ACUMESH

WIRELESS RS485 NETWORK

AcuMesh Wireless RS485 Network

Users Manual

ACCUENERGY

ACUMESH - WIRELESS METERING SYSTEM

SAFETY INFORMATION

Please read this manual carefully before installation, operation, and maintenance of Acuvim II series meter.

The following symbols in this manual and on Acuvim II series meters are used to provide warning of danger or risk during the installation and operation of the meters.

Electric Shock Symbol: Carries information about procedures which must be followed to reduce the risk of electric shock and danger to personal health.

Safety Alert Symbol: Carries information about circumstances which if not considered may result in injury or death.

Installation and maintenance of the AcuMesh wireless metering system should only be performed by qualified, competent professionals who have received training and should have experience with high voltage and current devices.

Accuenergy shall not be responsible or liable for any damages caused by improper installation and/or operation.

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AcuMesh Wireless RS485 Network

Chapter 1: Introduction

CHAPTER 1: INTRODUCTION

1.1 AcuMesh Overview

The AcuMesh wireless RS485 network solution is designed to connect energy meters and any devices that communicate using RS485 wirelessly. AcuMesh is a cost-effective solution that eliminates the need for installation of communication wires, saving premium time, labour, and reducing the challenges of retrofit applications. The AcuMesh transceiver uses Modbus-RTU protocol.

1.2 Communication

The AcuMesh wireless system uses the Mesh network structure which allows each transceiver to act as extension points in the network allowing for larger and more reliable range of communication. The AcuMesh can be used as an intermediate device between other units to improve communication when units are further apart. Using a Mesh arrangement for communication allows for point to multi-point communication, enabling the network to self-heal and optimize the communication pathway for reliable, robust communication, even at long distances.
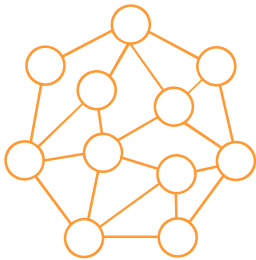
1.3 Applications

The AcuMesh wireless transceiver can be deployed in the following applications to expand the communication capability:

- Power and energy metering in commercial buildings, such as malls.
- Submetering and tenant billing for apartments or condominiums.
- Educational facilities or college campuses.
- Industrial or factory facilities.
- Renewable energy generation such as solar PV or wind.
- Any network with devices using Modbus-RTU over RS485 communication.

1.4 Hardware Overview

AcuMesh is available in 3 form factors that are functionally equivalent.

Standalone transceivers that can connect any device via RS485 and gateway.

AXM-MESH transceiver module that can only be attached to the Acuvim II series meters.

Chapter 2: Hardware Installation

CHAPTER 2: HARDWARE INSTALLATION

2.1 Installation Checklist

You'll need to confirm the following details in order to successfully complete the installation of your AcuMesh network:

✅ AcuMesh wireless system requires a minimum of two transceivers to form the network.

✅ Identify the Master device: The RS485 network master device can be a PC, PLC, data acquisition server or gateway, e.g., AcuLink 810 Data Acquisition Server.

✅ Identify the slave device(s): The slave devices can be our Acuvim II series power meters or any other meter or sensor with RS485 port. If it is the Acuvim II meter, the AXM-Mesh transceiver module should be used; for other devices the standalone transceiver should be used.

✅ Attach the provided antennas to the transceivers.

2.2 Standalone Transceiver

2.2.1   Power

The transceiver can easily be powered by connecting it to the USB port of a computer.

The AcuMesh transceiver can also be powered using a standard 24Vdc power supply or from an auxiliary wall socket to be powered.

Note: When the transceiver is connected to a gateway, PLC or power meter through the RS485 port then the transceiver must be powered using the external power supply.
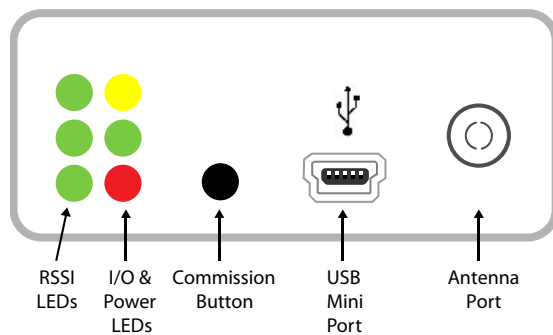
RSSI LEDs   I/O & Power LEDs   Commission Button   USB Mini Port   Antenna Port

Figure 1-AcuMesh-K

Antenna Port

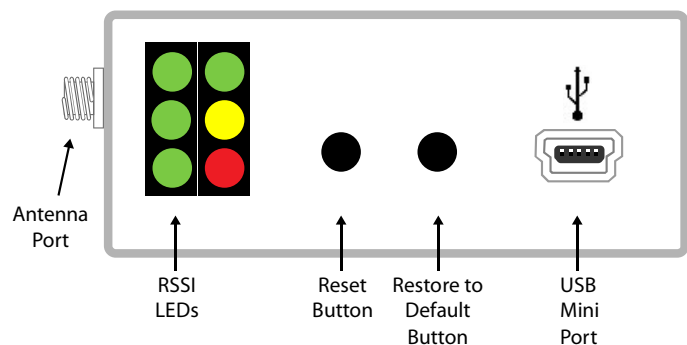RSSI LEDs   Reset Button   Restore to Default Button   USB Mini Port

Figure 2-AcuMesh-L

2.2.2   LEDs and Terminals

There are two sets of LED lights on the transceiver that indicate the transceiver's transmission and reception behaviour. The RSSI LED indicate the signal strength of the incoming signal.

