

ECM-1240 User Manual

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Introduction

The ECM-1240 Home Energy Monitor is a multi-channel power meter designed to measure the consumption of residential service panels and/or panel circuits. The measured data is then transferred to a computer or internet server for storage, analysis and real-time display.

The ECM-1240 continually samples current and voltage to calculate true power and energy. This information is then automatically sent to its communication port as often as once per second, depending on the user set parameters.

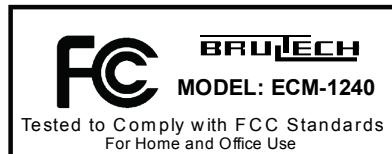
Safety

The ECM-1240 installation requires having current transformers (CT) installed inside the electrical service panel. This portion of the installation MUST be performed by a qualified electrician or individual. The installer must follow all local safety codes and use proper safety practices and equipment.

The qualified installer must be aware that main panels may still contain dangerous voltage levels even though the main breaker is in the "OFF" position.

WARNING: The following rules MUST be obeyed:

1. Any work performed inside the electrical panel must be done by an electrician or qualified individual. This individual will be familiar with the local electrical code and perform the installation accordingly.
2. NEVER install the ECM-1240 unit inside the electrical panel. Only low voltage (12VAC or less) galvanic isolated connections are to be made to the ECM-1240 terminals.
3. The current transformer (CT) leads must exit the electrical panel through an appropriate box connector, strain relief or bushing. The CT leads must be properly anchored on the outside of the panel.
4. The portion of the CT leads inside the panel must not have any damage, cuts or wear to the outside insulation.
5. The CT leads must be routed in such a way that its insulation will not be rubbing against live terminals. Care must be exercised not to pinch the CT leads especially when re-installing the panel cover.
6. Do not install the CTs in panels with voltages greater than 300V.
7. Do not install the ECM-1240 in a wet location.

Compliance:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

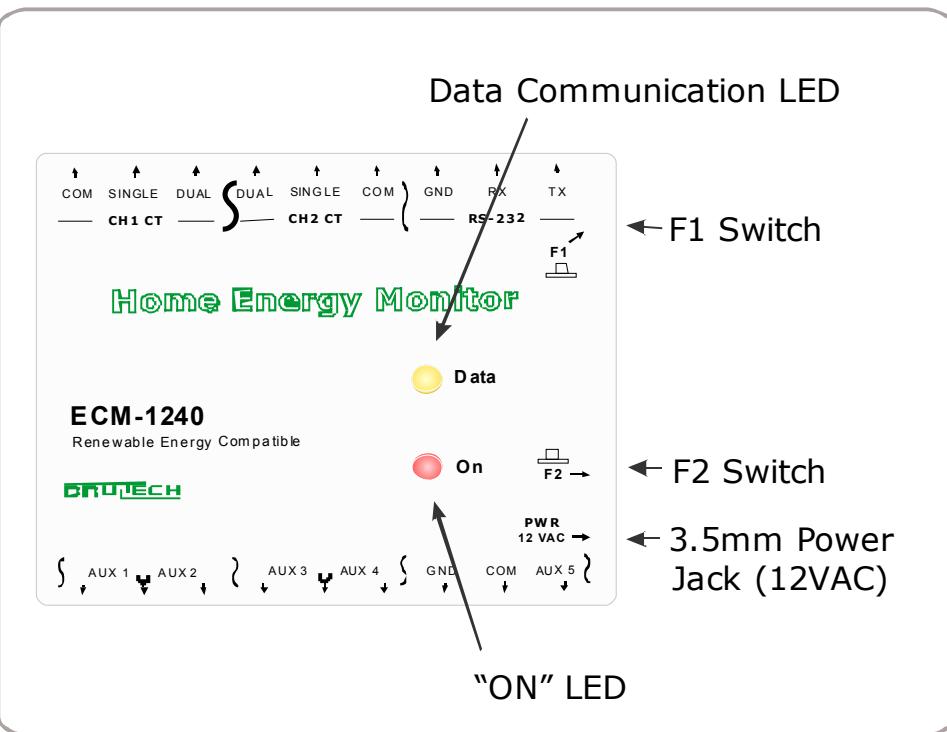
- (1) this device may not cause harmful interference, and
- (2) this device must accept any interference received, including interference that may cause undesired operation.

Wireless Versions:

Contains FCC ID: OUR-XBEE2 (USA) (Wireless Versions Only)

Contains Model XBee ZNet 2.5 Radio, IC: 4214A-XBEE2 (Canada)

The ECM-1240 Device

**DATA Communication LED:**

This yellow LED comes on anytime data is sent or received from either the RS-232 port or via XBee radio.

