

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.

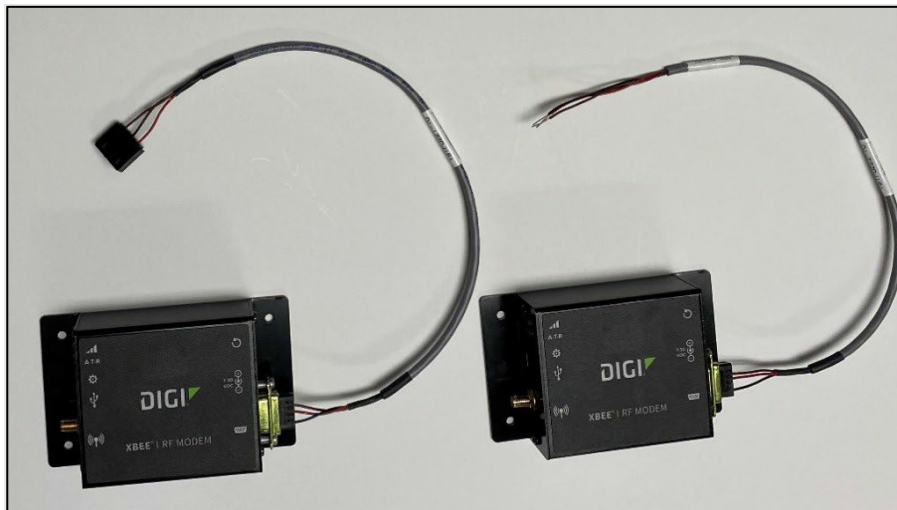


Figure 1. Digi XBEE Serial-to-RF Modem Devices



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 -40° F to 185° F and must be installed either inside an FMU or in a weatherproof box attached to, or near to, the FMU. The radio is not approved for installation in Class I, Division 1 or Division 2 locations, so it must be installed no closer than 18 inches from a Class I Division 1 or Division 2 fuel dispenser and at least 18 inches above grade level when installed within 20 feet of a Class I Division 1 or Division 2 fuel dispenser. The radio modem is certified by FCC, UL, and CE.

The longer external 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 shorter 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


Remote antenna kits include an adapter cable, antenna, antenna cable, and L-bracket antenna mount. The specified distance spans between the FMU and the remote antenna. For example, if the antenna needs to be mounted 48 feet away from the FMU, order the 191F0231-50 kit.

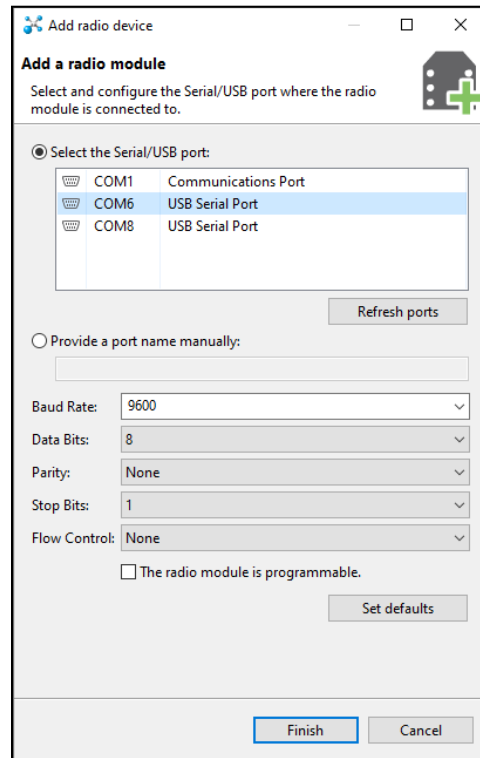
Configure the Modem

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.

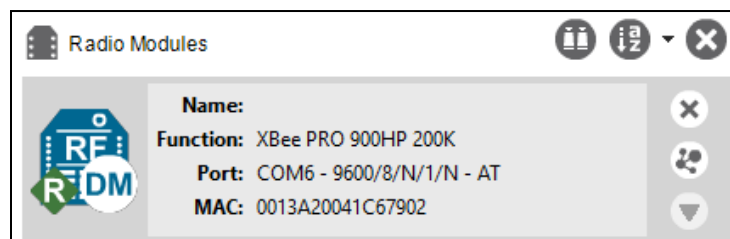
1. Visit <https://www.digi.com/products/embedded-systems/digi-xbee/digi-xbee-gateways/xbee-pro-900hp-rf-modems#productsupport>
2. Download configuration software from [Product Support > Utilities > Download XCTU](#).

