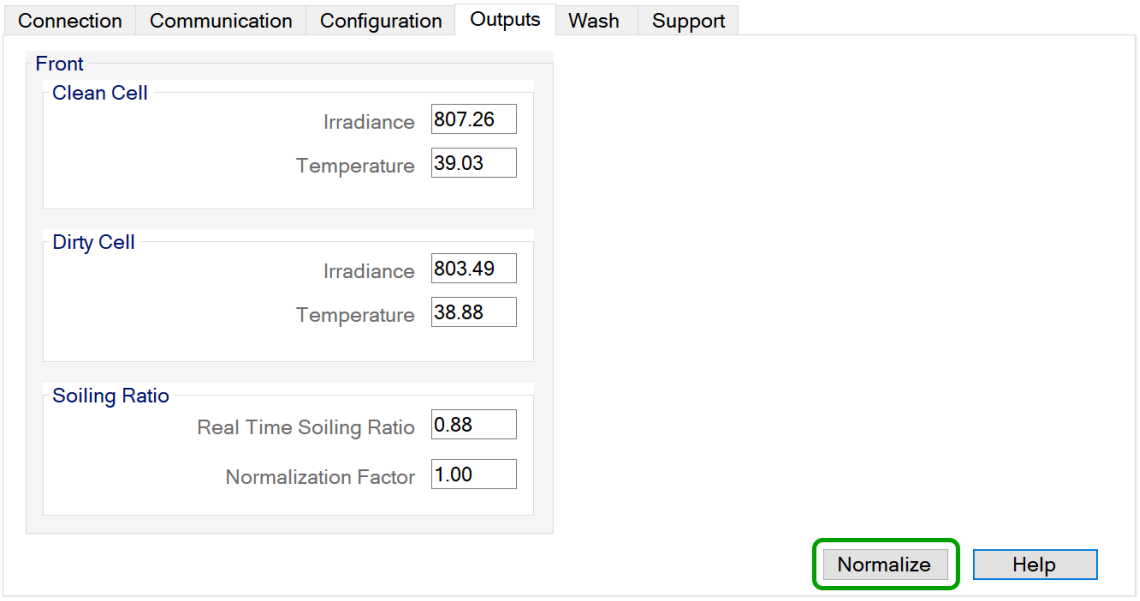

Figure 5-12: The Normalize button on the Outputs Tab

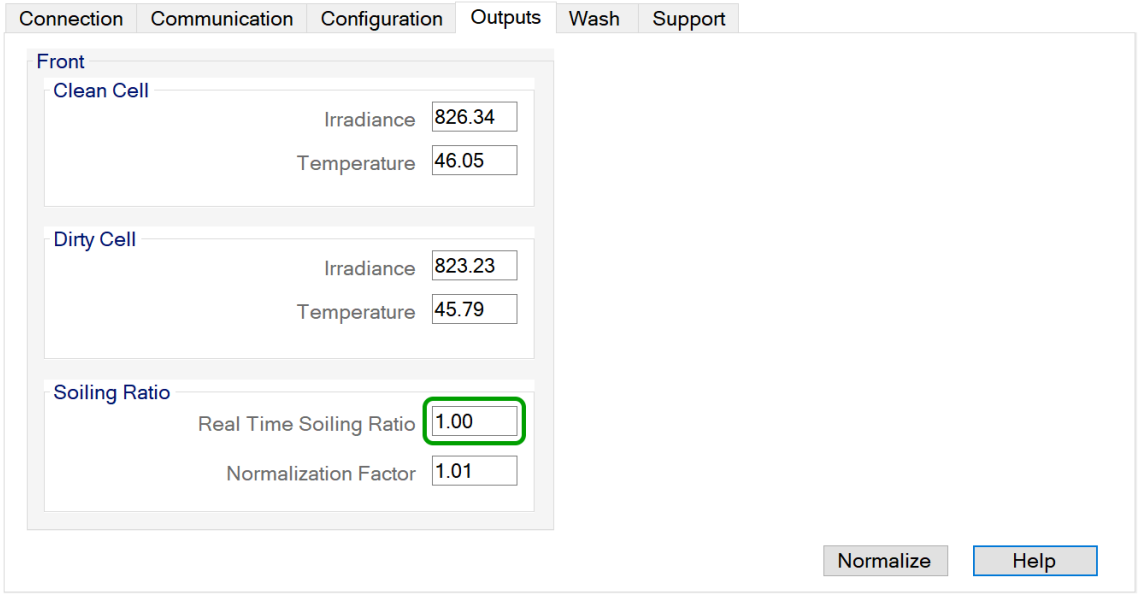

Figure 5-13: Soiling Ratio after successful normalization

5.3.3 Connect All System Cables

Disconnect the Configuration Kit and install power and communication cables per Section 8 (Wiring).

