METRUM UTILIWISE® ENDPOINT COMMUNICATION MODULE

USER'S MANUAL

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Notice

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Document History

Title: Metrum UtiliWise® Endpoint Communication Module User's Manual

Revision Level	Date Issued	Description
Original	07/2011	Initial Release
Version 2.0	12/7/2011	Major update
Version 3.0	12/21/2011	Modified FCC Compliance Section

CONTENTS

FCC Compliance

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference consult Metrum Support for help.

Safety Information

The following safety precautions must be observed during all phases of operation, service, and repair of this device. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and the intended use of the metering instrument. Metrum Technologies, LLC assumes no liability for the customer's failure to comply with these requirements.

- **Warning:** Any work on, or near, energized meters, meter sockets, or other metering equipment can present a danger of electrical shock. All work on this product should be performed only by qualified electricians and metering specialists in accordance with local utility safety practices, utility requirements and procedures outlined in Chapter 14 of The Handbook for Electricity Metering (10th edition). The information contained within this manual is intended to be an aid to qualified metering personnel. It is not intended to replace the extensive training necessary to handle metering equipment in a safe manner.

  - Use care when servicing with the power on.
  - Be aware that dangerous voltages exist at several points within the meter when this product is installed on a meter base.
  - Disconnect power before meter disassembly, soldering, or replacing components.

The meter is connected directly to line potential. Due to the possibility of the potential lines being reversed, points accessible with the cover off may be at line voltage.

LINE POTENTIAL IS PRESENT ON THE INCOMING CONNECTORS ON THE METRUM UtiliWise® COMMUNICATIONS BOARD AND ON THE MEASUREMENT BOARD INCLUDING THE BATTERY CONNECTOR.

Consult the meter Instruction/Technical Manual for meter specific information.

1. METRUM UTILIWISE® ENDPOINT OVERVIEW

Metrum Utiliwise® Endpoints are comprised of a Metrum Endpoint Communications Module (ECM) integrated with one of the supported electric meter platforms shown in Figure 1 below. Metrum also has an external ECM also shown in Figure 1 which enables wireless communications with distribution assets such as breakers, regulators, capacitor banks, or any device equipped with communication outputs. A detailed description of Metrum's External ECM is in Appendix 1.

Elster A3

Itron Sentinel

Landis+Gyr S4

Landis+Gyr Focus

Itron Centron II

Metrum External ECM

FIGURE 1 METRUM SUPPORTED ECM METER PLATFORMS

The ECM enables two-way, wireless communications between the meter and the utility interface over the public network carriers such as Sprint, Verizon, AT&T, or Metrum Wireless which is an aggregation of several public carriers. The ECM's are Internet Protocol (IP) devices using pass-through communications enabling Head-End software like MV-90 to retrieve and communicate across the public networks any registers, billing determinants or the contents of any ANSI table supported by the meter. Reading frequency and data retrieved is completely configurable and supports up to 4 sec interval communications between the Head-End and Endpoint. All ECM's can operate in multiple modes and support inbound and outbound TCP/IP and UDP communications, real-time communications, remote mode configuration, firmware upgrades, dynamic carrier selection, signal quality monitoring, remote diagnostics, self-registration, and pass-through communications. In addition, the ECM's feature a solid state, auto-ranging power supply which is independent of the meter power supply and can be easily retrofitted with multiple antenna options.

For communication with various devices in a ZigBee Smart Energy Home Area Network (HAN), the ECM's also have an optional integrated 100mW ZigBee module that is Smart Energy 1.0 certified and Smart Energy 2.0 ready. The ZigBee module firmware can be upgraded Over The Air (OTA) enabling easy migration from SE 1.0 to SE 2.0.

Each Utiliwise® Endpoint, as a standard feature, hosts a webpage for diagnostics and control similar to the one shown in

Landis + Gyr S4 Meter
Firmware Version: 0.208 4-29-2011

Readings	Polling	Port Speed	Outbound Connections
Serial Number: Date/Time: 0/0/0 0:00 Usage: 0.000000 kWH	Disabled ▼ Delay (seconds): 5 Password: •••••••••••••••••• Update Polling	Meter: 9600 ▼ Update Port Speed	Disabled ▼ Update Outbound

FTP

FTP Server	FTP Table Selection	FTP Upload Interval
FTP Server: [____] FTP Username: [____] FTP Password: [____] Update FTP Server	Selected Tables: ▼ Enter tables with comma separators. i.e. 4,6,45 [____] Add Tables Remove Tables	Upload Interval (minutes): [____] Update FTP Upload Interval Note: Setting the interval to 0 will disable FTP Uploads.

