



RV-M21 and RV-M22 **Tech Series Products**

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1. About This Manual

This manual covers interface options for Raveon's Tech Series products. Various radio models may be incorporated into the Tech Series products, so refer to the particular radio module Technical Manual for specific information about how to configure and use the radio features.

This manual covers Tech Series I/O features. The manuals for the radios used in Tech Series products are:

RV-M8	VHF/UHF 5W radio modem module
RV-M6	VHF 2W radio modem module
RV-M50	915MHz ISM Daisy radio
RV-Z50	3G cellular radio modem
RV-Z55	LTE cellular radio modem

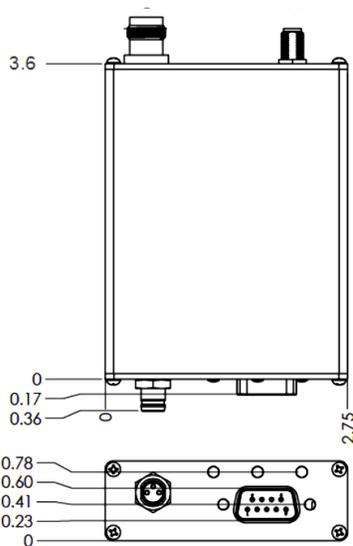
There are two different *Tech Series* Enclosures:

- RV-M21** For M8 radio modules, up to 5 watts TX power.
- RV-M22** For M6, M50m, Z50 radio models. Low power, miniature enclosure.

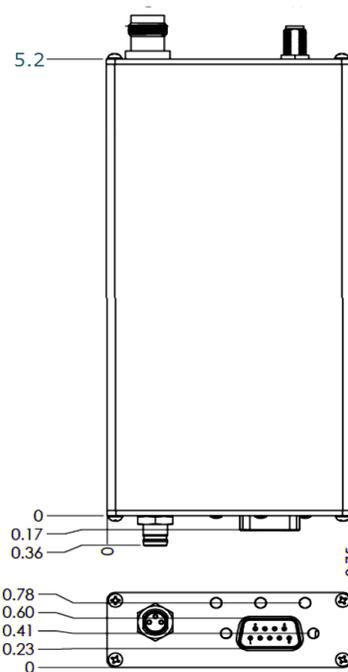
2. Tech Series Overview

2.1. M21 and M22

M22 Enclosure



M21 Enclosure



The M21 is larger to utilize the 5 watt M8 radio modems. Both enclosures have GPS options and can utilize the myriad of IO options.

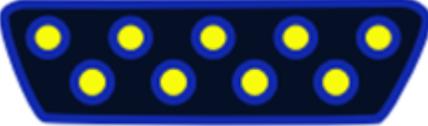
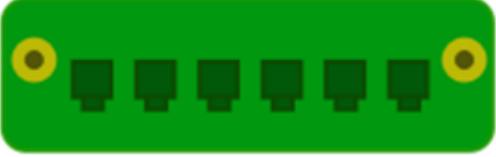
2.2. I/O Options