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 the first modem to your PC via USB. The AC adapter is unnecessary at this point.
4. Attach the RF antenna.
5. Select Add a radio module  from the toolbar. The Add radio device dialog opens.

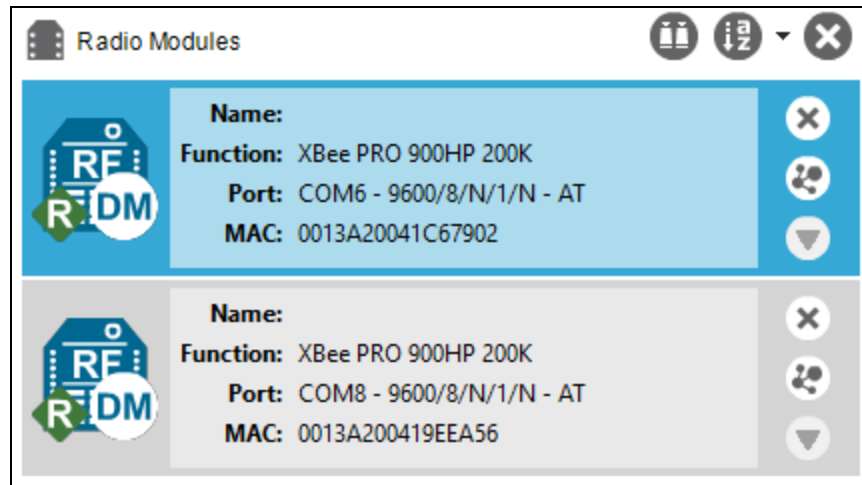


6. Select the serial port where the radio module is connected (or enter its name manually) and configure the port's serial settings.
7. Select **Finish** to add the radio module to the list of radio modules. If the settings were configured correctly and the radio module was connected to the selected port, the module is displayed in the device list.



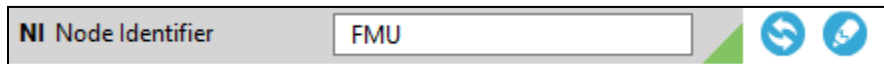
8. Repeat Steps 3-7 for the other RF Modem.


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

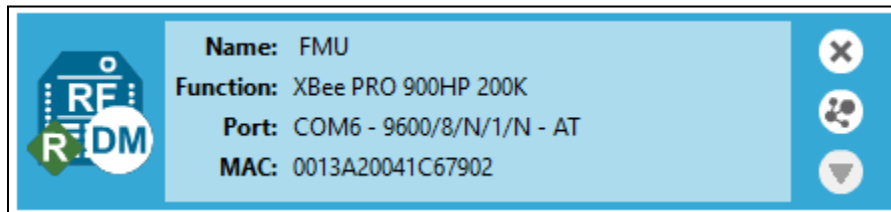


Name/Capture 1st Radio

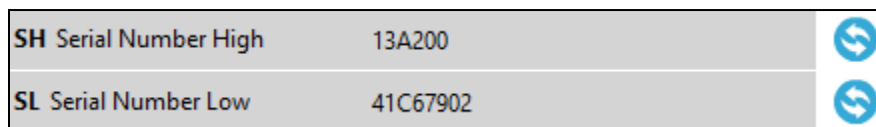
1. Select the first radio in the list. It will turn blue.
2. Under the Addressing Section, add a name in the Node Identifier parameter.



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.

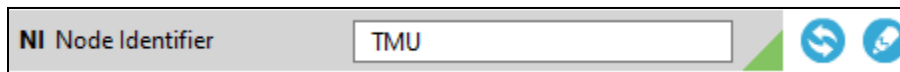



4. Find the serial number of the modem. Save this number for later.

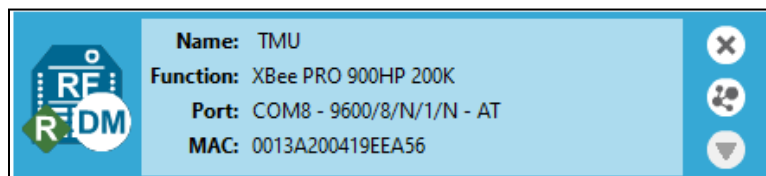


Name/Capture 2nd Radio



1. Select the second radio in the list. It will turn blue.
2. Under the Addressing Section, add a name in the Node Identifier parameter.



