LSI LASTEM PRPMA4100 Soil Particle Deposit Sensor User Manual

Contents

LSI LASTEM PRPMA4100 Soil Particle Deposit Sensor

Specifications:

- Product Name: PRPMA4100 Soiling Sensor
- Measurement: Soiling losses for PV installations
- Features: Internal camera for detecting soiling particles, no water required, compact and easy to install, no site-specific dust calibration needed
- Connection Port: Single M12 port for power and RS-485 data communication
- Data Communication: Modbus RTU over RS-485
- Enclosure: Aluminum, IP67 rated

Product Usage Instructions

Installation:

Mount the soiling sensor in a suitable location with clear exposure to the elements for accurate particle detection.

Power and Data Connection:

Connect the unit using the M12 port for both power and RS-485 data communication. Ensure a stable power supply for continuous operation.

Accessing the Web-Based User Interface:

To configure settings, connect your smartphone or laptop to the device's Wi-Fi network. Follow the steps below:

1. Connect to the device's Wi-Fi network.
2. Open a web browser and enter the device's IP address.
3. Log in with the default credentials provided in the user manual.

Configuration Steps:

Wi-Fi Password:

To change the Wi-Fi password, follow these steps:

1. Access the SETTINGS section on the web interface.
2. Enter a new password and save it by clicking the Update button.
3. Power cycle the device for the changes to take effect.

FAQ

- **Q: What should I do if I forget the Wi-Fi password?**
  - A: If you forget the Wi-Fi password, please contact LSI Lastem for assistance in resetting the password.

Product Overview

The PRPMA4100 Soiling Sensor provides simplified measurement of soiling losses for PV installations. It detects accumulated soiling particles on a soil collection window using an internal camera. The units require no water, have no moving parts, are compact and easy to install, and do not require site-specific dust calibration or technician cleaning visits. They are suitable for a wide range of PV installations. The unit has a single M12 user connection port. Use this M12 power and RS-485 port to power your unit and record data via Modbus RTU over RS-485. The unit's aluminum enclosure provides for various mounting options.

Figure 1: PRPMA4100 Soiling Sensor.

Note:

Some photos and drawings in this document show the original version with an additional M12 connector port.

Unpacking

Figure 2 shows the unit with its shipping box and included accessories. Each unit includes a U-shaped Standard Mounting Plate pre-attached in the bottom-mount configuration. Remove any protective film covering the soiling

collection window.

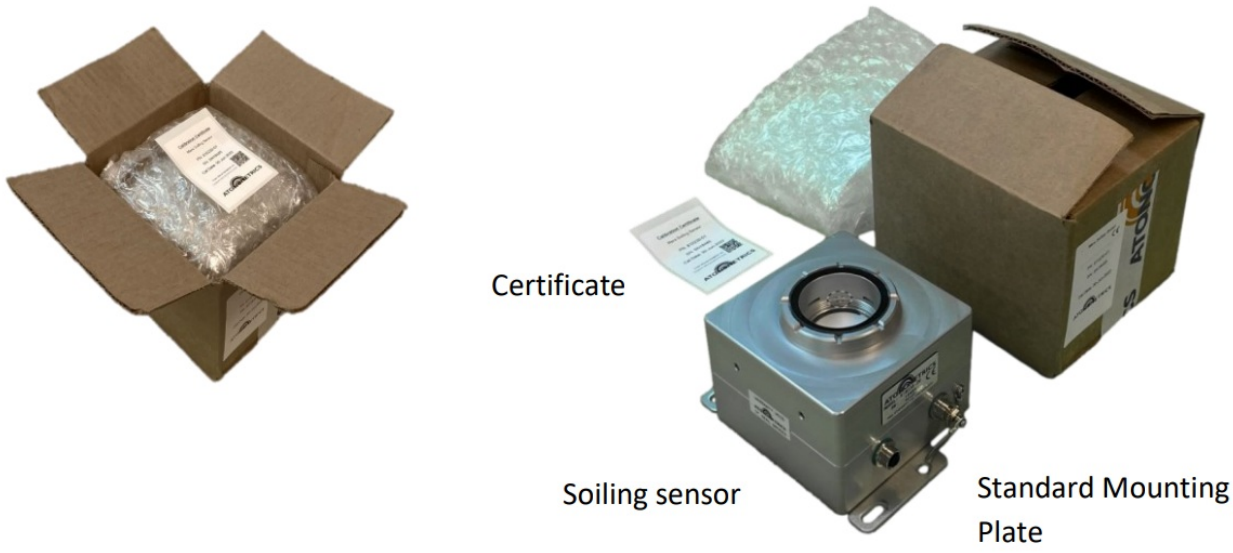

Figure 2: Unpacking the PRPMA4100.

Configuration

Accessing the Web-Based User Interface

To configure settings described in this User Manual, use Wi-Fi to connect your smartphone or laptop PC to the devices' web-based user interface.

To access the web-based user interface:

- Power on the unit. The unit's soil collection window will light up for a short time and then will go dark.
- Wait 1-2 minutes for the device to start it's Wi-Fi network for configuration.
- On your smartphone or laptop PC, use the network selection interface to select your unit's Wi-Fi network. Your unit's SSID (network name) and password are reported on the Certificate. If asked, select your PC to be non-discoverable.
- Launch a web browser, such as Chrome, Firefox, or Edge.
- Enter the default IP address of 10.244.69.66 in the brower's URL field.
- You will then see the unit web interface.