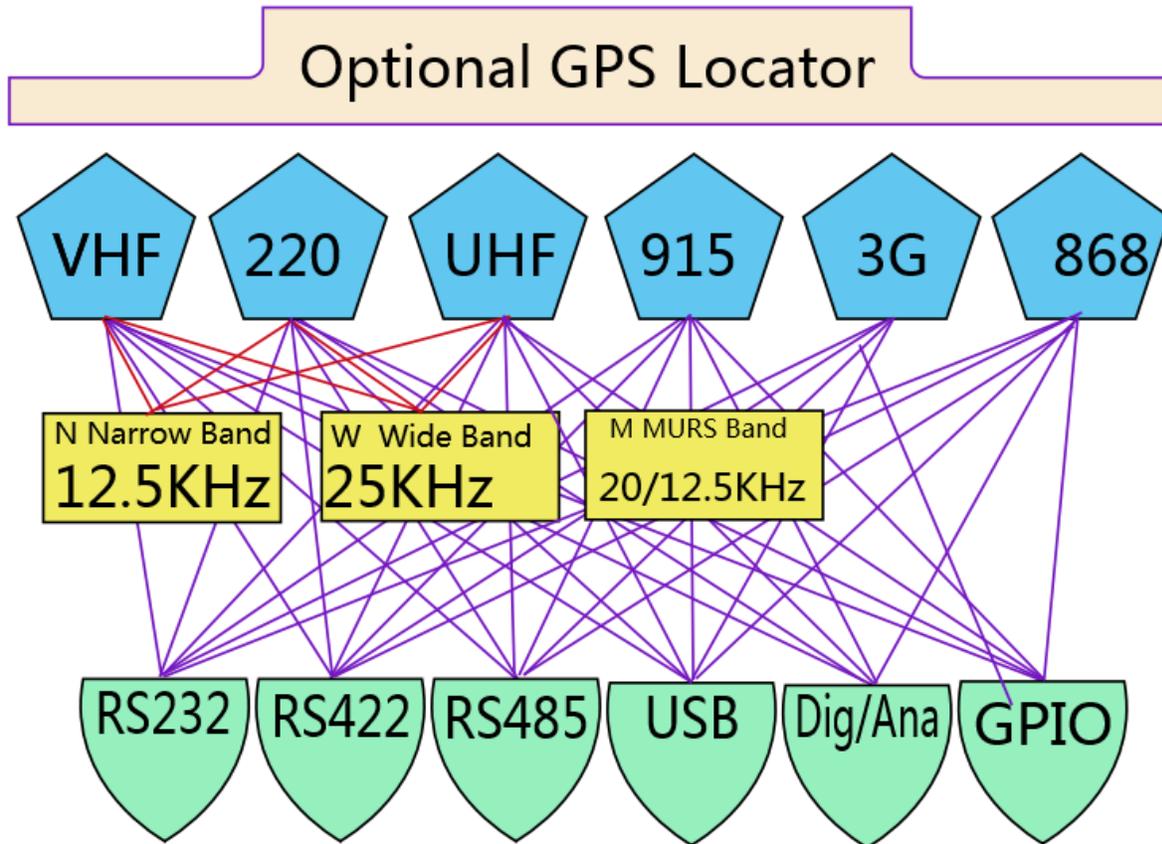
The front interface of the M21 is fully field-reconfigurable. The following interface boards may be attached or changed at any time:

- RS-232 [S] 5T835 RS232 serial port, DB9.
- USB [U] 5T837 USB for computer communication.
- RS-485 [T] 5T836-1 RS-485 2-wire interface.
- RS-422 [F] 5T836-2 RS-422 4-wire interface.
- GPIO [G] contact sales General Purpose IO.
- Analog [A] 5T838 Analog radio interface.
- FIO [D] 5T832-1 Flexible IO. Digital INs and OUTs

2.3. Tech Series Flexibility

The Tech Series radios from Raveon is the most flexible radio platform in the industry. A myriad of I/O options, and many RF band options, GPS options, wide/narrow channels, Arduino option, and wide DC input voltage range.

I/O Connector Type	Connector Code
	S
	U
	F, G, T
	A, D



The Tech Series RV-M21-xxxx radio modems come pre-configured from Raveon with the bandwidth, frequency band, GPS, and I/O option. The I/O interface may be changed in the field.

2.4. Features

The Tech Series radio modems from Raveon have many unique features. Compared to most radio modems, and Raveon's industry-standard M7 radio modem, the Tech Series products feature:

- 1) **Water-proof** DC power connection
- 2) **Locking DC** connector. A screw-on M8 type connector that will not come off without unscrewing it.
- 3) **Numerous I/O** options. I/O options such as RS232/485/422 and USB are all available, and field upgradable. The radio within the Tech Series enclosure detects the I/O it is using, and adjusts its operation accordingly.
- 4) **Low power** consumption. The power supplies, receiver, GPS, and transmitter all have lower power consumption than legacy products.
- 5) **Secure**. Built in AES encryption options allow users to add additional security to their communication systems.
- 6) **App Processor Option**. You can order a TechSeries product with a built-in Arduino application processor to run your own application on.

- 7) **Broad RF Options.** Radio modems used within the TechSeries enclosure are available from Raveon in VHF, 220MHz, UHF, 800MHz, 900MHz, and 3G cellular bands.
- 8) **Wide DC input.** Most Tech Series modems will work off of any DC input voltage from 10V to 30V DC, twice the range of most radios.
- 9) **Multiple Protocols.** Tech series radios support many different protocols, such as 4800, 9600, 19200 baud data modems, Bell 202 legacy analog AFSK modulation, POCSAG paging, and audio modulation. 3G cellular and LoRa WAN are also available.

