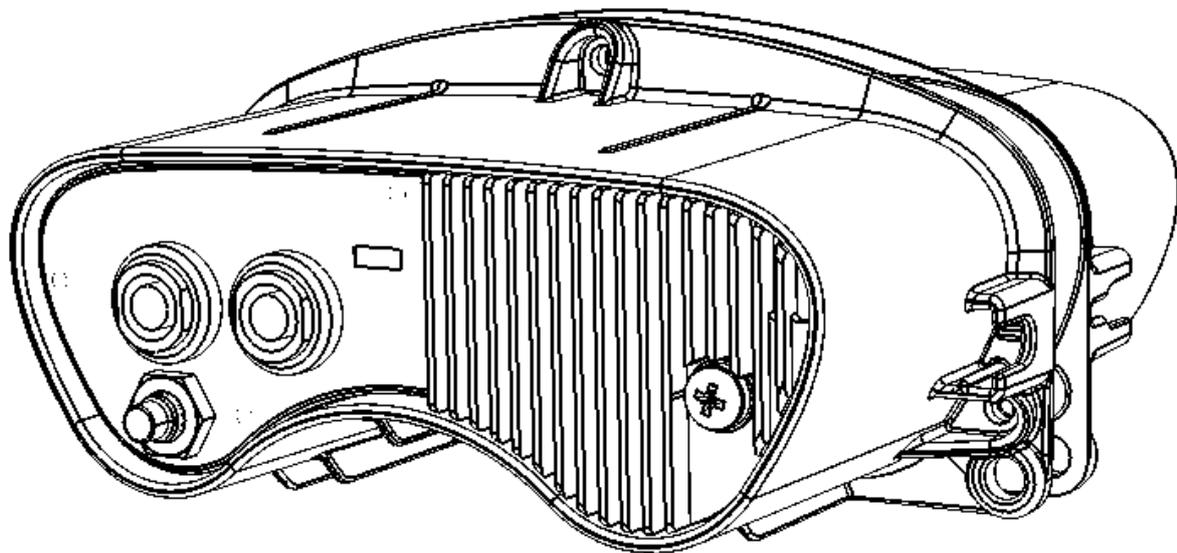




# RFD TX Pole

## User's Manual



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# Revision History

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Version	Date	Changes
1	30 - 05 - 2019	DRAFT prototype release

# 1.Introduction

## 1.1 Features

- Long range using RFD900x telemetry modem
- WiFi host or client
- Easy configuration by web-based wizard
- TCP and UDP packet format support
- Wide range 9 to 16 V input supply
- Built-in battery
- Expandable I/O port
- IP66 rated enclosure

## 1.2 Applications

- Ground Control Station (GCS) telemetry gateway over Wi-Fi
- Long range remote control (RC) via PPM
- Permanent field installations
- Long range backbone for remotely deployed sensors and controls
- Remote messaging network

## 1.3 Typical Application Diagram

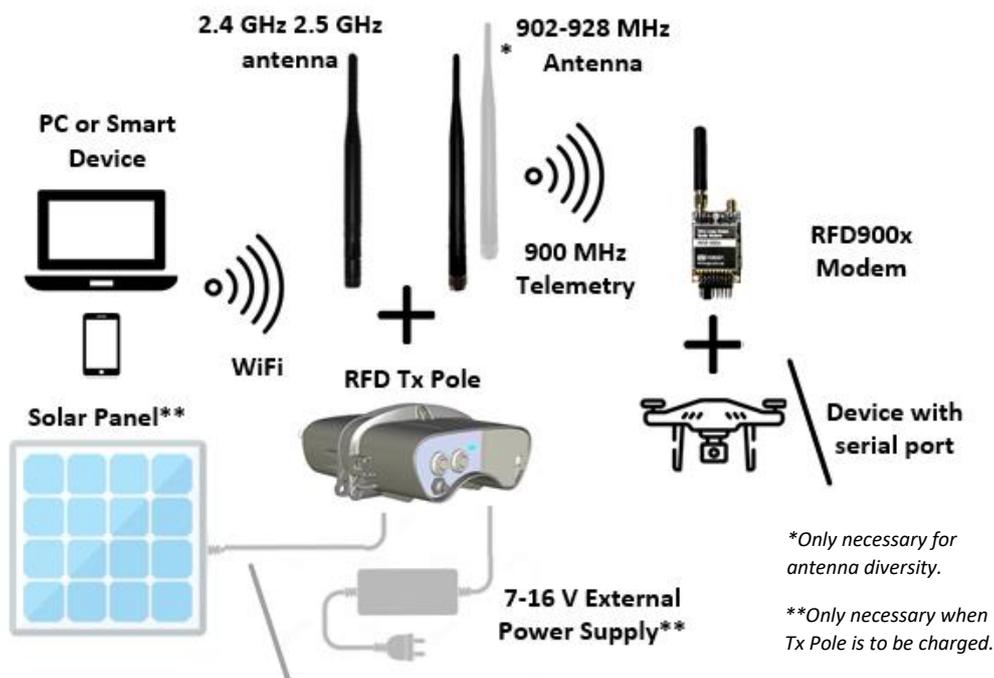


Figure 1 - Typical Application Diagram.

## 1.4 Description

The RFD Tx Pole is a rugged data and control system for long term outdoor deployment.

Providing long range connection through RFD 900x long range modem the system can be used for functions ranging from messaging to sensor monitoring or equipment controls.

The wide range of supported input voltages and internal battery system accommodates a wide range of power solutions. The heavy duty sealed enclosure protects the system in punishing outdoor conditions. The module's built-in Wi-Fi allows for simple webpage based configuration of the system even in the most inaccessible installations.

## 1.5 Package Contents

- Tx Pole
- (x2) 900MHz 3dBi Dipole Antenna (RPSMA)
- 2.4GHz 5dBi Dipole Antenna (RPSMA)
- Mounting bracket kit
- 5m pole mounting harness
- Power cable

## 1.6 Getting to know the product

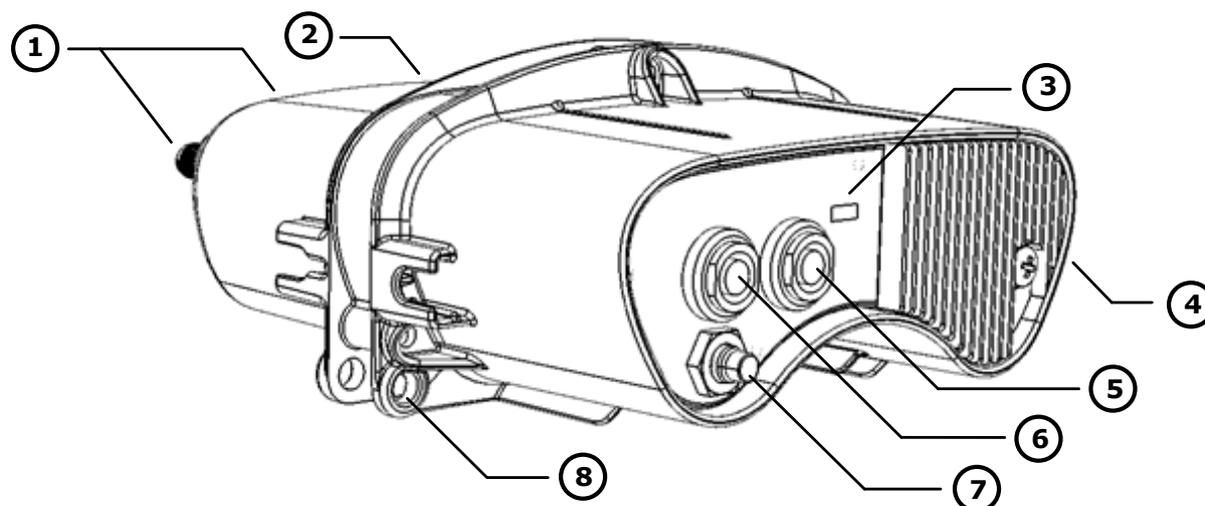
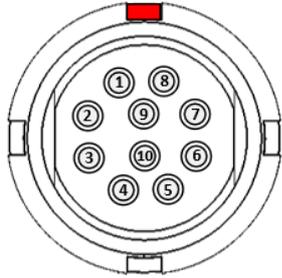