The DATA LED is also used to indicate when the "THRU" function (explained later) has been deployed.

ON LED:

Under normal operating circumstances, this LED remains "on" as long as the unit is powered. This LED will extinguish momentarily when a PAN discovery is in progress.

The LED will function slightly different for devices with firmware version 1.020 or greater with a wireless XBee radio installed. The red LED will extinguish momentarily each time a packet is sent.

F1 Switch:

This switch is used to allow the ECM-1240 to search and discover a PAN (personal area network). The "F1" switch needs to be pressed for approximately 6 seconds and released to initiate discovery. This switch is also used in the firmware upgrading process.

NEVER POWER THE ECM-1240 UP WHILE HOLDING THIS SWITCH AS THIS WOULD ERASE ALL CALIBRATION VALUES.

F2 Switch (discontinued):

This switch is present on older ECM-1240 models. It has been eliminated. If it is present on your device care should be taken to: NEVER POWER THE ECM-1240 UP WHILE HOLDING THIS SWITCH AS THIS COULD AFFECT CALIBRATION VALUES.

Power Jack:

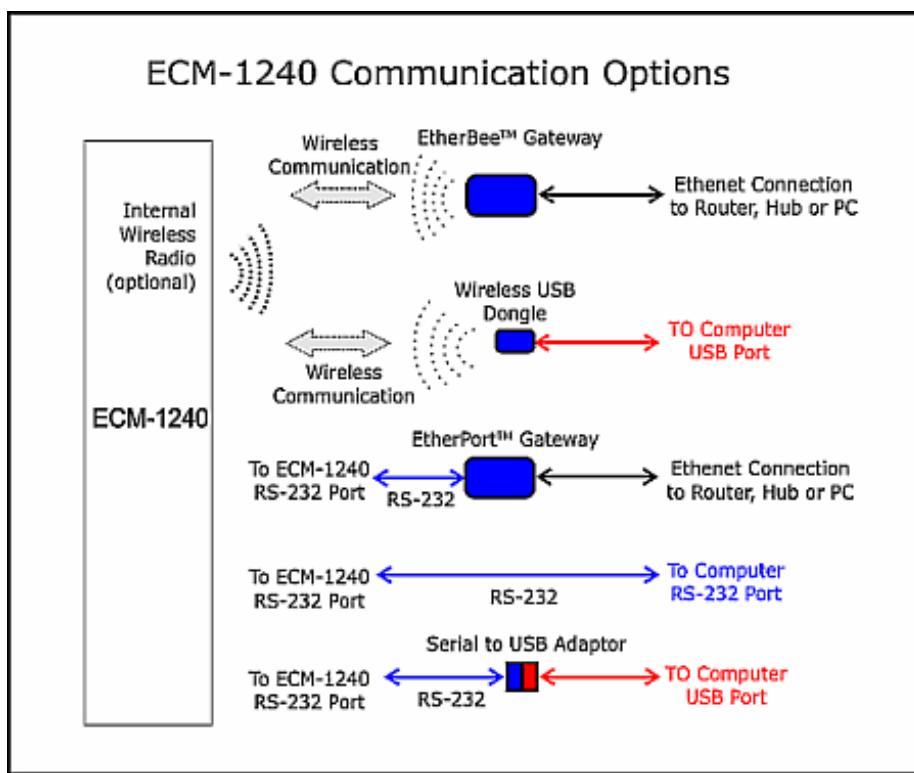
This is a 3.5mm jack in which the 12VAC power supply is plugged into. Only use the supplied wall transformer.

Establishing Communication with the ECM-1240

Overview:

The diagram below displays the various methods of communication between the ECM-1240 and a computer.

Please note that wireless communication is offered as an option.



The ECM-1240 has two hardware communications methods:

- RS-232 port via terminal strip connection
- XBee radio (optional)

Either or both of these methods may be used. The only restrictions are:

1. The XBee radio communication may not be used for ECM-1240 firmware upgrades.
2. Only the RS-232 port may be used to configure the XBee radio.

From the above two options, there are further options for connection to a computer:

1. Serial to USB adaptor
2. Direct RS-232 port
3. EtherPort gateway which provides a serial to Ethernet connection
4. XBee Wireless Dongle which provides XBee wireless to USB connection
5. EtherBee gateway which provides XBee wireless to Ethernet connection

RS-232 Port:

The RS-232 port may be connected directly or indirectly to a computer using one of the following methods:

1. Direct RS-232 connection to computer
2. RS-232 to USB to computer, using a serial to USB adaptor
3. RS-232 to EtherPort to Ethernet (LAN, router, hub, etc) to computer via LAN or internet.