Motorola C24

Status	GPS	Settings
RSSI: -91 dBm MSSI: 35% SSID: 6499 Carrier: Unknown Current Band: Automatic	Latitude: 38.368263° Longitude: -98.692177° Altitude: 53400 cm Map	Restart Interval (1-12): 6 Hours Update Interval Meter Socket: 2110 ZigBee Socket: 1200 Update Ports Default Band: Automatic ▼ Update Default Band

Figure 2 below. This feature allows users to change settings, map the meter location, confirm network settings, set communication ports, and obtain signal quality and strength for troubleshooting.

Landis + Gyr S4 Meter
Firmware Version: 0.208 4-29-2011

Readings	Polling	Port Speed	Outbound Connections
Serial Number: Date/Time: 0/0/0 0:00 Usage: 0.000000 kWH	Disabled ▼ Delay (seconds): 5 Password: ●●●●●●●●●●●●●●●●●●●● Update Polling	Meter: 9600 ▼ Update Port Speed	Disabled ▼ Update Outbound

FTP

FTP Server	FTP Table Selection	FTP Upload Interval
FTP Server: [____] FTP Username: [____] FTP Password: [____] Update FTP Server	Selected Tables: ▼ Enter tables with comma separators. i.e. 4,6,45 [____] Add Tables Remove Tables	Upload Interval (minutes): [____] Update FTP Upload Interval Note: Setting the interval to 0 will disable FTP Uploads.

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FIGURE 2 UTILIWISE® ENDPOINT WEBPAGE

2. UTILIWISE® ENDPOINT CONFIGURATION AND COMMUNICATION

Although the Utiliwise® Endpoints are usually shipped with activated modems, customers should always perform a "Settings" check before field installation which is also the first step in troubleshooting a Utiliwise® Endpoint.

2.1. UTILIWISE® ENDPOINT CONFIGURATION PROCEDURE

2.1.1. CONNECT USB CABLE TO THE UTILIWISE® ENDPOINT

The Metrum USB driver package is included on the Metrum CD with your order and is also available for download from the Metrum website at www.metrum.us/login where you will need your login credentials. The first step is to power-up the UtiliWise® Endpoint and connect the supplied USB cable which is a standard USB Mini cable. Connect the USB A end of the supplied cable to a USB port on your computer, and connect the USB Mini end of the cable to the exposed mini connector on the UtiliWise® Endpoint. The locations of the USB connector under the cover of the UtiliWise® Endpoint meter platforms are shown in Figures 3-7 below.

FIGURE 3 EXTERNAL ECM USB CONNECTOR

FIGURE 4 FOCUS ECM USB CONNECTOR

FIGURE 5 S4 ECM USB CONNECTOR

FIGURE 6 SENTINEL ECM USB CONNECTOR

FIGURE 7 A3 ECM USB CONNECTOR

When the Windows® new hardware wizard prompts for driver installation, browse to the Metrum USB folder where the driver is located. Once installed, follow the steps below.

1. Open **Device Manager**.
2. Open the **Properties** window for the Metrum USB.
3. Verify the COM port number for use in the Metrum Configurator application described in the next section
4. Verify the baud rate is set to 115200.
5. Click "OK" to close the **Properties** dialog window and exit **Device Manager**.

Once the USB cable is connected, apply power to the meter if not already powered up and ensure the LED's on the UtiliWise® ECM are lit before continuing. On each of the Metrum Utiliwise® ECM's, there are 4 LED's placed near each other and labeled D10, D11, D12, and D13. These LED's indicate the state of the ECM and are described in the table below.

LED Designator	Description	Normal State	Activity
D10	Power Indicator	Green blinking Red	
D11	Carrier Detect	Green	Solid Red during session
D12	Receive	Green	Blinking Red
D13	Transmit	Green	Blinking Red
All four LEDs above blink Red simultaneously once the ECM acquires its mobile IP and then every 10 seconds thereafter verifying it has not lost connectivity.			

2.1.2. INSTALL METRUM CONFIGURATOR SOFTWARE

The Metrum Configurator is the software used to perform a "Settings" check before field installation of the Utiliwise® Endpoint. It is compatible with Microsoft Windows® operating systems 98SE and later. Follow the steps below to install Configurator on your PC.

1. Copy the Configurator folder from the supplied Metrum CD-ROM to the desired location on your hard drive e.g. "C:\Program Files\Metrum".

2. Open the folder you copied and right click on "Configurator.exe" and create a shortcut to the program on your desktop.