Figure 2 - TX Pole product parts description

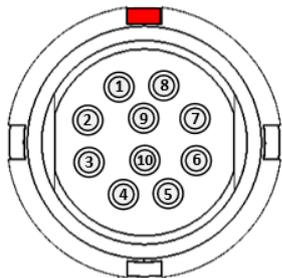
Table 1 - TX Module Description

#	Description /Note			
1	<b>WiFi Antenna Port</b>	Female RPSMA antenna connector. Connect an antenna matched to the 2.4 GHz ISM band. For antenna recommendations go to section 4.		
2	<b>Modem Antenna Ports (x2)</b>	Female RPSMA antenna connector. Connect an antenna matched to the 902-928MHz ISM band. For antenna recommendations go to section 4. Use of both antennas provides antenna diversity operation.		
3	<b>Status LED</b>	<b>Red</b>	<b>Solid</b>	Low battery warning / no Wi-Fi connection.
			<b>Blinking</b>	Battery low / connected (alternating with blue or green)
		<b>Green</b>	<b>Solid</b>	Station (STA) mode
			<b>Blinking</b>	Connected while in STA mode
		<b>Blue</b>	<b>Solid</b>	Access Point (AP) mode
		<b>Blinking</b>	Connected while in AP mode	
4	<b>Heat Dissipater</b>	Do not cover this side of the product to ensure efficient heat removal.		
5	<b>Expansion Connector</b>	Not implemented – Reserved for future models		
6	<b>Main Connector</b>	External supply connector to power and/or charge device. Two different harnesses can be used depending on application. Refer to section 7 for more information about the harnesses. For connector pinout refer to table 2.		
7	<b>Mode Button</b>	<b>Press for 1s while device is OFF</b>		Turn on the device.
		<b>Hold for 5 seconds</b>		Turn off the device.
		<b>Press 5 times within 5 seconds</b>		Perform a factory reset.
7	<b>Mounting Mechanism</b>	A kit with a variety of mounting mechanisms is supplied with the Tx Pole. Use the enclosure mounting holes to attach the one that best suits your application.		

**Table 2 – Main connector pinout**

PINOUT	PIN	Name	I/O	Description
 <p>Face view</p>	1	OPTO_OUT_PWR_P	O	Output optocoupler, drain
	2	GND	-	Ground
	3	ESP_RX0	I	ESP receive serial 0
	4	+V_PLUG	-	Device external supply with priority over internal battery.
	5	OPTO_OUT_PWR_N	O	Output optocoupler, source
	6	ESP_TX0	O	ESP transmit serial 0
	7	ESP_EN_BOOT	I	Connect to GND during power up to enter ESP bootloader.
	8	EXT_ON_N	I	A switch can be connected across EXT_ON_P and EXT_ON_N to turn on the device while mounted far up to a pole.
	9	EXT_ON_P	I	
		10	GND	-

**Table 3 - Expansion connector pinout – Reserved for future models**

PINOUT	PIN	Name	I/O	Description
 <p>Face view</p>	1	NC	-	Not connected.
	2	NC	-	Not connected.
	3	NC	-	Not connected.
	4	NC	-	Not connected.
	5	NC	-	Not connected.
	6	NC	-	Not connected.
	7	NC	-	Not connected.
	8	NC	-	Not connected.
	9	NC	-	Not connected.
	10	NC	-	Not connected.

**Table 4 - Power Supply Ratings**

Parameter	Minimum	Maximum	Units
Supply Voltage (+V_PLUG relative to GND)	+9	+16	V
DC Plug Current Consumption (I_PLUG)	0.12	3*	A

\*Maximum current consumption occurs when internal modem constantly transmits and internal battery is being charged.

For further detail about power consumption depending on mode of operation, see section 5.1.

## 2 Getting Started

### 2.1 Quick start

The Tx Pole has two communication links that require configuration before operation: WiFi and 900 MHz telemetry. The easiest way to set up your TX Pole for its initial use is through the 'First Run Wizard' as explained in this section. Further configuration will be explained in detail in sections 2.2 and 2.3.

Ensure the Tx Pole is charged or it is being supplied externally via the main connector. Power up the device by pressing the case button for at least 1 second or connect the EXT\_ON\_N and EXT\_ON\_P wires together on the power / interface cable.

The system defaults to be a Wi-Fi Access Point (AP) and uses 192.168.4.1 as its IP address. Use your computer or smart device to search for and connect to the access point WiFi network generated by the Tx Pole (SSID: **TXPOLE-XX-XX-XX**, Password: **txpole123** , by default). It may be necessary to disable mobile data on tablets and phones to force the browser to use the TX Pole network. If the Tx Pole is properly powered up, but the access point is not visible from your personal device, a factory reset may help bringing the WiFi settings back to a known state.

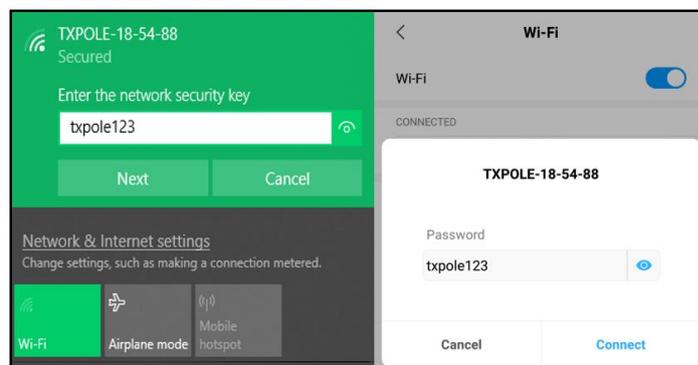


Figure 1 - Network settings. A) Windows 10. B) Android.

Once connected to the Tx Pole, point your preferred browser to the device IP address, which by default is <http://192.168.4.1/>, to access the configuration homepage of figure 2.