XBee Wireless Communication:

The wireless connection to a computer is accomplished using one of the following methods:

1. XBee Wireless Dongle which provides XBee wireless to USB connection
2. EtherBee gateway which provides XBee wireless to Ethernet connection

If the ECM-1240 is equipped with the wireless option, communication may be accomplished via ZigBee® protocol using a mesh network. The installed radio is a Digi International (www.digi.com) ZNET2.5 module with "ZB" firmware. This radio is programmed as a router device which is to communicate with a coordinator. It is setup with all of the factory default settings except for;

- PAN ID: 345
- Node ID: E3
- Baud: 19200

NOTE: Any of these parameters including firmware versions may be re-programmed by using the "THRU" function to connect the RS-232 port directly to the module.

The Zigbee communication may interface with one of the following:

1. EtherBee™ adaptor which is connected to a LAN/internet via RJ-45 cable and communicates wirelessly with the ECM-1240.
2. A Brultech USB dongle which plugs into a computer and behaves as a wireless RS-232 connection to the ECM-1240. (USB driver required)
3. A third party ZigBee® gateway device.

Regardless of the method used, the ECM-1240 will ultimately communicate via RS-232, Ethernet or both. The configuration software (downloadable from <http://www.brultech.com/ecmsupportupdate.html>) has either communication option available.

Depending on the communication method used, some setup may be required:

1. Direct RS-232 to computer, no setup required.
2. RS-232 to USB requires USB driver installed for the Serial to USB adaptor used.
3. RS-232 to Ethernet (EtherPort) requires the "EtherBee Configuration" software.
4. Wireless Dongle, requires the SiLabs USB driver.
5. Wireless to Ethernet (EtherBee), requires the "EtherBee Configuration" software.

USB driver installation for options 2 and 4 are straightforward. Once installed, the connection will appear as a COM port on the connected computer.

Options 3 and 5 require setting up using the EtherBee Configuration software. (Downloadable from <http://www.brultech.com/ecmsupportupdate.html>)

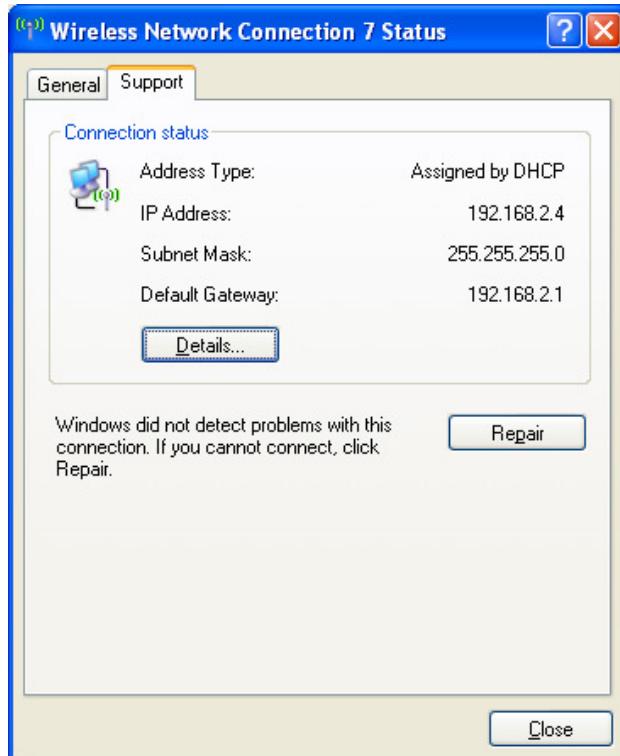
EtherPort and EtherBee Setup:

The following setup is required to establish a TCP/IP connection between the computer and the EtherPort or EtherBee gateway. This may be accomplished with both devices on a common LAN (network) or the gateway may also be connected to the computer's Ethernet port.

Download, install and deploy the EtherBee Configuration software.