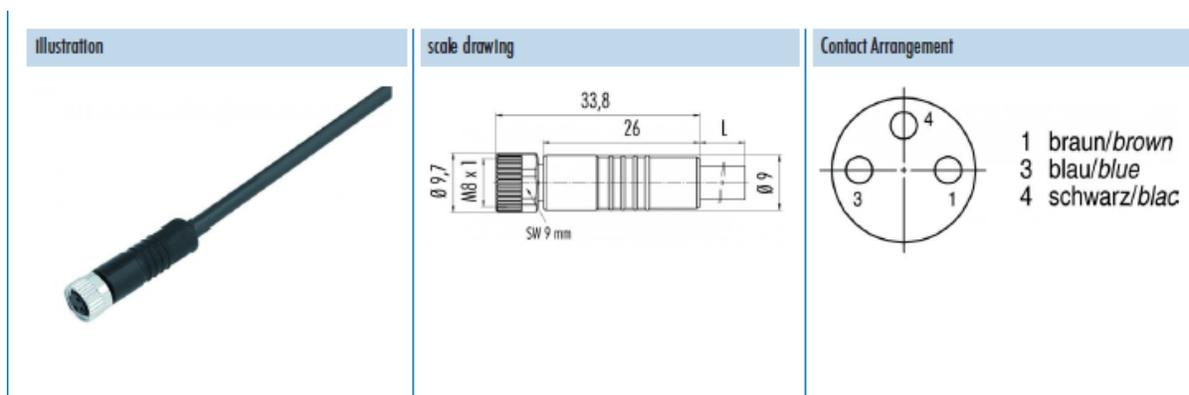
2.5. Power

The TechSeries products from Raveon utilize a 3-pin power connector. Coincidentally, the industry name for this connector is “**M8**”. The three pins are:

1. **VIN.** DC input voltage. Refer to the specific model number data sheet for input voltage range.
2. **GND.** Chassis ground and sometimes cable shield.
3. **GND.** Chassis and signal ground.
4. **Enable.** Voltage input to enable/disable the product. Normally this is connected to VIN. It must be > 2V for the product to start working.

2.6. Power Cable

The cable that connects to the M21 and all Tech Series products is typically wired as shown here. This 2 meter cable is Raveon part number 4C850-1.



Pin 1 (VIN) is a brown wire. Connect to + DC input voltage.

Pin 3 (Ground) is a blue wire. Connect to Ground or negative input voltage.

Pin 4 (Enable) is a black wire. Ground to disable product. Connect to Pin 1 or a voltage > 2V to enable product.

2.7. LED Indicators

The TechSeries have 3 LEDs on their front panel:

PWR Power LED

The power LED blinks green every two seconds. To conserve energy, the blink is a very short amount of time. If you look carefully at the PWR led, you will see the periodic green flicker of light when the product is powered on.

STAT LED

The status LED indicates the status of the transmitter, receiver, and GPS.

Green: The receiver is receiving data over the air, or the channel is busy.

Red: The transmitter is transmitting data.

Orange: The GPS receiver in the product has not yet locked to the GPS satellites.

LINK LED

The LINK led is used on DART systems where the radio modem connects to a secure network, and the LINK LED indicates the status. If the Dart system is not used, the link LED will remain off.

Connected: The device is authenticated and can communicate on the network.

Red: The device is denied access to the network.

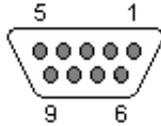
Off: The system does not use the LINK LED, or the user disabled it.

3. Tech Series I/O Interface Information

Products that are compatible with the Tech Series enclosure usually have an I/O mode command to configure them for auto-detect of Tech Series I/O interfaces. ATIO is the command. ATIO 8 sets the product to search the Tech Series front panel for information about which panel is plugged into it.

3.1. RS-232 [S] 5T835

The RS-232 9-pin serial I/O connector is a female 9-pin D-subminiature connector having the following pins configuration. It is pinned out so that it may be plugged directly into a computer or PC's 9-pin COM port.



