Serial-to-Wireless Digi Modem for Tank Monitor to FMU Communications

IMPORTANT	Modems will come preconfigured from Syntech. Each kit contains two modems that are paired to one another.

The Digi XBee-Pro 900HP RF Modem is a RS232 Serial-to-RF device that is used to convert the wired connection between the FMU and the TMU (or ATG) console to a wireless connection.

Figure 1. Digi XBEE Serial-to-RF Modem Devices

Figure 2. External Antenna

Figure 3. Internal Antenna

Equipment

The device includes an AC/DC adapter that must be plugged into 120VAC power outlet.

The radio modem is operable in temperature ranges from -40º F to 185º F. It must be installed either inside an FMU, or in a weatherproof box attached to or in close proximity to the FMU. The radio is not approved for installation in Class I Division 1 or 2 locations, so they must be installed not closer than 18 inches from a Class I Division 1 or 2 fuel dispenser, and at least 18 inches above grade level when installed within 20 feet of a Class I Division 1 or 2 fuel dispenser. The radio modem is certified by FCC, UL, and CE.

The internal antenna supplied with the radio modem has supported communications to 200 feet when the radio modem is installed inside an FMU cabinet. Greater distances are possible when the included external antenna is used.

Syntech Part Numbers

191F0223: WIRELESS TMU KIT, DIGI XBEE SERIAL-TO-RF MODEM

Part Name	**Part Number**
Digi XBEE RF Modem	266532
External Antenna Adapter Cable	266548
900MHz External Antenna	266558
FMU-to-Modem Cable	191F0221
TMU-to-Modem Cable	191F0222
Hardware for attached cables to modem	252611

NOTE In some cases, a remote antenna kit may be needed to ensure even greater distances or to prevent interference.

Kit #	**Description**
191F0231-100	Remote Antenna Kit, OMNI. 900MHz, 100 FT
191F0231-75	Remote Antenna Kit, OMNI. 900MHz, 75 FT
191F0231-50	Remote Antenna Kit, OMNI. 900MHz, 50 FT
191F0231-40	Remote Antenna Kit, OMNI. 900MHz, 40 FT
191F0231-25	Remote Antenna Kit, OMNI. 900MHz, 25 FT
191F0231-20	Remote Antenna Kit, OMNI. 900MHz, 20 FT

These kits include a new adapter cable, an antenna cable, a new antenna, and an L-bracket antenna mount. The distance specified in the kit is the distance between the FMU and where the remote antenna is located. For example, if the antenna needs to be mounted 50 feet away from the FMU, order the 191F0231-50 kit.

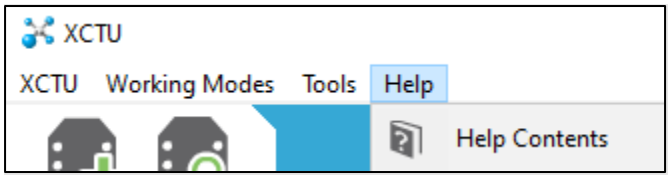
Configure the Modem

NOTE If you order the 191F0223 kit, both modems are preconfigured. These settings have already been applied. If you order a replacement modem, use the instructions below to pair the new modem to the existing modem.

1 Visit https://www.digi.com/products/embedded-systems/digi-xbee/digi-xbee-gateways/xbee-pro-900hp-rf-modems#productsupport

2 Download configuration software from Digi website under Product Support > Utilities > Download XCTU.

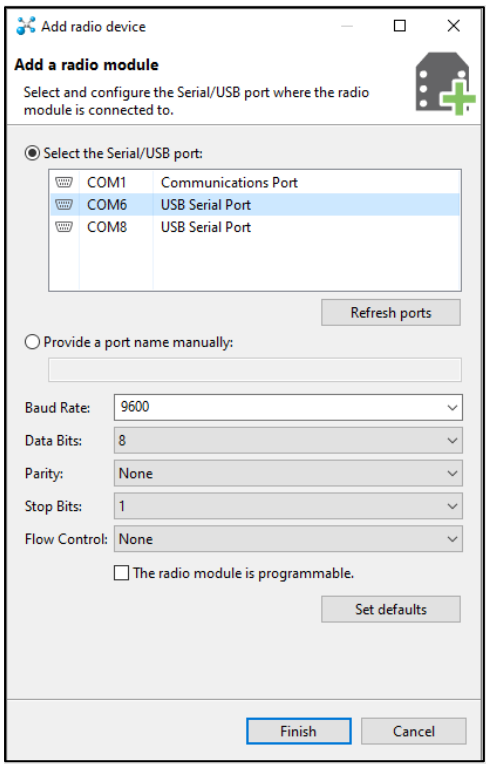
NOTE Once the software is installed, you can find a detailed software user guide by selecting Help > Help Contents from the main software menu.



3 Attach first XBEE RF Modem to your PC via USB. The radio is powered by the USB cable, so you do not need to use the plug-in AC adapter.