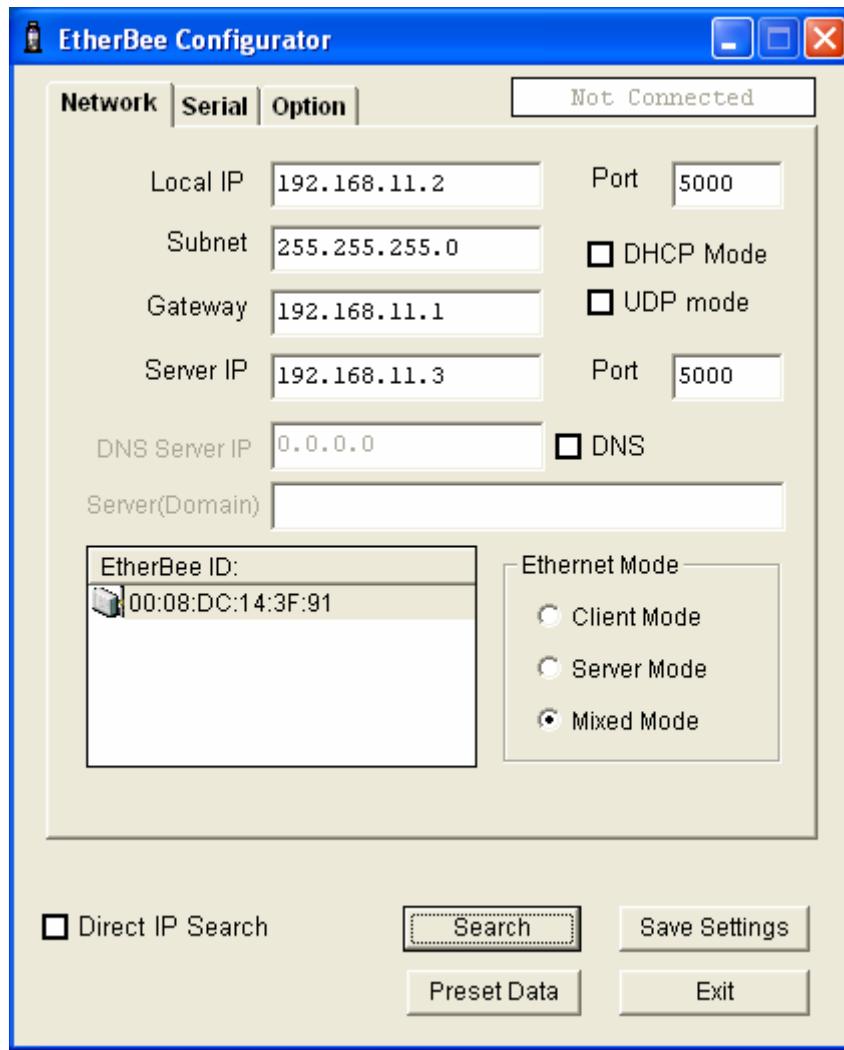
Connect the EtherPort or EtherBee device to a LAN using the RJ-45 Ethernet cable. Power the gateway using the included 5VDC power supply. A green and yellow LED under the gateway's RJ-45 jack should now be lit up.

Determine your computer's IP address. This can be done by double clicking the network icon in the taskbar or clicking "Start", "Run" type cmd then click OK, type "IPconfig /all" and your IP address will be displayed as "192.168.?.?"



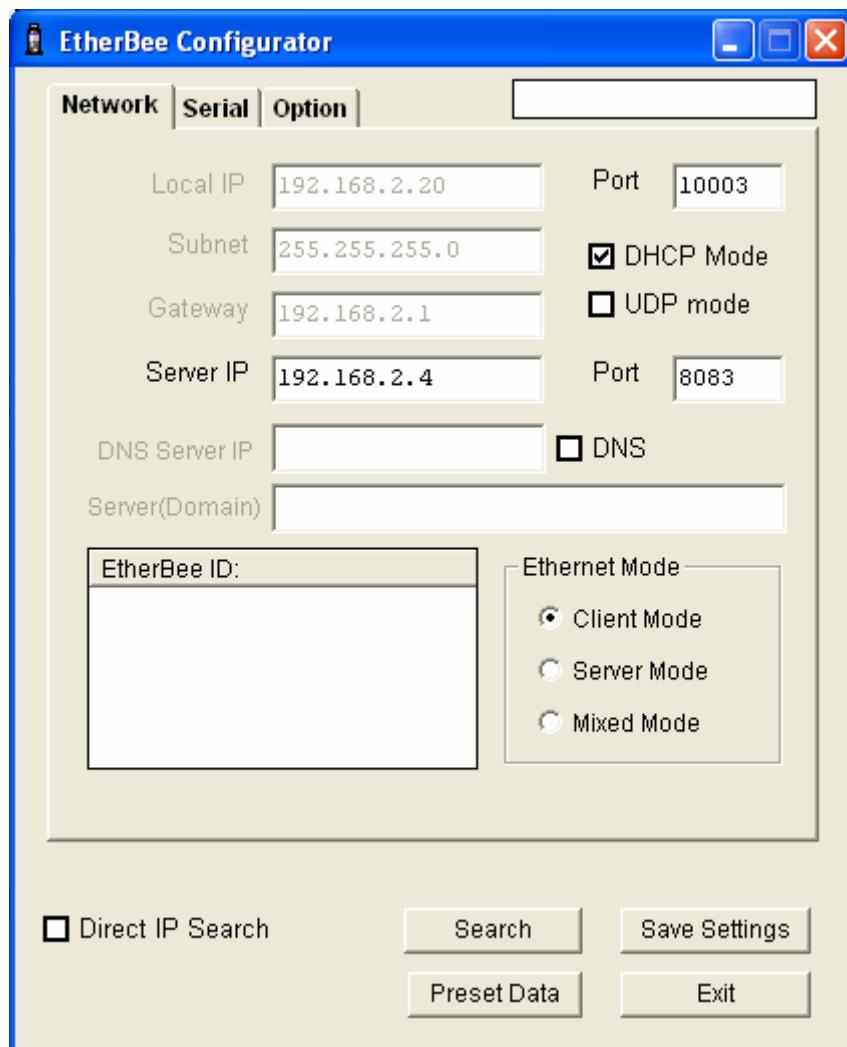
In this case, the computer IP is 192.168.2.4.