Front-view of DB-9 connector on modem (female)

Pin	Name	Dir	Function	Level / Specification
1	CD	out	Carrier detect	If enabled, indicates presence of carrier. Logical 0 (+ voltage on RS-232) means carrier is present. Logical 1 (- voltage) means no carrier detected. If disabled, it is asserted (0) whenever the modem is operational, and not in the configuration mode. It will be a 1 when the modem is in the configuration mode.
2	RxD	out	Receive data	Data out of the modem. It is the data received over the air.
3	TxD	in	Transmit data	Data into the modem. Also used as digital input IN2 for exception reporting. GND or floating for a 0, >3V for digital 1. If enabled for digital inputs, the serial data entering this pin is ignored (except in the command mode). Use the TRIGBITS command to set which bits are used as inputs.
4	DTR	in	Data terminal read	Normally ignored by the <i>RV-M7</i> modem. May control the power-state of the modem in low-power mode if this feature is enabled. Also used as digital input IN0 for exception reporting. GND or floating for a 0, >3V for digital 1. Use the TRIGBITS command to set which bits are used as inputs.
5	GND		Ground connection	Signal and power ground
6	DSR	out	Data Set Ready	Normally is set to 0 when modem is powered on and running. Modem sets to a 1 when in low-power mode.
7	RTS	in	Request to send or IN1	Used to stop/start the flow of data coming out of the modem TxD pin. 0 = OK to send, 1 = don't send. Leave disconnected if not used. Also used as digital input IN1 for exception reporting. GND or floating for a 0, >3V for digital 1. Use the TRIGBITS command to set which bits are used as inputs.
8	CTS	out	Clear to send	Used to stop the flow of data going into the RxD pin from the device connected to the <i>RV-M7</i> . 0 = OK to send, 1 = don't send. If the <i>RV-M7</i> cannot accept more data, it will negate this signal (level=1).
9	Power	In/out	DC power	User may supply the DC power to the modem on this pin.

Note: RS-232 signals use positive and negative voltages to represent digital 1s and 0s. A positive voltage is a 0, and a negative voltage is a digital 1.

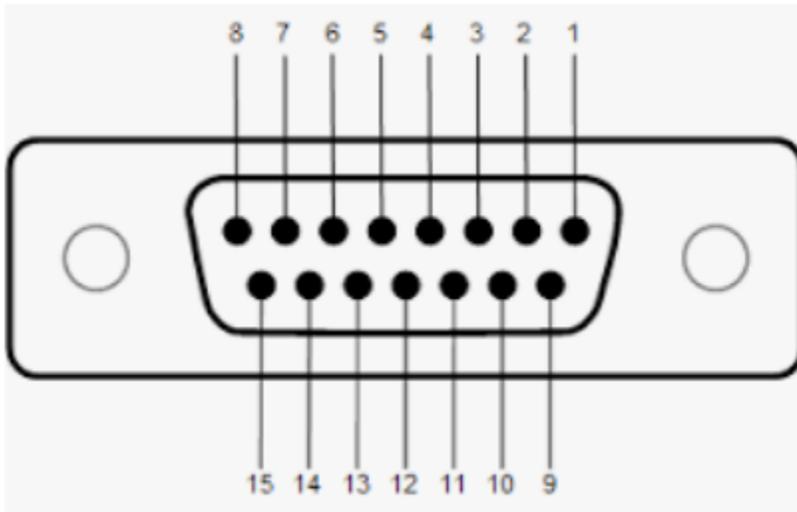
This pin-out allows it to be directly plugged into a computer's 9-pin serial port using a conventional 9-pin RS-232 serial cable. To connect it to a modem, or peripheral that has a serial port, you will need a "null-modem" cable.

3.2. Analog [A] 5T838

The DB15 connector on the front panel has the following pin functions.

Pin#	Function	Description
1	MIC	Analog Input
2	Audio Out	Analog Output
3	RSSI	Radio Signal Strength Out
4	IOC	General IO – C
5	DTR	Digital DTR out
6	VIN	DC Voltage Input
7	V3	3./3V Output
8	RXD	RX data out, RS232 level

9	TXD	TX data in, RS232 level
10	CTS	CTS, 3V digital level
11	NC	No connect
12	PTT	Transmitter Enable Line. Active low. Input impedance is 10K. TX Mode: Input < 2.9V RX Mode: > 3.0V or open circuit
13	NC	No connect
14	DCD	Data/Carrier Detect output. 0-0.1V no carrier, 2.2K pull-up resistor to VIN when carrier is detected. The 2200ohm pull-up resistor is driven by a MOSFET pulling it to ground when no carrier is present. With a 12V DC input, this output can go to 12V.
15	GND	Ground, chassis and power gnd.



Pin 12 is the Push To Talk (PTT) input. It has a pull-up resistor of about 10K on it. When PTT is low, the transmitter in the M8T will turn on, and output the audio signal on pin 1.

