

MetriNet

Cell Modem Manual

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PRODUCT WARRANTY

Analytical Technology, Inc. (Manufacturer) warrants to the Customer that if any part(s) of the Manufacturer's equipment proves to be defective in materials or workmanship within the earlier of 18 months of the date of shipment or 12 months of the date of start-up, such defective parts will be repaired or replaced free of charge. Inspection and repairs to products thought to be defective within the warranty period will be completed at the Manufacturer's facilities in Collegeville, PA. Products on which warranty repairs are required shall be shipped freight prepaid to the Manufacturer. The product(s) will be returned freight prepaid if it is determined by the manufacturer that the part(s) failed due to defective materials or workmanship.

This warranty does not cover consumable items, batteries, or wear items subject to periodic replacement including lamps and fuses.

Gas sensors carry a 12 months from date of shipment warranty and are subject to inspection for evidence of misuse, abuse, alteration, improper storage, or extended exposure to excessive gas concentrations. Should inspection indicate that sensors have failed due to any of the above, the warranty shall not apply.

The Manufacturer assumes no liability for consequential damages of any kind, and the buyer by acceptance of this equipment will assume all liability for the consequences of its use or misuse by the Customer, his employees, or others. A defect within the meaning of this warranty is any part of any piece of a Manufacturer's product which shall, when such part is capable of being renewed, repaired, or replaced, operate to condemn such piece of equipment.

This warranty is in lieu of all other warranties (including without limiting the generality of the foregoing warranties of merchantability and fitness for a particular purpose), guarantees, obligations or liabilities expressed or implied by the Manufacturer or its representatives and by statute or rule of law.

This warranty is void if the Manufacturer's product(s) has been subject to misuse or abuse, or has not been operated or stored in accordance with instructions, or if the serial number has been removed.

Analytical Technology, Inc. makes no other warranty expressed or implied except as stated above.

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Part 1 - Introduction

1.1 General

In operation, MetriNet controllers log measurement data at an interval programmed by the user, from a minimum of every 0.1 minute to a maximum of 99.9 minutes. Data is stored in on-board non-volatile memory. The MetriNet Cell Modem Option is designed to periodically transmit datalog and alarm records to a user specified data storage location (cloud site).

This manual describes how to configure the Q52 setup parameters that are unique to the cell modem option. Also included is the use of the ATI Q52 Utility program which is used to configure and test/troubleshoot the Cell modem Option.

MetriNet systems may be ordered with the SIM card already installed and the unit configured to upload data to the Water Quality Hub web site (<http://www.wqhub.com/>). For these systems, only the log interval, transit times and which files to send need to be configured. For systems ordered without a data plan, setup information is provided as well.

NOTE: The actual modem used is determined by the carrier service plan. For operation in North America, ATI recommends using Aeris for the data plan as it is the most cost effective solution. This plan uses a combination of AT&T and T-Mobile for carrier service. Installing a SIM card from another carrier will not work in a modem designed for use with AT&T or T-Mobile.

1.2 Power Consumption

MetriNet components are designed to minimize power usage. The total amount of power used depends on the number of M-Nodes used, whether operation is full-power or low-power and how the cell modem and data logging is configured. Predicting the exact usage is not possible due to the wide variation in modem power usage. The biggest impact is how often the unit calls out to send data, and the size of the datalog file.

The table below is intended to be a rough guide in determining the size of a power supply or battery pack required for a specific installation. Line powered DC power supplies should be large enough to deliver an instantaneous start-up current of 2 to 3 times the normal current. Battery supplies will normally handle very short duration start-up pulses. Estimating battery pack life and sizing solar power systems requires the use of information in this table.

<u>System Type</u>	<u>Full Power Mode (12V)</u>	<u>CYCL Mode (12V)</u>
12-24 VDC with modem	43 mA + 3 mA/node	15 mA + 3 mA/node
12-24 VDC without modem	30 mA + 3 mA/node	15 mA + 3 mA/node
12 V battery with modem	26 mA + 3 mA/node	4 mA + 3 mA/node
12 V battery without modem	12 mA + 3 mA/node	4 mA + 3 mA/node

Note: During modem operation, power draw can spike to about 150 mA for the duration of the data transfer. A typical daily data transfer takes about 3 minutes.

Part 2 – Setup/Configuration

2.1 SIM Card Installation

MetriNet controllers equipped with cellular modems require a SIM card with data service from a national service provider. Systems supplied for evaluation purposes will be delivered with a SIM card already installed and ready to operate.

For long term installations, users may continue to lease data service from ATI or can arrange their own data services from another supplier. This will require installation of the users SIM card into the MetriNet modem assembly.

NOTE: The actual modem used is determined by the carrier service plan. For operation in North America, ATI recommends using Aeris for the data plan as it is the most cost effective solution. This plan uses a combination of AT&T and T-Mobile for carrier service. Installing a SIM card from another carrier will not work in a modem designed for use with AT&T or T-Mobile.

To install a SIM card, turn off power and loosen the 4 enclosure screws to access the inside of the controller. Disconnect power and communication cables and remove the antenna from the controller. Place the front of the controller assembly face down and remove the 4 corner screws holding the terminal board in place.