On the main window of the configuration software, click "Search". A display similar to that below should appear.



Change the following settings:

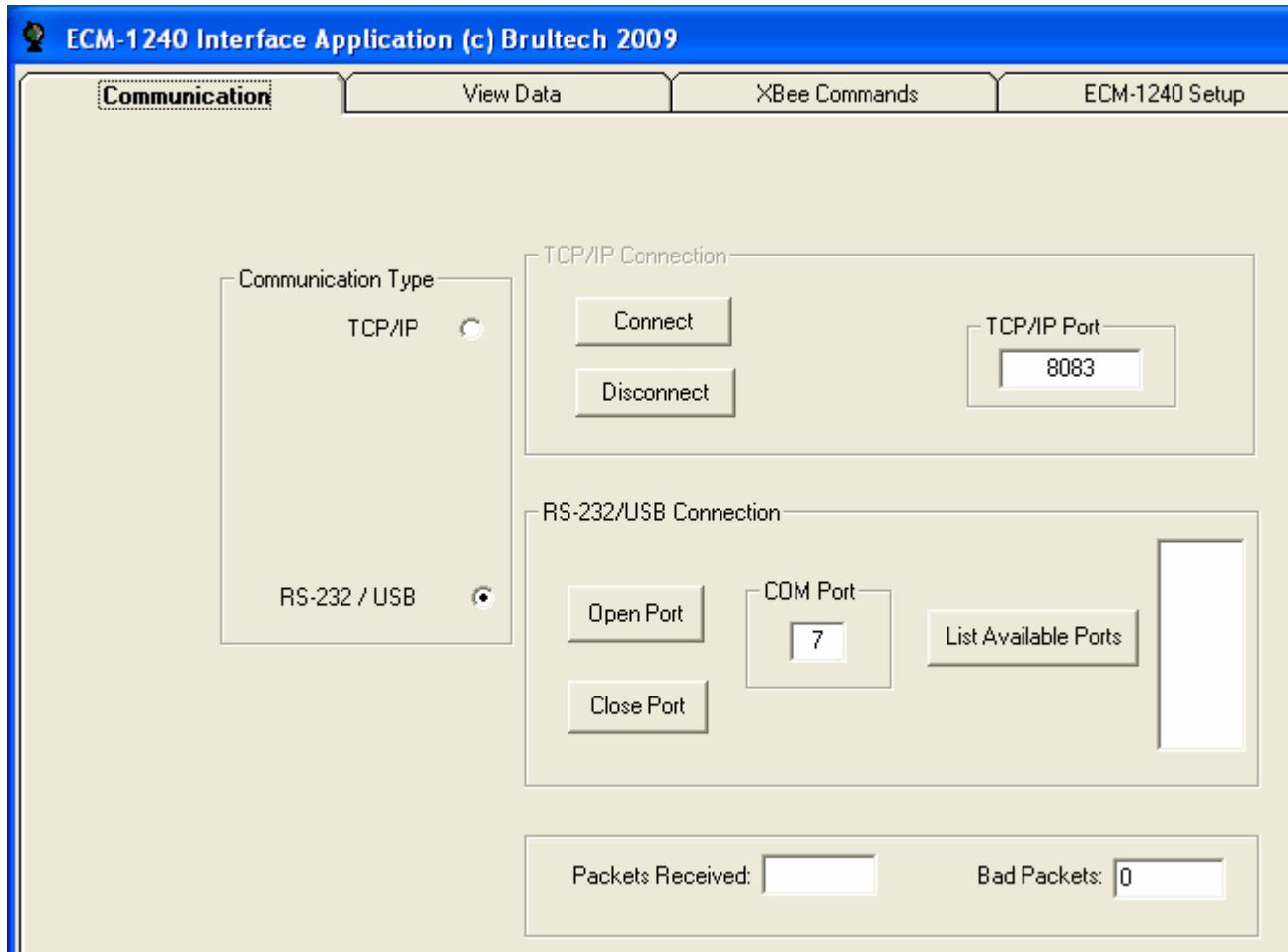
- Enter your computer's IP address in the "Server IP" box
- Enter 255.255.255.0 in the subnet box
- Check the DHCP Mode box
- Enter port 8083 in the box on the right of Server IP.
- Click the "Client Mode" radio button
- Click the Serial tab at the top and change the "Speed" to 19200
- Click the "Option" tab and verify that all box values are "0".
- Click "Save Settings" and verify that the prompt indicates "Successful"