The Power LED indicates the activity of the transceiver.

The green LED indicates the transceiver is transmitting data.

The yellow LED indicates the transceiver is receiving data and the red LED indicates the transceiver is powered on or it is communicating (the red light is on when powered, off briefly during RF transmission).

The LEDs are the same for both the AcuMesh-K and AcuMesh-L models. There are no LEDs on the AXM-MESH module.

The AcuMesh-K will have the following terminals and connectors:

Pin 1   Pin 2   Pin 5
TX/RX+   TX/RX+   GND
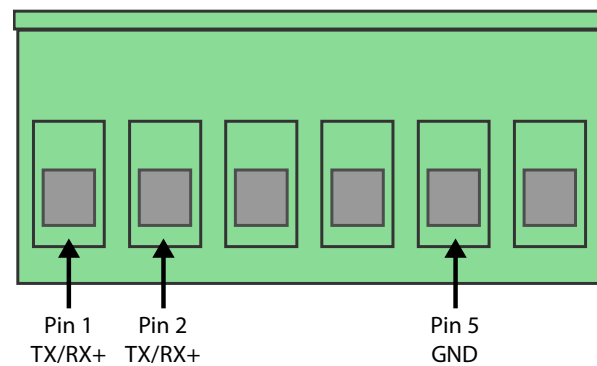
Figure 3-AcuMesh-K Terminals

PIN	RS485	Description
1	TX/RX+	Positive Transmission Line
2	TX/RX-	Negative Transmission Line
5	GND	Ground

Power Connection

- Connection for the 7-30Vdc power adapter.

DIP Switch

- Switch 1 should always be in the 'off' position for half-duplex communication.
- Switch 2 is for full-duplex communication. This switch should not be configured as most devices only support half-duplex communication.

Commission Button

- The commission button is used to reset the transceiver to its default settings when it is pushed 4 times consecutively. It can be used when the transceiver is unable to connect to the AcuMesh software. Once pushed 4 times the transceiver will contain the default settings as long as it is powered on and as long as the settings were not configured.

If a AcuMesh-L is being used, then the external power supply will be needed to power the transceiver only if it is being connected by RS485. The terminals for the power supply are labelled as '+' and '-' respectively.

The AcuMesh-L has two buttons; Reset and Restore Default. The Restore Default button will restore the default settings of the transceiver when pushed 4 times consecutively.

2.2.3   Configuration

When connecting the AcuMesh to a Accuenergy meter or other meter or device through RS485, the meter will require its baud rate and parity to be configured to the following:

- Baud rate: 9600.
- Parity: None1 (Or Parity None, stop bit 1).

If there are specific RS485 network configurations that must be met such as a different baud rate and parity, then the AcuMesh will need to be configured with those configurations from the AcuMesh configuration software before they can communicate with the other devices in the network.

NOTE: *The Acuvim II meters and any other RS485 connected devices in the network should be assigned a unique device address from 1-247.*

2.3 AXM-MESH Module

The AXM-MESH module is directly powered by the Acuvim II series meter that it is connected to.

The AXM-MESH module should be attached to the back of the Acuvim II series meter first. Other IO modules should be connected to the back of the AXM-MESH module.

2.3.1   Acuvim II Configuration

With the AXM-MESH module attached to the Acuvim II, the meter should be configured with the following settings to communicate:
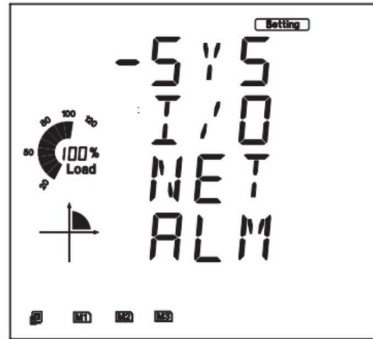
- Protocol 2: Mesh.

The procedure to configure the Acuvim II series meter to communicate with the AXM-Mesh is as followed:

Make sure you are in the 'Setting' mode. To get to this screen, press the 'H' and 'V/A' buttons simultaneously; the display selection mode will be activated, and the screen should become blank. With the cursor flashing, press either the 'P' or 'E' buttons to move the cursor to 'Setting'.

Press 'V/A' to enter the 'Setting' mode.

- You will be required to type in a password in the 'PASSWORD' screen. Leave the password as default '0000' and press 'V/A' to enter the parameter selection Mode.

- The cursor will be on 'SYS'. Press 'V/A' on this screen to get to the system settings. This will show screen 'S01 ADDR'.

- Press the 'E' button until you get to 'S34 PROTOCOL 2'. Select the 'Mesh' protocol.

  - Press 'V/A' to modify the setting; the cursor should now flash.
  - Press 'P' or 'E' to select 'Mesh'.
  - Press 'V/A' to confirm the change.

Note: By changing the 'Protocol 2' setting to Mesh in the meter this will automatically change the Baud rate 2 setting in the meter to 9600 and Parity 2 to None1.