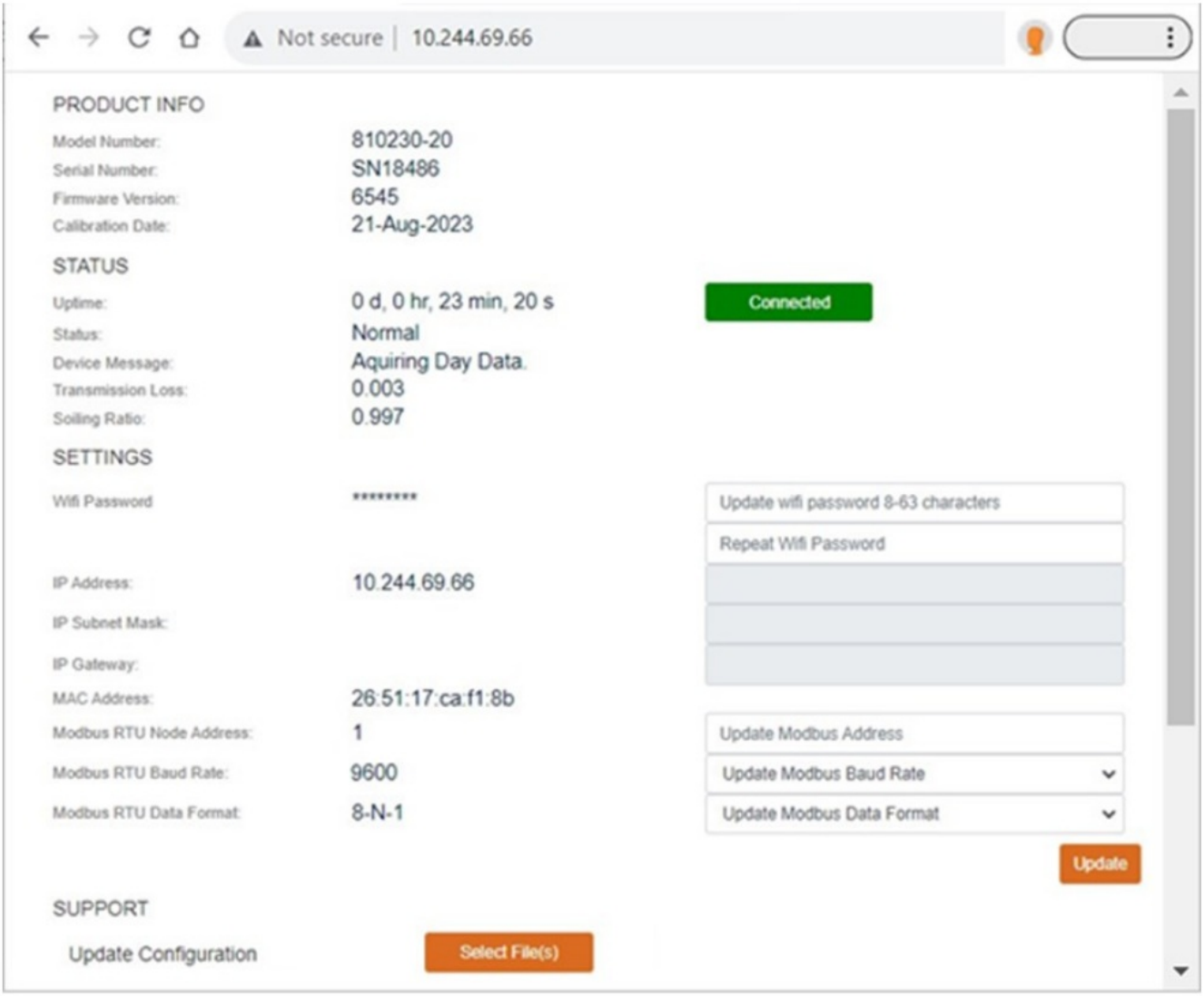

Figure 3: Web-based user interface

Note:
The Wi-Fi network will automatically disable after 60 minutes since power-up. This is a security feature. If needed, cycle power to the unit to regain access to the configuration screen.
Note:
The default Wi-Fi password may be changed by the user. If the password has been changed and is unknown, contact LSI Lastem.

Configuration Steps

Wi-Fi Password

You may change your unit's Wi-Fi network password if desired by using the Wifi password fields in the SETTINGS section of the user interface. After entering a new password, press the orange "Update" button to save it to the device. Cycle power to the device to make the new password take effect. Reconnect following the instructions in section 3.3 to verify the password is set.

Note:

If the password has been changed and is unknown, contact LSI Lastem.

IP Address, Subnet Mask, and Gateway

These settings cannot be changed on the unit model referenced in this document.

Setting Modbus RTU Settings

Configure the Modbus RTU settings for data logging over RS-485.

Modbus Node Address

- The unit's default node address for Modbus RTU is 1.
- To change the node address, enter the new address using the web interface (Figure 3-3), then press "Update".
- Node addresses from 1 to 247 are allowed.

Baud Rate and Data Format

- From the web interface you may also select the serial communication parameters for baud rate and data format.
- Supported baud rates are 9600, 19200, 38400, 57600, and 115200. The default is 9600.
- Supported data formats are 8-N-1, 8-N-2, 8-E-1, and 8-O-1. The default is 8-N-1.
- To change the settings, select the new values and press "Update".

Checking Status

Check the Status field on the web user interface (Figure 3) and confirm it reads "Normal". If an error condition is shown, confirm all configuration settings. If the error persists, contact LSI Lastem for support.
The "Device Message" portion of the web user interface will indicate current operations of the unit, including checking sky brightness, waiting, and acquiring data.

Note:

Upon initial shipment, the Transmission Loss and Soiling Ratio fields will read the last measured values recorded during factory test; these will correspond to clean glass with near 0 loss. These fields will update once the unit is deployed outdoors in its installation location overnight.

Checking Communication

For checking Modbus communication use the Modpoll third-party software. Below the command for query the first 2 values with the sensor connected to the PC Com1:

modpoll.exe -a 1 -r 1 -c 2 -t 4:float -b 9600 -p none -l 1000 com1

And here the answer:

```
modpoll 3.4 - FieldTalk(tm) Modbus(R) Master Simulator
Copyright (c) 2002-2013 proconX Pty Ltd
Visit http://www.modbusdriver.com for Modbus libraries and tools.
Protocol configuration: Modbus RTU
Slave configuration...: address = 1, start reference = 1, count = 2
Communication.....: com1, 9600, 8, 1, none, t/o 1.00 s, poll rate 1000 ms
Data type.....: 32-bit float, output (holding) register table
-- Polling slave... (Ctrl-C to stop)
[1]: 0.00238
[3]: 0.99676
-- Polling slave... (Ctrl-C to stop)
[1]: 0.00238
[3]: 0.99676
-- Polling slave... (Ctrl-C to stop)
…
```

Note:

Reading a value of NAN for Transmission Loss and Soiling Ratio is not a communication error condition. This value confirms that communication is correct but indicates that a measurement value is not available. The measurement value should update once the unit is deployed outdoors in its installation location overnight.

Wiring

Power

The unit requires 10-30 VDC and draws ~3 W of average power. However, it may draw up to 6 W on a transient basis.

Cable Assemblies

CCCFA0500 is the cable for connecting PRPMA4100 sensor. Figure 4 shows the wire colors for the M12 power and RS-485 cable.