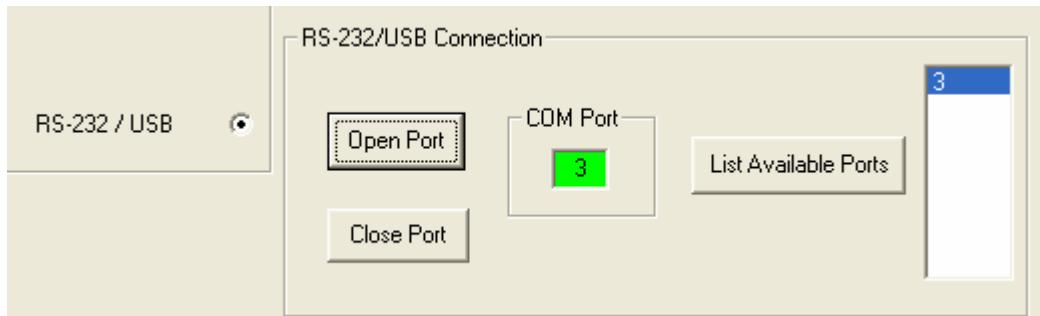
Configuring the ECM-1240 using the IA Software

Download and install the ECM-1240 setup program (ECM-1240 Interface or ECM-1240 Configuration software) from <http://www.brultech.com/ecmsupportupdate.html>

Start the IA software. With the ECM-1240 powered up and communication link connected (RS-232 or Wireless), establish a communication connection using the RS-232 or TCP/IP procedure below.