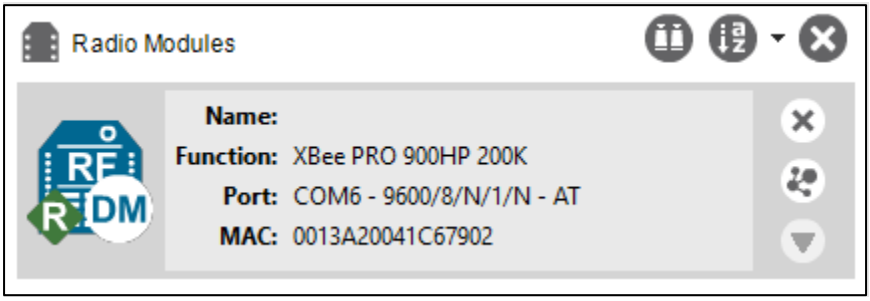
4 Attach the RF antenna.

5 Select Add a radio module from the toolbar. The Add a radio module dialog opens.



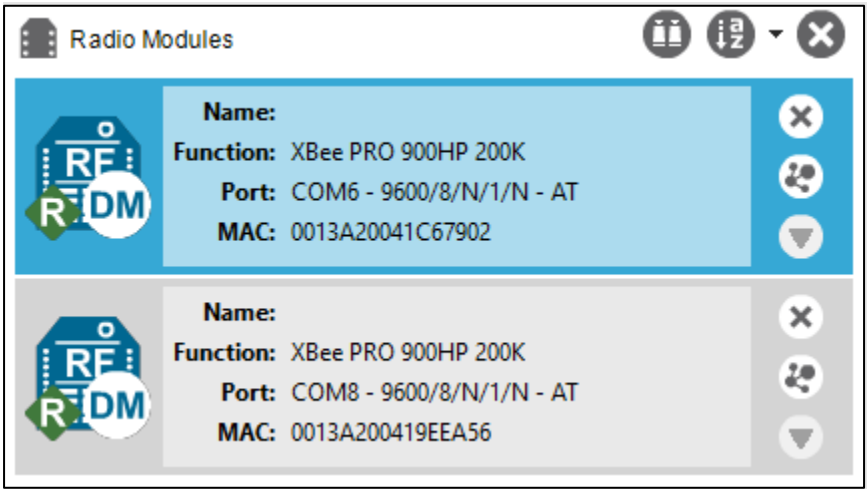
6 Select the serial port where the radio module is connected (or enter its name manually), and configure the serial settings of the port.

7 Select Finish to add the radio module to the list of radio modules. If the settings were configured correctly and the radio module was connected to the selected port, the module is displayed in the device list.



8 Perform the same steps listed above to add the other RF Modem.

NOTE You should now see both RF modems in the Radio module list.

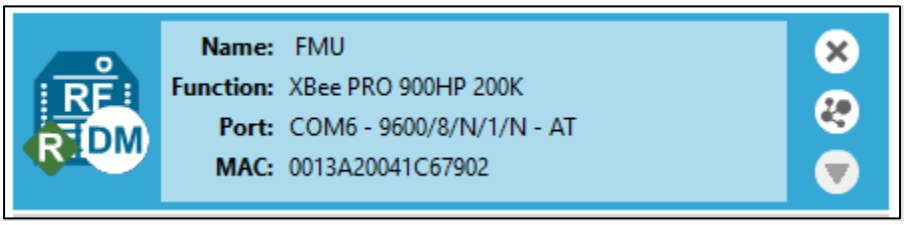


Name/Capture 1st Radio

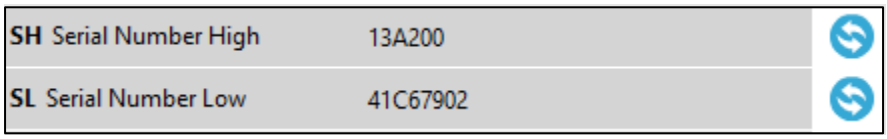
1 Select the first radio in the list. It will turn blue.

2 Under Addressing Section, create a name using the Node Identifier parameter. Used to easily identify modules, the field allows up to 20 ASCII characters.

3 Select Write module settings to save the firmware values to the module. You can now see this name displayed on the modem in the device list.



4 Also, under the Addressing Section, find the serial number of the modem.



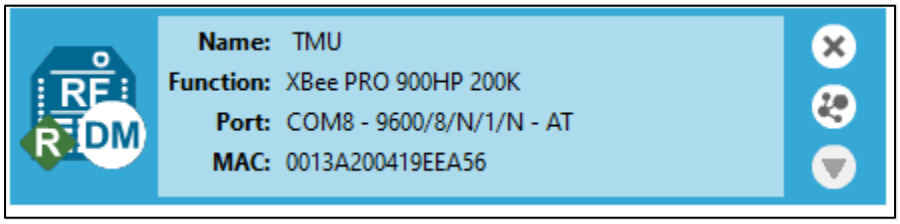
5 Write down or copy and paste these numbers to save them for later.