If the meter does not have the Mesh option in Protocol 2, please set Baud rate 2 and Parity 2 to 9600 and None1 respectively.

To communicate with the AXM-MESH module that is attached to the Acuvim II series meter, the meter will need to be uniquely identified using the 'ADDR 2' device address configuration.
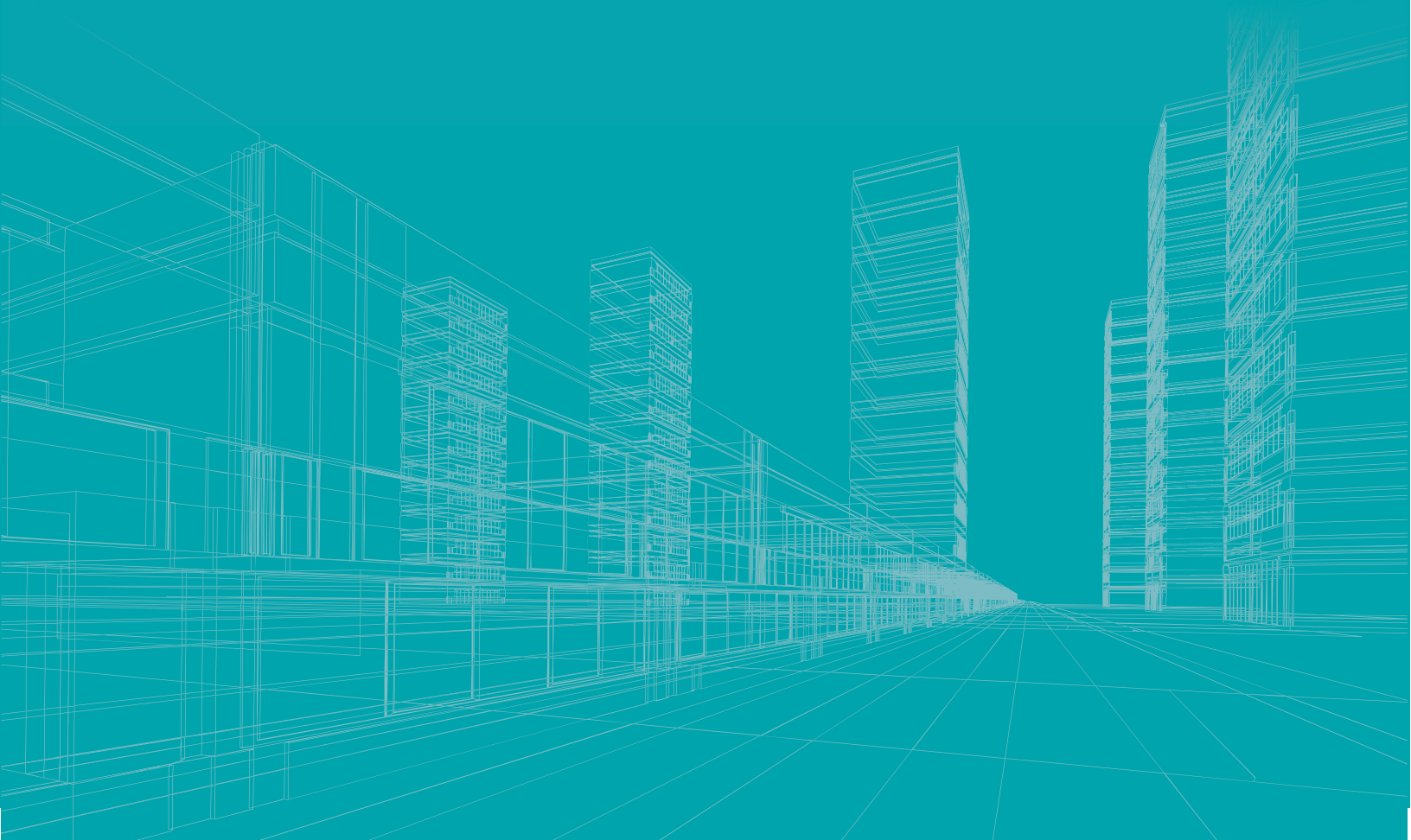
Chapter 3: Advance User Settings

CHAPTER 3: ADVANCE USER SETTING

3.1 AcuMesh Software Introduction

For advanced configurations such as configuring the transceivers to work in a different network, the AcuMesh configuration software needs to be used.

The transceiver must be connected to a PC using the USB cable to perform any configuration using the software.

The settings that can be configured from the software are as followed:

- Baud rate and parity of the transceiver.
- Network the transceivers will communicate in.
- Security of network.
- Transmission of messages.