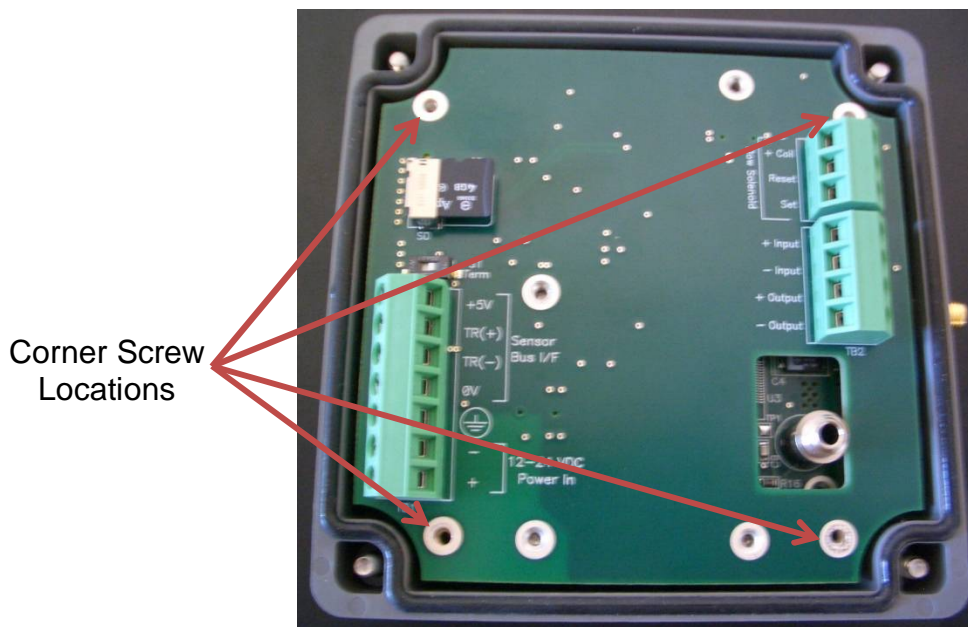


Figure 1 – MetriNet Terminals

Carefully unplug the terminal board/modem assembly from the display board. The terminal board can be disconnected by pulling straight up on the green terminals. Turn the terminal board over and the modem will be accessible as shown below. Remove the current SIM and install your new SIM card. Be careful not to disconnect the antenna cable.



Figure 2 – Modem Board with SIM Card

After installing the SIM card, plug the terminal board/modem assembly back into the display board. If you carefully line up the 4 corner screw locations with the standoffs on the display board, the multi-pin connector between the two boards will align properly. If the antenna cable gets disconnected, be sure to plug it back onto the connector labeled “M” (main), not “A” (aux).

2.2 Controller Programming

The OPTIONS menu contains all Q52 settings related to the data logging function and the internal cell modem.

OPTIONS Menu

Log Mode	Turns the data logger on or off and defines whether logging is continuous or stops when memory is full. If the data logger is shut off, the modem is disabled.
Log Interval	Sets the data storage interval. Range is 0.1 to 99.9 minutes.
Unit Addr	This number is part of the data log file name that is uploaded and is used to identify the controller that supplied the data. It is also used as the Modbus address if the unit is connected to an external Modbus network. Range is 1-247.
Clear Log	This routine clears all data stored in flash memory as well as the data that is held in the cell modem flash memory. Once cleared, it cannot be recovered. Verify that all data has been saved (or is not needed) prior to clearing the log.
Host Comms	Enables internal modem or communications interface if installed. Set this to CELL to enable the cell modem option.
Xmit Start	Defines when the first data transmission by modem will occur. Range is 00-23, 00=midnight, 23=11 PM.
Xmit Intval	Sets the interval between modem data transmission.
Alarm Enable	Enables uploading the Alarm Log record.
Enable GPS	Allows users to identify the location of the controller.

Part 3 – ATI Q52 Utility

3.1 General

The ATI Q52 Utility is a PC application program that is used to setup and configure the MetriNet Cell Modem option for a specific customer application. It also includes diagnostic troubleshooting capability required to assure proper operation or to monitor operation should a problem occur.

Requirements:

Windows based PC

FTDI-232R-3V3-AJ USB Communications Cable

Install the ATI Q52 Utility software on your PC by clicking on the ATI Utility.exe file. The program is available at www.analyticaltechnology.com or www.Wghub.com. Follow the instructions when prompted to install the program. When you install the utility, it will create an executable file in your Program Files directory. You should find an entry in your directory that looks like this:

"C:\Program Files (x86)\Analytical Technologies\ATI Q52 Utility\ATI Q52 Utility.exe"

3.2 Modem Programming

MetriNet systems supplied with cellular modems may already be programmed at the factory to send data to an ATI data site where data can be viewed, stored, and downloaded to your computer via the web. Users may wish to direct data to a site other than the ATI site. This is not a problem provided that your alternate site supports FTP transmission, as many cloud storage sites do.

Redirection of modem data requires that the modem be reprogrammed using the ATI Q52 Utility program. A special cable for connection between the modem and a USB port on your computer is included with each MetriNet controller that contains a cell modem option. This cable has a USB plug on one end and an audio plug to the modem on the other.

Note: Wait until the serial cable from the PC is plugged into the modem option before powering up the Q52 instrument. Once the modem sees the cable connected, it will stay powered up. Otherwise, the modem option will power down when not sending data, and you may get a communications error.

Plug the USB cable into a USB port on your PC. The first time you do this, it may take a few minutes to install the device driver. Plug the other end of the serial cable into the jack on the PCB inside the monitor as shown.

