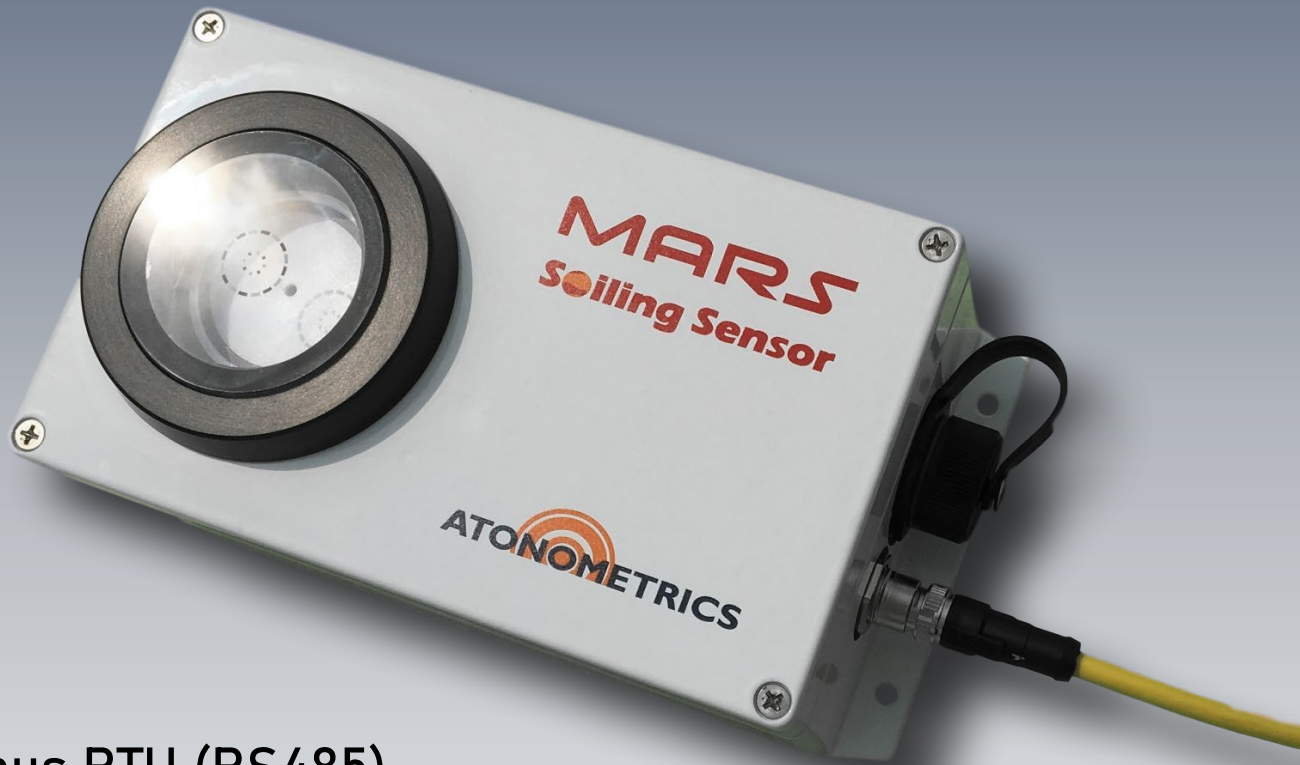


Application Note

Testing Modbus Communication on the Mars™ Soiling Sensor



Modbus RTU (RS485)
Modbus TCP (Ethernet)

Document Number 880084 Rev. A, August 2020



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1 Overview

This application note provides a guide on testing your Mars™ unit to verify Modbus communication using third-party PC-based Modbus software. The instructions are intended to help you confirm proper Modbus communication settings prior to setting up communication to your own datalogger or SCADA system. These steps are optional and are provided as a tutorial.

Several third-party tools are available for testing Modbus communication via a PC. A popular choice is Modbus Poll from Witte Software, for which we provide instructions here. You could also adapt these instructions to use other third-party software. These instructions will help you resolve common setup issues.

To follow this guide, you will need a Mars unit, the Configuration Kit for Mars (Atonometrics PN 810235-01), and a PC with Ethernet port and USB port (for RTU/RS485). In addition, you will need Modbus Poll software, available here: [Modbus Poll](#).