Upon opening the AcuMesh software you will see the following screen:
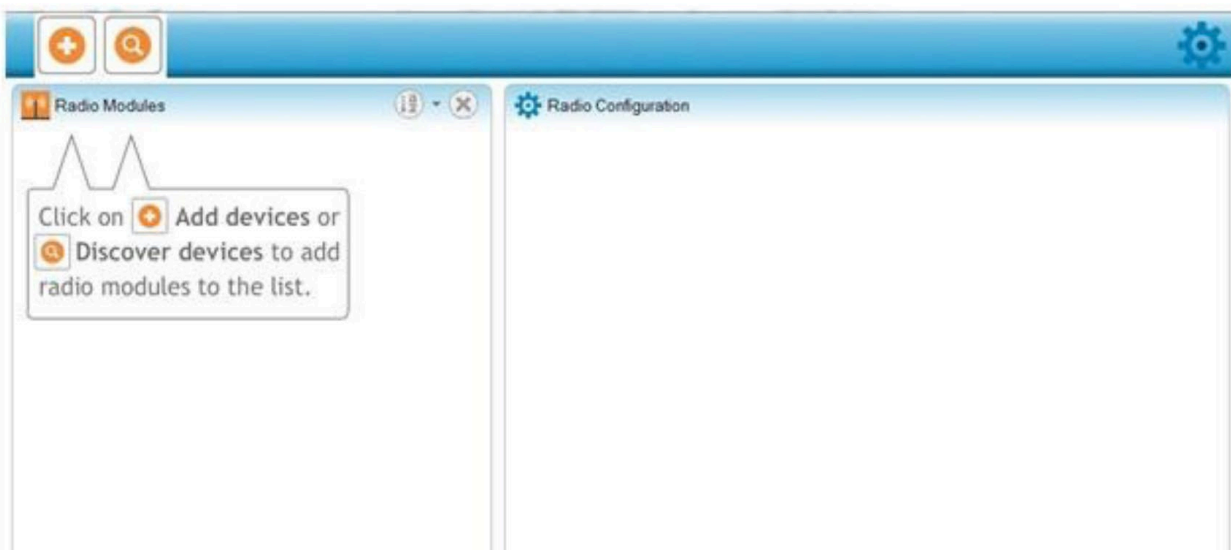

The software will be divided in two views. The left view "Radio Modules" will display all the transceivers that can be detected by the software. The right view " Radio Configuration" will display the configurations for the selected transceiver.

3.2 Configuration

To begin the software will need to locate the transceiver that is connected to the computer's USB port.

Click on the ⊕ to discover the Com port that the transceiver is connected to. Select the connection and click on 'Finish'.
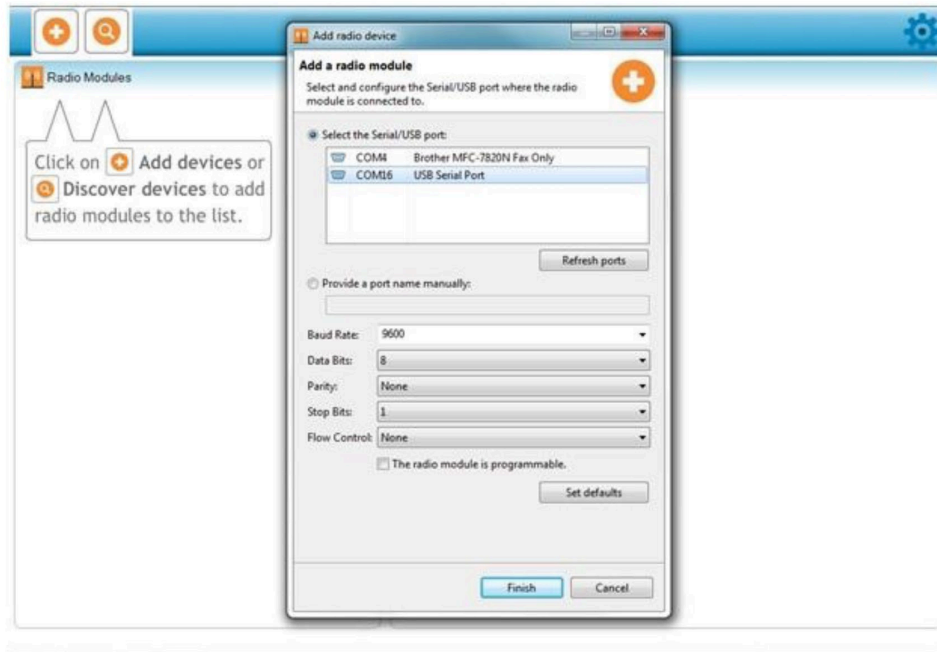
Click on the discovered transceiver under the "Radio Modules" view to view and configure the settings related to this transceiver.

The right view of the software will display the information and settings related to the transceiver under "Radio Configuration".

NOTE: *To configure a remote transceiver in the network, the transceiver needs to be in "remote control mode" (More information can be found below).*
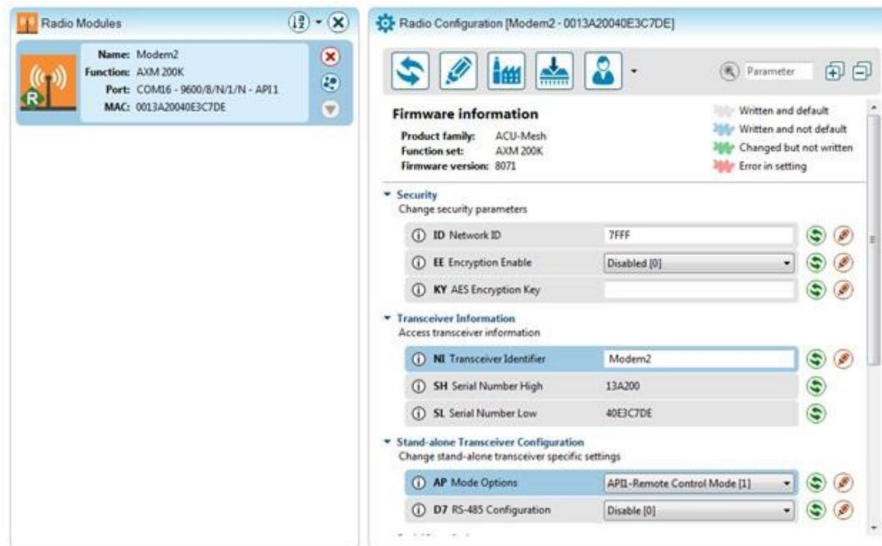
To read or retrieve a parameter from the transceiver press the ⟳ beside the parameter.