3. Open the Configurator software by double-clicking, or single-clicking depend on your Windows settings on the icon.

2.1.3. USE THE METRUM CONFIGURATOR TO VERIFY ENDPOINT SETTINGS

First, verify you have the correct COM port selected in the top right corner (e.g. COM1, COM2, etc.); the default is set to COM1. While the Utiliwise® Endpoint is connected via the USB cable to the computer, click on the "ModemStatus" button as shown in Figure 8 below.

Note: *The software will only work with the USB cable attached to the ECM. If an invalid COM port is selected, you will receive a timeout error message. If you receive a timeout error, retry the operation again. If you are still unsuccessful, cycle the power to the unit, reseat the cable connector, and retry.*
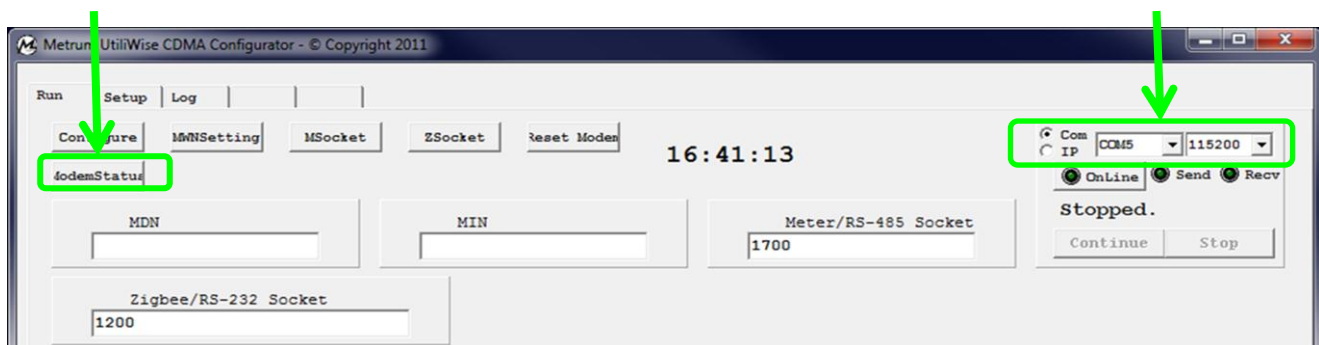

FIGURE 8 METRUM CONFIGURATOR SCREENSHOT

Once you click on the "ModemStatus" button highlighted above, the program will issue a series of AT commands to determine the status of the modem. These commands are listed in Table 1 below.

Command	Example	Description
AT+WMIN?	+WMIN: 2145559999	Query Mobile Identification #
AT+WMDN?	+WMDN: 2145551234	Query Mobile Dial # (Phone #)
AT+CSQ?	+CSQ: 24, 99	Query Received Signal Quality. <SQM>,<FER> Returns the Signal Quality Measure <SQM> and the Frame Error Rate <FER> as follows: **<SQM>:** 0-31 – Signal Quality Measurement; 99 – SQM is not known or is not detectable. **<FER>**: 99 – FER is not known or is not detectable.
AT+RSP?	+RSP: VERIZON	Query Wireless Carrier programmed in modem
AT+GMR	+GMR: S/W VER: gduvz14 PRL VER: 4	Query software and PRL (Preferred Roaming List) version
AT+GSN	+GSN: 6C1BD859	Query Hexadecimal ESN
AT*LISTENPORT?	1700	Query IP PORT programmed in modem.
AT*LOCALIP?	*LOCALIP: 70.196.178.164	Query IP Address assigned to modem NOTE: This should never change with a Static IP address.
AT*LISTENMODE=n	LISTENMODE=0	Set modem's IP listening mode On or Off - 0=Off 1=On
AT*LISTENCLOSE		Disables IP listen mode.