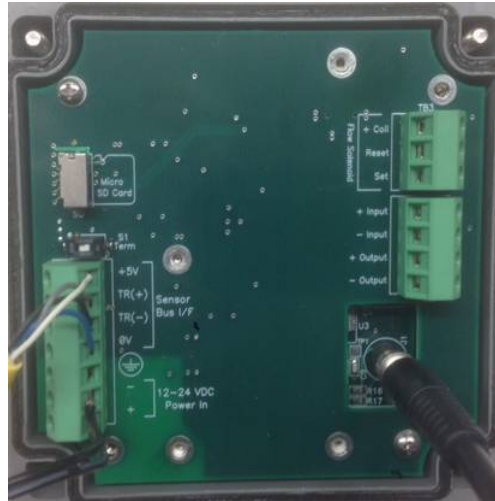
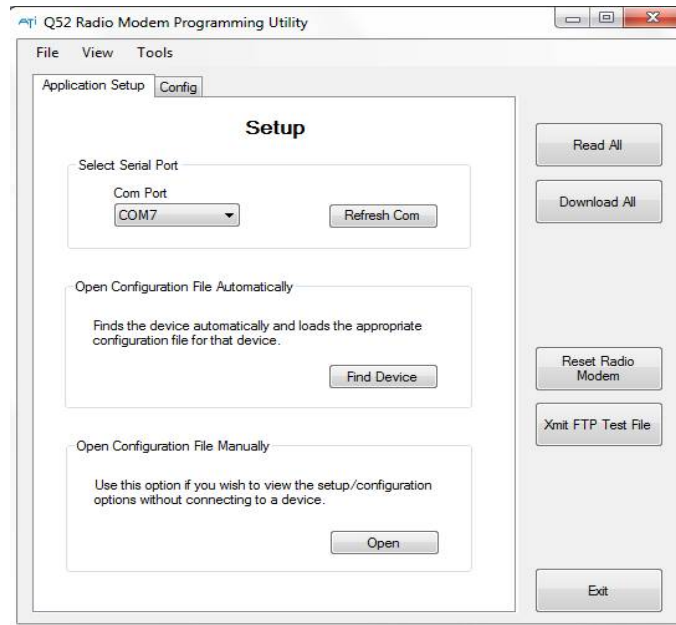
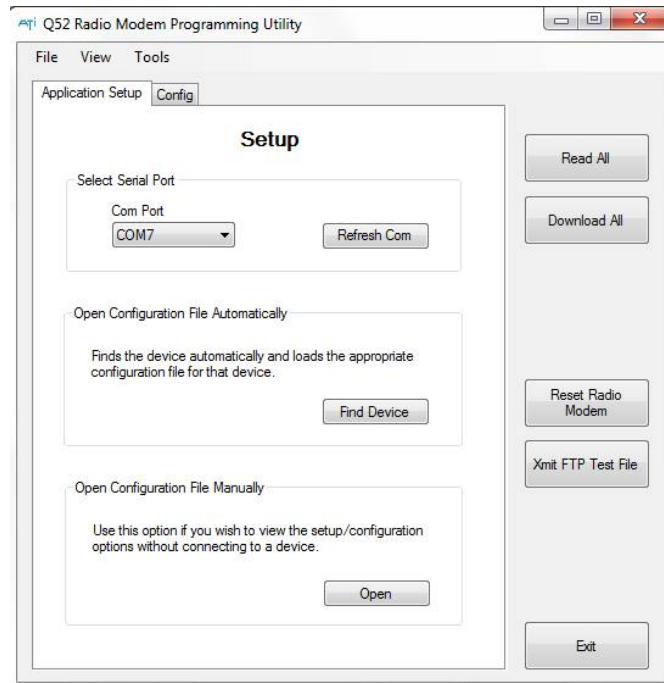


Figure 3 – PC Cable Connection

Once the device is ready for use, click on the ATI Icon to start the program. The ATI Splash screen will be displayed, then the following window will open.

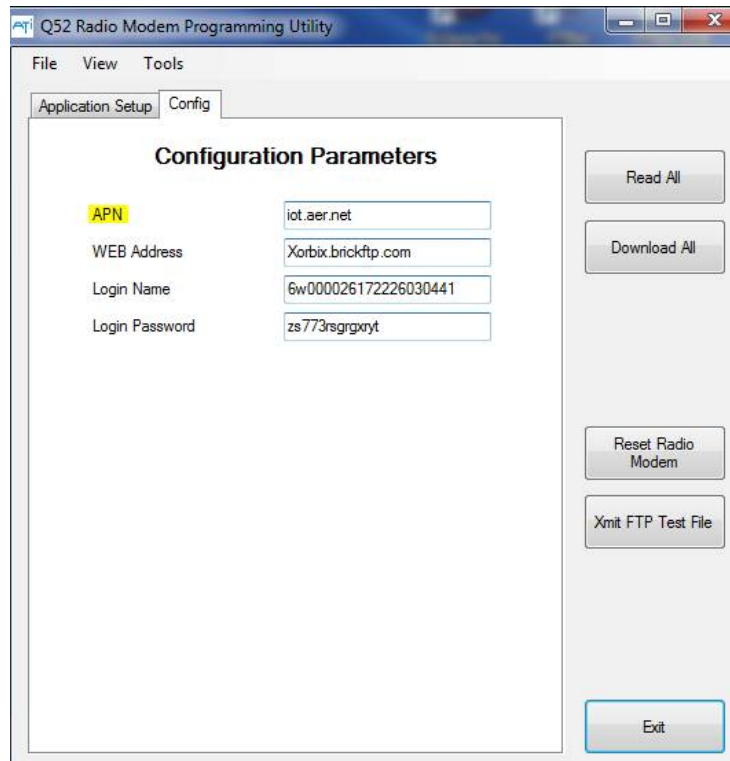


Click on refresh Com List. The program will search for all available Com ports. Then click on the Com Port drop down list and select the com port for the USB cable. If not sure which com port it is, unplug it and click Refresh Com List. Then plug the cable back in and click Refresh Com List again to see what new port appears.



Now click on the Find Device button. The program will attempt to communicate with the Cell Modem Option. An associated configuration file is loaded. You can also manually select a configuration file by clicking on Open and selecting a configuration file. You must have the correct configuration file for the device and version software running on it. So clicking Find Device will automatically open the correct configuration file.

Now click the Read All button. The PC will query the device and display current setup/configuration settings as shown below.



APN is the Access Point Name. This will vary depending upon your data plan provider.

For an Aeris SIM card in the United States, the APN is “iot.aer.net”.
For an AT&T SIM card in the United States, the APN is “broadband”.

WEB Address is the address of the web site you are using to upload data to. This may be up to 40 characters in length.

The **Login Name** and **Login Password** are whatever the WEB site requires to log onto the web site. These are also limited to 40 characters each.