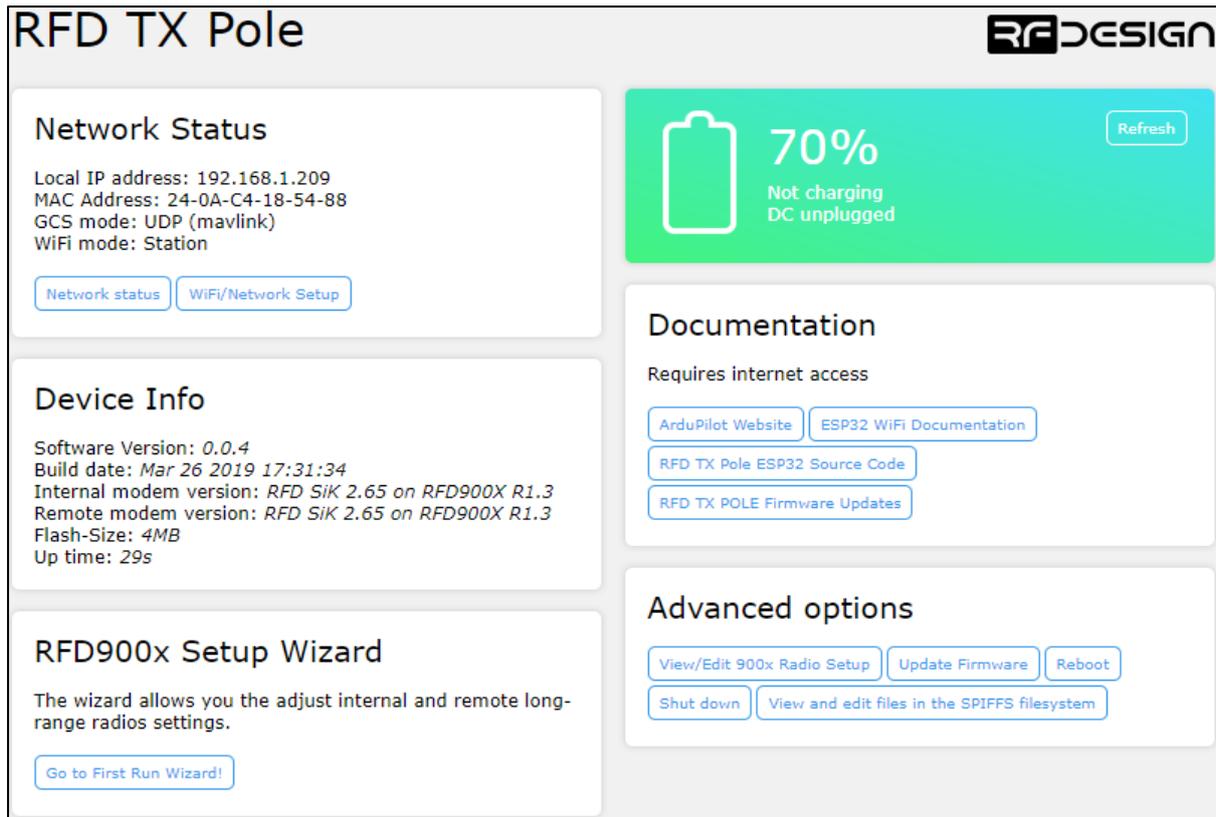


Figure 2 - Configuration homepage.

Click on 'Go to First Run Wizard!' button to access the wizard on figure 8 which will guide you through the steps to get your module ready to use.

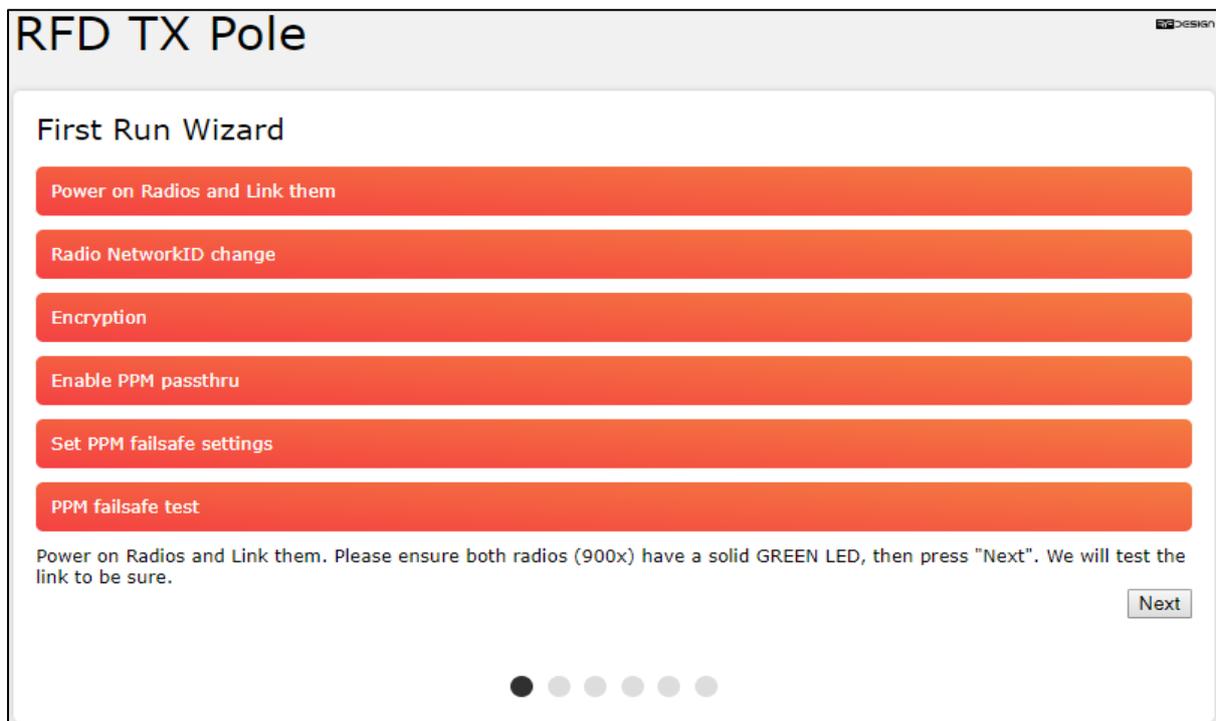


Figure 3 - First run wizard

To complete the wizard, the remote modem on the aircraft should be powered up, have the same firmware version and be bound to the Tx Pole. If the remote RFD900x modem is the one supplied along the Tx Pole, both devices are ready to proceed. If it is not, refer to section 2.5 to flash on the remote modem the same firmware version being used on the Tx Pole, which is displayed on the 'Device Info' section of the homepage interface of figure 2 under 'Internal modem version:'. If both firmware versions are already the same, reset remote modem to default settings and the green LED on the modem should go green indicating it has been bound to the Tx Pole. If that were not case, press the button on the Tx Pole 5 times rapidly to reset default values. After that, the wizard can be reengaged.

Follow on-screen instructions and once the wizard is successfully completed, your device is ready to be used and further configuration is optional.

## 2.2 Wi-Fi Configuration

It is strongly recommended to change the default Wi-Fi settings to ensure the security of the radio link and overall system. How to do so is explained throughout this section:

### a) Change Network Settings

While on the configuration homepage of figure 2, click on the 'WiFi/Network Setup' button, to access the WiFi settings configuration page of figure 4.