Provide power to the unit, then check that the indicator LED is flashing. The indicator LED is on the bottom surface of the internal electronics enclosure, facing downwards.

Close the Cell Wash enclosure. Installation is complete.

6 Other Device Configurations

System installation follows the same steps as listed in Section 5 (Installation of System Configuration C1). Instead of using the configuration settings for C1, reference the sections below per your system configuration.

Attach Nozzle Bracket Kits to each of the washed RC22 units in your system configuration. Rear-side RC22s are either clamped to the module frames using the Rear-Side Module Clamps or mounted to a flat plate with torque tube clamp kit.

For wiring the system, refer to the wiring diagrams in the Ordering Guide (880100).

For systems integrating Cell Wash with RDE300i, see the RDE300i User Guide for instructions on configuring the Leader RDE300i unit. For these systems, soiling ratio and normalization is also handled in the scope of the RDE300i.

Note: If any Aux networked unit is not properly configured or connected, its status may be displayed with an error in the System Status box. To resolve this condition, connect to the Aux device according to its User Guide, configure the device to the required settings, and then reconnect the Cell Wash's Aux port to the device or device network.

6.1 C2 Configuration

To set Cell Wash to the C2 configuration, select “C2 (4 reference cells)” from the Choose Device Configuration drop-down in the Configure tab of Cell Wash Configuration Manager, as shown in **Figure 6-1: C2 Configuration**, and press Apply.

Configure the four RC22 units to the communication settings shown in **Table 6-1**.

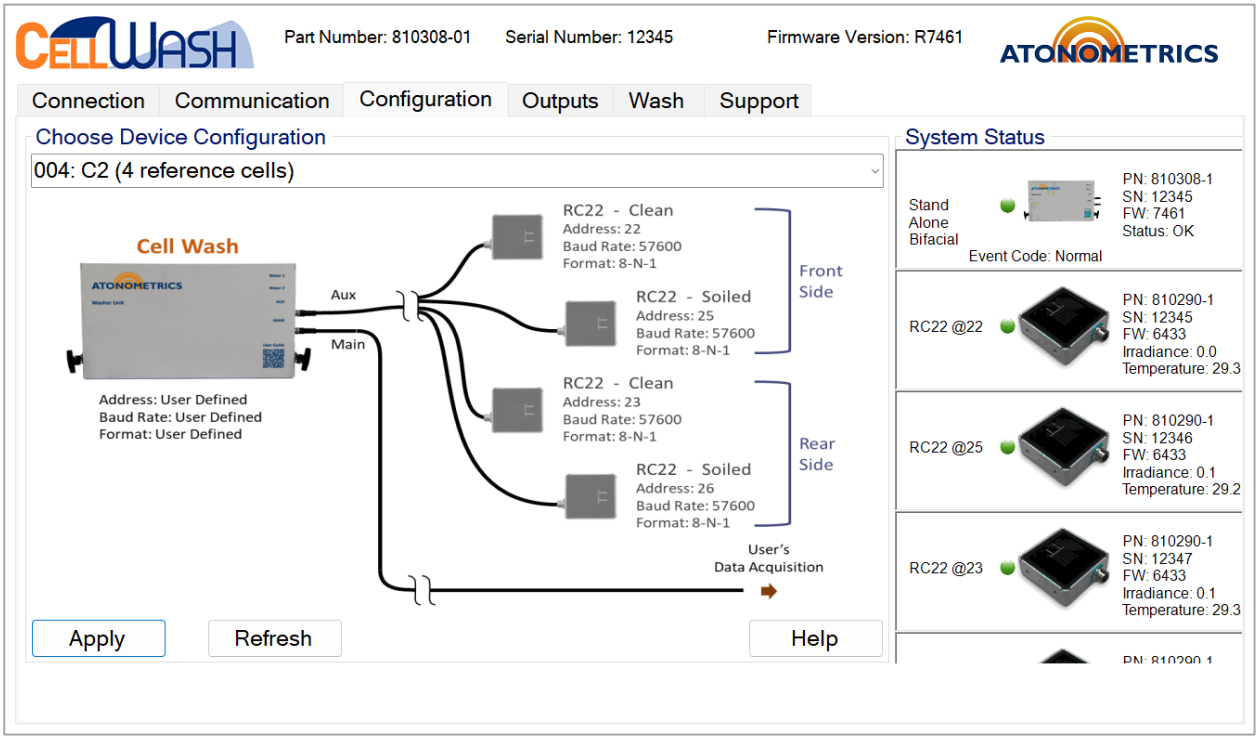

Figure 6-1: C2 Configuration

Table 6-1: RC22 Communication Settings for C2 System Configuration

RC22 unit	Address	Baud Rate	Data Format
Front Side Clean Cell	22	57600	8-N-1
Front Side Soiled Cell	25	57600	8-N-1
Rear Side Clean Cell	23	57600	8-N-1
Rear Side Soiled Cell	26	57600	8-N-1

6.2 R1 Configuration

To set Cell Wash to the R1 configuration, select “R1 (1 reference cell)” from the Choose Device Configuration drop-down in the Configure tab of Cell Wash Configuration Manager, as shown in **Figure 6-2**, and press Apply.