To write a setting to the transceiver press on the 'pencil' icon ✏ beside the parameter if it is read and write parameter.

The configurations related to the network's security can be found below:

The configurations for AcuMesh can be divided into the following sections: Security, Transceiver Information, Stand-alone Transceiver, Serial Interfacing, and Advanced Settings.

To obtain more information about each configuration, you can simply press the information symbol beside each parameter.
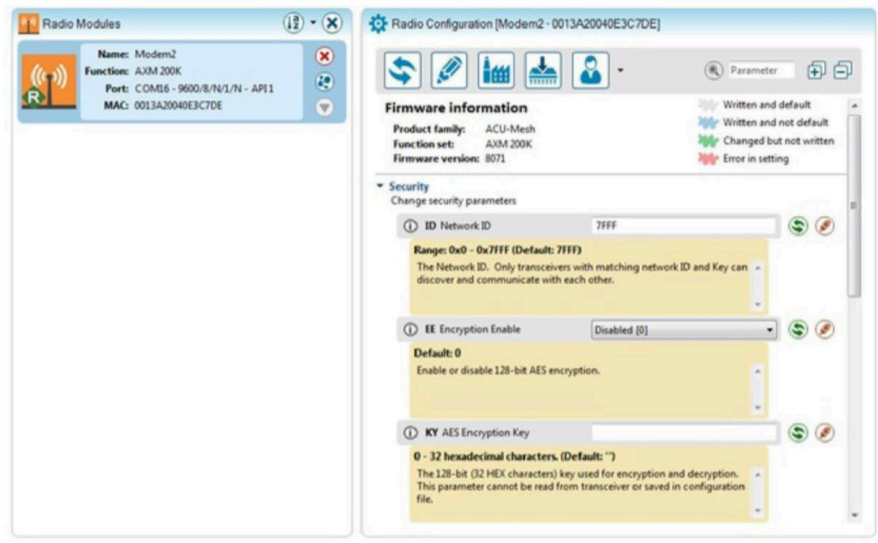
Security:

ID Network ID: The network or channel that the transceivers will communicate in. All transceivers need to be configured with the same Network ID to communicate with each other. Transceivers with different Network ID will not be able to join the wireless network. By default, all the transceivers are configured in the same network. The transceivers will be configured with the default network ID of 7FFF.

EE Encryption Enable: This parameter is for enabling an encryption for the transceivers in the network.

KY AES Encryption Key: If the EE Encryption Enable parameter is enabled then a encryption key needs to be entered. This key must be set between 0-32 characters in Hexadecimal. Every transceiver must have the Encryption Key correctly configured to join the network.

Transceiver Information:

NI Transceiver Identifier: This parameter is for assigning the transceiver with a name so it can be easily identified in the network when searching for transceivers. By default, no identifier is assigned to the transceivers.

SH Serial Number High: A read only parameter for returning the upper 32 bits of the 64-bit unique assigned address to the transceiver.

SL Serial Number Low: A read only parameter for returning the lower 32 bits of the 64-bit unique assigned address to the transceiver.

Stand-Alone Transceiver Configuration:

AP Mode Options: For the transceiver to communicate with other transceivers in the network this parameter must be set in 'AT-Communication Mode[0]'.

To configure a remote transceiver, this parameter must be set to 'AP1-Remote Control Mode[1]'.