Name/Capture 2nd Radio

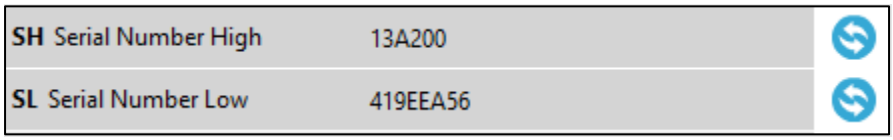
1 Select the 2nd radio in the list. It will turn blue.

2 Under Addressing Section, create a name for the device to help easily identify modules. The node identifier string for this module can be up to 20 ASCII characters. This value is returned in a ND query.

3 Select Write module settings to save the firmware values to the module. You can now see this name displayed on the modem in the device list.



4 Under the Addressing Section, find the serial number of the modem.



5 Write down or copy and paste these numbers to save them for later.

Configure FMU Radio

1 Select the first radio in the list. It will turn blue.

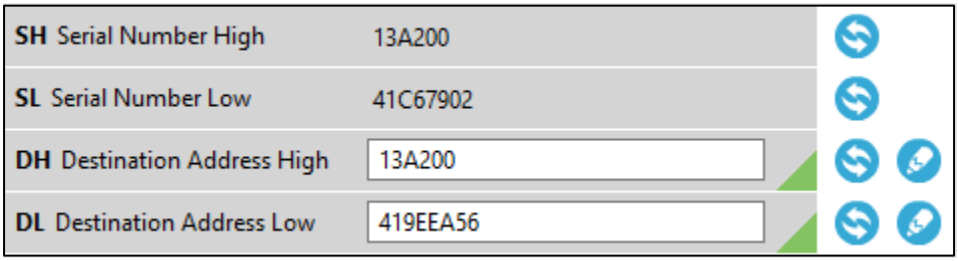
2 Under MAC/PHY Settings, update the network ID to a custom ID. Range: [0x0- 0x7FFF). Only modules with matching IDs can communicate with each other.

NOTE This must be the same as the other XBEE RF modem that it is communicating to.

For this example, we will set it to 1111.

3 Select Write module settings to save the firmware values to the module.

4 Under Addressing Section, save the serial number, previously captured from the other radio, to the destination address.

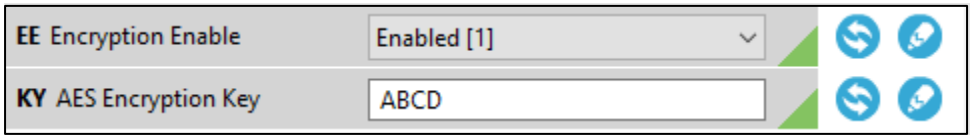


5 Select Write module settings on both rows to save the firmware values to the module. Ensure both triangles change from green to blue.

6 Under Security Section, setup the RF encryption.

7 Enable encryption and set the AES encryption key.

NOTE This must be the same as the other XBEE RF modem that it is communicating to.



8 Select Write module settings on both rows to save the firmware values to the module. Ensure both triangles change from green to blue.

Configure TMU Radio

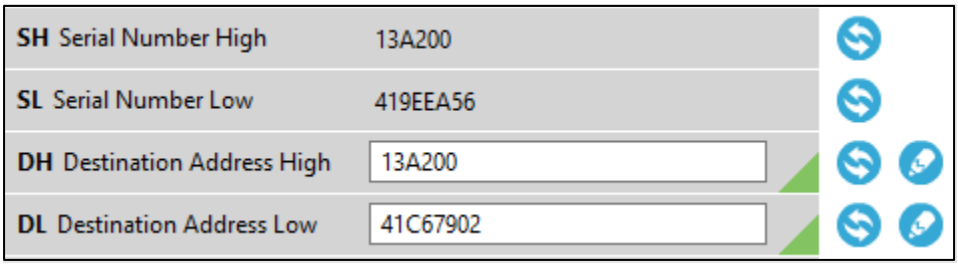
1 Highlight (select) first radio in the list. It will turn blue.

2 Under MAC/PHY Settings, update the network ID to a custom ID. Range: [0x0-0x7FFF). The network ID. Only modules with matching IDs can communicate with each other. When receiving a packet this is checked after the preamble ID. If using OEM network IDs, 0xFFFF will use the factory value.

NOTE This must be the same as the other XBEE RF modem that it is communicating to. For this example, we will set it to 1111.

3 Select Write module settings to save the firmware values to the module.

4 Under Addressing Section, save the serial number, previously captured from the other radio, to the destination address.

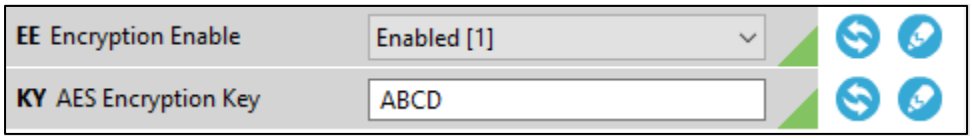


5 Select Write module settings on both rows to save the firmware values to the module. Make sure both triangles change from green to blue.