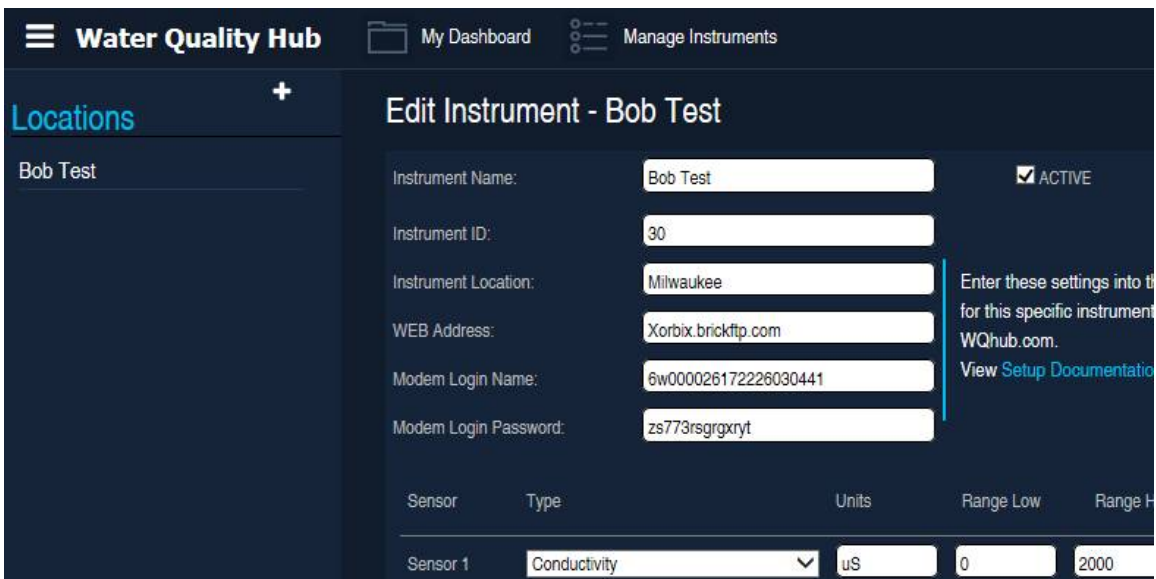
After all setup/configuration data has been entered, click on the Download All button. All of the setup data will be downloaded to the Cell Modem Option and stored in flash memory.

3.3 WQ Hub Login and Password

If using the WQ Hub web site, the Login Name and Login Passwords are assigned by the WQ Hub web site when the user account is created. To get the password and login information, login into the WQ Hub user account.



Click on the Manage Instruments ICON. This will bring up the following screen.



Simply cut and paste the Web Address, Modem Login Name and Modem Login Password from this web page into the ATI Q52 Utility fields. After all setup/configuration data has been entered, click on the Download All button. All of the setup data will be downloaded to the Cell Modem Option and stored in flash memory.

Part 4 – Operation

4.1 General

The MetriNet controller is used to calibrate the measurement nodes, to store data supplied by the nodes, and to communicate the stored data to the outside world. Data is stored in non-volatile flash memory and is transmitted by cellular modem to cloud storage sites. Data is actually stored in two places. A cumulative data record is stored in flash memory on the main CPU board. This can be copied to an SD card. Data is also stored in flash memory on the modem CPU board until the record is sent to the FTP web site. Once the data is sent, the flash is cleared and a new record is created.

4.2 INFO Menu

The controller program is organized into MEASURE, INFO, SENSOR, CONFIG, and OPTIONS menus. The INFO menu contains information related to the cell modem option.

Q52 UNIT 10	Specific ID of this Q52. User set.
13:59:40	Hour/Minute/Sec time. 24 hour format.
Dec 31, 2016	Current date
10min 40sec	Time until next data point is recorded. Useful if you wish to perform service before next logged data point. To manually force an upload via the cell modem, press the ◀ key while this time is displayed. The message "Sending Data" will be displayed to indicate transmission has been initiated.
LAT 1234.56N	GPS captured latitude position
LON 1234.56W	GPS captured longitude position
DC In = 12.1	Measured DC input voltage (from battery or power supply)
Q52 Ver 1.00	Q52 software version number

4.3 GPS Function

MetriNet controllers contain a GPS chip that allows the controller to transmit its position to the data site. This function is mainly useful if you plan to move the system around to different locations. However, it can also be useful if the location of the installation is to be displayed on a mapping program.

The GPS function is not active when controllers are shipped. The GPS location system uses a substantial amount of power so it is best to leave it off unless the longitude and latitude information is desired. The GPS function is activated in the Options menu.

The antenna for the GPS chip is internal to the controller and is not a strong receiver. It may be necessary to temporarily activate the controller outdoors at the installation site to get valid data. The GPS data is only acquired when initiated in the OPTIONS menu. The controller will not continuously look for new coordinates during normal operation. However, once the position is acquired, the data will remain in the controller and need not be updated unless the system is moved to another location.

Part 5 – Data & Alarm Log

5.1 General

The primary purpose of a MetriNet system is to monitor water quality parameters and log the data. The data may then be either transmitted to a remote data storage cloud site by modem or collected manually by writing data to the SD RAM card located in the controller. The amount of data depends on the number of sensors used and the logging frequency.

5.2 Data File Format

Data stored and transmitted is in a standard .CSV format. Data can be easily displayed and analyzed using Excel or other spreadsheet programs. Shown below is part of a typical data file that has been sent by modem to a storage site. When sent to a FTP site, the file name includes unit ID and time stamp to show when and where the file came from. The format of the file name is Data_Dev_ID_YYMMDD_HHMM where Data indicates it is a data file as opposed to an alarm file, Dev_ID is the unit address number, Date and Time as entered in the Q52. Time is in 24 hour format.