TABLE 1 AT COMMAND LISTING

The Configurator program will scroll through and display the AT commands used during the verification sequence. An example screenshot is shown in
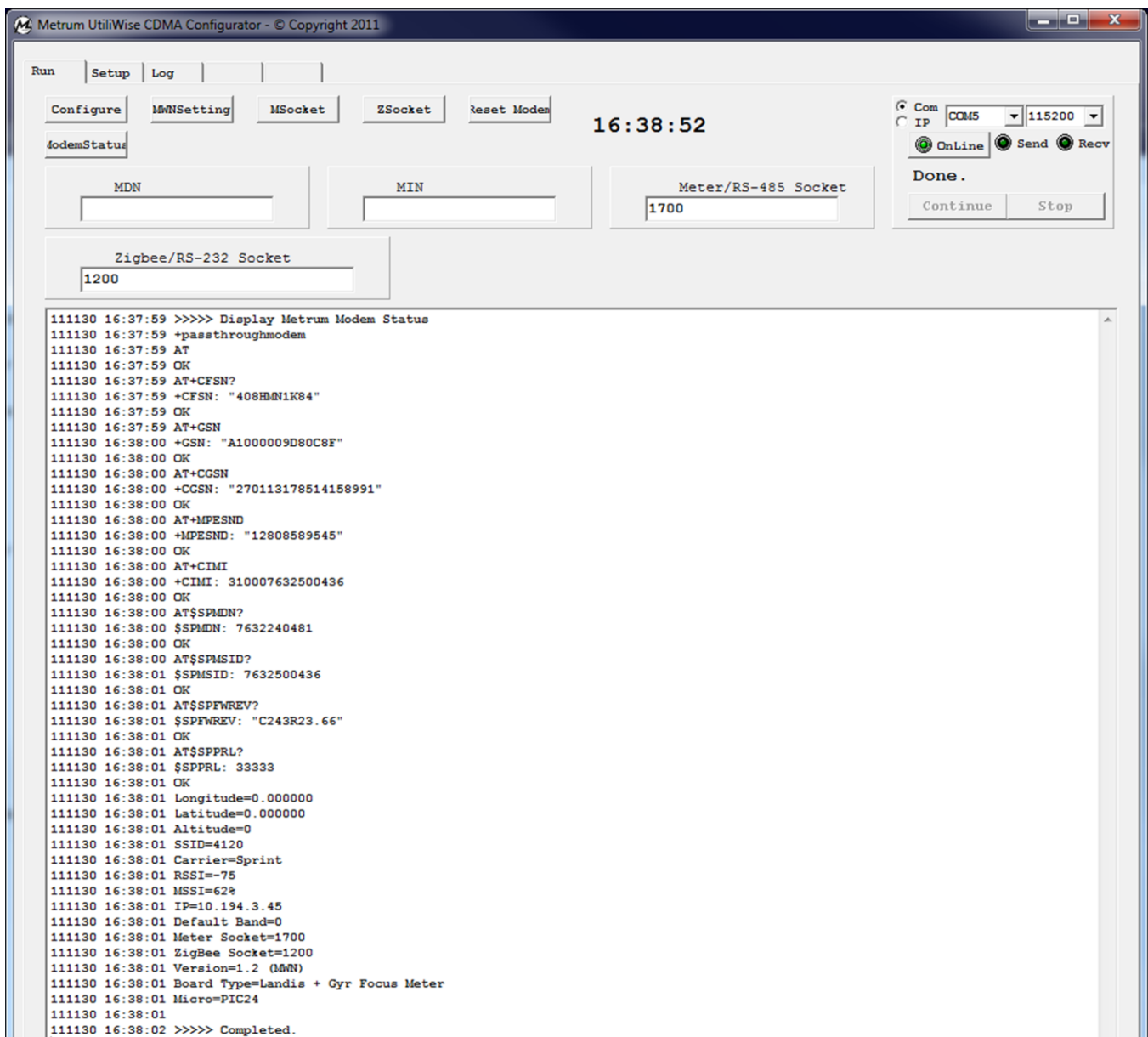
Figure 9 below.

FIGURE 9 METRUM CONFIGURATOR AT COMMAND LISTING

In this AT command listing, the settings to note are shown in

```
111130 16:38:00 AT$SPMDN?
111130 16:38:00 $SPMDN: 7632240481        ➡ Phone Number
111130 16:38:00 OK
111130 16:38:00 AT$SPMSID?
111130 16:38:01 $SPMSID: 7632500436       ➡ Modem Identifier Number
111130 16:38:01 OK
111130 16:38:01 AT$SPFWREV?
111130 16:38:01 $SPFWREV: "C243R23.66"
111130 16:38:01 OK
111130 16:38:01 AT$SPPRL?
111130 16:38:01 $SPPRL: 33333
111130 16:38:01 OK
111130 16:38:01 Longitude=0.000000
111130 16:38:01 Latitude=0.000000
111130 16:38:01 Altitude=0
111130 16:38:01 SSID=4120                 ➡ System ID
111130 16:38:01 Carrier=Sprint
111130 16:38:01 RSSI=-75                  ➡ Received Signal Strength
111130 16:38:01 MSSI=62&
111130 16:38:01 IP=10.194.3.45            ➡ IP Address
111130 16:38:01 Default Band=0
111130 16:38:01 Meter Socket=1700
111130 16:38:01 ZigBee Socket=1200
111130 16:38:01 Version=1.2 (MWN)
111130 16:38:01 Board Type=Landis + Gyr Focus Meter
111130 16:38:01 Micro=PIC24
111130 16:38:01
111130 16:38:02 >>>>> Completed.
```

FIGURE 10 METRUM CONFIGURATOR AT COMMAND SETTINGS OF INTEREST

If the ECM has a valid IP address, SSID, phone number, Modem Identifier Number, and an RSSI greater than -110, the ECM is configured correctly and ready for IP communication.