6 Under Security Section, setup the RF encryption.

7 Enable encryption and set the AES encryption key.

NOTE This must be the same as the other XBEE RF modem that it is communicating to.



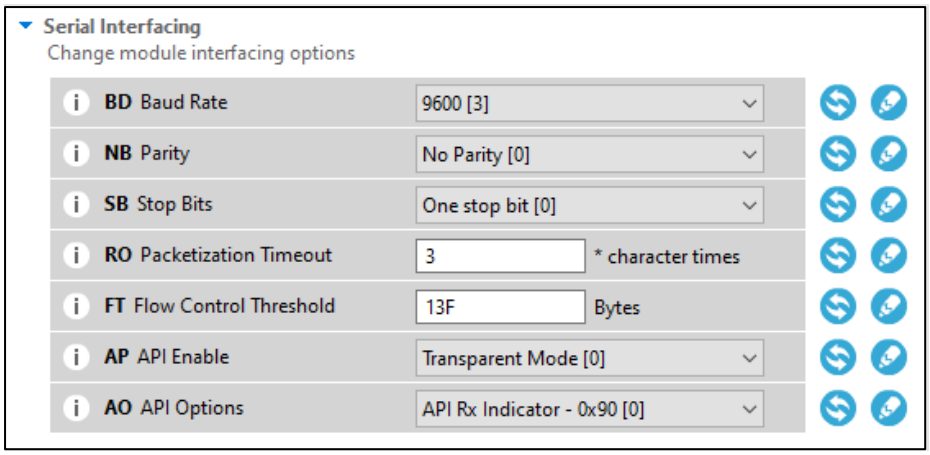
8 Select Write module settings on both rows to save the firmware values to the module. Make sure both triangles change from green to blue.

Serial Communications Settings

The default serial communications settings are 9600/8/N/1. Baud rate: 9600 ; Data Bits: 8 ; Parity: No Parity ; Stop Bits: 1

WARNING Both the FMU and the TMU must be configured to use these settings. Otherwise, the units will not communicate correctly. For the FMU, this can be done in the software: FM*Live* or in FMPlus (Legacy).

Most TMUs support the default rate, however, if the TMU does not, you must change the Serial Communications settings under the Serial Interfacing menu.



Confirm Radios can communicate

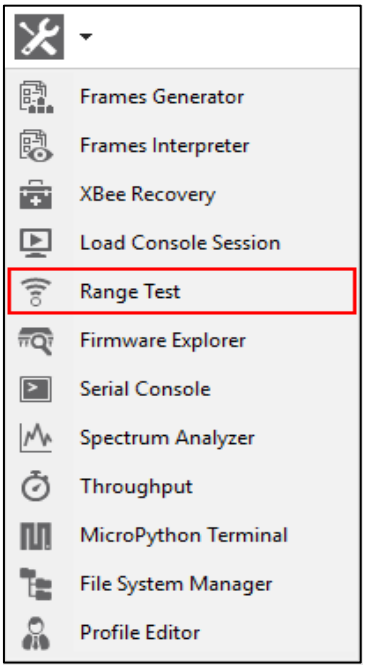
On the FMU radio, select Network  to discover radio nodes in the same network.

If the TMU radio is discovered, radios are configured correctly. If not, go back through the settings and confirm everything is configured correctly.

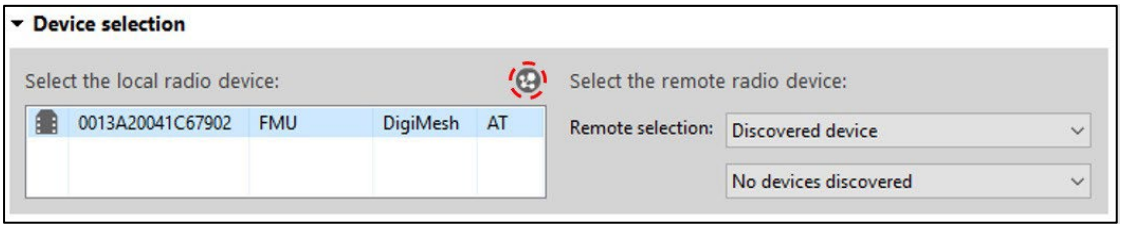
Range Test (Optional)

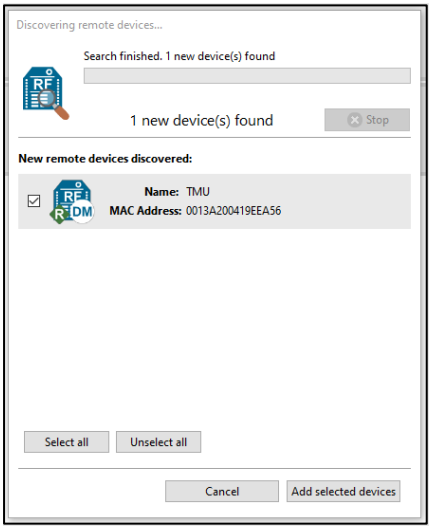
Perform a range test to measure the performance of the devices before installation or for troubleshooting. For more detailed information, see the Range test tool under the XCTU tools page on the Digi website.