Other information included in the file include:

Radio Model number, 16 digit Radio IMEI number, and 20 digit SIM Card number.

The Signal Level and Bit Error Rate indicated reported radio signal strength. A value of 10 or more is typical, A Signal level less than 10 may work, but may take longer to send data, or intermittently have problems calling out.

The Supply Voltage is the measured DC voltage powering the Q52. For battery powered systems, this provides the user with an indication of battery charge status and can be used to know when it is time to change out or charge a battery pack.

Latitude and Longitude displays the physical location of the unit. This may be captured location data or manually enter values.

Data Record										
Radio Model	HE910-D									
IMEI Number	35613607	4512551								
SIM Number	89011702	27202478	6805							
Signal Level	11									
Bit Error Rate	3									
Supply Voltage	12.1									
Latitude	5453.34N									
Longitude	8531.52W									
Date	HH:MM:SS	Temp	Sensor 1	Sensor 2	Sensor 3	Sensor 4	Sensor 5	Sensor 6	Sensor 7	Sensor 8
9/23/2018	15:10:58	26040	2374	7000	13040	1000	0	0	0	0
9/23/2018	15:25:58	26130	2368	7000	13030	1000	0	0	0	0
9/23/2018	15:40:58	26190	2364	7000	13030	1000	0	0	0	0
9/23/2018	15:55:58	26410	2349	7000	13040	1000	0	0	0	0
9/23/2018	16:10:58	26430	2348	7000	13020	1000	0	0	0	0
9/23/2018	16:25:58	26600	2336	7000	13000	1000	0	0	0	0
9/23/2018	16:40:58	26640	2334	7000	12990	1000	0	0	0	0
9/23/2018	16:55:58	26700	2330	7000	13020	1000	0	0	0	0
9/23/2018	17:10:58	26670	2332	7000	13020	1000	0	0	0	0
9/23/2018	17:25:58	26640	2334	7000	13020	1000	0	0	0	0
9/23/2018	17:40:58	26630	2334	7000	13010	1000	0	0	0	0
9/23/2018	17:55:58	26550	2339	7000	13020	1000	0	0	0	0
9/23/2018	18:10:58	26480	2344	7000	13010	1000	0	0	0	0
9/23/2018	18:25:58	26480	2344	7000	13020	1000	0	0	0	0
9/23/2018	18:40:58	26430	2348	7000	13010	1000	0	0	0	0
9/23/2018	18:55:58	26430	2348	7000	13010	1000	0	0	0	0

Figure 42 – Raw Data Format

All data is stored as 16-bit data with 4 decimal resolution. In order to convert raw data to actual engineering units, simply divide each value by 1000. Since each controller can accommodate up to 8 nodes, zero values are stored for each unused sensor input. Data manipulation such as appending files and generating graphical reports is left to the user.

5.3 Data Storage Capacity

MetriNet controllers can store large amounts of data. The time period required to fill the memory depends on how many nodes are connected and how often data is stored. A controller with a maximum of 8 nodes logging data every 6 seconds can store 48 hours of data. That’s about 230,000 data points. A more typical application with 4 M-Nodes taking data once every 10 minutes will hold about 239 days of data.

Data held in flash memory may be recorded until the memory is full.

5.4 Alarm File Format

In addition to the data log file, the controller also generates an alarm log file. The alarm file format is similar to the data file format. When sent to a FTP site, the file name includes unit ID and time stamp to show when and where the file came from. The format of the file name is Alarm_Dev_ID_YYMMDD_HHMM where Alarm indicates it is an Alarm file as opposed to a Data file, Dev_ID is the unit address number, Date and Time as entered in the Q52. Time is in 24 hour format. The alarm file logs an alarm event any time one of the sensor setpoints A or B changes state. If communications is lost to a sensor, Error is shown. The time stamp shows when the alarm occurred. Up to 200 alarm events may be stored.

Q52 Alarm Record									
Date	HH:MM:SS	Sensor 1	Sensor 2	Sensor 3	Sensor 4	Sensor 5	Sensor 6	Sensor 7	Sensor 8
8/22/2018	1:28:43	OK	OK	OK	OK	0	0	0	0
8/22/2018	21:18:36	A	OK	OK	OK	0	0	0	0
8/22/2018	21:20:58	OK	B	OK	OK	0	0	0	0
8/22/2018	23:09:22	OK	OK	A B	OK	0	0	0	0
8/22/2018	23:23:10	OK	B	A B	OK	0	0	0	0
8/22/2018	23:26:20	OK	OK	AB	OK	0	0	0	0
8/25/2018	20:26:48	OK	OK	OK	OK	0	0	0	0
8/25/2018	20:28:24	OK	OK	OK	Error	0	0	0	0
8/25/2018	21:02:06	OK	OK	OK	OK	0	0	0	0