D7 RS485 Configuration: If the transceiver is connected via a RS485 port then this parameter must be set to 'RS485 Enable High[7]'.
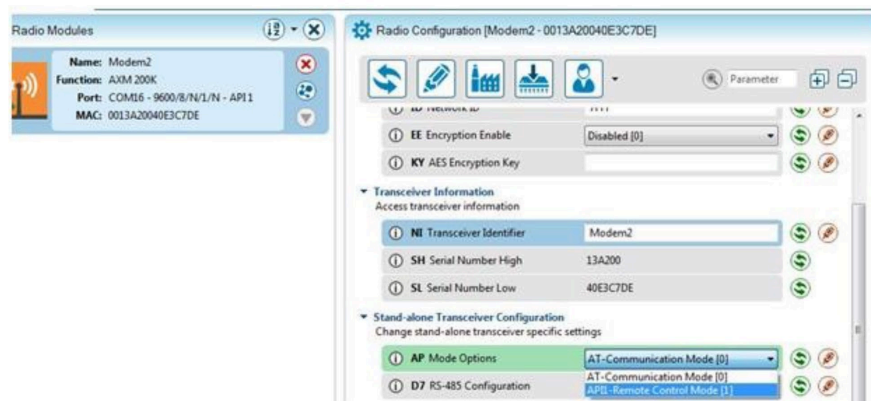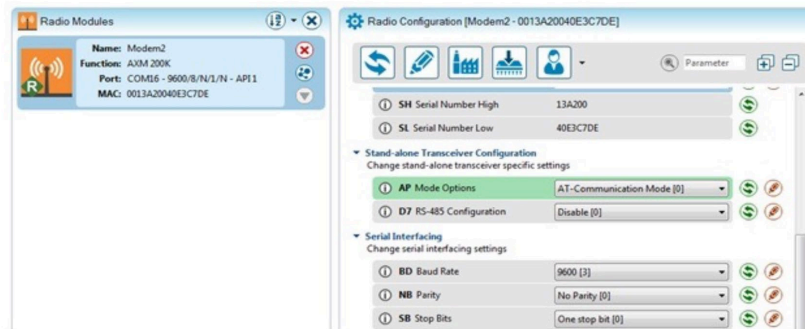

Serial Interfacing:

BD Baud Rate: The baud rate for serial communication between the serial port of the module and the host. Default setting is 9600.

NB Parity: Parity for the serial communication. Default is None.

SB Stop Bits: Number of stop bits used in the serial communication. Default is one stop bit.

Advanced Settings:

The advanced settings section is for configuring settings related to how the transceivers transmit and receive messages. The settings in this section will change the performance of the transceiver therefore, it is suggested that only users with knowledge in RF communication should attempt to modify any parameters in this section.

CE Routing Mode: The routing mode of the transceiver. By default, this configuration is set to Router so that the transceivers will forward packets of data in a Mesh topology. A non-routing module will not forward any packets and will communicate point-to-point.

DH Destination Address High: The upper 32 bits of the 64-bit destination address of the transceiver to receive the packets.

DH Destination Address Low: The lower 32 bits of the 64-bit destination address of the transceiver to receive the packets. By default, this configuration is configured to FFFF which is the broadcast address.

TO Transmit Options: The transceiver's transmit options.

- By default, this configuration is configured to 0XC0 for Mesh transmission
- Configure to 0x40 for point-to-point
- Configure to 0x80 for Direct-broadcast.

3.3 Locating Remote Transceivers

Once a transceiver is connected to the computer using the USB cable, this transceiver can be used to locate and configure all remote transceivers that are within the network.

To discover the remote transceivers within the network, press the "Discover radio nodes in the same network" icon that is present for the transceiver that is located under the Radio Modules view.

All the remote transceivers that are in the same network as the local transceiver that are found will appear in the "Discover remote devices" pop up box.

- Press "Add Selected Devices".

Once added, these remote transceivers will appear under the local standalone transceiver and will be denoted as remote modules.

Note: By default, these remote modules will be identified by their MAC Address.
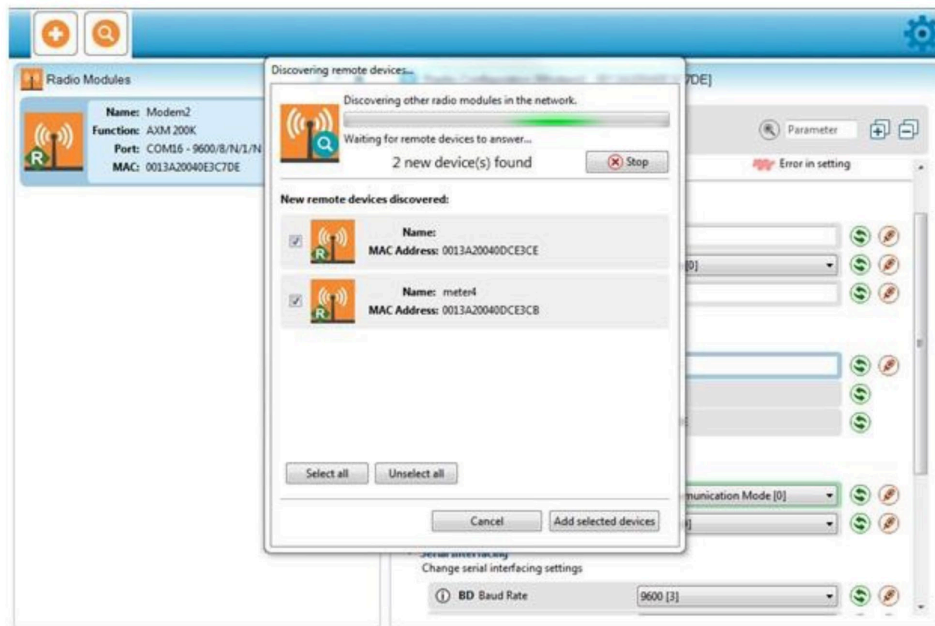

To configure the settings for the remote transceivers, select the remote module you wish to configure, and its information will load under the radio configuration view.

NOTES: In order to configure a remote transceiver, the local transceiver will need to have its "AP Mode Options" configured to "AP1-Remote Control Mode[1]".