Note:

When using long power cables, voltage drop along the cable can be significant. Use 15 V DC power supply voltage to compensate.

Note:

CCCFA0500 cable include an additional wire not used for the product.

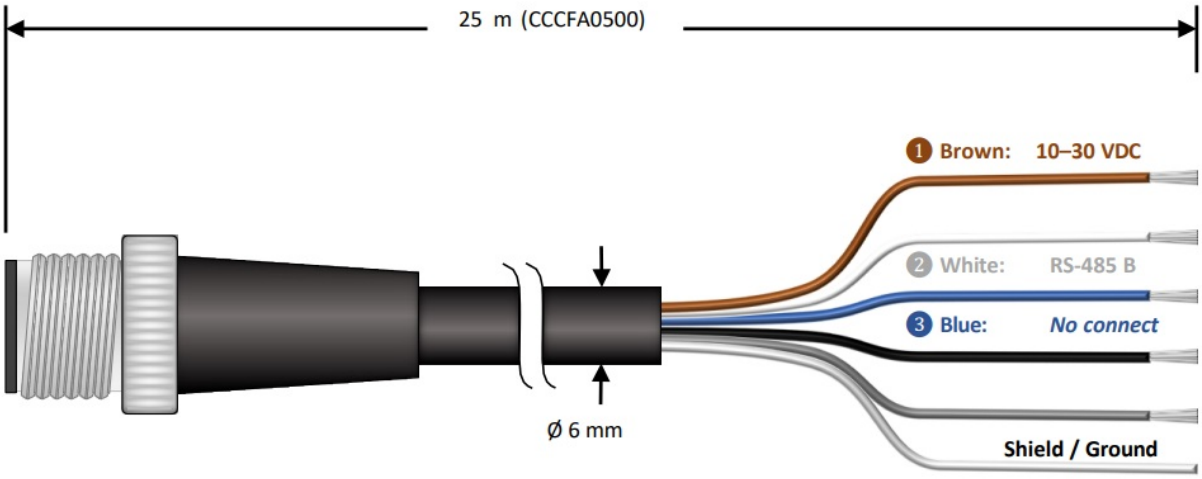

Figure 4: Wire colors for M12 power & RS-485 cable.

Note:

Use only the supplied connectors or cable assemblies. Although other connectors may appear to fit, use of non-approved components may result in water penetration

WARNING:

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

Protecting Unused Wires

Protect any unused wires from accidental contact by cutting to unequal lengths, folding back, and insulating, as shown in Figure 5.

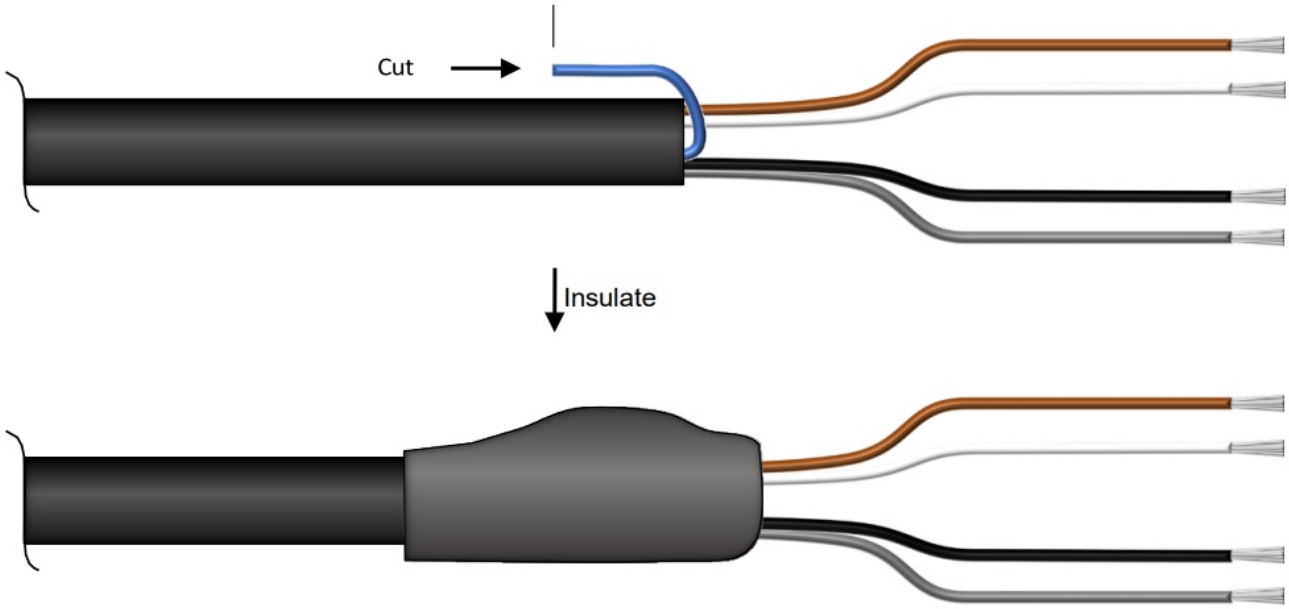

Figure 5: Protecting unused wires from accidental contact.

Mounting

Mounting Requirements

Mount the unit in the plane of array of your PV modules, choosing a location where the unit will have a clear view of the sky within a cone at least 30 from the normal, as shown in Figure 6.