WiFi Mode	<input type="radio"/> AccessPoint	<input checked="" type="radio"/> Station
AP SSID	<input type="text" value="TXPOLE-18-54-88"/>	
AP Password	<input type="text" value="txpole123"/>	8 characters minimum
WiFi Channel	<input type="text" value="11"/>	
Station SSID	<input type="text"/>	
Station Password	<input type="text"/>	
Station IP	<input type="text" value="0.0.0.0"/>	
Station Gateway	<input type="text" value="0.0.0.0"/>	
Station Subnet	<input type="text" value="0.0.0.0"/>	
Host Port	<input type="text" value="14550"/>	
Client Port	<input type="text" value="14555"/>	
Baudrate	<input type="text" value="57600"/>	

Figure 4 -WiFi settings configuration page.

The WiFi settings of figure 4 are described in table 5:

**Table 5 - WiFi Settings Description**

Parameter	Description
<b>WiFi mode</b>	This sets the module to act as an access point (default) or as a station on an existing access point, such as a home network.
<b>AP SSID</b>	Is the SSID used for creating the Access Point (AP).
<b>AP Password</b>	This is the password that will be used for the access point. It must be a minimum of 8 character long
<b>WiFi Channel</b>	Allows the user to set the channel as per the WiFi 802.11 standard definitions. This can be used as needed to prevent interference or to meet the requirements of the network that the module is joining. The default is channel 11 a part of the most commonly used channel set of 1, 6 and 11.
<b>StationSSID</b>	The SSID of the network that the Tx Pole should attempt to join.
<b>Station Password</b>	The password of the network that the Tx Pole should attempt to join.
<b>Station IP</b>	The static IP address to assign the Tx Pole when joining the network. ( <b>Note</b> this may require appropriate settings to be made on the network router. Once assigned as a station the landing page for the Tx Pole settings becomes the Station IP address that was assigned.)
<b>Station Gateway</b>	The Gateway IP address of the network that the Tx Pole should attempt to join.
<b>Station Subnet</b>	The Subnet Mask of the network that the Tx Pole should attempt to join as a station.
<b>Host Port</b>	This is the UDP host port number. This is the port that you will direct a connection to in UDP mode
<b>Client Port</b>	This is the UDP client port number.
<b>Baudrate</b>	Baudrate of the serial link with the modem. It must match the modem serial speed setting to allow the two to communicate.

After changing the desired settings, press 'Save Settings' and power cycle the Tx Pole either by holding the main button for 5 seconds to power off and then 1 second to power up again, maintaining EXT\_ON\_N and EXT\_ON\_P or by pressing the button 'Reboot' of the 'Advanced options' on the configuration interface of figure 2 .

Note that after the changes take place, it might be required to change the network settings saved on your computer or personal device in order to reconnect to the Tx Pole. It may be required to force the system to forget the old password/settings and then try to connect again with the new Wi-Fi settings.

## b) Tx Pole as a station

To use the TX Pole on an existing WiFi network to provide telemetry data to a GCS while still allowing access to the internet, for example to download maps, there are a couple of possible implementations.

### Basic users

Windows and Linux users will require the installation of a support software. For Windows, the Bonjour Service from Apple ([https://support.apple.com/kb/DL999?locale=en\\_US](https://support.apple.com/kb/DL999?locale=en_US)) and for Linux the Avahi service are suitable. Windows users may also need to use Chrome (or Chrome based) browsers as this has more consistent interoperability with the Bonjour service.

Once this has been installed, connect to the TX Pole in default AP mode go to WiFi settings and choose 'Station' in 'WiFi Mode', set the correct SSID (in StationSSID) and password of the network in "Station Password", leave "Station IP", "Station Gateway" and "Station Subnet Mask" as 0.0.0.0 then press "Save" and finally reboot the device. You can connect now your computer or smart device to the WiFi network with the name specified on StationSSID in the previous step. On your device open a chrome based browser and enter the following address `http://TXPOLE-XX-XX-XX.local` where the Xs are the same as the Xs in the access point network name. Analogously on Android download Bonjour Browser app to find and access to the Tx Pole IP address.

### Advanced users

The module must be set up by choosing 'Station' in 'WiFi Mode', set the correct SSID (in StationSSID) and password of the network in "Station Password".

You will need to find the Gateway and Subnet mask of the network then to write the appropriate values in 'Station Gateway', 'Station Subnet'. Assigning the 'Station IP' requiring that a static IP is set on the DHCP server, normally the network router, this is so the device will be at a known address on the network allowing for the user to connect using this new fixed IP in place of the 192.168.4.1 of access point mode. Network information such as the Subnet Mask and Gateway address can be found on a network connected device. For instance, in windows launch a command prompt, type 'ipconfig' and press enter. Information similar to figure 5 will be shown. In linux based devices typing 'ifconfig' to the terminal should give similar results.

```
C:\Users\j>ipconfig
Wireless LAN adapter Wi-Fi:

    Connection-specific DNS Suffix  . : 
    Link-local IPv6 Address . . . . . : 
    IPv4 Address. . . . . : 192.168.1.XX
    Subnet Mask . . . . . : 255.255.255.X
    Default Gateway . . . . . : 192.168.1.X
```

Figure 5 – Command Prompt.

Default Gateway ->'Station Gateway'

Subnet Mask ->'Station Subnet'

## c) WiFi Troubleshooting:

If you forget your settings or the device is not available on the network, A reset of the TX Pole unit to its default WiFi settings may be required. This is done by pressing the button 5 times rapidly within 5 seconds. The TX pole unit will then reset to factory default configuration and reboot.

In some cases, user connection settings may prevent devices from accessing the WiFi addresses. It may therefore be necessary to do some basic troubleshooting such as removing the existing network settings from the device memory, resetting the wireless adaptor, turn off mobile data and disconnect other networking devices such as LAN cables. In other cases, running the Windows Network Diagnostics may help.

## 2.3 Tx Pole Internal RFD900x Modem settings

A description of the parameters that define the communication between Tx Pole and remote RFD900x modem is presented in [Table 6 - RFD900x parameters](#). For further information regarding the internal modem on which the Tx Pole is based on, refer to the *RFD900x Peer to Peer Firmware* and *RFDDesign Modem 900x Datasheet* documents using the links in [section 6](#).

**Table 6 - RFD900x parameters**

Reg #	S Register Description	Default Value	Maximum Value	Minimum Value	Must be the same at both ends of the link?
<b>S0</b>	<b>FORMAT</b> This is for EEPROM version, it should not be changed. It is set by the firmware	Firmware dependant	N/A	N/A	No
<b>S1</b>	<b>SERIAL_SPEED</b> Serial speed in 'one-byte form'. Accepted values are 1, 2, 4, 9, 19, 38, 57, 115, 230, 460 corresponding to 1200bps, 2400bps, 4800bps, 9600bps, 19200bps, 38400bps, 57600bps, 115200bps, 230400bps, 460800bps and 1000000bps respectively.	57	1000 <sup>4</sup>	1	No
<b>S2</b>	<b>AIR_SPEED</b> Air data rate in 'one-byte form'. Accepted values are 4,64,125,250,500, 750 corresponding to 4000bps, 64000bps, 125000bps, 250000bps, 500000bps and 750000bps respectively.	64	750 <sup>4</sup>	4	Yes
<b>S3</b>	<b>NETID</b> Network ID. The same on both modems in the pair	25	255	0	Yes
<b>S4</b>	<b>TXPOWER<sup>1</sup></b> Transmit power in dBm. Maximum is 30dBm	30	30	0	No
<b>S5</b>	<b>ECC<sup>2</sup></b> Enables or disables the Golay error correcting code. When enabled, it doubles the over-the-air data usage	0	1	0	Yes
<b>S6</b>	<b>MAVLINK<sup>3</sup></b> Enables or disables the MAVLink framing and reporting	1	1	0	No
<b>S7</b>	<b>OP_RESEND</b>	0	1	0	No