1. Plug in one Digi Modem (FMU) via USB to your computer.
2. Ensure the radio is added to XCTU.
3. Disconnect the USB cable from the TCM Digi Modem, and move it a few feet away from the FMU Digi Modem; then, connect power supply.
4. Ensure antennas are installed on both devices.
5. Select Range test from the Tools drop-down menu on the main toolbar.



6 Select the local radio device and network  to discover radio nodes in the same network.

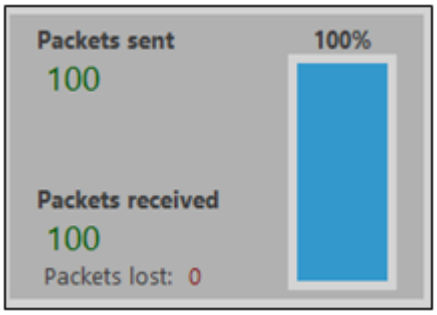




7 Add the selected device.

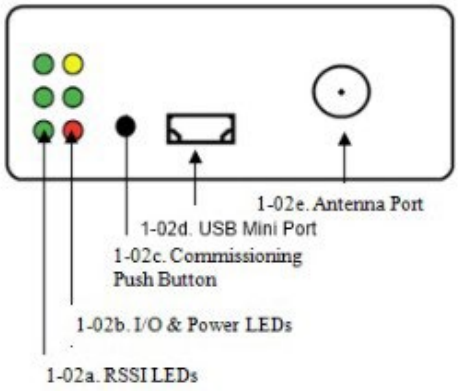
8 Start the range test by selecting Star Range Test: 

. On a perfect test, you would have 100 packets sent and 100 packets received.



TIP	If there is high packet loss, you may need move the antenna on one or both the devices. The kit comes with a remote antenna option that allows the antenna to be mounted up to 12 inches from the modem. If you are using this setup and it still isn't working, add an extension cable, and mount the antenna in a better location.