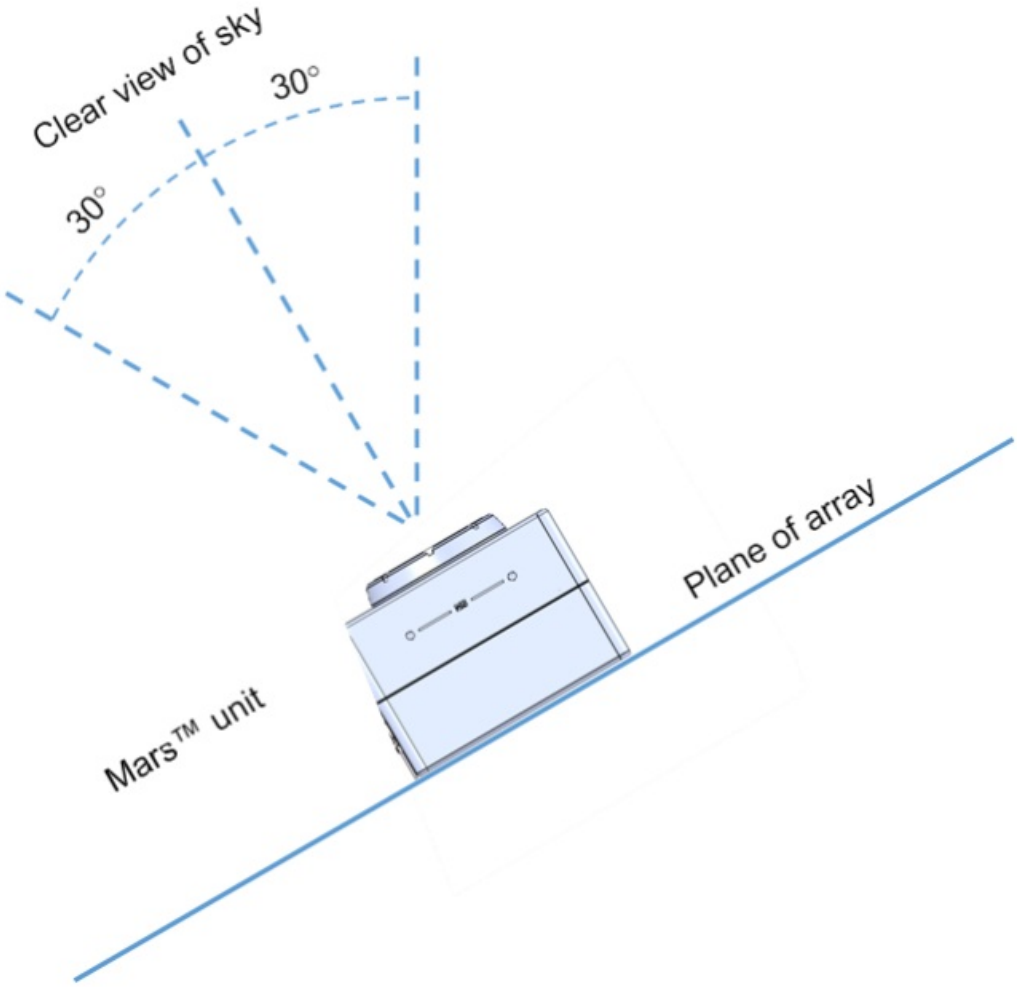

Figure 6: Mounting requirements and view of sky.

To mount the unit, use the 6 threaded mounting holes on the enclosure, shown in Figure 7, or use the 4 mounting holes on the standard mounting plate, as shown in Figure 10. To minimize the potential for water entry to the sealed housings, always mount the unit with the cables facing down or to the side, as shown in Figure 8, and never with the cables facing up.

See Figure 9 for dimensions.

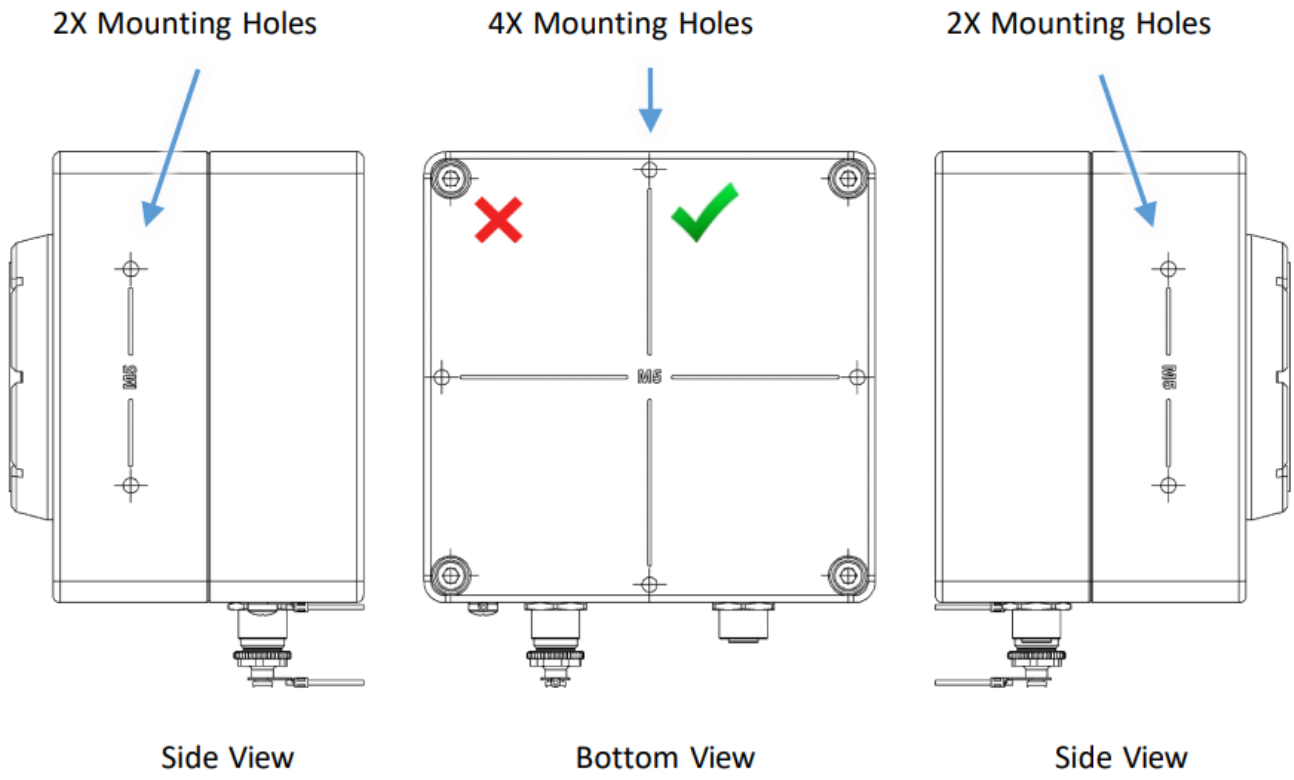

Figure 7: Mounting holes.