This document provides instructions for both Modbus RTU and Modbus TCP. Just follow the section of the document that is relevant to you.

2 Testing Modbus RTU (RS485)

2.1 Check Settings with Mars™ Web Interface

Before testing your Mars unit with Modbus Poll, we will connect to it using the Atonometrics web interface to confirm that the device is working and to ensure all communication settings are known.

Power your Mars unit using the Configuration Kit described in the [Mars User Guide](#), then connect your Mars unit's Ethernet port to your PC's Ethernet port. See the section of the Mars User Guide titled "Configuration" and follow the instructions there.

Note: On Mars units with serial number 15000 and above, an Atonometrics-supplied M12-to-RJ45 Ethernet cable is required. On Mars units with serial number less than 15000, a standard RJ45-to-RJ45 Ethernet cable is used.

Following the instructions from the Mars User Guide, open the Mars web interface. Note the Modbus Address, Baud Rate, and Data Format as shown below.

Modbus RTU Node Address:	16
Modbus RTU Baud Rate:	57600
Modbus RTU Data Format:	8-N-1

Update any communication parameters on the unit as necessary by using the settings inputs, as shown below, and pressing Update.

Update IP Address [xx.xx.xx.xx]

Update Subnet Mask [xx.xx.xx.xx]

Update IP Gateway [xx.xx.xx.xx]

Update Modbus Address

57600

8-N-1

Update Latitude

Update Longitude

Update Altitude (m)

NTP Time Server (IP Address)

UTC Time

Update UTC Time [YYYY-MM-DDThh:mm:ss]

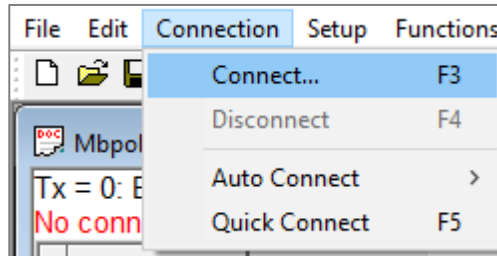
Update

2.2 Test Using Modbus Poll

2.2.1 Setting Up

Open Modbus Poll

From the Connection tab, press “Connect:”

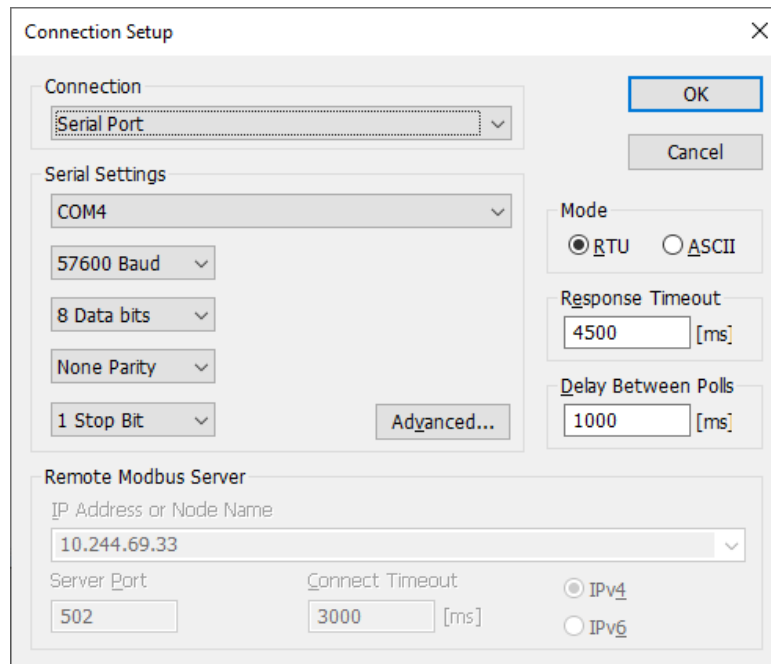


If you have the free trial version, you may see an option to register the software to remove time limits.

Select Serial Port and then select the COM port corresponding to your configuration kit's USB-RS485 adapter, which should be labeled as “USB serial port”. In this example, it is COM3.