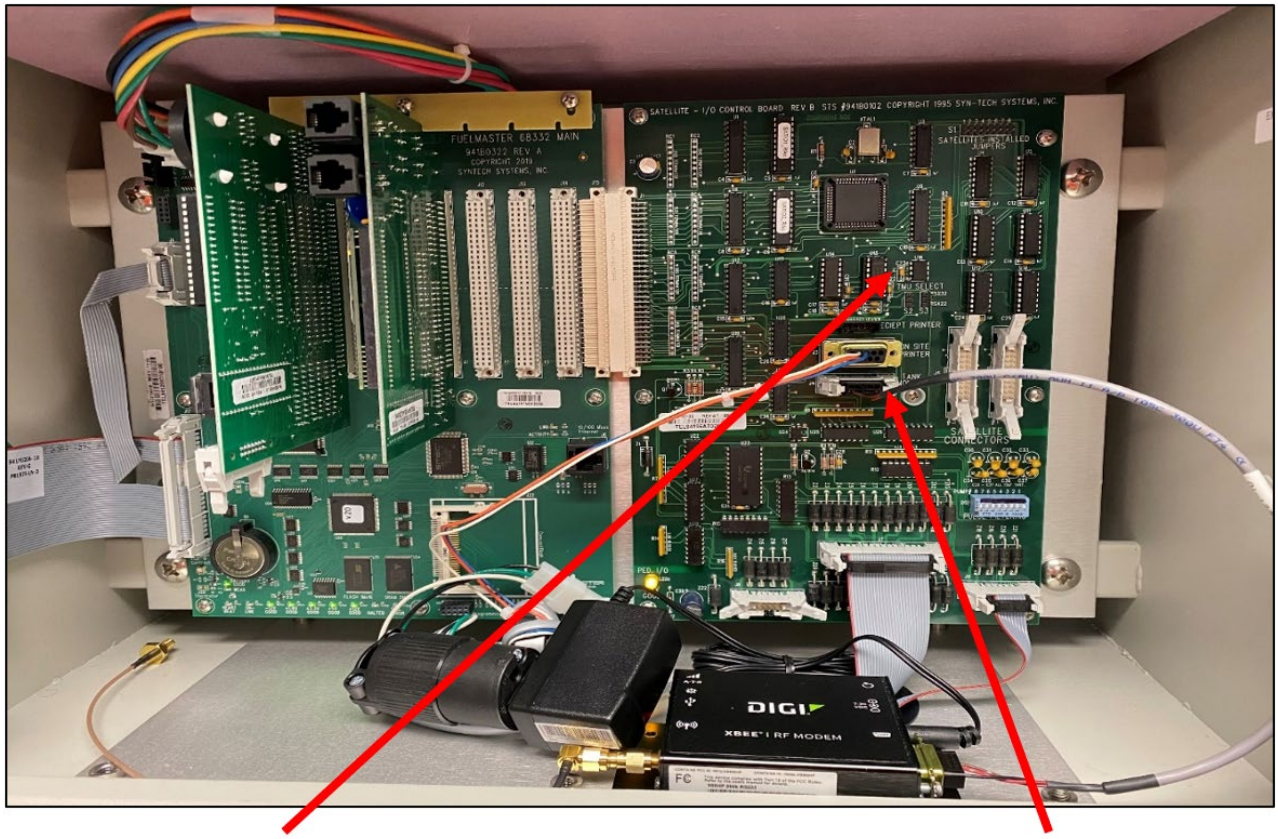
LED Description

Back view of the RS-232 interface	Description
	1-02a. RS-232 RSSI LEDs RSSI LEDs indicate the amount of fade margin present in an active wireless link. Fade margin is defined as the difference between the incoming signal strength and the modem's receiver sensitivity. 3 LEDs ON = Very Strong Signal (> 30 dB fade margin) 2 LEDs ON = Strong Signal (>20 dB fade margin) 1 LED ON = Moderate Signal (>10 dB fade margin) 0 LED ON = Weak Signal (<10 dB fade margin) 1-02b. RS-232 I/O and Power LEDs LEDs indicate RF modem activity as follows: Yellow (top LED) = Serial Data Out (to host) Green (middle) = Serial Data In (from host) Red (bottom) = Power/TX Indicator (the red light is on when powered, off briefly during RF transmission) 1-02c. RS-232 Commissioning Push Button The commissioning push button provides a variety of simple functions to aid in deploying devices in a network. See "Commissioning Push-button" in the XBee-PRO 900HP/XBee-PRO XSC RF Modules Product Manual for more detail. 1-02d. RS-232 USB Mini-B Port When the USB Mini-B is plugged in, all RS-232 communications to and from the XBee are disabled. The USB is to serve as a configuration port. The XBee should not transmit when the USB is plugged in. 1-02e. RS-232 Antenna Port The antenna port is a 50? RF signal connector for connecting to an external antenna. The connector type is RPSMA (Reverse Polarity SMA) female. The connector has threads on the outside of a barrel and a male center conductor.

Legacy FMU Tank Monitor Loopback Test

1 Remove USB cable from Digi RF Modem.

2 Connect RS-232 Serial Cable from Digi RF Modem to Tank Monitor on SAT I/O board of Legacy FMU.



3 Install jumpers on SAT I/O board for RS232.

4 Connect 9V DC power supply to Digi RF Modem.

5 Turn on the FMU.

6 Set second RF Modem (Tank Monitor side) a few feet away from the FMU.

7 Connect RS-232 Red wire (TXD) to Green wire (RXD).

8 Connect FMU using Procomm.

9 Type command 5A; then, hit Enter to set up parameters as follows:

   a Tank Monitor Interface: Enabled

   b TMU Data Format: 8, N, 1

   c TMU Baud rate: 9600

10 Save the configuration.

11 Type command 99; then Enter. Procomm will display any keys you type on the keyboard now.

12 Label “FMU” for the FMU Modem and “Tank Monitor” for the Tank Monitor Modem.

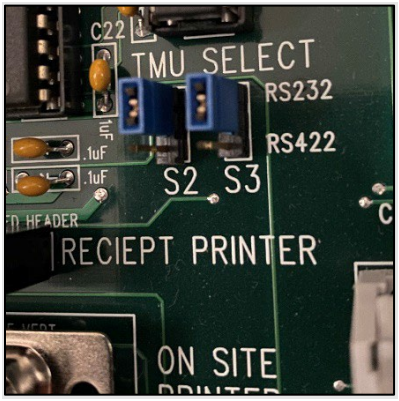
Main Items to be Configured Before Shipping Out

- **Network ID:** 1111 for both modems
- **Destination Address High**: Unchanged, same address for both modems
- **Destination Address Low**: Enter “Serial Number Low” from the other modem here
- **Nole Identifier:** FMU or TMU
- **Encryption Enable:** Enable [1]
- **AES Encryption Key:** ABCD
- **Serial Interfacing Setting:** 9600-8-N-1

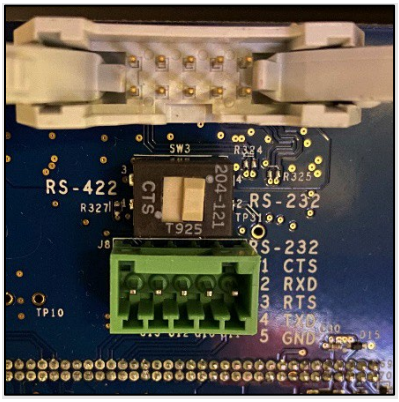
Installation

For the FMU side, the modem must be installed inside the FMU cabinet or another weatherproof enclosure. Check space constraints early when planning the installation. Additional space may be necessary depending upon the application.