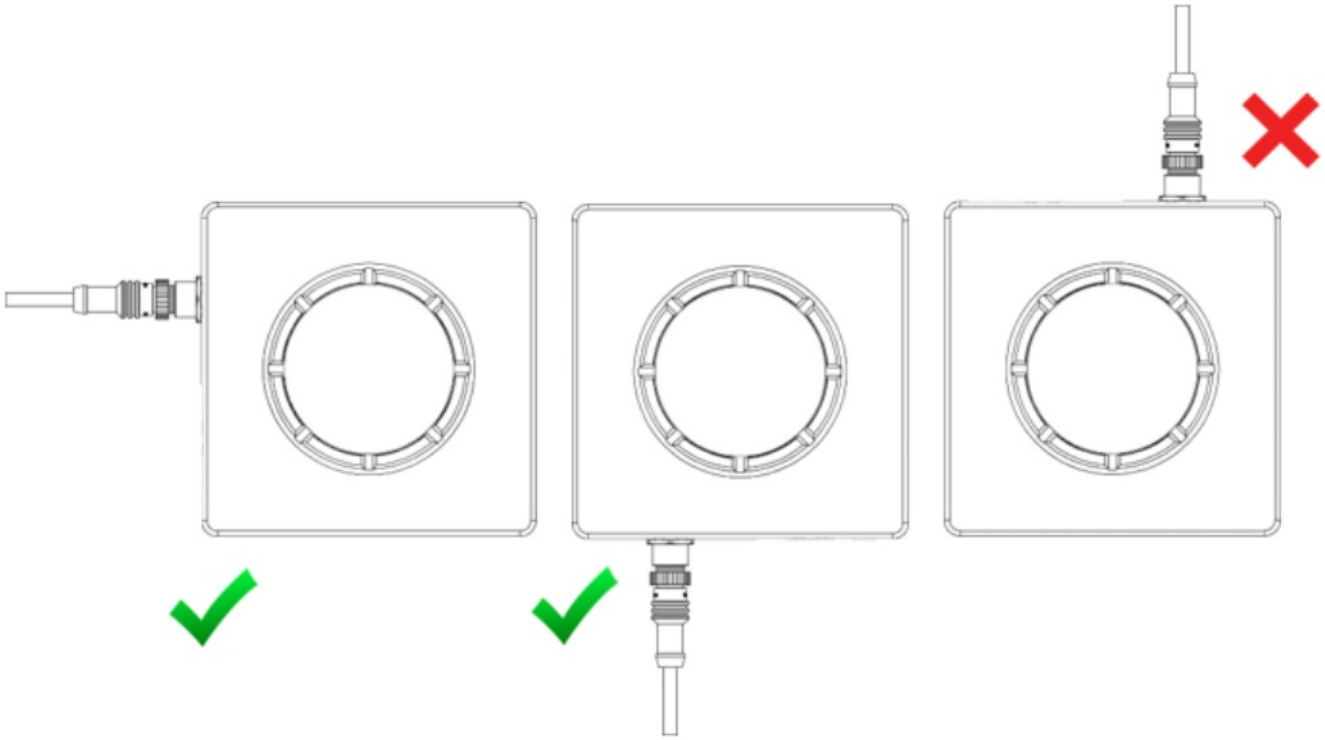

Figure 8: Mount with cables down or to the side.

Dimensions

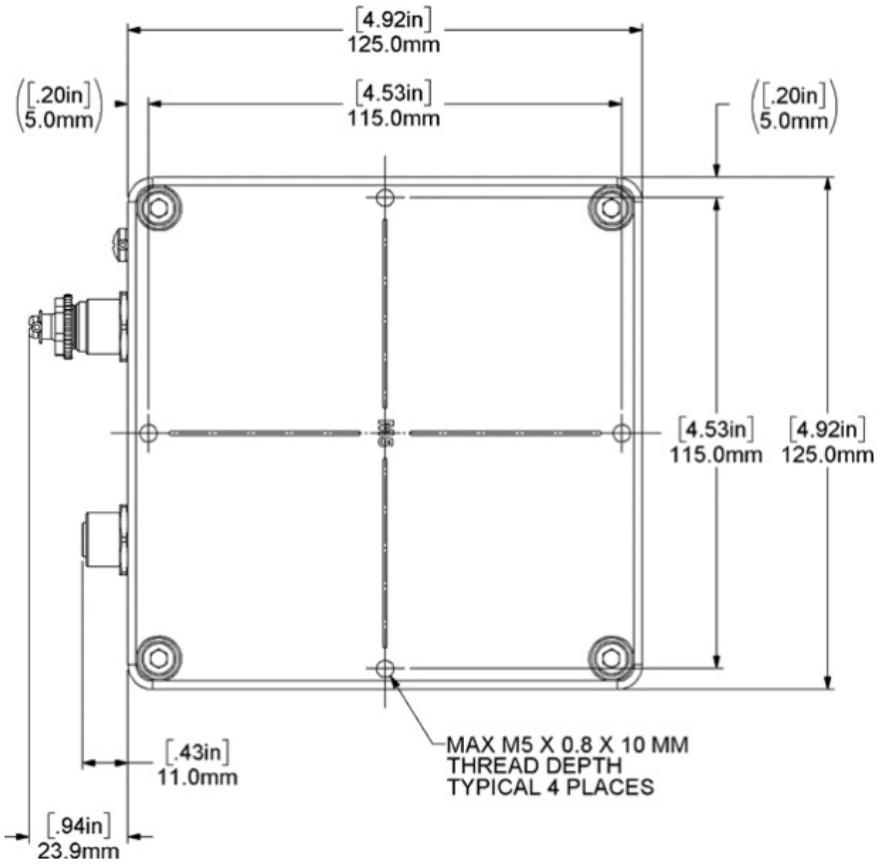

Figure 9: PRPMA4100 dimensions.

Mounting Accessories

Standard Mounting Plate

The standard mounting plate accessory, shown in Figure 10, is shipped with every Unit. It can be mounted in 4 orientations on the bottom of the enclosure and 2 orientations on either side of the enclosure. The plate will be pre-mounted to the Unit; remove and reposition it as desired.