Note: Your computer may have multiple COM ports. If you are unsure which one is connected to the Mars, check the Ports list in Windows Device Manager for “USB Serial Port”.

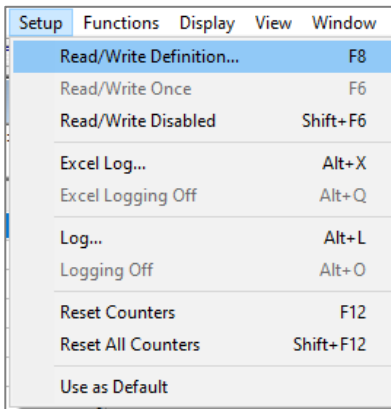
Enter the Mars unit's baud rate, parity, and stop bit settings, which were found earlier on the Mars web interface.



Press “OK.”

2.2.2 Polling Uptime

From the Setup tab, press “Read/Write Definition:”



Input the Modbus RTU Node Address found on the Mars web interface into the Slave ID field. Per the Mars User Guide, the uptime is at register 501 and is 2 registers of data, so type in 501 to the address box and 2 to the quantity box. Also type in the desired scan rate. **The recommended scan rate for Mars RTU is ≥ 5000 ms.** Then press “Apply.”

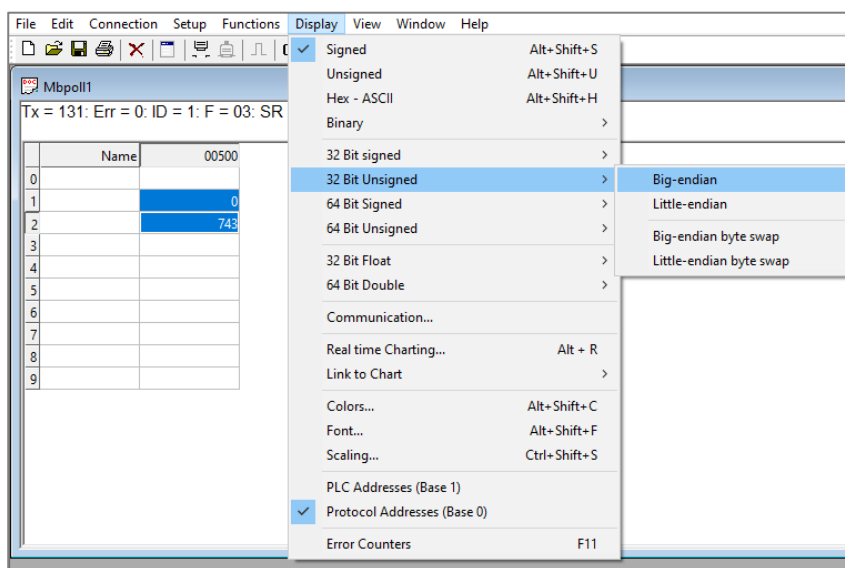
A screenshot of a dialog box titled 'Read/Write Definition'. The dialog has several fields and buttons. The 'Slave ID' field contains '16'. The 'Function' dropdown is set to '03 Read Holding Registers (4x)'. The 'Address mode' has 'Dec' selected. The 'Address' field contains '501' and a label 'PLC address = 40502' is next to it. The 'Quantity' field contains '2'. The 'Scan Rate' field contains '5000' with '[ms]' next to it. There are 'OK', 'Cancel', and 'Apply' buttons. Below these are checkboxes for 'Disable' (Read/Write Disabled, Disable on error) and a 'Read/Write Once' button. A 'View' section has radio buttons for 'Rows' (10, 20, 50, 100, Fit to Quantity) and checkboxes for 'Hide Name Columns', 'PLC Addresses (Base 1)', 'Address in Cell', and 'Enron/Daniel Mode'. At the bottom, there are 'Request' fields for 'RTU' (10 03 01 F5 00 02 D6 84) and 'ASCII' (3A 31 30 30 33 30 31 46 35 30 30 32 46 35 0D 0A).

Note: When using Modbus RTU the minimum recommended scan rate for Mars is 5 seconds.

Note: Ensure that the box marked “PLC Addresses (Base 1)” is unchecked. If this box is checked, you must add 1 to the register addresses listed in the Mars User Guide.