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.



- Find the serial number of the modem. Save this number for later.

SH Serial Number High	13A200	
SL Serial Number Low	419EEA56	


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







Configure FMU Radio


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





ID Network ID	<input type="text" value="1111"/>	 
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- Select Write module settings  to save the firmware values to the module.
- Under Addressing Section, enter the serial number from the other radio in the destination address.

SH Serial Number High	13A200	
SL Serial Number Low	41C67902	
DH Destination Address High	<input type="text" value="13A200"/>	 
DL Destination Address Low	<input type="text" value="419EEA56"/>	 

- Select Write module settings  on both rows to save the firmware values to the module. Ensure both triangles change from green to blue.
- Under Security Section, set up the RF encryption.
- Enable encryption and set the AES encryption key.

NOTE This must match the other XBEE RF modem.

EE Encryption Enable	<input type="text" value="Enabled [1]"/>	 
KY AES Encryption Key	<input type="text" value="ABCD"/>	 


- 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


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





ID Network ID	1111	 
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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.

DH Destination Address High	13A200	 
DL Destination Address Low	41C67902	 

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.

EE Encryption Enable	Enabled [1]	 
KY AES Encryption Key	ABCD	 


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 settings are 9600/8/N/1. Baud rate: 9600; Data Bits: 8; Parity: No Parity; Stop Bits: 1. Both the FMU and TMU must be configured for these settings. Most TMUs support the default rate, however, if the TMU does not, you must change the Serial Communications settings under the Serial Interfacing menu.

Serial Interfacing		
Change module interfacing options		
 BD Baud Rate	9600 [3]	 
 NB Parity	No Parity [0]	 
 SB Stop Bits	One stop bit [0]	 

Confirm Radios can communicate

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

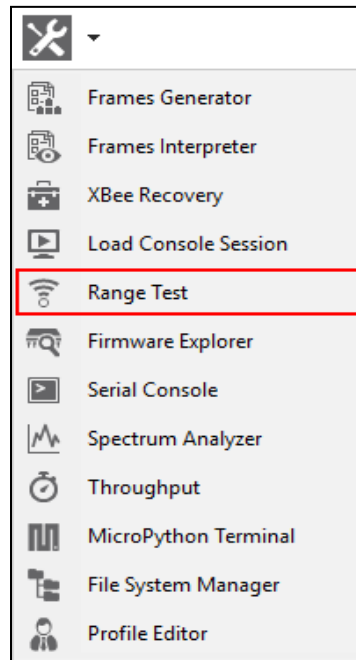
	Name: FMU	  
	Function: XBee PRO 900HP 200K	
	Port: COM6 - 9600/8/N/1/N - AT	
	MAC: 0013A20041C67902	

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.



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

▼ Device selection

Select the local radio device: 

	0013A20041C67902	FMU	DigiMesh	AT


Select the remote radio device:

Remote selection: Discovered device ▼

No devices discovered ▼


Discovering remote devices...

Search finished. 1 new device(s) found



1 new device(s) found ✕ Stop

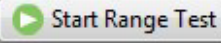
New remote devices discovered:

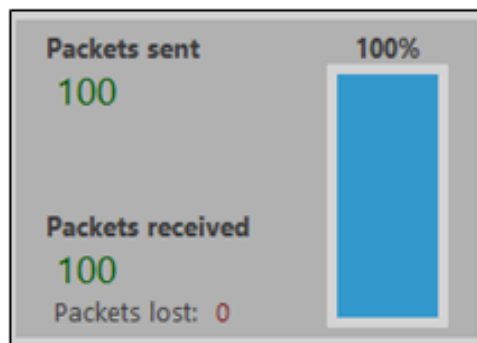


Name: TMU
MAC Address: 0013A200419EEA56

Select all
Unselect all

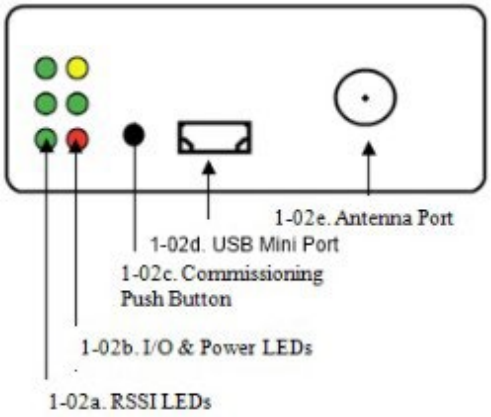
Cancel
Add selected devices

- Add the selected device.
- Start the range test by selecting Star Range Test: . On a perfect test, you would have 100 packets sent and 100 packets received.



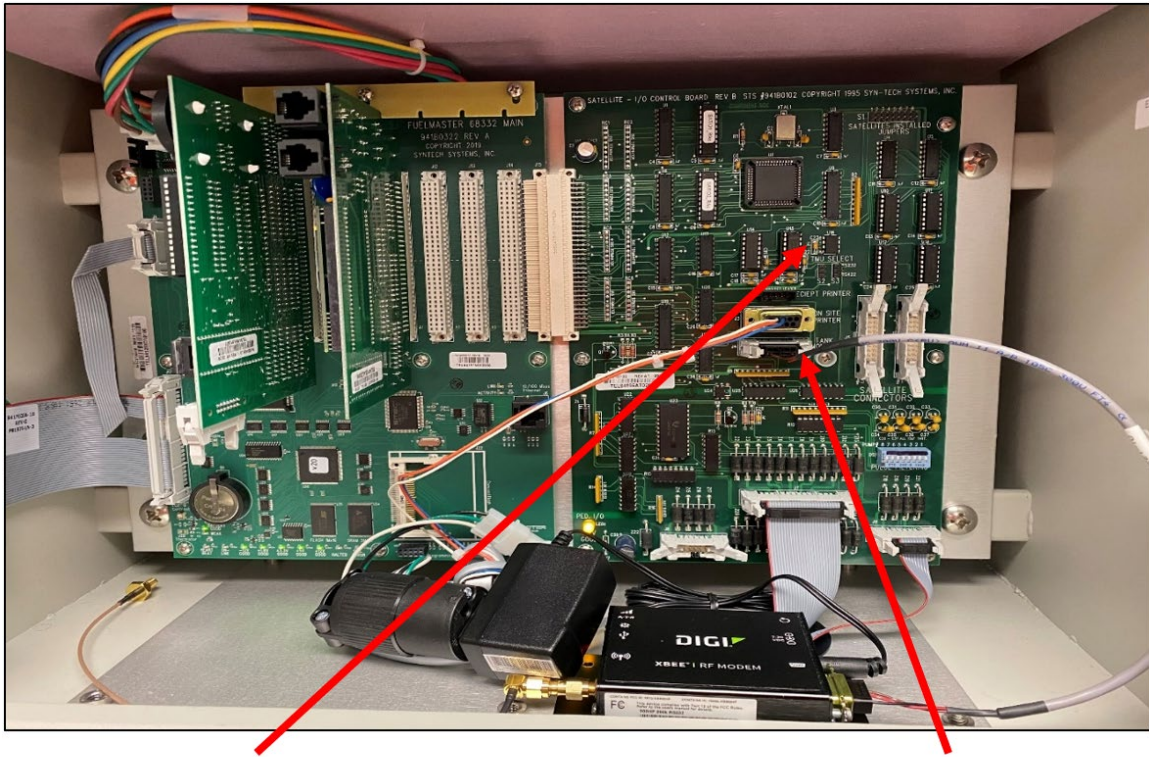
TIP If there is high packet loss, move the antenna on one or both devices. The kit comes with a remote antenna that allows the antenna to be mounted up to a foot from the modem. If you are already using this setup, add an extension cable and mount the antenna in a better location.