When PTT is high, the M8T is in the receive mode, and the receive audio will be output on pin 2.

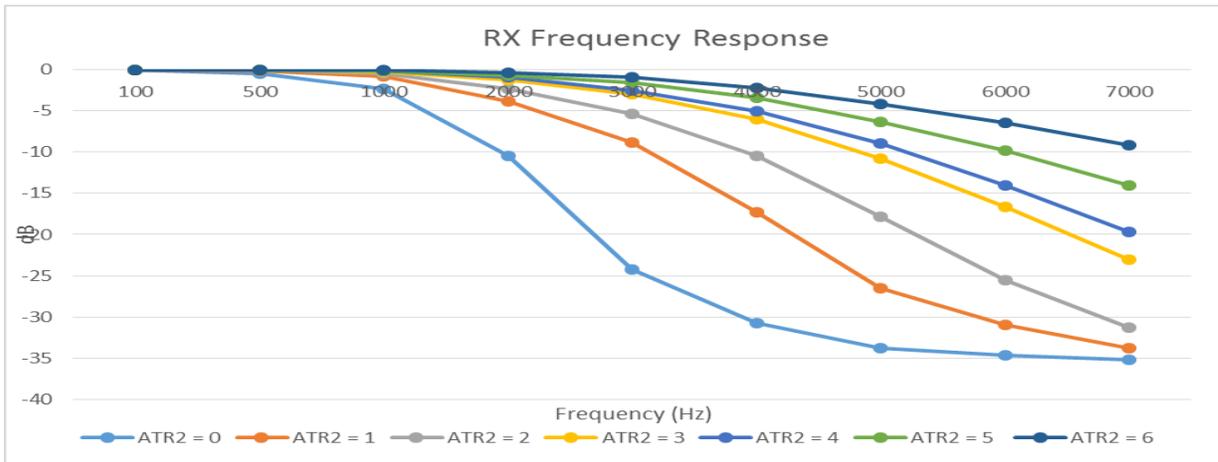
On Tech Series products utilizing M8 radio modules, the PTT can be set to active high via the **ATPTT** command.

There are a few commands designed specifically for use in configuring the operation of the M8S in audio pass-through mode.

AFLVL	Audio input level gain – internal gain of the audio input signal, in % . Adjust this setting for the audio input deviation level.	Range: 0-2000% mV	100
AFDC	Audio input DC offset – The DC bias level on the audio input in millivolt. Adjust this setting so the audio transmissions are on the center of the channel. Set to 0 to have the M8S auto-detect the average.	Range: -2000 - 2000 mV	0

AFLIM	Audio deviation limit – Sets the peak audio deviation limit for TX audio in the audio pass-through mode. In % of data deviation 100% limits audio to same as data. .	Range: 0-300%	100
TXTOT	Transmit Time-Out-Timer – Sets the maximum number of seconds that the M8S will stay transmitting when the PTT input is asserted.	Range: 0-500 seconds	10
ATPTT	Push To Talk Polarity – Sets the PTT polarity. Default is active low (0) and set to 1 for active high.	Range: 0-1	0
ATR2	Audio Frequency Response – In the audio mode use the ATR2 OTA baud setting to set the audio frequency response. See table below	Range: 0-6	3

Receive Frequency Response:



Transmit Sampling Rate

Sampling Rate	
ATR2 = 0	8kHz
ATR2 = 1	12kHz
ATR2 = 2	24kHz
ATR2 = 3	48kHz
ATR2 = 4	80kHz
ATR2 = 5	96kHz
ATR2 = 6	96kHz

The transmit audio input pin 1 is designed to have audio sent in with a 1.66 V DC bias. If the audio input has a different DC bias voltage, the M8 can be reconfigured to use the different DC bias offset. The **AFDC** sets the nominal DC bias voltage. Note, the analog input range of the M8S is 0-3.3V. Ideally bias the DC input to 1.66V or AC couple it with a capacitor and add two bias resistor to ground and 3.3V. One hundred counts (or 100mV) will shift the frequency about .7kHz, use caution with this command. To have the M8 determine the DC bias input automatically and use the measured DC level as the DC input, set **AFDC** to 0 to have the M8 automatically find the DC input bias and compensate for it.

The **AFLVL** command sets the DC gain of the TX audio input. With it set to 100%, an audio signal with a peak-to-peak value of 500mV will produce +/- 2kHz of FM deviation. With **AFLVL** set to 200, 250mV p-p input will give 2kHz p-p of FM deviation.