	Opportunistic resend allows the node to resend packets if it has spare bandwidth				
<b>S8</b>	<b>MIN_FREQ</b> Min frequency in KHz	915000 /868000 <sup>5</sup>	927000 /869000 <sup>5</sup>	902000 /868000 <sup>5</sup>	Yes
<b>S9</b>	<b>MAX_FREQ</b> Max frequency in KHz	928000 /869000 <sup>5</sup>	928000 /870000 <sup>5</sup>	903000 /869000 <sup>5</sup>	Yes
<b>S10</b>	<b>NUM_CHANNELS</b> Number of frequency hopping channels	20	50	1	Yes
<b>S11</b>	<b>DUTY_CYCLE</b> The percentage of time to allow transmit	100	100	10	No
<b>S12</b>	<b>LBT_RSSI</b> Listen before talk threshold (This parameter shouldn't be changed)	0	220	25	Yes
<b>S13</b>	<b>RTSCTS</b> Ready-to-send and Clear-to-send flow control.	0	1	0	No
<b>S14</b>	<b>Max Window</b> Max transit window size used to limit max time/latency if required otherwise will be set automatically	131	400	20	Yes
<b>S15</b>	<b>Encryption Level</b> Encryption level 0=off, 1=128bit AES	0	1	0	Yes
<b>S16</b>	<b>R/C input GPIO1.1</b> Set GPIO 1.1 as R/C(PPM) input	0	1	0	No
<b>S17</b>	<b>R/C output GPIO1.1</b> Set GPIO 1.1 as R/C(PPM) output	0	1	0	No
<b>S18<sup>6</sup></b>	<b>ANT_MODE</b> 0= Diversity, 1= Antenna 1 only, 2= Antenna 2 only, 3= Antenna 1 TX and antenna 2 RX	0	3	0	No
<b>S19<sup>6</sup></b>	<b>PKT_DROP_RSSI</b> Sets a RSSI threshold below which the packet will be discarded. 0 disables the feature	0	255	0	No
<b>R0</b>	<b>TARGET_RSSI</b> Optimal RSSI value to try to sustain (255 disables the feature)	255	50	255	No
<b>R1</b>	<b>HYSTERESIS_RSSI</b> Amount of change before power levels altered	50	20	50	No

**Notes:**

<sup>1</sup> When setting up the power level and the frequency band, please check the radiofrequency spectrum plan in your area to operate in compliance with its legislation.

<sup>2</sup> ECC - Software Detection and correction, extra packet information, twice the packet length, is sent to allow the recovery of corrupted packets.

<sup>3</sup> Injects RSSI packet when MAVLink protocol used and heartbeat packet detected.

<sup>4</sup> Maximum from version 2.60 onwards

<sup>5</sup> 868 modems

<sup>6</sup> Introduced in V2.55

**a) Modifying parameters with the TX Pole web interface**

The settings described in table 6 can be set up on the Tx Pole and on any modem it may be bonded by using the browser interface. The Tx Pole will appear as local and the aircraft modem as remote.

Click on 'View/Edit 900x Radio Setup' to access the modem's setup interface of figure 6. If the Tx Pole has not been paired yet with any other modem, the remote side will appear empty and the message "Sorry no parameters available" will be shown.

RFD TX Pole


### Radio parameters

This page shows the last-known settings from the radios by default. If you have changed the settings elsewhere, such as with AT commands, or run the "wizard", then you should press the "Load Fresh Params" button to get up-to-date information here.

If you have your remote radio turned off, or disconnected, pressing 'Load Fresh Params' will allow you to display and save the local 900x radio settings, but you will have to ensure your remote 900x radio is configured correctly on your own.

Load fresh parameters

**ATTENTION** If your remote params list does not show, press this again. This will interrupt any ongoing communications between local and remote radios. You must be sure you have a remote radio synced (ie. both radios solid green LED). If encryption is used then it must be configured the same on both radios.

Save parameters

**ATTENTION** Saving the incorrect settings here may result in loss of connection between the radios.

#### Local radio parameters

S0:FORMAT	39
S1:SERIAL_SPEED	57
S2:AIR_SPEED	64
S3:NETID	25
S4:TXPOWER	30
(...)	

#### Remote radio parameters

S0:FORMAT	39
S1:SERIAL_SPEED	57
S2:AIR_SPEED	64
S3:NETID	25
S4:TXPOWER	30
(...)	

Figure 6 – T Pole modem configuration page.

Settings can be refreshed using the 'Load Fresh Params' button. Parameters can be adjusted in the text boxes as required and then applied by means of the 'Save Params' button. Changes on the AIR\_SPEED, NETID, TXPOWER, MIN\_FREQ, MAX\_FREQ and NUM\_CHANNELS parameters should be applied to remote radio settings as well to avoid losing the radio link.

## 2.4 Firmware Update

Updating the Tx Pole requires two different files; the 'firmware.bin' and the 'spiffs.bin' files which can be found through the links in [section 6](#).

Then, on the browser configuration landing page shown in figure 2, select 'Update Firmware' and follow the on-screen commands on figure 7 to flash the \*.bin files onto the device. **These files should not be uploaded and flashed simultaneously.**

After flashing the 'spiffs.bin' file and power-cycling the device, the firmware on the RFD900x modem inside the module will be automatically updated if required.

## RFD TX Pole



### Firmware update

The TX Pole features two microcontrollers and they require different binaries. The main controller has an internal filesystem called SPIFFS that should be loaded in a separate step. For full system update you are required to upload the main firmware and the SPIFFS file system, which correspond to steps 1 and 2. The radio firmware upgrade is optional.

#### Step 1 - Main controller

Choose `firmware.bin` or something like `RFDTxPole-V1.0.bin`

#### Step 2 - SPIFFS file system

Choose `spiffs.bin` or something like `RFDTxPole-V1.0.spiffs.bin`

#### Optional step - RFD900x firmware update

Choose `RFDSiK900x.bin` or something like `RFDSiK V2.65 rfd900x.bin`

Figure 7 - Update page

## 2.5 Vehicle Modem

If the vehicle modem to be used is the one supplied with the Tx Pole, unless changed by the user, it will have a compatible firmware version and it will be bound to the modem in the Tx Pole. If that is the case, the easiest way to configure it is through the browser interface already explained in the previous section.

On the other hand, if the modem is not the one supplied with the kit or both modems are not bound, the vehicle modem should be flashed with the same firmware and configured with the same parameters as the modem on the Tx Pole to ensure a proper communication link. To do so, an FTDI cable, a jumper and the RFD900 tools or a serial terminal program are needed.