Figure 5 – Alarm Data Format

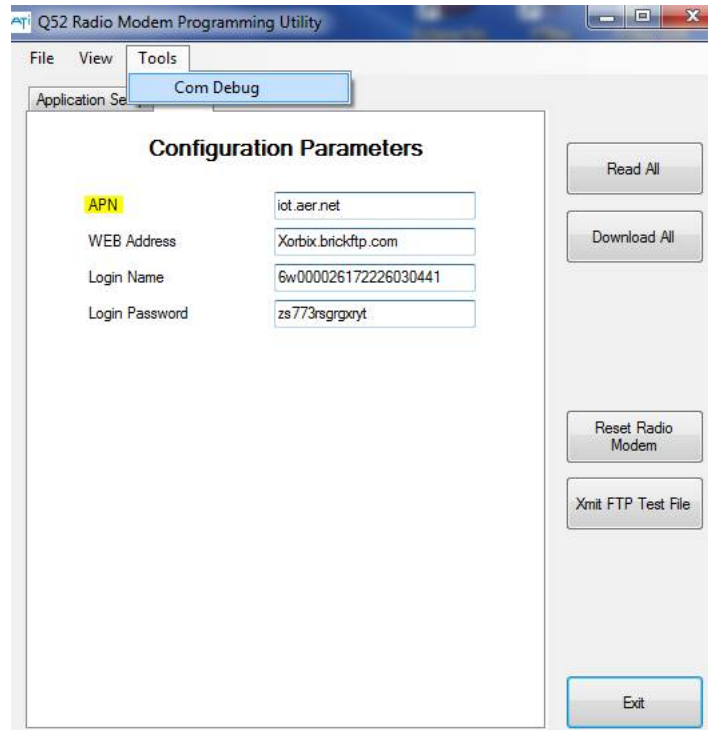
5.5 Alarm File Upload

The alarm file is only sent to the FTP site when it is enabled via the Enable Alarm configuration setting in the OPTIONS menu. If there are no alarm conditions, the alarm file is not sent. The first time an alarm occurs, the Metrinet will call out and upload the alarm file along with the data file. Once an alarm occurs and an alarm file is sent, the Metrinet will not continue to send an alarm record if more alarms occur. It will only send the alarm file when it is time to send the data record (i.e. once a day, twice a day, etc.). Once all of the alarms clear, the logic is reset, and the Metrinet will send an alarm file the next time an alarm occurs.

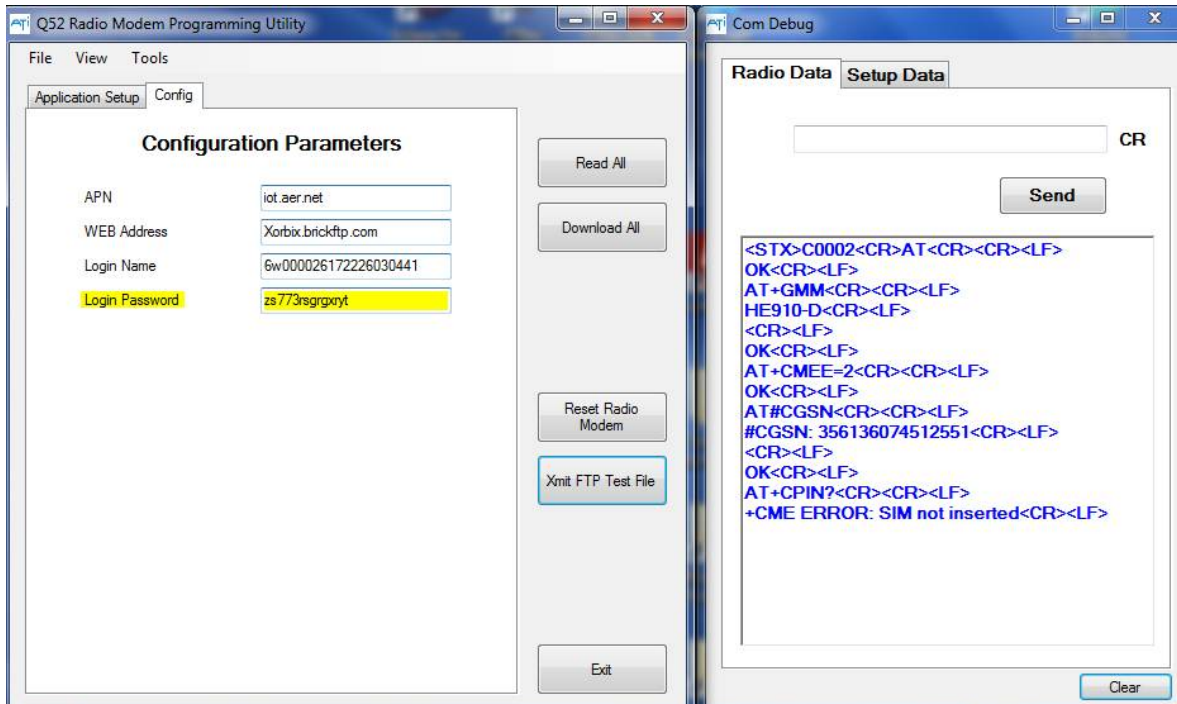
The alarm file data is not currently displayed on the WQ Hub web site, but may be useful for users uploading data to their own web site.

6.0 Diagnostics/Troubleshooting

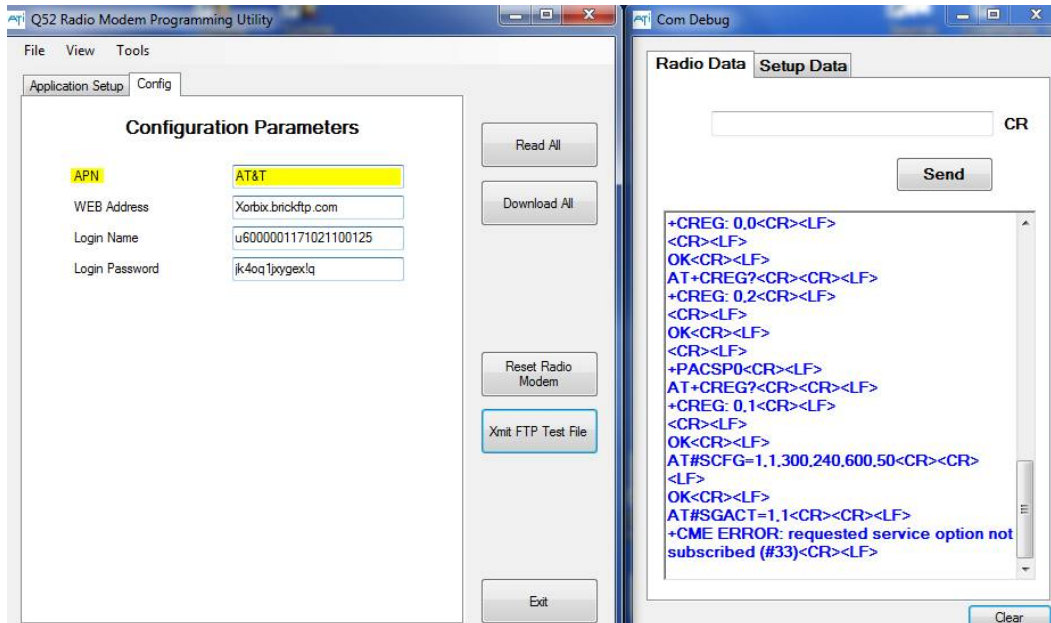
Click on the Tools option on the menu bar and select Com Debug.