On a Legacy FMU (non-FMLive), verify jumpers are installed as required on the Satellite I/O Control Board at positions S2 and S3, TMU SELECT, and both jumpers are in the appropriate RS232 positions – the top two headers.



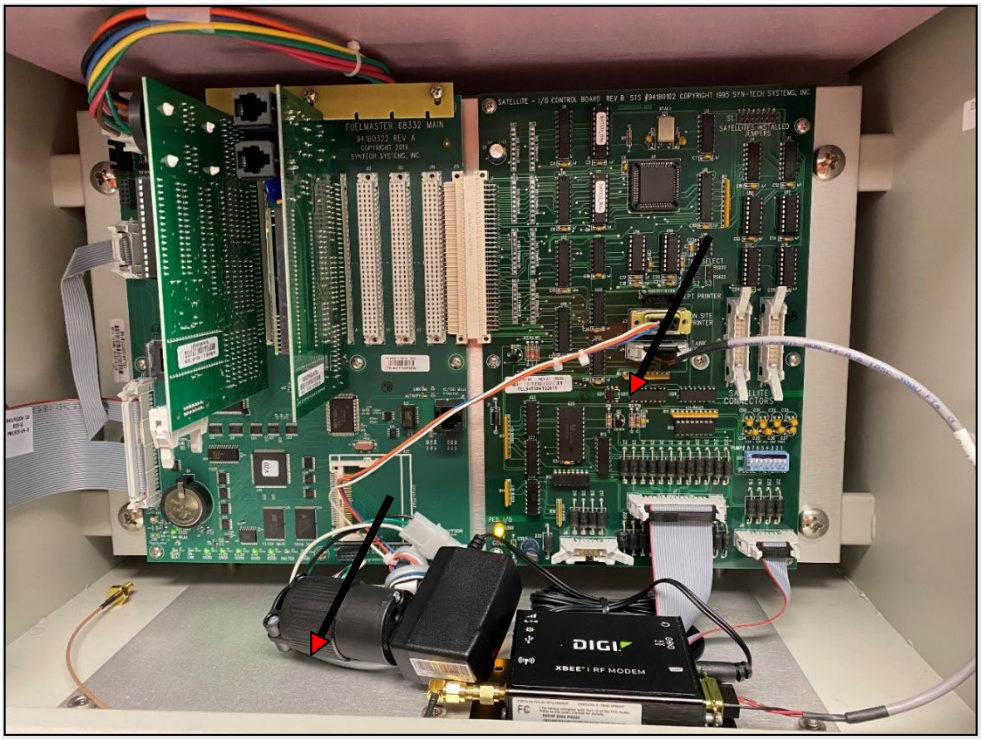
On an FMLive FMU, verify the switch underneath the Tank Monitor connector is slid to the right. This selects RS-232.



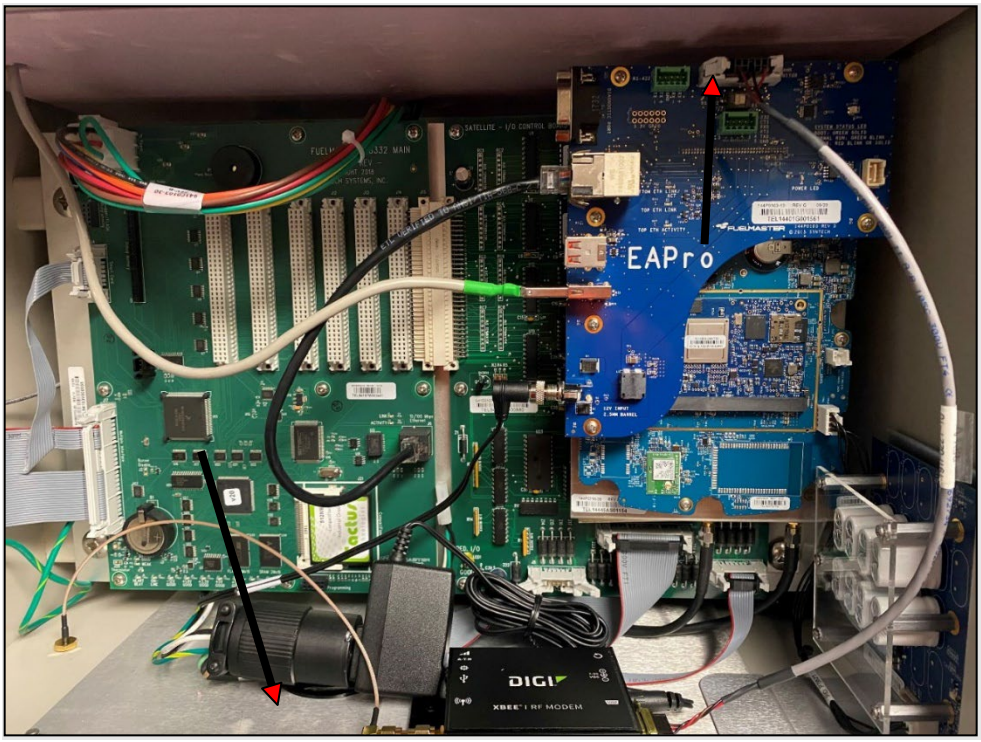
Connect the AC adapter into the internal AC power receptacle inside the FMU cabinet. If the FMU does not have one, you can order one from Syntech – STS# 178802A.