Connect the FTDI cable and the jumper as per figure 8. The black wire of the FTDI, i.e. pin 1, should connect to pin 1 on the modem and the jumper should connect pins 2 and 3 on the top row together.

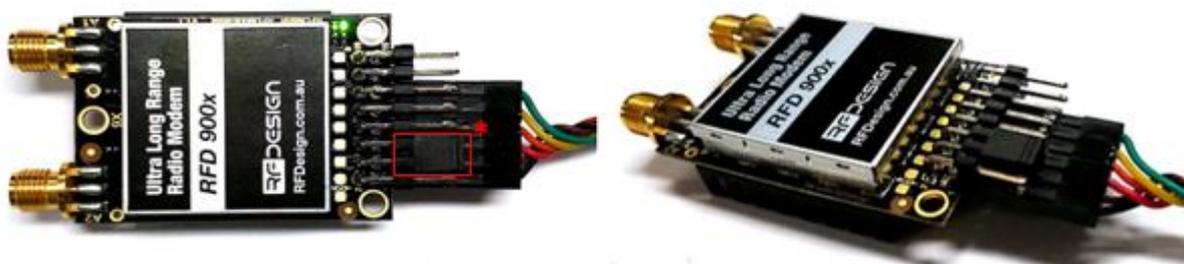


Figure 8 - Modem connected to FTDI cable (pins 1,3,5,7,9,11) to enable serial communications. **\*Jumper (pins 4&6).**

To configure the modem using the RFD900 tools, download and install the software using the links on [section 6](#) if it is not installed on your computer yet. Launch the program and the configuration interface of figure 8 should pop-up.



Figure 8 – Vehicle modem configuration on RFD900 tools.

First ensure the firmware on the vehicle modem is the same as the one on the Tx Pole, the version of which can be obtained in the first page of the browser interface of figure 2. If both versions don't match download the one currently in use on the Tx Pole through the links in [section 6](#).

Then on the RFD900 tools click on 'Upload Firmware' and choose the \*.bin file you just downloaded. Wait until the process finishes (a message will appear at the bottom of the page) and reboot the modem. You have successfully updated the firmware.

Then use the interface to configure the parameters described in [Table 6 - RFD900x parameters](#). The AIR\_SPEED, NETID, TXPOWER, MIN\_FREQ, MAX\_FREQ and NUM\_CHANNELS parameters should be the same as the ones in the Tx Pole modem. When connected directly through the FTDI cable the vehicle modem will appear as local. If these parameters have been not modified on the Tx Pole side or they have been reset to default values by pressing the button 5 times rapidly, the easiest way to configure them on the remote modem is by pressing 'Reset to Defaults' button.

Another important step is to set modem GPIO1.1 as a PPM output. This allows the modem pin 15 to output the PPM stream received from the TX Pole modem. This will be configured automatically by the First Run Wizard. In case the wizard were not to be used, enable this by checking the 'CPI1\_1R/COU' box in any and ensure later on that 'CPI1\_1R/CIN' is unchecked on the TX Pole. Then save the settings to upload the configuration onto the modem.

After the modem has been configured correctly it will be able to link with the TX Pole modem, indicated by a solid green LED on both devices. From this point onwards the FTDI cable is no longer needed to configure the vehicle modem. Instead this can be done over the air via the TX Pole using

the browser interface. This only works while the modem in the vehicle and TX Pole are linked as indicated by a solid green LED.

## 3 Applications

### 3.1 Ground Control Station

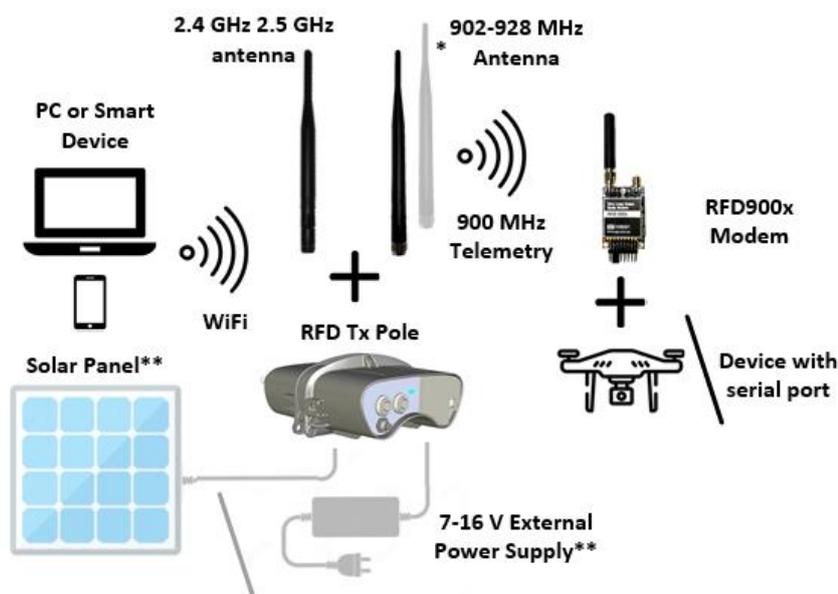


Figure 9 - Typical Application Diagram.

The immediate application for the Tx Pole is to set up a ground station for unmanned aircraft applications where long range and reliable communications are a must.

In this scenario, the Tx Pole will allow control of the aircraft from your computer or personal device and at the same time display on your preferred software the telemetry data received from the aircraft.

In this section, the process is explained using Mission Planner for Windows and Tower for Android. However, this process can be extrapolated to other software supporting Transmission Control Protocol (TCP) or User Datagram Protocol (UDP).

Once the Tx Pole is configured as described throughout section 2, connect your computer or smart device to the configured WiFi network; that is either the Tx Pole Access Point or the linked network when using the module as a station. Then open Mission Planner on your computer or Tower App on your Android device and choose TCP or UDP and press the button "CONNECT" as per figure 10. Parameters should start loading provided that the Tx Pole is properly bonded to the modem on the aircraft (solid green LED) and both devices are powered up.

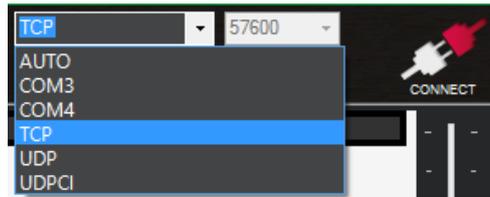


Figure 10 – Mission planner connection options.

Then, when asked for, enter the IP address and port number in the pop-up boxes. Default values in AP mode are IP [192.168.4.1](http://192.168.4.1), TCP port number 23 and UDP 14550. After that, if properly connected, telemetry data should be available, and the control software should run missions as normal.

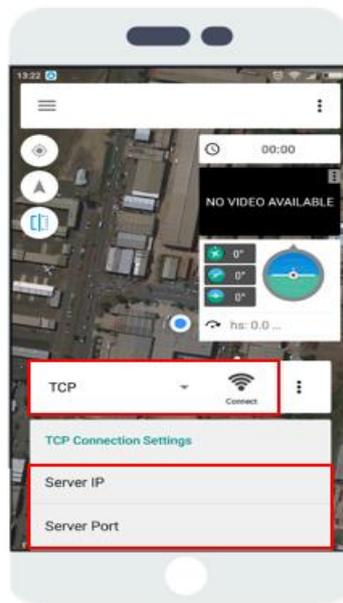


Figure 11 - Tower configuration on Android.