Note: Note that some Modbus communication software uses Base 1 register offsets by default. In these cases, you must add 1 to the register addresses listed in the Mars User Guide.

Per the Mars User Guide, the uptime data are formatted as a 32-bit unsigned integer with most significant bytes first. In Modbus Poll, select the data field, then from the Display tab, select “32 Bit Unsigned” and “Big-endian.”

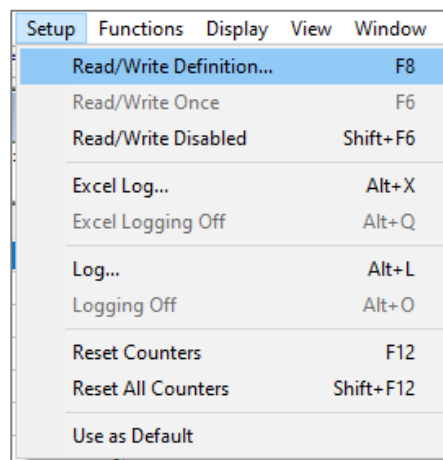


Here, the uptime is displayed in seconds, and should update with each scan. (In our example it will update by 5 every 5 seconds.) This indicates correct communication.

	Name	00000
0		
1		747
2		
3		
4		
5		
6		
7		
8		

2.2.3 Polling Transmission Loss

From the Setup tab, press “Read/Write Definition:”



Input the Modbus RTU Node Address found on the Mars web interface into the Slave ID field. Per the Mars User Guide, the transmission loss is at register 1 and is 2 registers of data, so type in 1 to the address box and 2 to the quantity box. Also type in the desired scan rate. The recommended scan rate for Mars RTU is ≥ 5000 ms. Then press “Apply.”

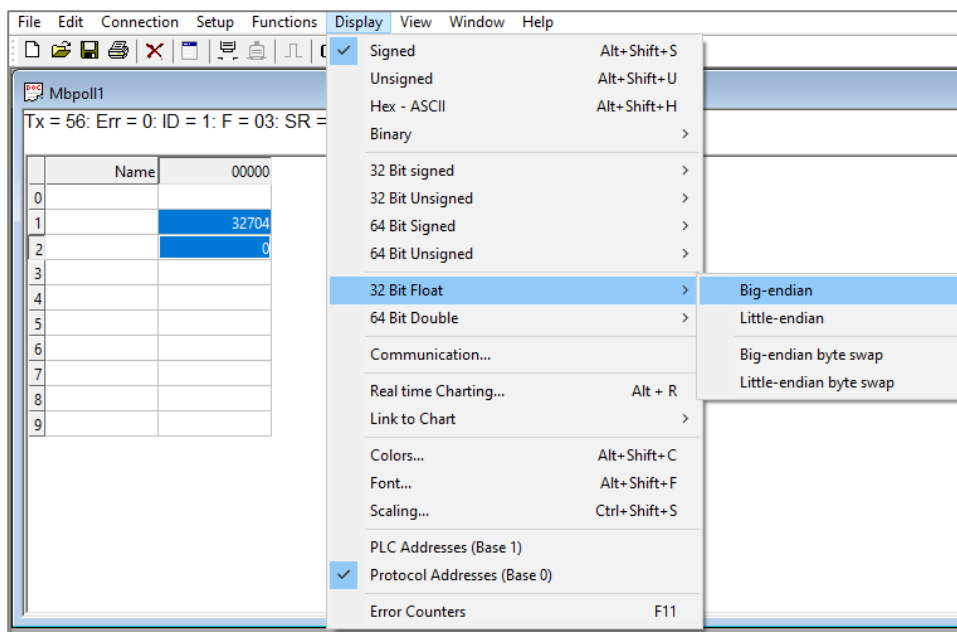
A screenshot of a dialog box titled 'Read/Write Definition'. It contains several input fields and checkboxes. The 'Slave ID' field is set to '16'. The 'Function' dropdown is set to '03 Read Holding Registers (4x)'. The 'Address mode' has 'Dec' selected. The 'Address' field is set to '1', with a note 'PLC address = 40002' next to it. The 'Quantity' field is set to '2'. The 'Scan Rate' field is set to '5000' with '[ms]' next to it. There are checkboxes for 'Read/Write Disabled' and 'Disable on error', both of which are unchecked. A 'Read/Write Once' button is present. The 'View' section has 'Rows' set to '10' and checkboxes for 'Hide Name Columns', 'PLC Addresses (Base 1)', 'Address in Cell', and 'Enron/Daniel Mode'. The 'Request' section shows 'RTU' as '10 03 00 01 00 02 96 8A' and 'ASCII' as '3A 31 30 30 33 30 30 31 30 30 30 32 45 41 0D 0A'.