LED Description

Back view of the RS-232 interface	Description
 <p>1-02a. RSSI LEDs</p> <p>1-02b. I/O & Power LEDs</p> <p>1-02c. Commissioning Push Button</p> <p>1-02d. USB Mini Port</p> <p>1-02e. Antenna Port</p>	<p>1-02a. RS-232 RSSI LEDs</p>
	<p>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.</p> <ul style="list-style-type: none"> 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)
	<p>1-02b. RS-232 I/O and Power LEDs</p>
	<p>LEDs indicate RF modem activity as follows:</p> <ul style="list-style-type: none"> 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)
	<p>1-02c. RS-232 Commissioning Push Button</p>
<p>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.</p>	
<p>1-02d. RS-232 USB Mini-B Port</p>	
<p>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.</p>	
<p>1-02e. RS-232 Antenna Port</p>	
<p>The antenna port is a 50Ω 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.</p>	

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.



Jumpers for RS-232

Tank Monitor Connector

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 now display all keyboard input.

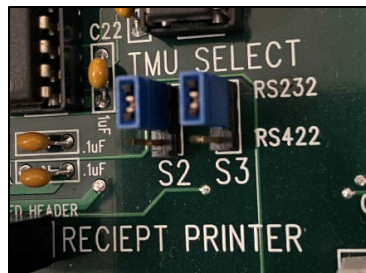
Main Items to be Configured Before Shipping Out

- 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
- Node Identifier: FMU or TMU
- Encryption Enable: Enable [1]
- AES Encryption Key: ABCD
- Serial Interfacing Setting: 9600-8-N-1

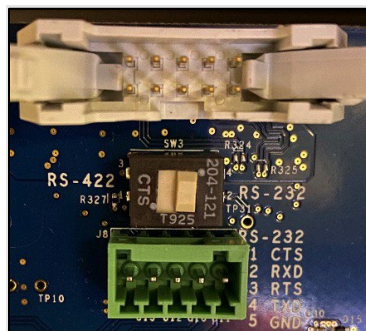
Installation

Modem Connection to FMU

1. Find a weatherproof installation location for the modem – whether in the FMU cabinet itself or inside another weatherproof enclosure.
2. Prepare the FMU:
 - a. Legacy: Install jumpers on the Satellite I/O Board on the top two pins of positions S2 and S3, labeled *TMU SELECT*.



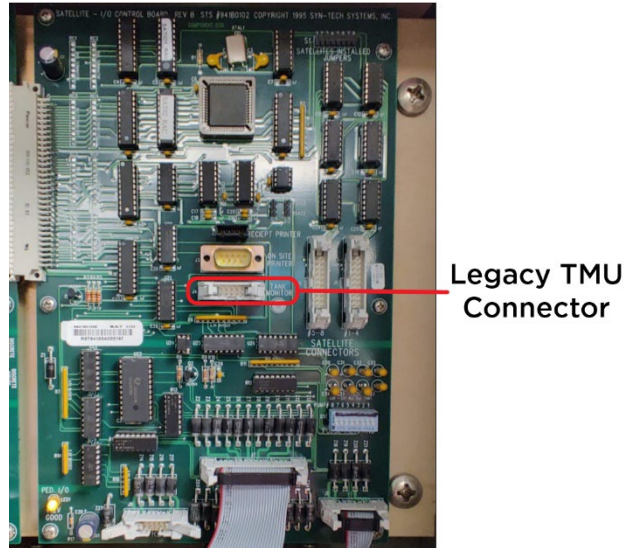
- b. *FMLive*: Verify the switch underneath the *Tank Monitor* connector is toggled to RS-232 on the right.



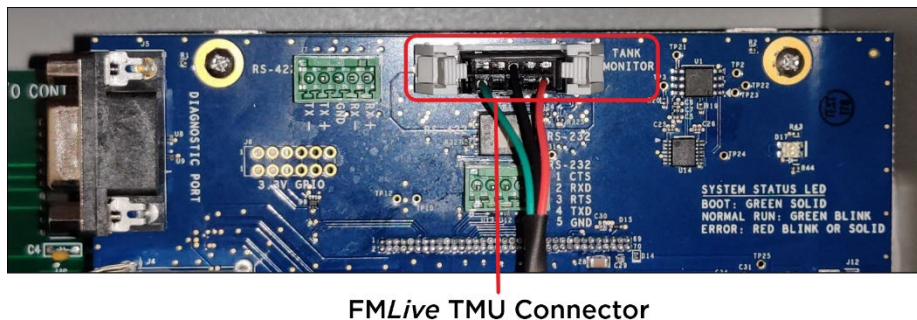
3. If utilizing the AC adapter, connect it into the internal AC power receptacle inside the FMU cabinet. If the FMU does not have an AC power receptacle, you can order one from Syntech (STS#: 178802A). However, if a USB port is available in the FMU, you may connect the USB power cable there.