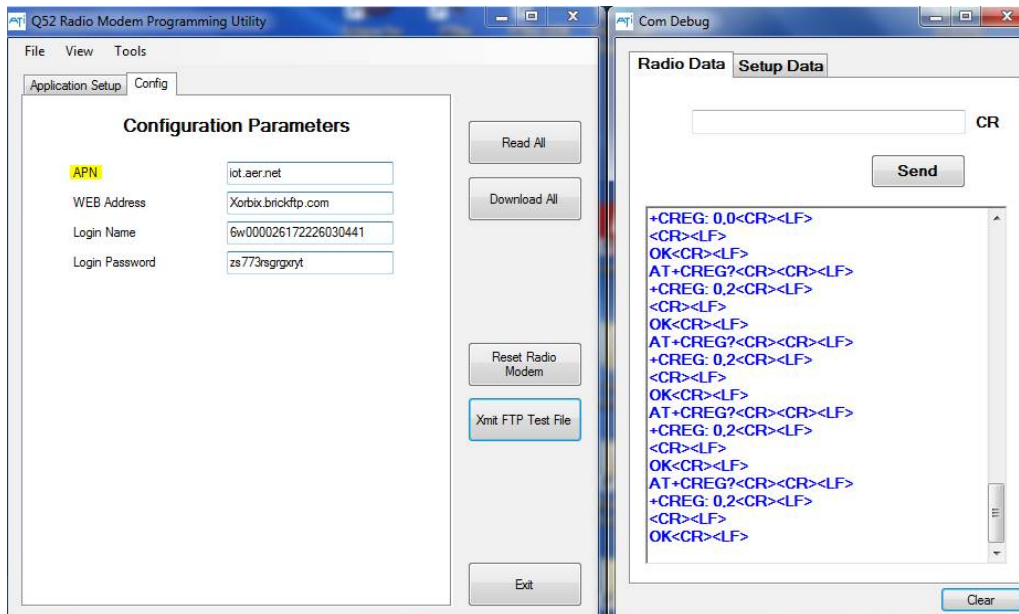
An additional window will appear. Select the Radio Data tab. Click on Reset Radio Modem, then Click on Xmit FTP Data. It takes 6 to 10 seconds for the radio modem to boot up. After that delay, you should see data appear in the Radio Data window. If no data appears, the CPU is not communicating with the Radio Modem. This would indicate some type of hardware failure.



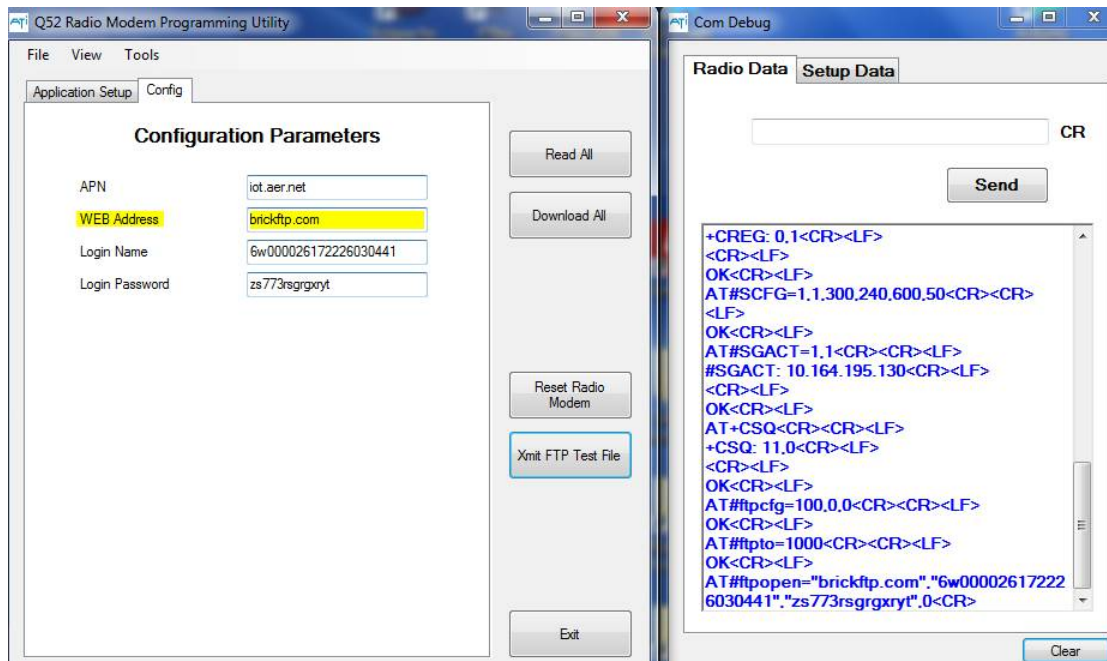
The above example shows that there is no SIM card installed in the radio modem. When there is no SIM card, data communications to the cell network is not possible.