Note: When using Modbus RTU the minimum recommended scan rate for Mars is 5 seconds.

Note: Ensure that the box marked “PLC Addresses (Base 1)” is unchecked. If this box is checked, you must add 1 to the register addresses listed in the Mars User Guide.

Note: Note that some Modbus communication software uses Base 1 register offsets by default. In these cases, you must add 1 to the register addresses listed in the Mars User Guide.

Per the Mars User Guide, the transmission loss data are formatted as a 32-bit float with most significant bytes first. Select the data field, then from the Display tab, select “32-Bit Float” and “Big-endian:”



The transmission loss will be displayed. If your device is indoors in an office environment or has not yet been set up and operating outdoors as instructed in the Mars User Guide you will likely see the value NAN displayed in the transmission loss register – as in this example. This is normal and indicates correct communication. The transmission loss value will update when the device has been installed properly outdoors and has experienced at least one sunset. (See the Mars User Guide.)

	Name	00000
0		
1		nan
2		--
3		
4		
5		
6		
7		
8		

Note: Upon initial configuration, the Transmission Loss and Soiling Ratio fields could read 0, 1, or NAN. These fields will update once the unit is correctly configured (including latitude, longitude, and clock) and deployed outdoors in its installation location for a period including at least one sunset.

3 Test Modbus TCP (Ethernet)

3.1 Check Settings with Mars™ Web Interface

Before testing your Mars with Modbus Poll, we will connect to it using the Atonometrics web interface to confirm the device is working and ensure all communication settings are known.

Power your Mars unit using the Configuration Kit described in the [Mars User Guide](#), then connect your Mars unit's Ethernet port to your PC's Ethernet port. See the section of the Mars User Guide titled "Configuration" and follow the instructions there.

Note: On Mars units with serial number 15000 and above, an Atonometrics-supplied M12-to-RJ45 Ethernet cable is required. On Mars units with serial number less than 15000, a standard RJ45-to-RJ45 Ethernet cable is used.

Note: Configure your PC's Ethernet adapter so that your PC's subnet matches the subnet of the Mars unit. See the Mars User Guide for more info. You may also need to consult Windows documentation for help on changing your Ethernet adapter subnet.

Following the instructions from the Mars User Guide, open the Mars web interface. Note the Mars IP address in the web interface:

IP Address:	10.244.69.66
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Update any communication parameters as needed by entering in the web interface, as shown below, and pressing Update.

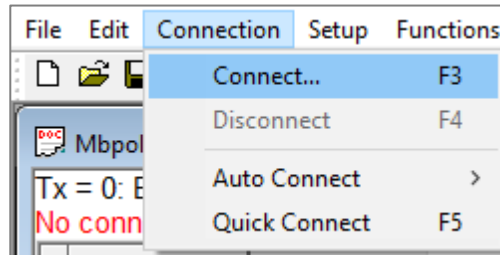
Update IP Address [xx.xx.xx.xx]	
Update Subnet Mask [xx.xx.xx.xx]	
Update IP Gateway [xx.xx.xx.xx]	
Update Modbus Address	
57600	▼
8-N-1	▼
Update Latitude	
Update Longitude	
Update Altitude (m)	
NTP Time Server (IP Address)	
UTC Time	Update UTC Time [YYYY-MM-DDThh:mm:ss]
<div>Update</div>	