Note: *The default meter socket and ZigBee socket are 1700 and 1200 respectively, but these can be changed in Configurator by changing the default values in the socket fields and clicking on "Configure."*

2.1.4. ECM CONFIGURATION FEATURES FOR THE VERIZON NETWORK

Upon initial power up of a newly activated modem on the Verizon network, the ECM will automatically acquire and program its MDN and MIN. This process can take up to 5 minutes to complete during which time you will not be able to communicate remotely with the meter. Three

minutes after every subsequent power cycle and approximately every thirty days the ECM will perform an over-the-air self-activation (OTA) and PRL (Preferred Roaming List) update.

## 2.2. IP COMMUNICATION PROCEDURE FOR METRUM WIRELESS ECM'S

Note: *For ECM's activated on the Verizon or AT&T networks, the IP communication procedure should be coordinated with the carrier in terms of VPN access, etc.*

For ECM's activated on the Metrum Wireless Network, there are 2 ways to establish IP communication with the Utiliwise® Endpoint using a VPN connection depending on the way the head-end meter-reading software is setup.

2.2.1. CISCO ANYCONNECT

Using the Cisco AnyConnect VPN client is the preferred VPN connection method for customers reading Utiliwise® Endpoints over the Metrum Wireless Network (MWN) from a single host or remote location with meter reading software. All Metrum Wireless Network (MWN) customers that use the Cisco AnyConnect VPN client has an access control list (ACL) applied to their user credentials which allow access only to customers assigned Metrum Wireless IP addresses with all others denied.

This is not recommended for customers using automated server side meter reading software systems or customers that have multiple hosts with metering software on their local area network (LAN).
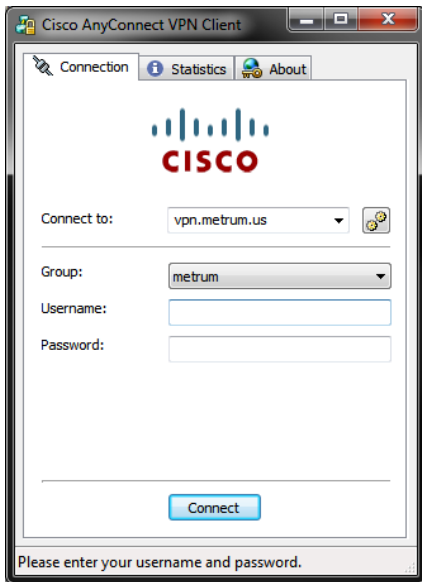
Cisco AnyConnect is compatible with the following Operating Systems.

- Windows XP SP2 and SP3
- Windows Vista (32-bit and 64-bit) SP2 or Vista Service Pack 1 with KB952876
- Windows 7 (32-bit and 64-bit)
- Red Hat Enterprise Linux 5 Desktop
- Ubuntu 9.x
- Mac OS X 10.5, and Mac OS X 10.6, 10.6.1, 10.6.2 (32-bit and 64-bit)

2.2.2. SITE-TO-SITE VPN TUNNEL

A site-to-site VPN tunnel is the preferred hardware VPN connection for customers reading Utiliwise® Endpoints over the Metrum Wireless Network (MWN) that have automated server side meter reading software systems or that have multiple hosts with metering software on their local area network (LAN). All Metrum Wireless Network (MWN) customers that have a site-to-site VPN tunnel with Metrum has a group policy in place with an access control list (ACL) applied to it. This allows access only to customers assigned Metrum Wireless IP addresses with all others denied.

Compatible hardware includes the following:

- Cisco ASA 5500 Series Adaptive Security Appliances and Cisco routers
- SonicWall security appliances
- Check Point security appliances

For Metrum Wireless Network (MWN) customers wanting to setup a site-to-site VPN tunnel between MWN and their company, please complete Table 2 below with your IT department and send it back to the Metrum Wireless Network Administrator.

Please enter the details below. This information will be used to configure the Site-to-Site VPN tunnel.