Connect the FMU-to-Modem Cable to:

- Legacy: Tank Monitor connector in the middle of the the SAT I/O board.
- FM*Live*: Tank Monitor connector at the top of the EAPro board.



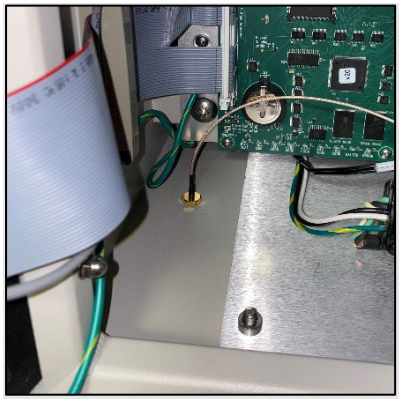
Legacy FMU

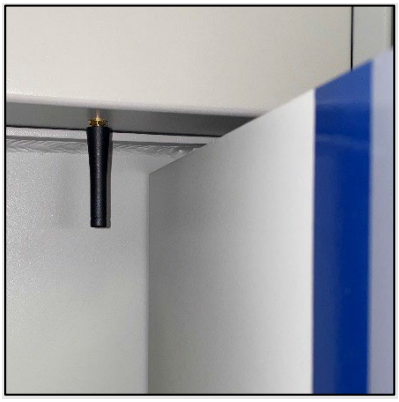


FM*Live* FMU

An internal antenna is included with the modem but it is recommended to install the external antenna because it improves the RF performance of the modem.

You can install the external antenna adapter cable anywhere on the FMU that is out of the way. A common location is facing down in the left side of the cabinet. When installing here, care must be taken to ensure the antenna is installed behind the pedestal door. Otherwise you could damage the antenna when opening the door.





Install the Radio Modem in or near a Tank Monitor

1 Verify the tank monitor power switch is off.

2 Verify an RS-232 input/output board is installed in the tank monitor.

3 Determine a suitable mounting location for the radio modem. Connection to the tank monitor will be to an RS-232 port in the control panel. Most control panels are mounted indoors, so weatherproofing should not be a factor. The radio modem does not require heating, but the standard Zlinx must be protected from rain and snow. Consider visibility of the indicator lights on the radio modem when selecting a mounting location.

4 Affix the radio modem to its mount location.

5 Most tank monitors utilize pins: 2 (transmit), 3 (receive), and 7 or 5 (ground) for RS-232 communications. Connect the TMU-to-Modem cable from the radio modem to the tank monitor as follows:

Signal	TMU-to-Modem Wire Color	TMU RS-232 Port (DB9)	TMU RS-232 Port (DB25)
TMU RX	Green (or Brown)	Pin 3	Pin 2
TMU TX	Red	Pin 2	Pin 3
GROUND	Black	Pin 5	Pin 7

6 Connect the AC adapter into the internal AC power receptacle.

7 Turn the FMU and tank monitor power switches ON.

8 Test the connection. If the radio modems do not communicate, try reversing the from Rx to Tx serial connections. If this still doesn't work, try performing a range test as described above.

TIP If any questions arise, contact Syntech Systems, Inc.'s Customer Satisfaction Center (CSC) at 1-800-888-9136, ext. 2, or email support@myfuelmaster.com.

Change Log

Date	Description
12/1/2020	Original
07/01/2021	Modified title to include “Digi”. Under Configure FMU Radio and Configure TMU Radio, modified the following step: Under Addressing Section, save the serial number, previously captured from the other radio, to the destination address.
08/26/2021	Under Configure the Modem, modified the following steps: Attach first XBEE RF Modem to your PC via USB. The radio is powered by the USB cable, so you do not need to use the plug-in AC adapter. Attach the RF antenna. Under Range Test (Optional), modified the following steps: Plug in one Digi Modem (FMU) via USB to your computer. Ensure the radio is added to XCTU. Disconnect the USB cable from the TCM Digi Modem, and move it a few feet away from the FMU Digi Modem; then, connect power supply. Added Legacy FMU Tank Monitor Loopback Test section.
9/16/2021	Removed section on Line of Sight as it is no longer necessary with Digi Modem.
11/5/2021	Under Syntech Part Numbers, added section on remote antenna kits.