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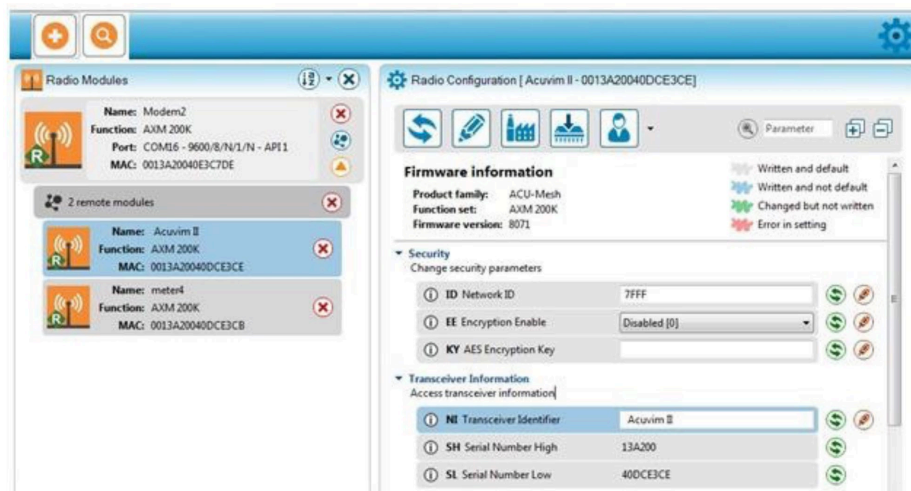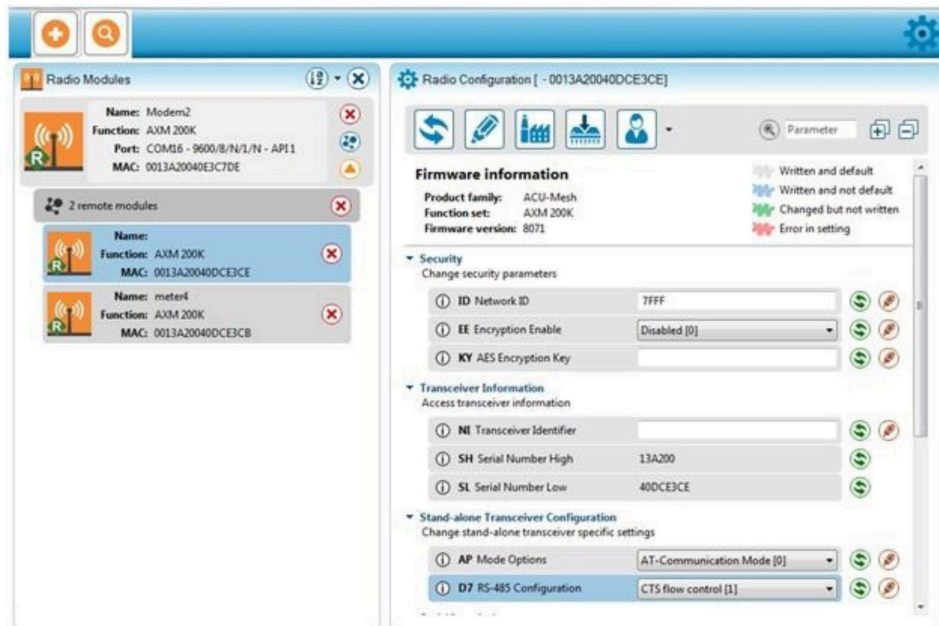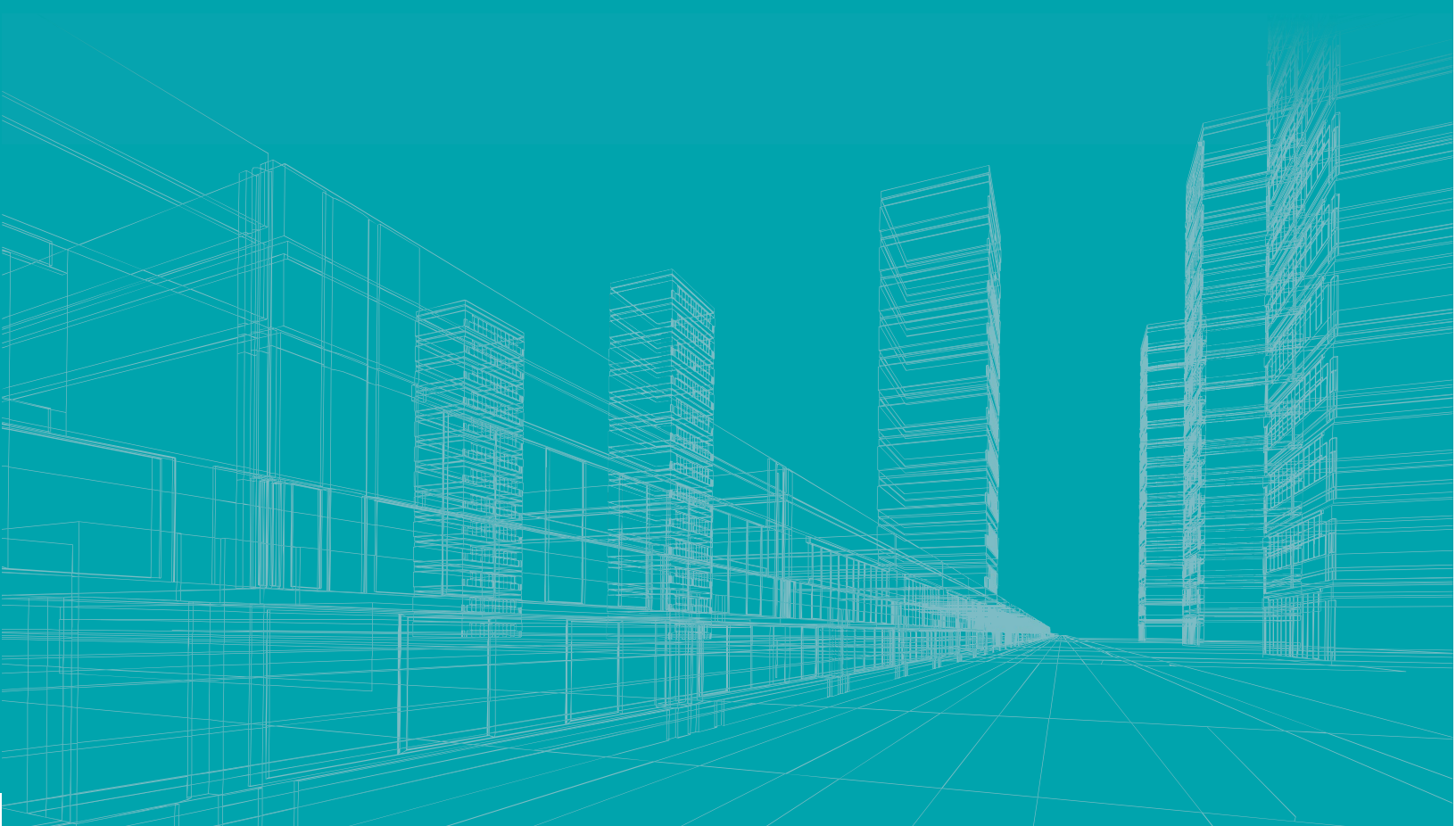