3.2 Test Using Modbus Poll

3.2.1 Setting Up

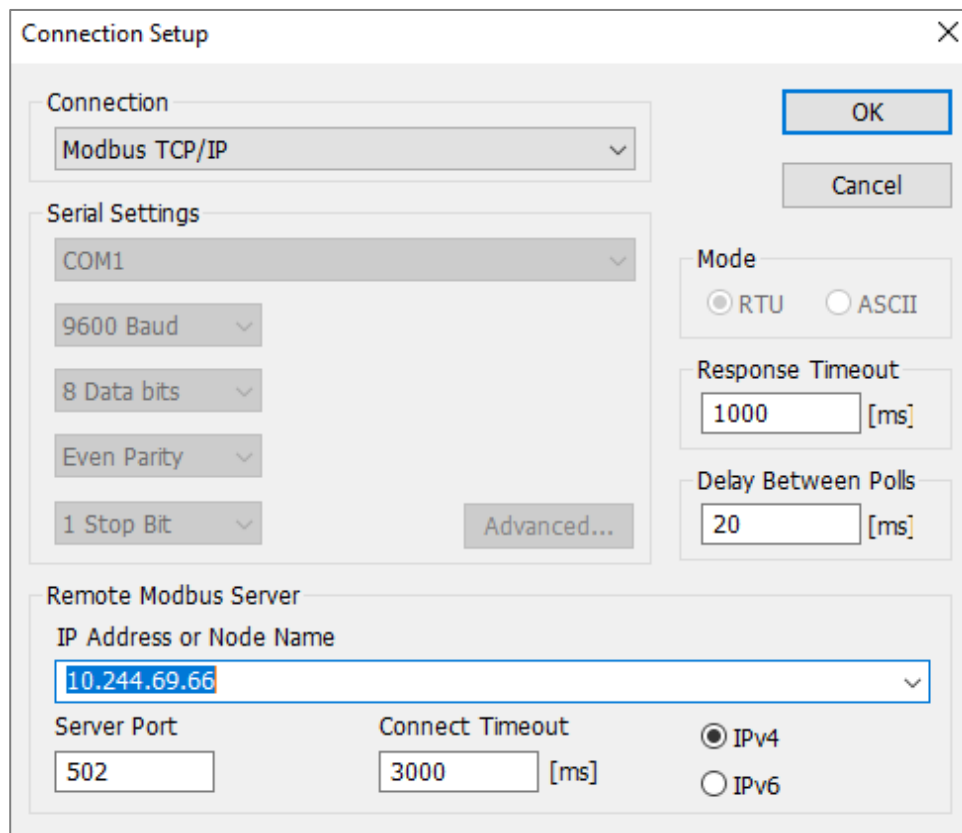
Open Modbus Poll

From the Connection tab, press “Connect:”



If you have the free trial version, you may see an option to register the software to remove time limits.

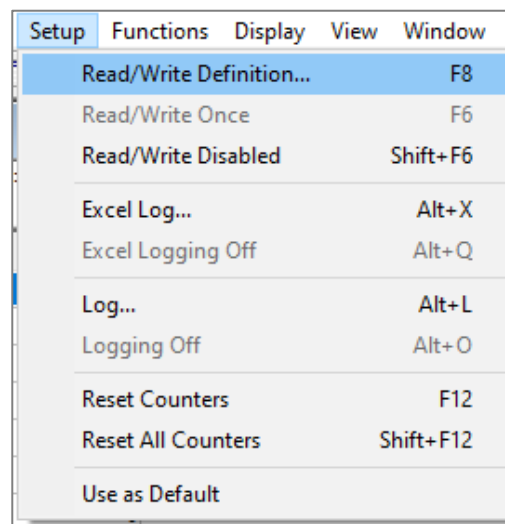
From the dropdown list, select Modbus TCP/IP, and enter the IP address of the Mars in the box below. The default IP is 10.244.69.66.



Press “OK.”

3.2.2 Polling Uptime

From the Setup tab, press “Read/Write Definition:”



Per the Mars User Guide, uptime is at address 501 and is 2 registers of data, so type in 501 to the address box and 2 to the quantity box:

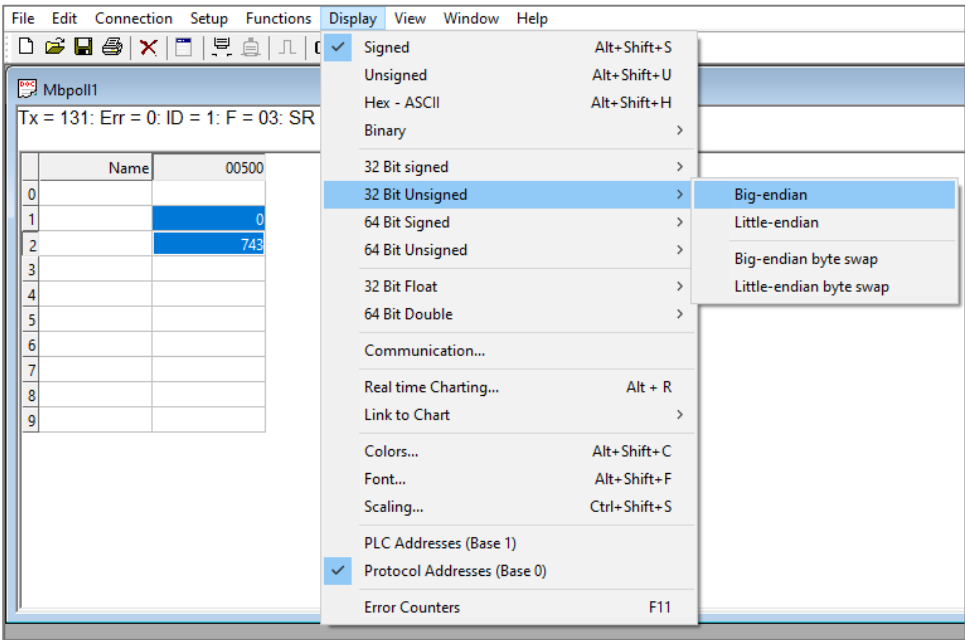
A screenshot of the 'Read/Write Definition' dialog box. The 'Slave ID' is set to 1. The 'Function' is set to '03 Read Holding Registers (4x)'. The 'Address mode' has 'Dec' selected. The 'Address' is 501, with a note 'PLC address = 40502'. The 'Quantity' is 2. The 'Scan Rate' is 1000 [ms]. There are checkboxes for 'Disable', 'Read/Write Disabled', and 'Disable on error'. A 'Read/Write Once' button is present. The 'View' section has 'Rows' set to 10, and checkboxes for 'Hide Name Columns', 'PLC Addresses (Base 1)', 'Address in Cell', and 'Enron/Daniel Mode'. The 'Request' section shows 'RTU' as '01 03 01 F5 00 02 D5 C5' and 'ASCII' as '3A 30 31 30 33 30 31 46 35 30 30 30 32 30 34 0D 0A'.

Note: For Modbus TCP, the minimum recommended scan rate for Mars is once per second.

Note: Ensure that the box marked “PLC Addresses (Base 1)” is unchecked. If this box is checked, you must add 1 to the register addresses listed in the Mars User Guide.

Note: Note that some Modbus software systems use Base 1 register offsets by default. In these cases, you must add 1 to the register addresses listed in the Mars User Guide.

Per the Mars User Guide, the uptime data are formatted as a 32-bit unsigned integer with most significant bytes first. Select the data fields. Then, from the Display tab, select “32 Bit Unsigned” and “Big-endian.”

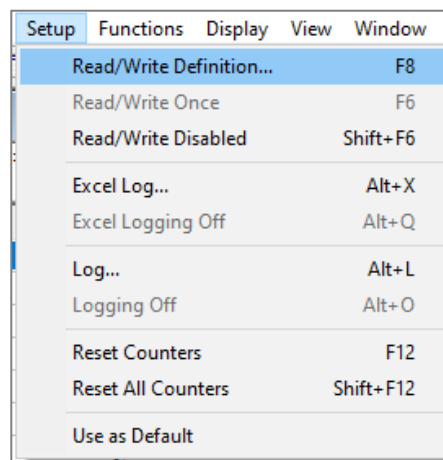


Here, the uptime is displayed in seconds, and should update by 1 every second. This indicates correct communication.