MWN - VPN Device Make/Model	**Cisco ASA 5510**
MWN - VPN Device OS/Software Version	**Software Version 8.0(4)**
MWN - VPN Peer IP Address	**66.112.39.18**
MWN - Network Range/s	**10.194.0.0/16** **10.192.0.0/16 (Only needed for customers with MWN IP addresses assigned before 7/15/2011).**
Remote - VPN Device Make/Model	**?**
Remote - VPN Device OS/Software Version	**?**
Remote - VPN Peer IP Address	**?**
Remote - Network Range/s	**?**
Pre-Shared Secret (IPsec) *(Min 20 Characters)*	**Shared over phone or sent in email w/o a subject**
IKE Phase 1 Encryption Algorithm *(AES-256/3DES/DES)*	**AES-256**
IKE Phase 1 Data Integrity Method *(SHA1/MD5)*	**SHA**
IKE Phase 1 Timeout Period *(Default: 86400 Seconds)*	**Default**
IKE Phase 1 Diffie-Hellman Group *(Group1/Group2/Group3)*	**Group2**
IKE Phase 2 Encryption Algorithm *(AES-256/AES-128/3DES/DES)*	**AES-256**
IKE Phase 2 Data Integrity Method *(SHA1/MD5)*	**SHA**
IKE Phase 2 Timeout Period *(Default: 28800 Seconds)*	**Default**
IKE Phase 2 PFS Required *(YES/NO)*	**NO**
PFS Diffie-Hellman Group *(Group1/Group2/Group3; If PFS not required leave blank)*	**NO**
Additional Notes/Comments:	**Ports/protocols to allow:** **tcp/80** **tcp/1200** **tcp/1300** **tcp/1700** **tcp/ customer specific port (optional)** **ICMP**

TABLE 2 SITE-TO-SITE VPN TUNNEL INFORMATION

2.3. INITIAL INSPECTION, POWER-UP, AND TROUBLESHOOTING PROCEDURES

In addition to the "Settings" check of the Utiliwise® Endpoint with the Metrum Configurator described in this document, we recommend the following visual inspection and initial power-up procedure before field installation.

2.3.1. Visual Inspection

2.3.1.1. Without completely disassembling the unit; inspect the unit for apparent damage.

2.3.1.2. Verify all wire connectors are still connected.

2.3.1.3. If present, verify the KYZ or other option boards are in place and connected.

2.3.1.4. Verify the ECM boards components soldered properly.

2.3.1.5. If visible, verify that the MEID of the ECM modem matches nameplate label.

2.3.2. Initial Power up

2.3.2.1. Verify the meter LCD and ECM board LED's are lit.

2.3.2.2. Read the meter optically to verify remote options are set correctly.

2.3.2.3. Power down the unit.

If there are any issues found during inspection, power-up, the "settings" check in Configurator, or field operation, use the Endpoint Troubleshooting Guide in Table 3 below to diagnose/resolve the problem.

If you are still unable to resolve the problem, send a description and any relevant documentation like a screenshot of the AT command listing in Configurator to support@metrum.us or contact Metrum directly at 254-752-7300.

Problem	Possible Causes	What to Check
No LED's	• No power to the Endpoint • No/corrupt ECM firmware	• Ensure the Endpoint has power. There should be at least 120V AC at the input power leads of the ECM • Ensure the ECM has a firmware label on the board
No / Incorrect ECM Response in Configurator	• No power to the Endpoint • No/poor USB connection to the Endpoint • No/poor ECM connections • No/corrupt firmware on the ECM	• Ensure the Endpoint has power. There should be at least 120V AC at the input power leads of the ECM • Check the USB connection between the Endpoint and PC • Check the ECM connections with the meter • Ensure the ECM has a firmware label on the board

Cannot Communicate Remotely with ECM	• Poor antenna connection
	• Low signal strength
	• Incorrect MDN and/or MIN
	• Incorrect IP address
	• No/corrupt ECM firmware
		• Check the antenna connection
		• In Configurator, check the following
		   o Signal strength
		   o MDN and MIN
		   o IP Address
		   o ECM Firmware
		• Verify account is provisioned correctly (e.g. 3G, static IP, etc.)
		• Try to Ping the IP address for a response
		• Try to access the ECM webpage by browsing to the IP address associated with the endpoint

TABLE 3 ENDPOINT TROUBLESHOOTING GUIDE

APPENDIX 1 METRUM UTILIWISE® EXTERNAL ENDPOINT COMMUNICATION MODULE

The Metrum Technologies' External ECM utilizes the same public network as the other Utiliwise® Endpoints which have internal ECM's integrated with the meter platform. The External ECM is mounted in a NEMA 4X weather-tight enclosure and features the ability to configure each communications interface on a different port for multi-threaded communications with multiple devices connected to the three different interfaces on the board.