4. Connect the FMU-to-Modem Cable to to:

- a. Legacy: the *Tank Monitor* connector in the middle of the SAT I/O board.

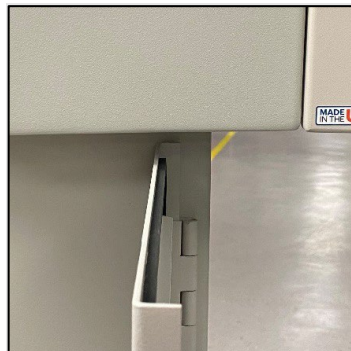
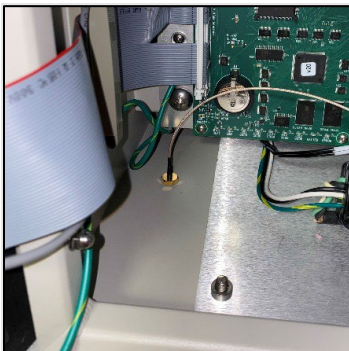


- b. FMLive: the *Tank Monitor* connector at the top of the EAPro board.



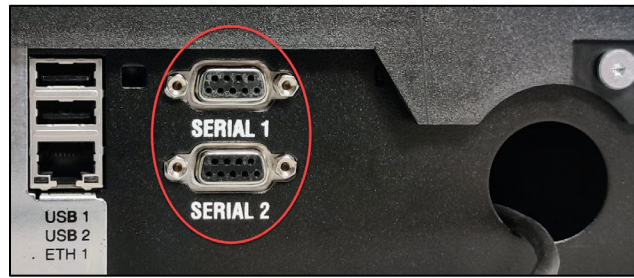
External Antenna Mounting

If desired, the smaller external antenna may be installed to further improve the performance of the modem. Do not use the larger antenna cable that comes with the Digi, as it is not compatible with the flex cable. You can install the external antenna adapter anywhere on the FMU that is out of the way. A common location is pointing down through the bottom of the cabinet on the left side. Utilize a 9/32-inch drill bit to create the correct sized hole. When installing here, take care to ensure the antenna is installed behind the fully opened pedestal door to avoid antenna damage when opening the door.



Modem Connection to TMU

1. Verify the TMU power switch is off.
2. Verify the TMU has an RS-232 input/output board installed.



3. Determine a suitable mounting location for the radio modem by considering line-of-sight and indicator light visibility. The modem will connect to the TMU via a DB9 or DB25 port. Most TMUs are mounted indoors, so weatherproofing should not be a factor.
4. Affix the radio modem to its mount location.
5. Connect the TMU-to-Modem cable from the radio modem to the tank monitor as follows:

Signal	Color
TMU Transmit	Red
TMU Receive	Green
Ground	Black

NOTE

Different makes and models of TMU have different serial pinouts. Consult with the TMU's manual and/or manufacturer to verify how to land the signals above. Additionally, if it doesn't seem to be working as specified, flip the transmit and receive wires.

6. Connect the AC adapter into the internal AC power receptacle or plug the USB connector into a standard USB port.
7. Turn the FMU and TMU power ON.
8. Test the connection. If the radio modems do not communicate, try reversing Tx and Rx. 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
12/01/2020	Original
07/01/2021	<ul style="list-style-type: none"> Modified title to include "Digi". Modified steps under Configure FMU Radio and Configure TMU Radio.
08/26/2021	<ul style="list-style-type: none"> Modified steps under Configure the Modem. Added Legacy FMU Tank Monitor Loopback Test section.
9/16/2021	Removed Line of Sight section, as it is no longer necessary.
11/05/2021	Under Syntech Part Numbers, added section on remote antenna kits.
01/17/2025	Brought in line with Syntech Style Guide, added notes on which external antennas work in which configurations.