***Using RS-232 Communication:***

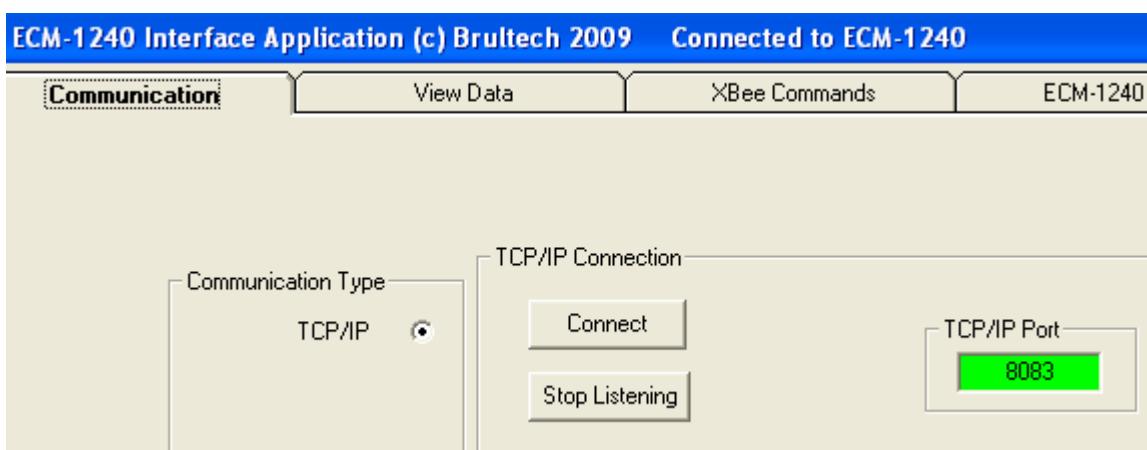
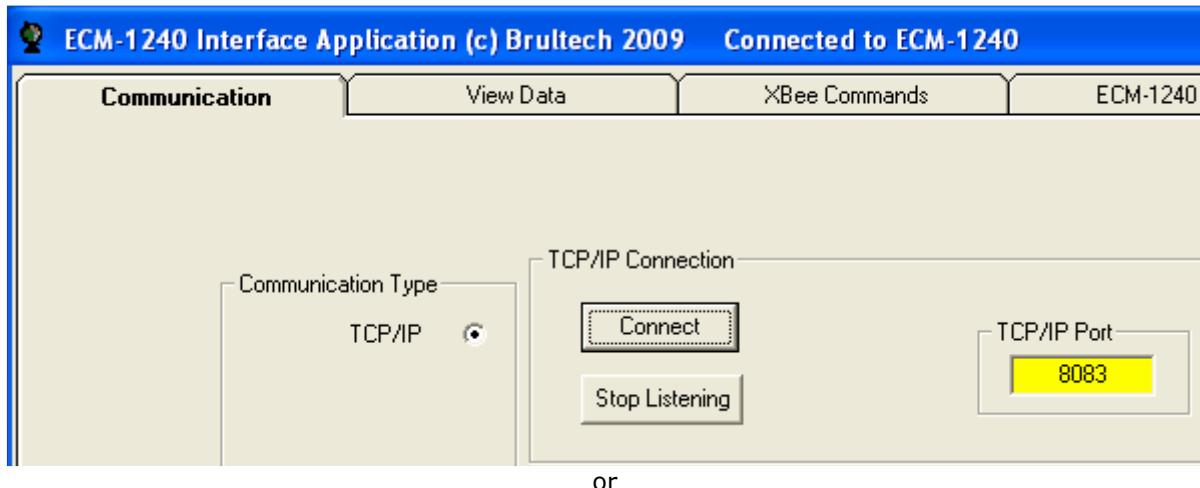
- Make sure the "Communication Type" is set to "RS-232/USB".
- Click "List Available Ports"
- Select from the box, the COM port you are using.
- Click "Open Port" and the "Com Port" box should change to green.



The RS-232 connection is now established. Proceed to "**Connecting to the ECM-1240**".

Using TCP/IP Communication:

- Make sure the "Communication Type" is set to "TCP/IP".
- The TCP port number should match that used in the EtherBee or EtherPort configuration, typically set to 8083.
- Click "Connect". The box will change to yellow or green.



Ultimately, once communication with the ECM-1240 begins, the box would be green.

Making a Communication Connection to the ECM-1240

Click the **XBee Commands** tab. At this point, there may be a string of binary data coming in every time the ECM-1240's yellow LED flashes. If this is not the case and you are communicating wirelessly, then follow the step below for "Discovering the Coordinator". If you are not communicating wirelessly then proceed to "Stop Real-Time Data" below.

Essential Steps for Devices Communicating Wirelessly:

If you are using wireless communication, it is important to have the ECM-1240:

1. **Discover the Coordinator (EtherBee or Dongle)**
2. **Set the "destination node" using XBee AT commands.**

Discovering the Coordinator (EtherBee or Dongle):

The EtherBee or Dongle is configured as a ZigBee coordinator. There is only one coordinator allowed in a Personal Area Network (PAN). The ECM-1240 device is configured as a ZigBee "router". Many "routers" are allowed in a single PAN, reporting to a single coordinator. Initially, each router device must discover the coordinator and connect to the PAN. Once this has been accomplished, the ECM-1240 (router) will always remember which PAN it is associated with, even after power has been interrupted. The "discovery" process may only need to be performed once and may have already been done before your package was shipped.

If you have followed the steps and are now receiving data via the IA software (under the "**XBee Commands**" tab), you may proceed to the next step "**Setting the Destination Node**".

The procedure for discovering the coordinator is as follows:

With the EtherBee or Wireless Dongle connected and the ECM-1240 in close range and powered up, press the F1 button of the ECM-1240 for approximately 6 seconds then release it. The ECM-1240 LEDs should go dark for a moment of time and come back on once this step is completed. This may take 30 seconds or so. Once the red LED comes back on, the ECM-1240 should have discovered the EtherBee or Dongle.

After having completed this step, click the "XBee Commands" tab. Wait approximately 30 seconds. There should be a string of binary data being displayed every time the ECM-1240's yellow LED flashes.

Setting the Destination Node:

Once the coordinator has been discovered and the IA software is receiving live packets, your next step will be to assign a destination node before sending any setup commands to the ECM-1240.