1. EXTERNAL ECM INTERFACES

The External ECM supports communications through Ethernet, RS232, and RS485 (both 2-wire and 4-wire) interfaces and can support multi-threaded communications through all 3 interfaces. All of the External ECM interface connections are shown in Figure 11 below.
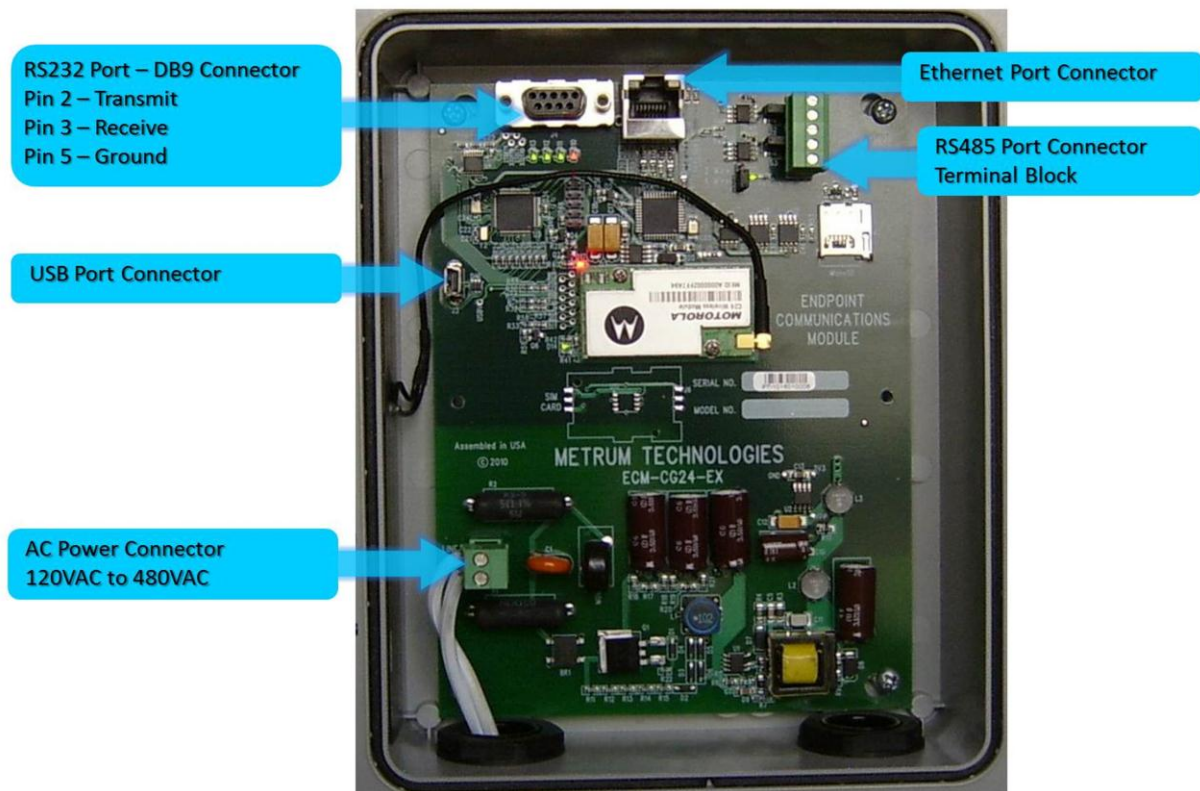