Configure the RC22 unit to the communication settings shown in **Table 6-2**.

Leave the Cell Wash unit at the default communication settings as shown in **Figure 6-2**.

Refer to the RDE300i User Guide (880093) for instructions on configuring the RDE300i unit.

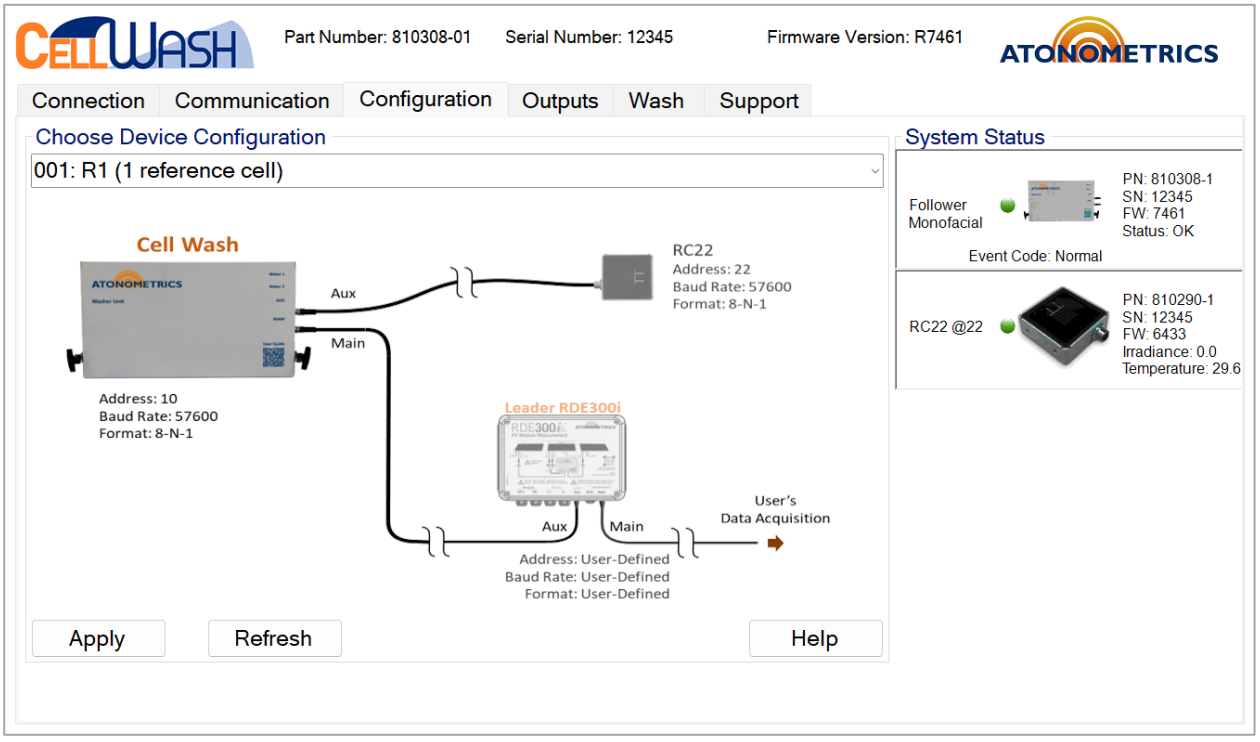

Figure 6-2: R1 Configuration

Table 6-2: RC22 Communication Settings for R1 System Configuration

RC22 unit	Address	Baud Rate	Data Format
Front Side Clean Cell	22	57600	8-N-1

6.3 R2 Configuration

To set Cell Wash to the R2 configuration, select “R2 (3 reference cells)” from the Choose Device Configuration drop-down in the Configure tab of Cell Wash Configuration Manager, as shown in **Figure 6-3**, and press Apply.

Configure the 3 RC22 units to the communication settings shown in **Table 6-3**.

Leave the Cell Wash unit at default communication settings as shown in **Figure 6-3**.

Refer to the RDE300i User Guide (880093) for instructions on configuring the RDE300i unit.