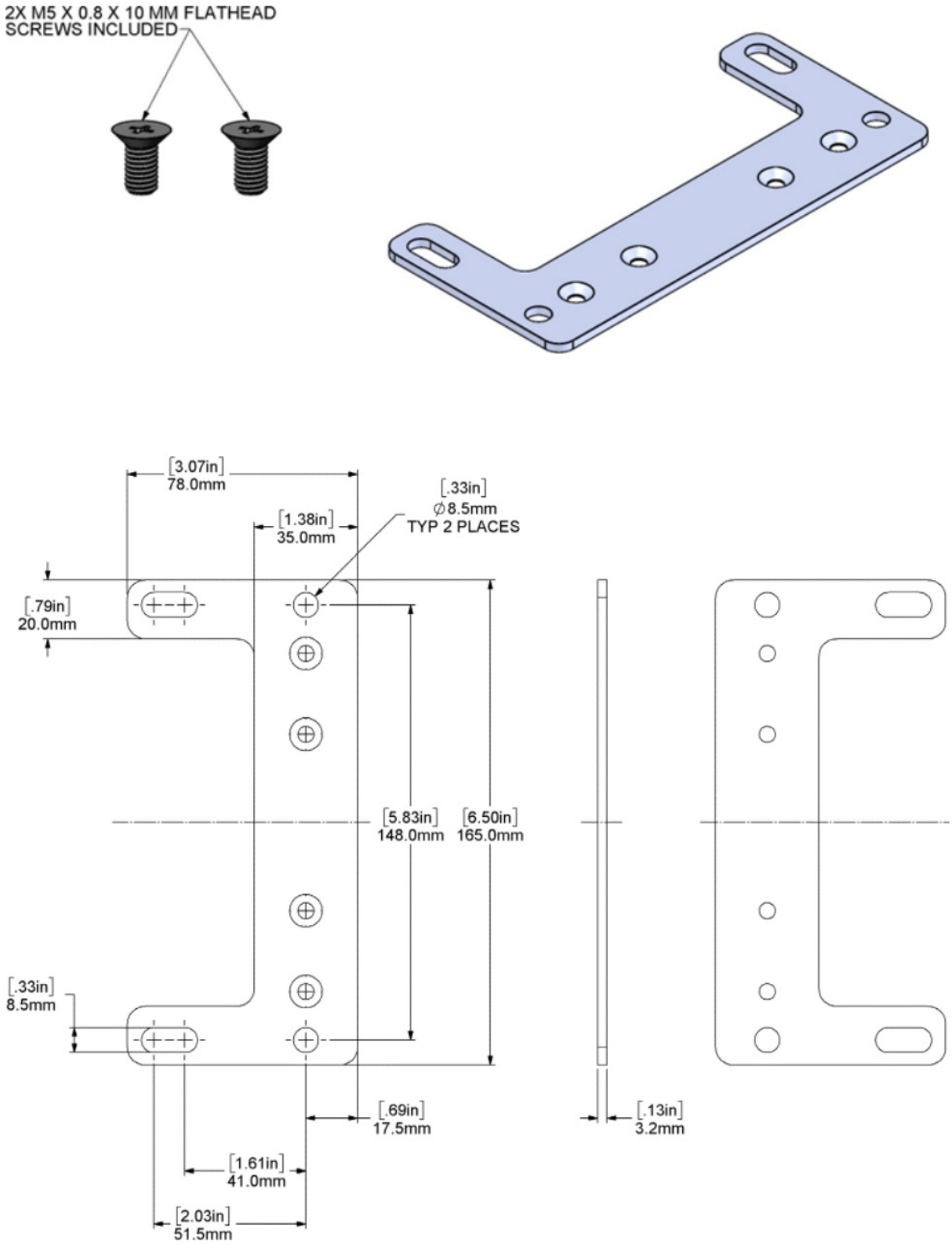

Figure 10: Standard mounting plate dimensions.

Bottom Mount Configuration

The bottom mount configuration of the standard mounting plate, shown in Figure 11, enables the user to mount

the Unit on surfaces parallel to the plane of array.