FIGURE 11 EXTERNAL ECM INTERFACE CONNECTIONS

2. EXTERNAL ECM LED INDICATORS

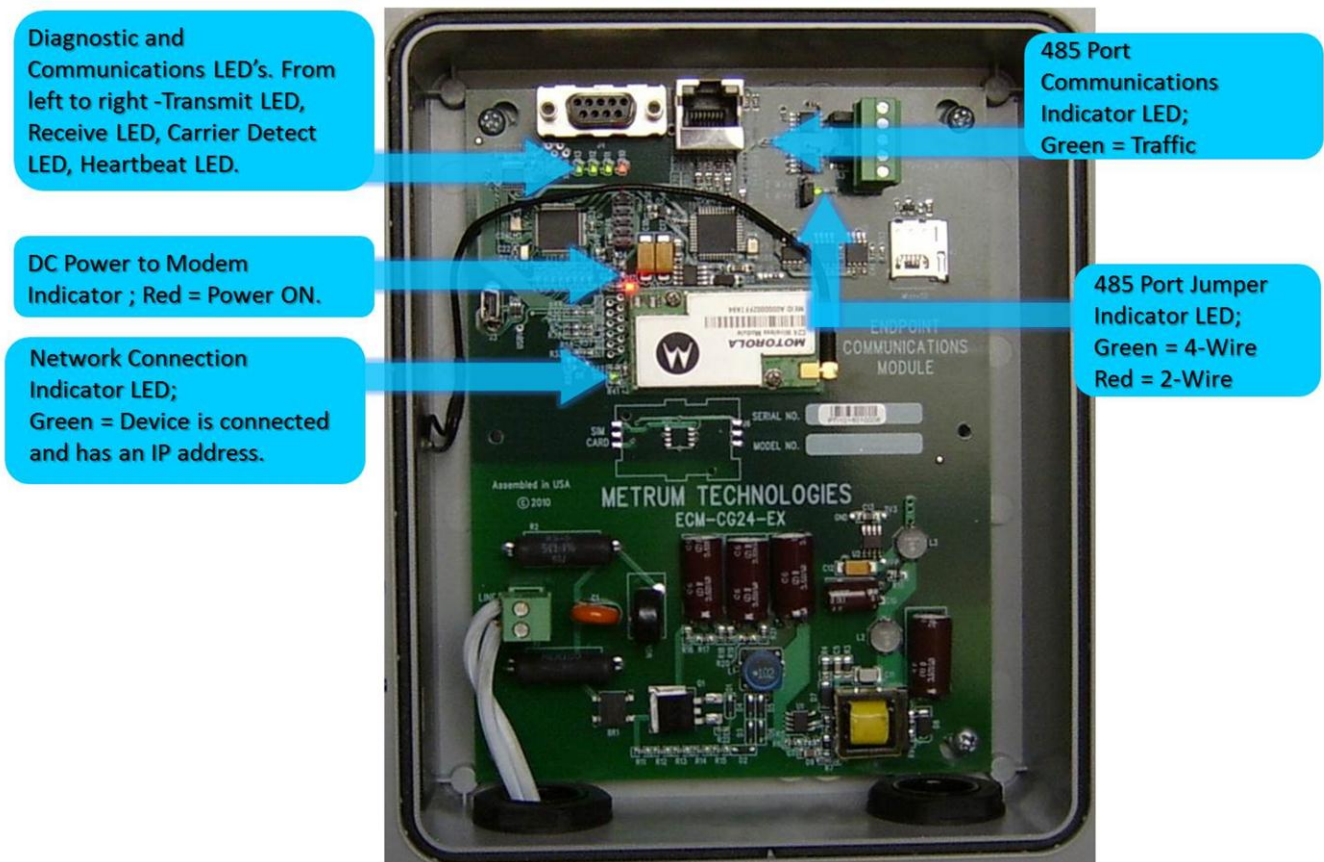For diagnostics and troubleshooting, the External ECM has 8 LED indicators as shown in Figure 12 below.

Diagnostic and Communications LED's. From left to right -Transmit LED, Receive LED, Carrier Detect LED, Heartbeat LED.

DC Power to Modem Indicator ; Red = Power ON.

Network Connection Indicator LED; Green = Device is connected and has an IP address.

485 Port Communications Indicator LED; Green = Traffic

485 Port Jumper Indicator LED; Green = 4-Wire Red = 2-Wire

FIGURE 12 EXTERNAL ECM LED INDICATORS

Table 4 below describes the meaning of the LED indicators in more detail.

LED Indicator	Indication
Diagnostic and Communication LED's (4)	• **Transmit LED** - Toggles from Green to Red with communication to the meter through the modem indicating that data packets are passing through the device. • **Receive LED** - Toggles from Green to Red with communication to the meter through the modem indicating that data packets are passing through the device. • **Carrier Detect LED** - Stays Green until connected to the modem and then it will turn Red and stay Red while connected to the modem. It will turn Green again once you are disconnected from the modem. • **Heartbeat LED** – Toggles from Green to Red at a one-second rate indicating normal device operation.
DC Power to Modem LED (1)	Red indicates power ON to the Modem
Network Connection LED (1)	Green indicates the device is connected to the wireless network and the device has obtained its IP address
RS485 Communications LED (1)	Blinks green when communicating through the 485 port
RS485 Jumper Position LED (1)	Green indicates the jumper is configured for 4-wire operation; Red indicates it is configured for 2-wire operation

TABLE 4 EXTERNAL ECM LED INDICATOR DESCRIPTIONS