	Name	00000
0		
1		747
2		
3		
4		
5		
6		
7		
8		

3.2.3 Polling Transmission Loss

From the Setup tab, press “Read/Write Definition:”



Per the Mars User Guide, the transmission loss is at register 1 and is 2 registers of data, so type in 1 to the address box and 2 to the quantity box:

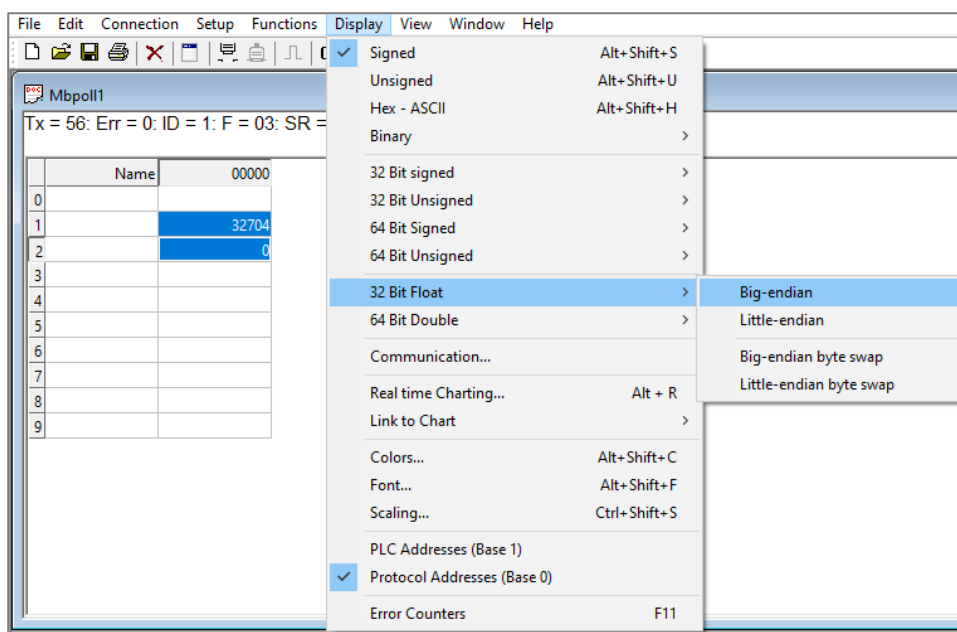
A screenshot of the 'Read/Write Definition' dialog box. The 'Slave ID' is set to 1. The 'Function' is set to '03 Read Holding Registers (4x)'. The 'Address mode' is set to 'Dec'. The 'Address' is set to 1, with a note 'PLC address = 40002'. The 'Quantity' is set to 2. The 'Scan Rate' is set to 1000 [ms]. There are checkboxes for 'Disable Read/Write Disabled' and 'Disable on error'. There are buttons for 'OK', 'Cancel', 'Apply', and 'Read/Write Once'. There is a 'View' section with radio buttons for 'Rows' (10, 20, 50, 100, Fit to Quantity) and checkboxes for 'Hide Name Columns', 'PLC Addresses (Base 1)', 'Address in Cell', and 'Enron/Daniel Mode'. There is a 'Request' section with text boxes for 'RTU' and 'ASCII' containing hexadecimal data.

Note: For Modbus TCP, the minimum recommended scan rate for Mars is once per second.

Note: Ensure that the box marked “PLC Addresses (Base 1)” is unchecked. If this box is checked, you must add 1 to the register addresses listed in the Mars User Guide.

Note: Note that some Modbus software systems use Base 1 register offsets by default. In these cases, you must add 1 to the register addresses listed in the Mars User Guide.

Per the Mars User Guide, the transmission loss data are formatted as a 32-bit float with most significant bytes first. Select the data fields. Then, from the Display tab, select “32 Bit Float” and “Big-endian:”



The transmission loss will be displayed. If your device is indoors in an office environment or has not yet been set up and operating outdoors as instructed in the Mars User Guide you will likely see the value NAN displayed in the transmission loss register – as in this example. This is normal and indicates correct communication. The transmission loss value will update when the device has been installed properly outdoors and experienced at least one sunset. (See the Mars User Guide.)

	Name	00000
0		
1		nan
2		--
3		
4		
5		
6		
7		
8		

Note: Upon initial configuration, the Transmission Loss and Soiling Ratio fields could read 0, 1, or NAN. These fields will update once the unit is correctly configured (including latitude, longitude, and clock) and deployed outdoors in its installation location for a period including at least one sunset.