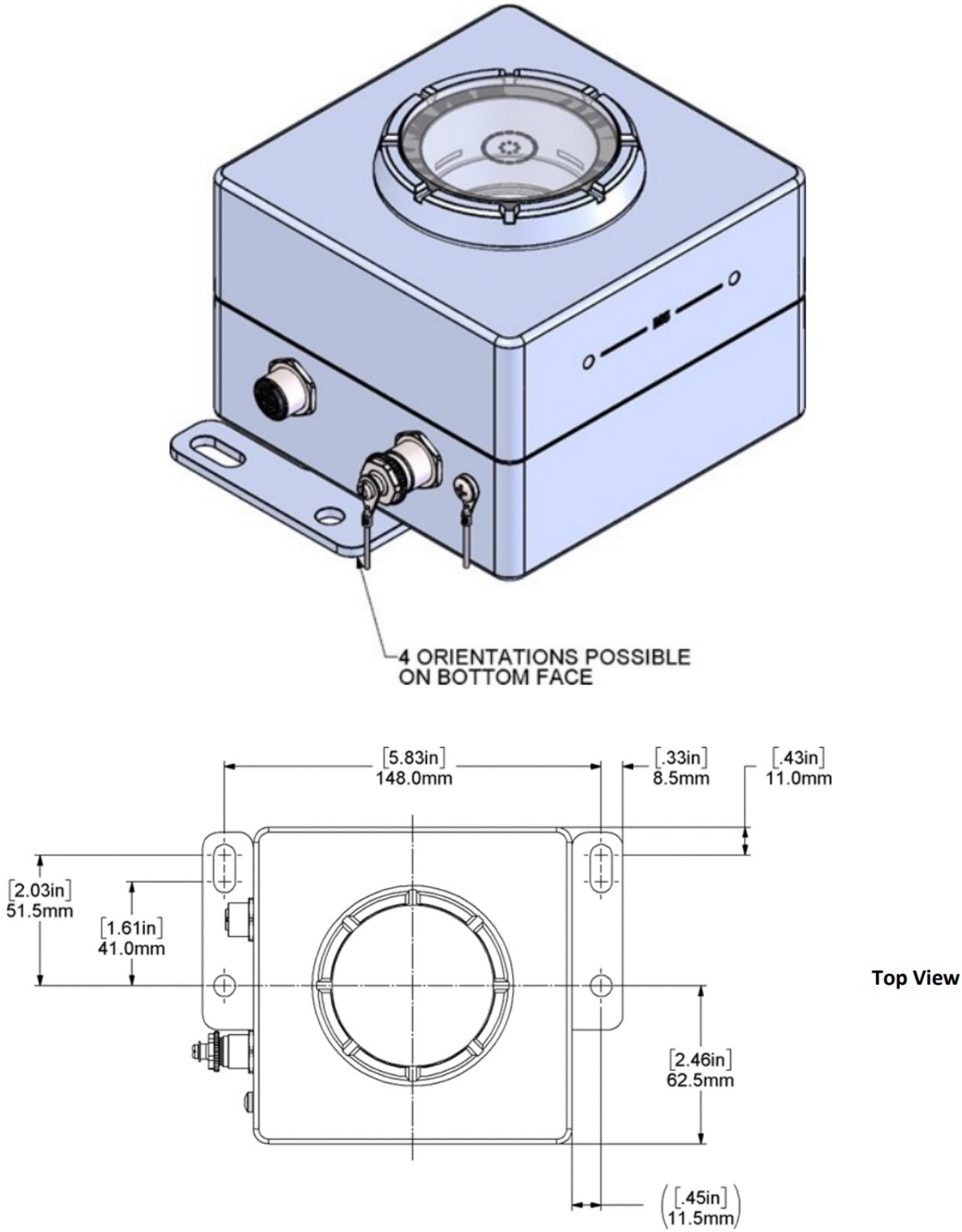

Figure 11: Bottom mount configuration.

Bottom Mount Configuration

The side mount configuration of the standard mounting plate, shown in Figure 12, enables the user to mount the unit on surfaces at a right angle to the plane of array.

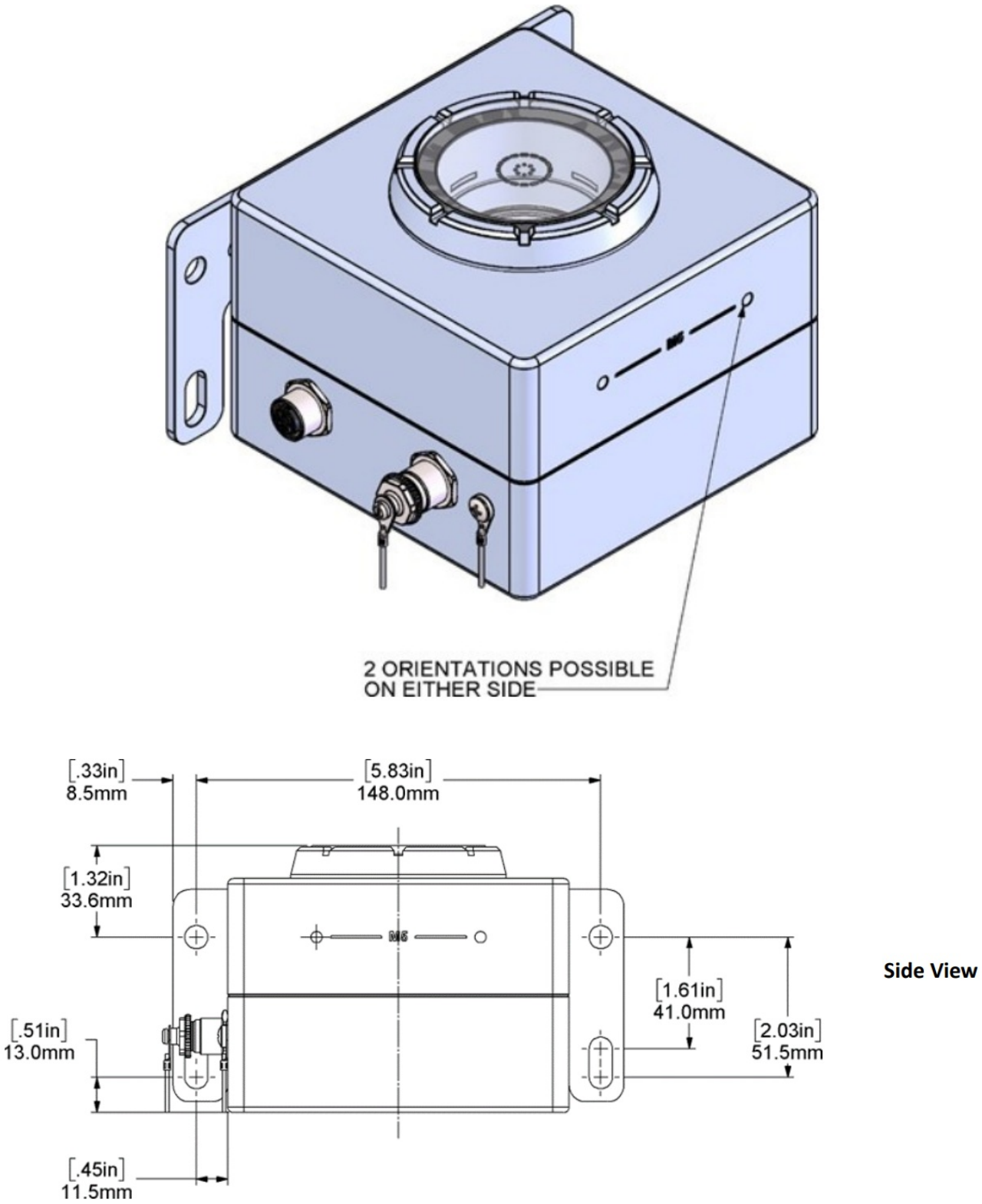

Figure 12: Side mount configuration.

Tube Mount Configuration

The tube mount configuration of the standard mounting plate, shown in Figure 13, enables the user to mount the Unit on tubes for meteorological station applications.

Note:

Note that options for U bolts are pictured but any U bolts are to be provided by the user.