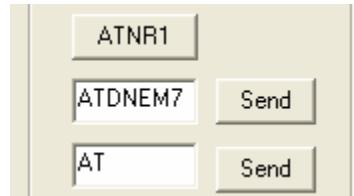
This is simply a method of selecting the device which is to respond to the ECM-1240 setup commands. Once this has been issued, it does not need to be repeated for subsequent commands unless the power has been interrupted at some point in time. This procedure is generally only required when initially configuring the ECM-1240 device for the first time.

Setting the destination node is accomplished by clicking the “+++” button of the software and waiting for an “OK” response (IA software with “XBee Commands” tab active). Within a few seconds of obtaining the OK response, the ATDNE3 button should be clicked and an “OK” response received (a different value other than ATDNE3 may be required depending on the ECM-1240 XBee Node ID. See below*)

If this last step was successful, wait a few seconds then proceed with the following sequence:

1. Click “+++” button.
2. Wait for “OK” response.
3. Click ATWR button (saves to non-volatile memory)
4. Wait for “OK” response
5. Click ATCN button. (exits AT mode)

*Clicking the “ATDNE3” button assumes that the ECM-1240 radio is set to its default Node ID of “E3”. Since this value may be altered, the ECM-1240’s Node ID may be inserted in a spare box which would be used instead of the “ATDNE3” button. For example if the ECM-1240’s node ID had been previously changed to EM7 then the command would now be “ATDNEM7” instead of “ATDNE3”



Click the “ECM-1240” tab, then click “Read Settings” button. A list of all the parameters should appear. This may take a couple of tries.

Stop Real-Time Data:

Click the “Stop Real-time” button on the top right. The yellow LED on the ECM-1240 device should then stop flashing every second.

Click the “ECM-1240” tab, then click “Read Settings” button. A list of all the parameters should appear. This may take a couple of tries.

Setting the ECM-1240's Configuration

When making adjustments to the ECM-1240's configuration, it is recommended to halt the real time data transmission by clicking the "Stop Real-Time" command button. Remember to re-enable it when you are done with the configuration changes. Click the "Start Real-Time" button to enable real time data transmission.

CH1 or CH2 CT Setting

If your installation consists of two series connected "split-core" CTs, click the "Dual" button, otherwise the "Single" button should be active and a single CT connected.

Select the CT model type connected to this channel. If a different type is used, contact support@brultech.com for additional information.

Click the "Accept" button.

Number of MicroCTs:

Depending on the number of MicroCTs connected to a given AUX channel, a slight adjustment is required for the ECM-1240 to properly read the connected loads. This is done by inserting a number corresponding to the number of connected CTs on that particular channel.

When complete, click the accept button.

AUX 5 Input:

The AUX 5 channel may be used for purposes other than energy monitoring. Select the desired configuration and click "Accept"

PT Setting:

The PT setting is typically set to type230, range3. No change is required unless a separate PT is used on the optional PT input.

Packet Trigger Power:

This is the configuration for one the ECM-1240's unique features. This prevents data packets from being transmitted needlessly if there are no serious changes in power and causes packets to be sent should an "on" or "off" load transition event occur. The "Trigger" value is a threshold value of power which will cause a packet to be sent immediately.

For example, if set to 70 watt, cycling a 60W lamp would not trigger the monitor to send a packet immediately, however, a 100 watt lamp would.

Typically the sent packets caused by a trigger may come in a group of two or three over the following two or three seconds following the detected load transition. The reason being that the original power value before the trigger took place is sent, followed by the value causing the trigger which could take an additional second to ramp up or down to its new state.

The triggered packet send is only affected by changes in CH1 or CH2. Typically one of these channels would be monitoring the entire panel and therefore detect a change in any of the load connected to it.

Packet Send Interval:

The packet send interval is a set amount of seconds between packet sends. If this value is set to "5", then every five seconds a packet will be transmitted.

This interval time may be overridden by a triggered send. For example, if set to 30 seconds, packets are sent every 30 seconds unless a power change greater than the trigger threshold occurs. A trigger will cause the packet to be sent immediately then reset the interval timer so that with no additional power transition, the next packet would be sent exactly 30 seconds after the triggered packet has been sent.

Device Serial Number:

This is a unique serial number assigned to each device. Its value is sent as part of the packet to identify the source of the packet should multiple devices be reporting to a single destination. This would be the case for sending data to a hosting website, or if several energy monitors be used in a single dwelling.

"THRU" Function: ("Serial to XBee" button under the XBee Command tab)

This function stops the ECM-1240 operation and connects the RS-232 line to the XBee module. This provides a means of upgrading the XBee firmware or changing its parameters.

When set to THRU mode, communication baud is strictly dependant on that of the XBee module.

To exit this mode, the power to the ECM-1240 needs to be cycled.