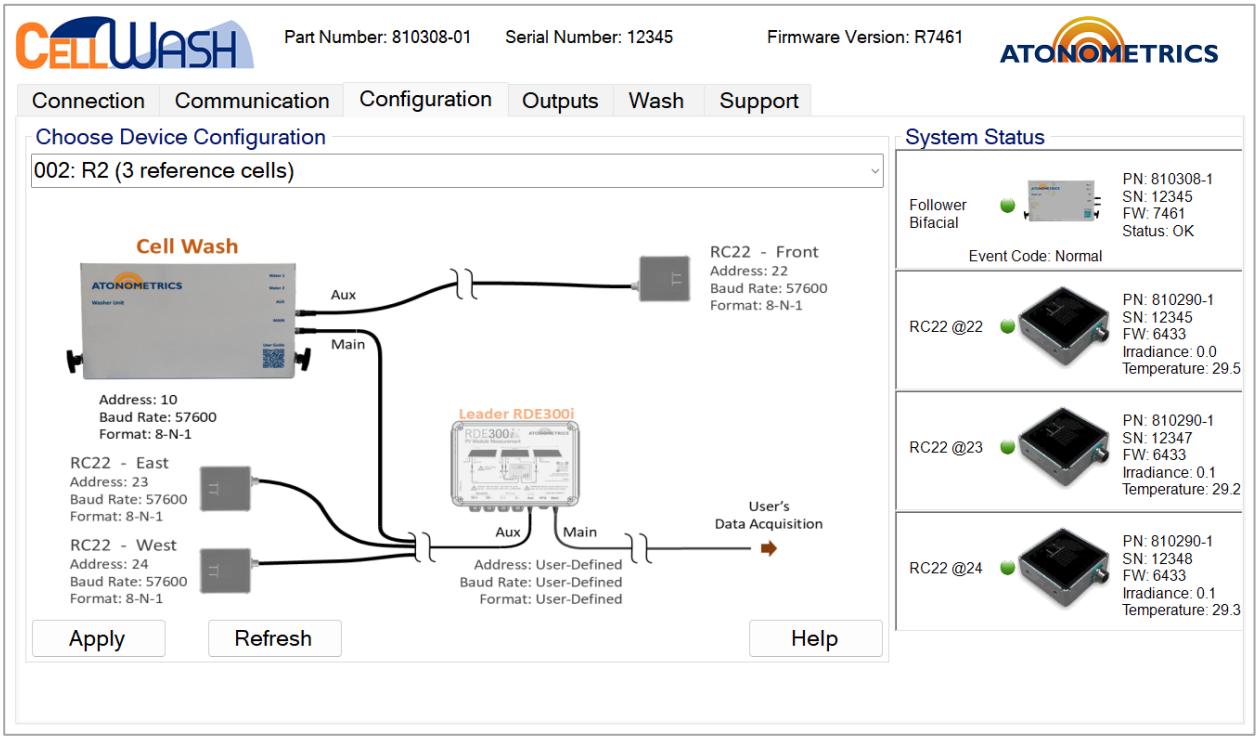

Figure 6-3: R2 Configuration

Table 6-3: RC22 Communication Settings for R2 System Configuration

RC22 unit	Address	Baud Rate	Data Format
Front Side Clean Cell	22	57600	8-N-1
Rear Side East Clean Cell	23	57600	8-N-1
Rear Side West Clean Cell	24	57600	8-N-1

7 Mounting

7.1 Location

Mount your Cell Wash unit as close as possible to the mounting position of the Washed RC22 reference cells. If possible, choose a shaded location underneath the modules.

To avoid siphoning water from the Cell Wash water tank, mount the unit below the lowest washed RC22 unit. Take special care for tracking systems, as the RC22 units may not be at the lowest point during installation.

Mount the Cell Wash with the text upright. The lid must be removable for regular water tank refills.

Limit distances between components as follows:

	Maximum Distance
Power supply (or RDE300i) to Cell Wash	100 meters
Cell Wash to Washed RC22 Cells	3 meters

Note: The Cell Wash water tubing is 3 meters long and cannot be extended. Ensure that cables and tubing have adequate service length for module motion if using a tracker.

Note: Do not compress the water tubes with cable ties or other methods of cable management.

7.2 Water

- When filling the water tank, use distilled water only.
- For Cell Wash to sense there is water in the tank, the water must be filled above the water sensor (a small, white, circular sensor pressed to the front of the water tank).

Note: Use only distilled water. Using tap water may result in cloudy deposits on the reference cells caused by minerals present in the water.

7.3 Dimensions

Figure 7-1 shows the Cell Wash enclosure dimensions and mounting hole positions. To mount the Cell Wash unit, use the 4 mounting holes on the rear flanges of the enclosure.