After configuring the remote transceivers, the local transceiver must have its "AP Mode Options" configured back to "AT-Communication Mode [0]" in order for the transceivers to communicate data.

AcuMesh Wireless RS485 Network

APPENDIX

Key Specifications

APPENDIX

KEY SPECIFICATIONS

Technical specifications regarding the AcuMesh can be found below. For any specification not mentioned, please contact Technical Support at Accuenergy.

	AcuMesh-K Wireless Transceiver Kit		AcuMesh-L Wireless Transceiver Kit
Part Number	AcuMesh-K	AcuMesh-L-868	AcuMesh-L-900
Compatible Countries/ Regions	North and South America, Oceania, part of Asia. International Telecommunication Union Region 2 and 3	Europe, Middle East, Africa, part of Asia. International Telecommunication Union Region 1	North and South America, Oceania, part of Asia. International Telecommunication Union Region 2 and 3
Connection	RS485 screw terminal, USB mini-B (power supply and/or configuration)		
Serial Baud Rate Range	9600 – 230400		
RF Properties			
Operating Frequency Band	902 to 928 MHz (900 MHz ISM Band)	863 to 870 MHz Configurable Band	902 to 928 MHz (900 MHz ISM Band)
Number of Channels	64	30 channels, Listen Before Talk (LBT) + Automatic Frequency Agility (AFA)	64
Spread Spectrum	Frequency Hopping		Frequency Hopping
Transmit Power Output	24 dBm (250 MW)	14 dBm (50 MW)	24 dBm (250 MW)
Receiver Sensitivity	-101 dBm		
Indoor/Urban Range	Up to 1000' (305 m)	Up to 275' (84 m)	Up to 1000' (305 m)
Outdoor RF Line-of-Sight Range	Up to 4 miles (6.5 km) with 2.1 dB dipole antennas	Up to 2.6 miles (4.2 km) with 2.1 dB dipole antennas	Up to 4 miles (6.5 km) with 2.1 dB dipole antennas
RF Data Rate	Up to 200 kb/s	Up to 80 kb/s	Up to 200 kb/s
Antenna			
Impedance	50 ohms unbalanced		
Networking and Security			
Supported Network Topologies	Mesh, point-to-point, point-to-multipoint, peer-to-peer		
Addressing Options	Personal Area Network Identifier (PAN ID) and 64-bit MAC add addresses		
Encryption	128-bit Encryption Standard (AES)		
Power Requirements	Power Supply		Power Supply
Power Supply	7-30 Vdc		24 Vdc Din-Rail Mount
Power Supply Range	7-30VDC Power		
Receive Current	0.54 mA		
Transmit Current	1.26 mA		
Physical Properties			
Size	4.5 x 2.75 x 1.125 inch (11.4 x 7.0 x 2.9 cm)	NA	3.54 x 2.1 x 1.26 inch (9 x 5.3 x 3.2 cm)
Weight	50g	NA	80g
Mounting	Surface Mount		Din-Rail or Wall Mount
Includes	Transceiver, Antenna		
Certification	United States (FCC Part 15.247) Industry Canada (IC) Australia C-Tick	ETSI (Europe)	United States (FCC Part 15.247) Industry Canada (IC) Australia C-Tick

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