## 4 Antenna Recommendation

The RFD Tx Pole has three antenna connectors: one for the WiFi and two for the 900 MHz communication link. Any antenna with a male RPSMA fitting and matched to the 2.4 GHz and to the 902-928MHz ISM band respectively can be used, however the ones supplied along with the Tx Pole and shown in figure 12 are recommended for almost every application. For other antenna options visit our store at <http://store.rfdesign.com.au/>.



Figure 12 – a) [900MHz 3dBi Half Wave Dipole Antenna \(RPSMA\)](#) , b) [Antenna 2.4GHz 5dBi Dipole \(RPSMA\)](#)

Any of the two 900 MHz antennas can be left unmounted if antenna diversity is not to be used. For further detail about the diversity options that the modem inside Tx Pole provide, refer to the RFDesign Modem 900x Datasheet, the link of which can be found in section 6 of this document:

## 5 Technical Specifications

### 5.1 Power Consumption

Table 7 – Power Consumption vs Mode of Operation

Mode of operation	Average Consumption [A]	Expected Battery Life [Hours]
Modem constantly transmitting while connected via WiFi in AP	0.53	11
Modem constantly receiving MAVLINK stream while connected via WiFi in AP	0.2	30
Modem not transmitting (jus bound) and WiFi in AP	0.19	32
Modem not bound (trying to connect) and WiFi in AP	0.18	33
Modem Disconnected	0.12	50
Powered off	19E-6	-

\*The product has an internal battery of 6Ah, 7.4 V. Expected battery life assumes no external charge is applied.

#### Recommended external power supply:

In order to charge the device, an external power supply of +9V to 16V is needed and must be able to supply at least 2A. If additionally the device is to be used while charging, the power supply must supply the nominal current consumption. **For this reason a power supply of +9V to 16V and 3A is recommended.**

### 5.2 Modem Specification

Table 8- Performance	
Supported RF Data Rates	4, 64, 125, 250 and 500 kbits/sec
Indoor Range	500 m – 1 km
Line-Of-Sight Range	40km or more depending on antennas

Transmit Power	0 to 30dBm in 1dBm steps
Receiver Sensitivity	>121dBm

**Table 9 - Features**

Configuration Method	AT Commands, APM Planner, Customized Configuration Tool
Frequency Band	902 MHz – 928 MHz
Interference Immunity	FHSS (Frequency Hopping Spread Spectrum)
Serial Interface Data Rate	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 450800, 1000000 baud/s

**Table 10 - Networking and Security**

Addressing Options	Network ID: 0 –255
Channels	Up to 50 Frequency Hopping Channels
Supported Network Topologies	Point to point

### 5.3 WiFi Specifications

**Table 11 - WiFi Parameters**

WiFi Protocols	802.11 b/g/n (802.11n up to 150 Mbps) A-MPDU and A-MSDU aggregation and 0.4 $\mu$ s guard interval support
Frequency Range	2.4 GHz - 2.5 GHz
Wi-Fi mode	Access Point (AP) /station (STA)
Security	WPA/WPA2
Encryption	WEP/TKIP/AES
Firmware Upgrade	OTA (via network)
Network Protocols	IPv4, TCP/UDP/HTTP/FTP
User Configuration	Browser interface

**Table 12 – WiFi Radio Characteristics**

Parameters	Condition	Min	Typical	Max	Unit
Input Frequency	-	2412		2484	MHz
Output Impedance	-	-	50	-	$\Omega$
Tx Power	11n, MCS7	<b>12</b>	<b>13</b>	14	dBm
	11b mode	<b>17.5</b>	<b>18.5</b>	20	dBm
Sensitivity	11b,1 Mbps	-	-98	-	dBm
	11b,11 Mbps	-	-89	-	dBm
	11g, 6 Mbps	-	<b>-92</b>	-	dBm
	11g, 54 Mbps	-	<b>-74</b>	-	dBm
	11n, HT20, MCS0	-	<b>-91</b>	-	dBm
	11n, HT20, MCS7	-	-71	-	dBm
	11n, HT40, MCS0	-	-89	-	dBm
	11n, HT40, MCS7	-	-69	-	dBm
Adjacent Channel Rejection	11g, 6 Mbps	-	31	-	dB
	11g, 54 Mbps	-	14	-	dB
	11n, HT20, MCS0	-	31	-	dB
	11n, HT20, MCS7	-	13	-	dB

## 5.4 Module Compliance

<b>Radio</b>	AS4268 : 2017 FCC 47CFR 15.247 FCC 47CFR Part 1.1307 FCC 47CFR 1.1310 IC RSS247
<b>WiFi</b>	FCC/CE-RED/IC/TELEC/KCC/SRRC/NCC

### 5.5 Physical Dimensions

The TX Pole physical dimensions in mm are presented below:

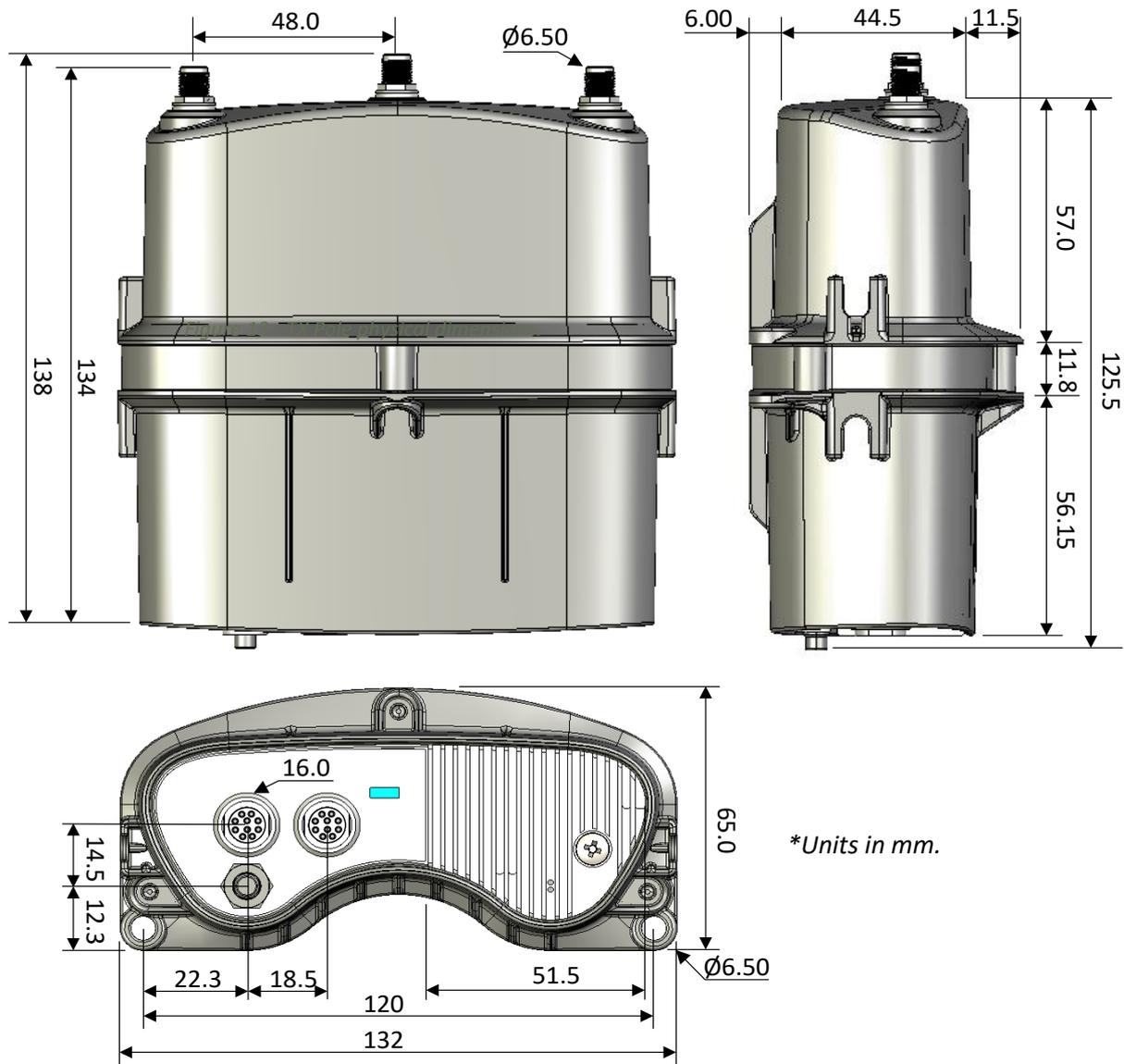


Figure 13 - TX Pole physical dimensions.

## 6 Useful Links

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### **TX Pole WiFi firmware - Pending**

<http://files.rfdesign.com.au/firmware/>

### **RFDDesign Modem 900x**

#### **Datasheet**

<http://files.rfdesign.com.au/Files/documents/RFD900x%20DataSheet.pdf>

#### **Firmware**

<http://files.rfdesign.com.au/firmware/>

### **Peer to Peer firmware - User Manual**

<http://files.rfdesign.com.au/Files/documents/RFD900x%20Peer-to-peer%20User%20Manual%20V1.1.pdf>

### **RFDDesign Programming Tools**

#### **Software:**

<http://files.rfdesign.com.au/tools/>

#### **Manual:**

<http://files.rfdesign.com.au/Files/documents/RFD%20Modem%20Tools%20Manual%20V1.1.pdf>

### **Mission Planner**

<http://ardupilot.org/planner/docs/common-install-mission-planner.html>

## 7 Harnesses Pinout

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In this section the different harnesses that can be used with the Tx Pole are presented:

- HRN-01-A – Desktop Harness (1.5m)
- HRN-01-B – External Mast Harness (5m)

### 7.1 HRN-01-A - Desktop Harness (1.5m)

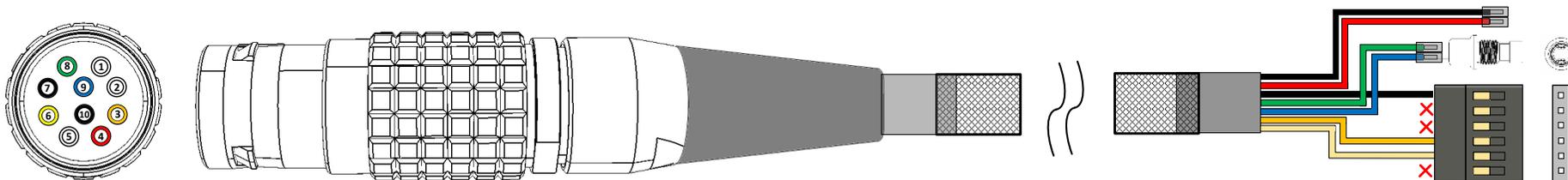


Table 14 – Main connector pinout

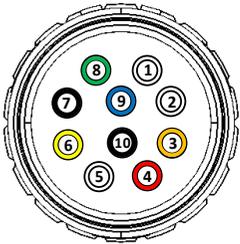
PINOUT	PIN	Name	I/O	Description
 <p>Face view</p>	1	NC	-	Not connected
	2	NC	-	Not connected
	3	TXP_RX0	I	TXPOLE receive serial 0
	4	+V_PLUG	-	Device external supply with priority over internal battery.
	5	NC	-	Not connected
	6	TXP_TX0	O	TXPOLE transmit serial 0
	7	TXP_EN_BOOT	I	Connect to GND during power up to enter TXP bootloader.
	8	EXT_ON_N	I	A switch can be connected across EXT_ON_P and EXT_ON_N to control the Tx Pole power mode when installed on an antenna mast.
	9	EXT_ON_P	-	
	10	GND	-	Ground

Table 15 – Main connector pinout

	PIN	Name	I/O
Connector TBD by user		GND	-
		+V_PLUG	-
		EXT_ON_N	I
Switch		EXT_ON_P	-
 <p>1 Face view Optional</p>	1	GND	-
	2	Not connected	-
	3	Not connected	-
	4	TXP_TX0	O
	5	TXP_RX0	I
	6	Not connected	-

### 7.2 HRN-01-B – External Mast Harness (5m)

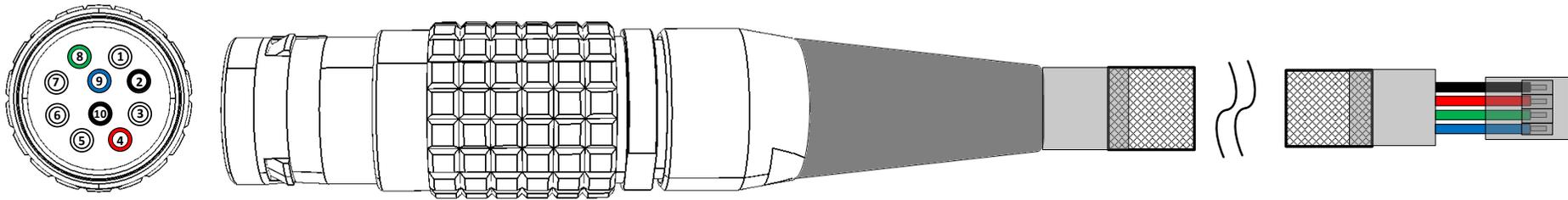


Table 16 – Main connector pinout

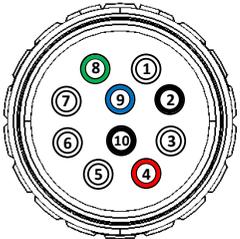
PINOUT	PIN	Name	I/O	Description
 <p>Face view</p>	1	NC	-	Not connected
	2	GND	-	Ground
	3	NC	-	Not connected
	4	+V_PLUG	-	Device external supply with priority over internal battery.
	5	NC	-	Not connected
	6	NC	-	Not connected
	7	NC	-	Not connected
	8	EXT_ON_N	I	A switch can be connected across EXT_ON_P and EXT_ON_N to switch on and off Tx Pole when connected far up to a pole.
	9	EXT_ON_P	-	
		10	GND	-

Table 17 – Main connector pinout

PINOUT	PIN	Name	I/O
Connector TBD by user		GND	-
		+V_PLUG	-
		EXT_ON_N	I
		EXT_ON_P	-