Note: Dimensions are approximate and may vary slightly due to material variations.

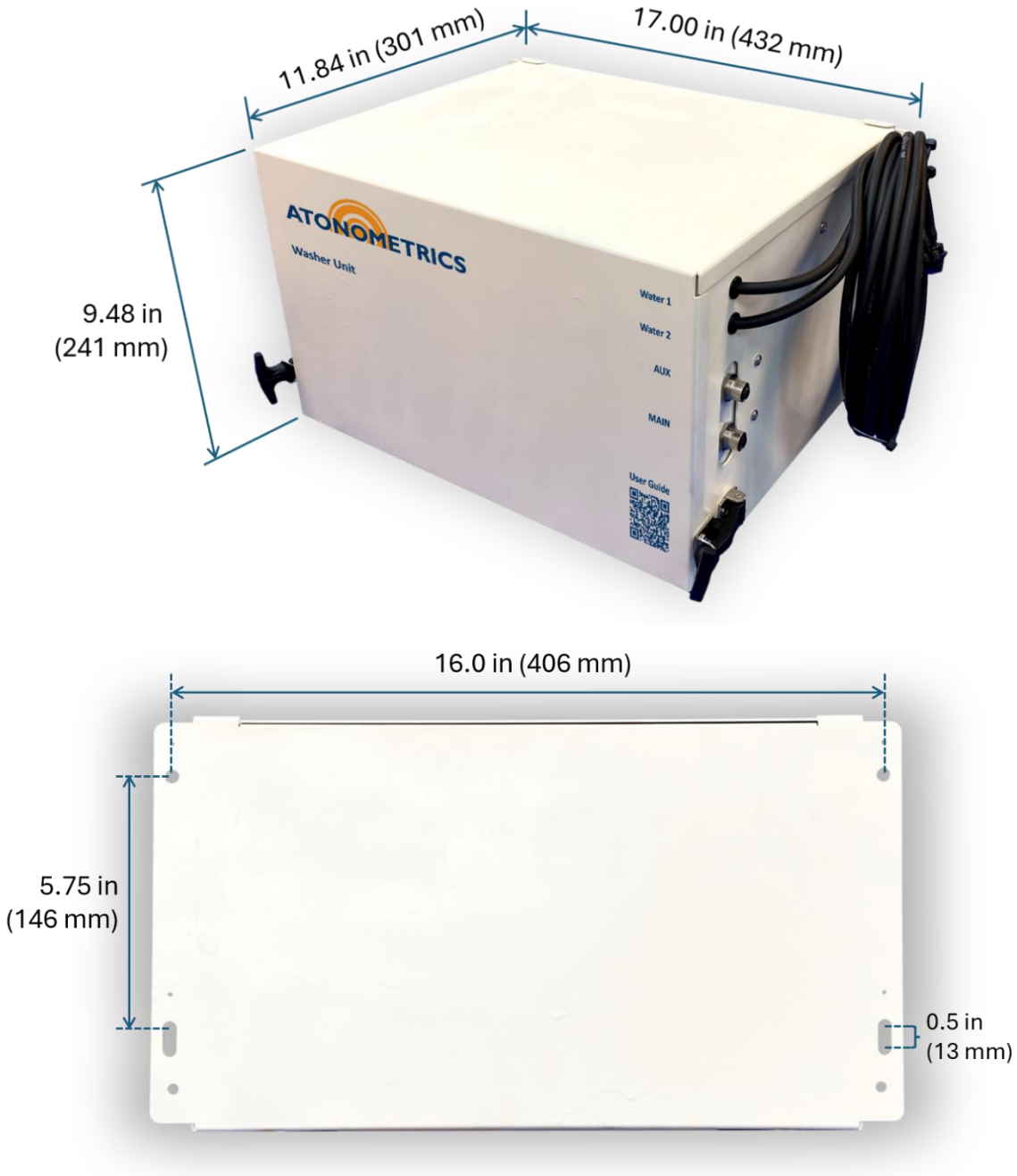

Figure 7-1: Dimensions and mounting hole spacing on rear flange

8 Wiring

Cell Wash requires 24-30 VDC and 2-6 W of power at its power input.

Typical power draw is <2 W but increases to 6 W for a few minutes after a wash.

Note that total power draw will be larger with longer cables because of cable resistance. Power supply voltage must be at least 24 VDC to account for cable voltage drops.

Power supplies should be sized for >~2 times the required power to provide for startup currents.

Communication is via Modbus RTU protocol over RS485.

Both power and communication are applied to the Cell Wash unit at the M12 connectorized port labeled Main. A second M12 connectorized port labeled Aux provides power and communication to the RC22 network.