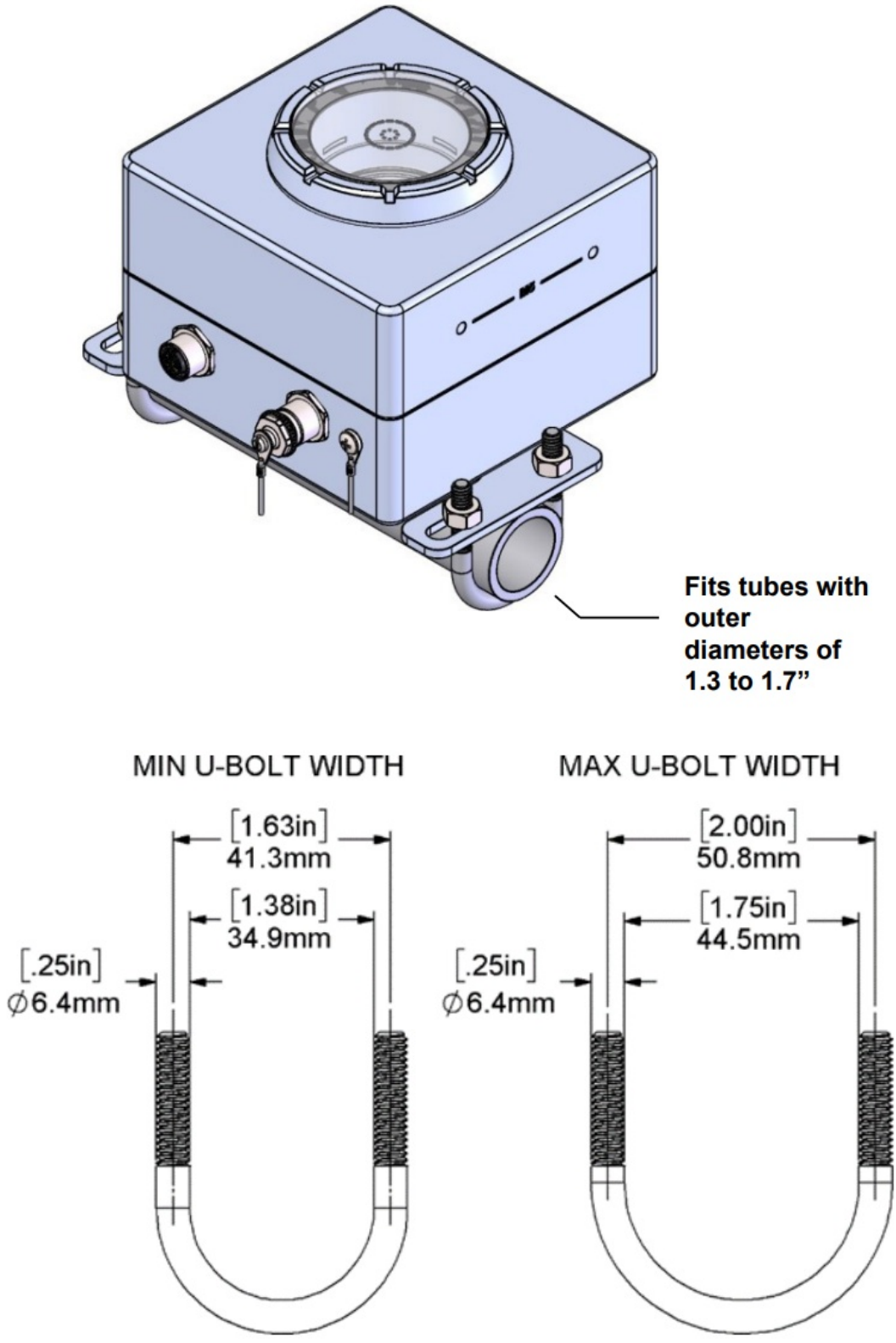

Figure 13: Tube mount configuration.

Modbus

Table 6-1 lists the registers available for your client software to read data from the Unit.

Each numbered register in the table is a 16-bit (2-byte) register. Parameters requiring more than two bytes must be read from sequential registers as indicated by the Register Start and Register End columns. For a 4-byte value with bytes in the order ABCD, from most to least significant, the first register reads out bytes AB and the second reads out bytes CD.
For detailed information on Modbus protocols, please reference the specifications published by Modbus.org.

Note:

On some user data acquisition devices, it is necessary to add 1 to all the register values shown in Table 1 to determine the Modbus address.

Note:

Recommended parameters for Modbus communication are scan period ≥ 1 s, timeout ≥ 500 ms, delay between polls ≥ 30 ms. Do not poll the unit more than once per second. Using shorter timeouts may result in communication errors.

Register Start	**Register End**	**Parameter**	**Data Type**	**Bytes**	**Notes**
1	2	Transmission Loss	(1) Float	4	Fractional loss of transmission due t o soiling particles
3	4	Soiling Ratio	(1) Float	4	1 – Transmission Loss
207	216	Part Number	Char x 10	20	String: 10 registers, 1 char each
217	224	Serial Number	Char x 8	16	String: 8 registers, 1 char each
225	225	Software Version	Uint16	2	Software version number
228	233	Calibration Date	Uint16 x 6	12	6 registers: Y, M, D, H, M, S
501	502	Uptime	Uint32	4	Seconds
503	503	Status Code	Uint16	2	0 = Normal

Troubleshooting

Issue	Solutions
• Wi-Fi network not found during configuration attempt	• Confirm the unit is powered and has been on for less than 60 minutes. • Cycle power if needed to restart. Confirm window lights up for a short time and then turns dark. • Follow connection procedure
• Wi-Fi password forgotten	• Contact LSI Lastem Support.
• Modbus communication for logging unsuccessful	• Confirm Modbus register numbers • Verify whether register addresses require +1 offset for your client device. • Confirm byte order • Confirm timeouts and polling rate.
• Soiling ratio values out of expected range	• Confirm Unit is installed outdoors in desired plane of array with clear view of sky • Allow Unit to operate through at least one sunset and night and check the readings the next day. • If needed, visually inspect unit for damage or fouling.

Specifications

General	Model name	Soiling Sensor
	Part number	PRPMA4100
	Ambient working temperature	-20 to 60 °C
	Input power	10 to 30 VDC
	Power consumption	⁓3 W average (up to 6 W transient)
	Transmission loss accuracy	±1%
	Local dust calibration	Not required
	Communication protocols	Modbus RTU (RS-485)
Enclosure	Material	Anodized aluminum housing
	Outdoor rating	IP67
	Dimensions	4.53 x 4.53 x 3.86 in. / 115.0 x 115.0 x 98.1 mm without connectors and mounting plate
	Weight	3.27 lbs. / 1.48 kg
	Mounting	6 mounting holes, M5 x 0.8, 10 mm thread depth Standard mounting plate accessory: 4 mounting holes (two slots), dia. 0.33 in. / 8.5 mm
Cables	Power & RS-485	Shielded, weather resistant, UV-rated 24 awg / 0.2 mm2 M12 circular connector, IP67

Documents / Resources

	LSI LASTEM PRPMA4100 Soil Particle Deposit Sensor [pdf] User Manual PRPMA4100, PRPMA4100 Soil Particle Deposit Sensor, Soil Particle Deposit Sensor, Particle Deposit Sensor, Deposit Sensor, Sensor

References

- Modbus Protocol Software
- User Manual