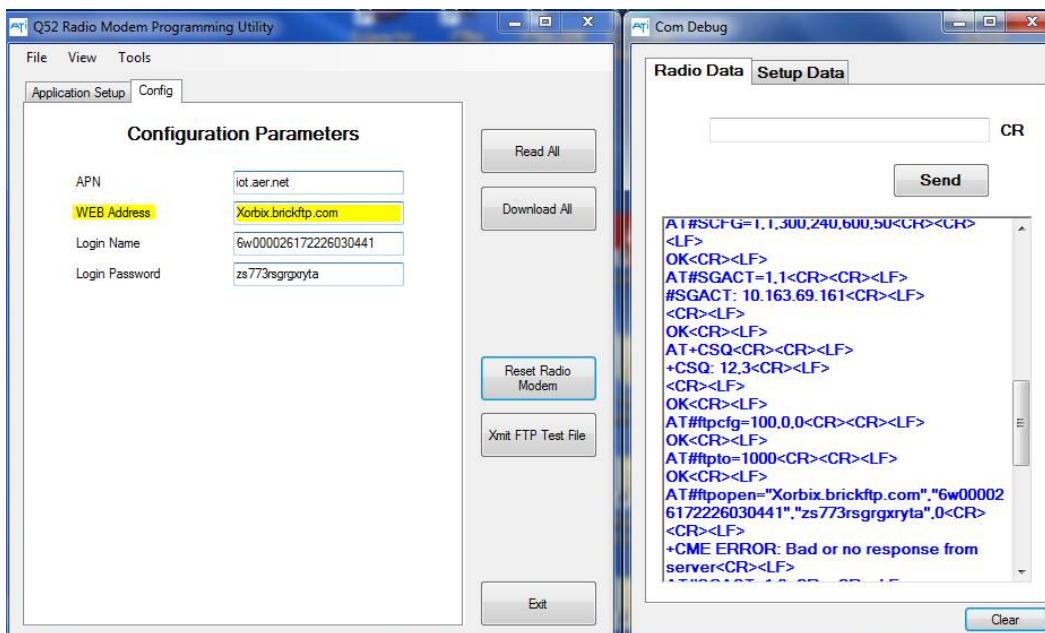
The above example shows the response when an incorrect APN name is entered.



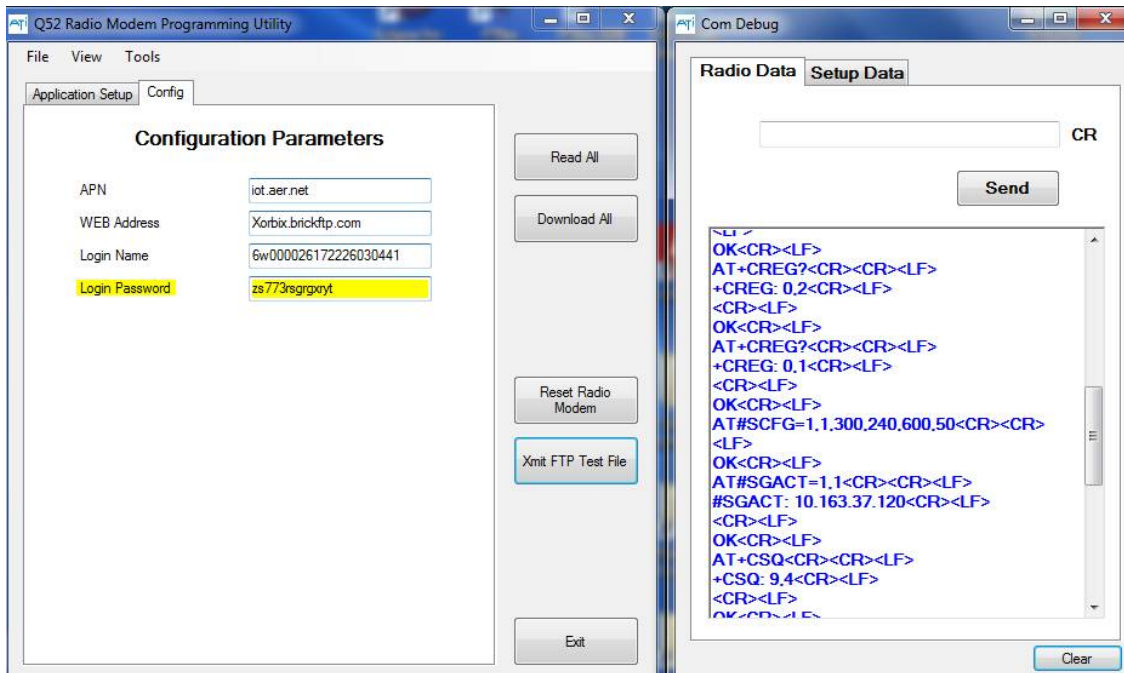
The above example shows that the radio modem is not able to register itself with the cell network. When it begins the process, +CREG 0,0 is displayed. Once it registers, +CREG 0,1 is displayed. A value of +CREG 0,2 or +CREG 0,4 indicates some problem communicating with the cell network. In this case the antenna is not connected to the radio modem. Make sure the antenna is screwed onto the connector all the way, and that the antenna cable inside the monitor is plugged onto the radio modem connector labeled M.



The above example shows that the radio modem is getting out to the network, but having a problem logging onto the file server. If the process hangs at this step, check the WEB address, login name and the login password to make sure they are correct. In this example, the sub domain name is missing from the WEB address.



The above example shows the response from the file server where the WEB address is correct, but the login password is not correct.



One bit of data that is displayed is the signal quality as shown above (+CSQ: 11,1). This indicates how good the connection is from the radio modem to the cell tower. A value of 10 or more is good. Less than 10 may still work, but connections may be intermittent, or data transfer may take longer due to the number of retries required to get data uploaded.

The data in this window is absolutely required to aid in diagnosing a communications problem with the radio modem, or between the radio modem and the web site. The data in this window may be copied and pasted into an email message or text file to be sent to tech support.

Spare Parts

Part No. **Description**

Electronics

54-0043	MetriNet Antenna
31-0205	MetriNet Internal Antenna Cable