Cell Wash must be connected to the user's power and communication equipment. Use cable series 830303, which connects to the Main port and provides bare wires for connection to the user's equipment. This series uses 24 AWG conductors. See M12 power and communication cables listed in **Table 8-1**. For long cables, place the 830331 RS485 termination accessory between the cable and the Cell Wash Main input as indicated in the table. **Figure 8-1** lists the wire colors for cable series 830303. Cable length to the Main input must not exceed 50 meters.

Connect the RC22(s) to the Aux port of the Cell Wash. If the system configuration uses one RC22, use cable 830284-04. If the system configuration uses multiple RC22s, depending on the number, the Y-cables 830314, 830341 and/or 830352 may be used. For more information on device configurations, see Section 3 (Device Configurations).

For additional wiring and power information, including system diagrams and which cables are used per system configuration, see the Ordering Guide (document 880100).

Table 8-1: M12 Power and Communication Cables

Length	Main to User's Power & RS485 (M12 5-pin / Bare Wire)	Minimum Power Supply Voltage	830331 RS485 Termination Required?
4 m	830303-004	24 VDC	No
10 m	830303-010	24 VDC	No
25 m	830303-025	24 VDC	No
50 m	830303-050	24 VDC	Yes

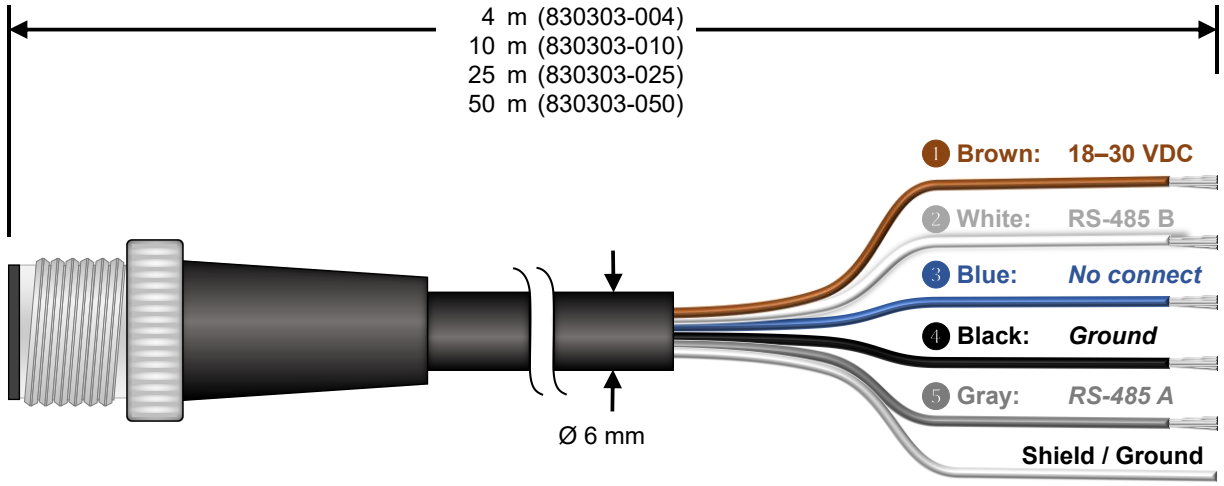

Figure 8-1: Wire colors for 830303 cables

Note: **Use only Atonometrics-supplied cable assemblies.** Although other components may appear to fit, use of non-approved components may result in water penetration.

Note: Connect the shield / ground wire of the 830303 cable to ground in your equipment cabinet.

Note: Cut the blue wire, which is not used in this product.

Note: For additional wiring and power information regarding systems configured to have RDE300i integrated with one or more additional Atonometrics sensors, see the Ordering Guide (880100).

WARNING: **Check all wiring before turning on power.** Incorrect wiring may damage the unit and/or other equipment.

9 Support

To check for Cell Wash Configuration Manager or Cell Wash Firmware software updates, use the software updates Check button on the Support tab, shown in **Figure 9-1**, or visit support.atonometrics.com. Keep your software up to date.

The Event Code Queue shown on the Support tab is useful for diagnosing any issues with your Cell Wash unit. Press the View button to observe the real-time event code. Press the Pause button on the Event Code Queue screen to freeze the currently displayed event codes. Event codes are displayed with respect to time from newest (position 1) to oldest (position 60). See **Table 9-1: Event Codes and Troubleshooting Actions** for more information.

If support is needed, send screenshots of the Configuration tab, the Event Code Queue window, and the Diagnostic Info window with your ticket. Sending these will help us resolve your issues more quickly.

Note: If internet is available, the software updates Check button will determine if there is newer Cell Wash software available. Otherwise, it will display a QR code that may be scanned with a cell phone to obtain Cell Wash software versioning information.

Note: As shown below, the Support tab also provides convenient links to the Atonometrics support website for obtaining product documentation and accessing our support portal.

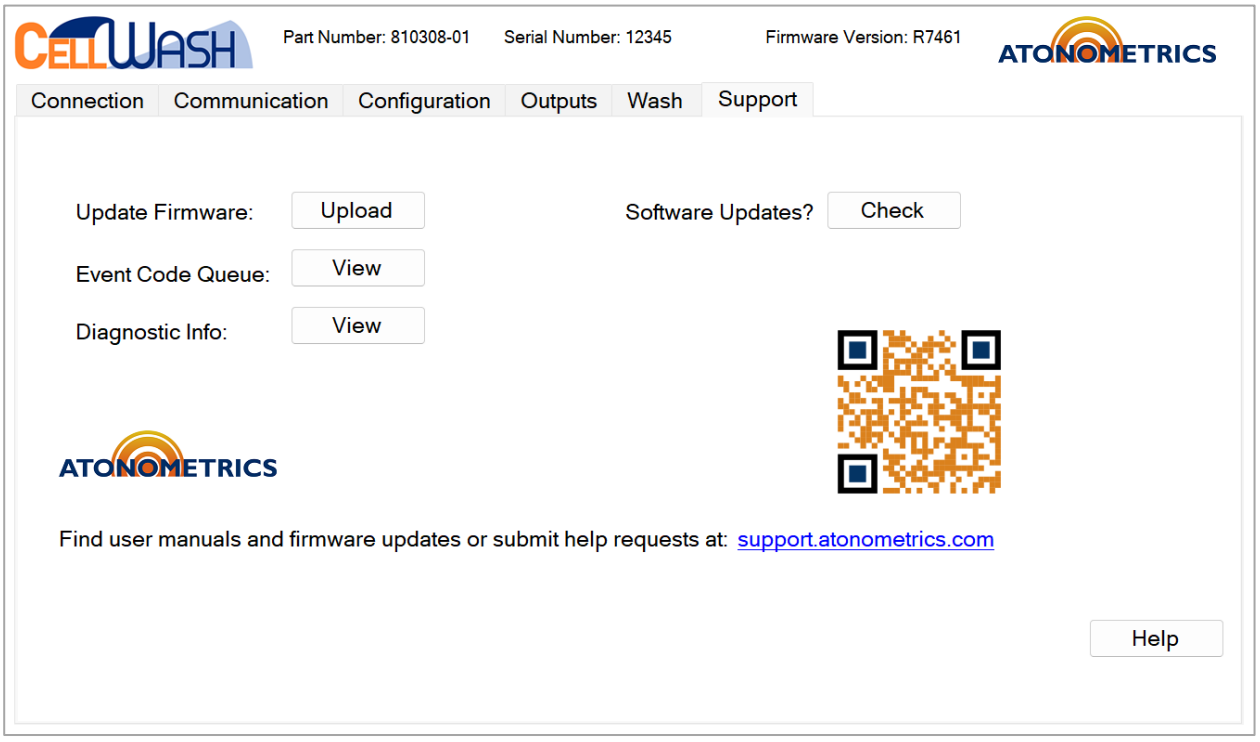

Figure 9-1: Support Tab

Table 9-1: Event Codes and Troubleshooting Actions

Event Code	Event Description	Troubleshooting Actions
0	No Event	• No action needed.
1	Hardware Fault	• Restart the unit.
2	AUX Network Fault	• Check cables to AUX network devices. • Check communication settings of AUX devices match requirements of System Configuration.
3	Battery Issue	• Check the battery and pump wiring are connected. • Restart the unit. • Check the battery voltage. • If the battery voltage is very low, check the age of the battery and replace if needed.
101	Pump Failed to Wash	• Check the Water Level to ensure there is water in the tank • Check the temperature. Cell Wash does not wash while temperatures are freezing. • Check the battery and pump wiring are connected.
102	Water Level Low	• Add more distilled water to the water tank. • If there is water in the tank and it is higher than the water sensor (a small circular sensor pressed to the front of the water tank), contact Atonometrics for support.
103	Temperature Too Low	• No action needed. This is an alert that Cell Wash will not wash until the temperature is above freezing (as measured by the unit).
104	Equipment Testing Mode	• Restart the unit.
Any Other	Software Event	• Ensure both Cell Wash Firmware and the Cell Wash Configuration Manager are up to date. • Newly added event codes will be defined in the Configuration Manager.

If support is needed, send screenshots of the Configuration tab, the Event Code Queue window, and the Diagnostic Info window with your ticket. This will help us resolve your issues more quickly. The Event Code Queue and Diagnostic Info window buttons can be found on the Support Tab of the Configuration Manager.

10 Modbus Registers

Cell Wash supplies data outputs using Modbus RTU protocol. For detailed information on Modbus protocols, please reference the specifications published by Modbus.org.

All parameters are returned as single-precision 32-bit floating point per IEEE 754, requiring four bytes. Modbus defines a register as a two-byte value. Therefore, each parameter occupies two successive registers. Bytes are returned big-endian: bytes *ABCD* are ordered from most to least significant, and the first register in a pair returns bytes *AB* while the second returns *CD*.

Note: On some user data acquisition devices, it is necessary to add 1 to all the register values.

Note: Recommended rates: scan period ≥ 1 s, timeout ≥ 500 ms, delay between polls ≥ 30 ms.

Table 10-1 lists the registers available for your client software to read data from Cell Wash.

Note that for the C1 Configuration, there are only two, front-facing RC22 units. This means that the registers for the rear RC22 units are not used.

For systems including an RDE300i unit, all data will be routed through the RDE300i. See the RDE300i User Guide (880093) for Modbus register information.

See Section 3 (Device Configurations) for more details about system configurations.

Table 10-1: Cell Wash Modbus Registers

Parameter	Reg. Start	Count	Data Type	Units	Notes
Status	1001	2	Float		0 = Normal; 1 = Warning; 2 = Error. If status is not 0, check the Event Code for more information.
Event Code	1003	2	Float		The latest Event Code in the Event Code queue. The configuration manager shows the entire queue of recent codes. See **Table 9-1** for more Event Code definitions.
Reserved	1005	2	Float		*Not in use. Returns NaN*
Reserved	1007	2	Float		*Not in use. Returns NaN*
Reserved	1009	2	Float		*Not in use. Returns NaN*
Reserved	1011	2	Float		*Not in use. Returns NaN*
Water Level Low	1013	2	Float		1 indicates water is low and needs refill with distilled water.
PCB Temperature	1015	2	Float	°C	Temperature is measured by Cell Wash to avoid washing while water is frozen.
Number of RC22s	1017	2	Float		This number is determined by the system configuration.
Front Clean RC22 (Address 22) Irradiance	1019	2	Float	W/m²	Instantaneous measurements from RC22 at address 22. The unit at address 22 is assumed to be the front-facing clean unit, per system definition.
Front Clean RC22 (Address 22) Temperature	1021	2	Float	°C	
Front Soiled RC22 (Address 25) Irradiance	1023	2	Float	W/m²	Only used for system configurations with more than 1 RC22. Instantaneous measurements from RC22 at address 25. The unit at address 25 is assumed to be the front-facing soiled unit, per system definition.
Front Soiled RC22 (Address 25) Temperature	1025	2	Float	°C	
Rear Clean RC22 (Address 23) Irradiance	1027	2	Float	W/m²	Only used for system configurations with more than 2 RC22s. Instantaneous measurements from RC22 at address 23. The unit at address 23 is assumed to be the rear-facing clean unit, per system definition.
Rear Clean RC22 (Address 23) Temperature	1029	2	Float	°C	
Rear Soiled RC22 (Address 26) Irradiance	1031	2	Float	W/m²	Only used for system configurations with more than 3 RC22s. Instantaneous measurements from RC22 at address 26. The unit at address 26 is assumed to be the rear-facing soiled unit, per system definition.
Rear Soiled RC22 (Address 26) Temperature	1033	2	Float	°C	
Time Since Last Washed Pump 1	1035	2	Float	seconds	The time in seconds since the last successful wash of the front-side clean cell.
Time Since Last Washed Pump 2	1037	2	Float	seconds	This is only used for systems with two pumps. The second pump washes the rear-side cells. The time in seconds since the last successful wash of the rear-side clean cell.
Front Real-Time Soiling Ratio	1039	2	Float		10 second average Soiling Ratio (Performance Index) output of Cell Wash for the front-side RC22s.
Front 10min Avg Soiling Ratio	1041	2	Float		The average front-side Soiling Ratio over the last 10 minutes of data.
Front 24-hr Avg Soiling Ratio	1043	2	Float		The Soiling Ratio average of the last 24 hours of Cell Wash front-side data. This is the effective daily Soiling Ratio for monofacial systems.
Rear Real-Time Soiling Ratio	1045	2	Float		10 second average Soiling Ratio (Performance Index) output of Cell Wash for the rear-side RC22s.
Rear 10min Avg Soiling Ratio	1047	2	Float		The average rear-side Soiling Ratio over the last 10 minutes of data.
Rear 24-hr Avg Soiling Ratio	1049	2	Float		The Soiling Ratio average of the last 24 hours of Cell Wash rear-side data.