The **AFLIM** command sets a hard FM deviation limit, which will stop the M8 from deviating the FM carrier beyond the preset limit when the input TX audio exceeds a threshold that would cause the M8 to over-deviate.

Raveon suggests the **AFDC**, **AFLVL**, and **AFLIM** always be adjusted and calibrated by trained radio technicians familiar with setting FM deviation gain and FM limiters.

The **TXTOT** command sets the transmit time-out-timer (TOT). The TOT protects the radio and the system from damage and interference due to accidental over-keying of a transmitter. Set the **TXTOT** value to the maximum number of seconds a TX audio pass-through transmission should ever take. If the **TXTOT** times-out, the M8 will automatically un-key, and not re-key again until the PTT line is negated, and then some time re-asserted.

Typically, the audio output with a 2kHz FM deviation, will have a peak to peak of 300mV - 400mV and a DC offset around 500-1000mV. If your circuit does not accommodate DC offset be sure to add a coupling capacitor.

3.3. USB [U] 5T837

The USB works as a serial to USB converter. This requires a FTDI USB driver. This should automatically install to your computer when the radio is plugged in, if not, please download the driver from the Raveon website.



3.4. RS-485 [T] 5T836-1

RS-485 is two-wire connection, with the pair of wires transmitting and receiving data.



Pin #	Name	Direction	Function	Level / Specification
1				Do not connect this pin to anything.
2	B	I/O	B(+)	Non-inverting RS-485 data line
3	A	I/O	A(-)	Inverting RS-485 data in line
4				Do not connect this pin to anything.
5				Do not connect this pin to anything.
6	GND	-	Ground	Connect to earth ground.

The RS-485 differential line consists of two pins, A and B.

A TxD+/RxD+ non-inverting pin which is positive (compared to B) when the line is idle.

B TxD-/RxD- aka inverting pin which is negative (compared to A) when the line is idle.

Configuring

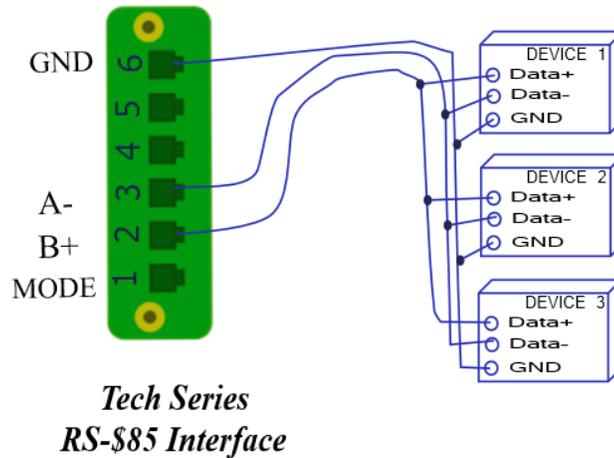
The radio will auto-detect the 485 Tech Series board and set all necessary parameters to enable RS485 communication.

The radio will only support RS485 Simplex. In simplex RS-485 mode, the *radio's* serial data receiver is internally disabled whenever it sends a character out the serial port, so that it will not receive its own data.

If you wish to run the RS-485 in full-duplex mode using two radios, the interface must be wired with two separate pairs of wires; A&B on one pair, and Out+ & Out- on the other pair.

The radio's RS-485 I/O circuit uses 3.3V logic to drive the lines, and the RS-485 pins are ESD protected to $\pm 15\text{kV}$ and 7kV human body model. Input current is less than 150uA. Output current when not driving the line is less than 50uA.

RS-485 (Half Duplex to/from many Devices)



Simplex or Full Duplex

Simplex is the default. In simplex RS-485 mode, the serial data receiver is internally disabled whenever it sends a character out the serial port, so that it will not receive its own data nor will it receive data from any other device when it is sending data out.

If you want to use RS-485 full duplex with tri-state outs, utilize the RS-422 version of the Tech Series panel, and use it in your system. RS-422 4-wire tri-state operates the same as RS-485 4-Wire Tri-State Simplex.

3.5. RS-422 [F] 5T836-2

RS-422 communications uses 4-wire differential signals. The Tech Series 422 board has the following pin configuration.



Pin #	Name	Direction	Function	Level / Specification
1	MODE	I	T Mode	1 (or Float) to default to tri-state simplex mode. 0 (ground) to enable full duplex, dual mode output.
2	Y	Out	Out+	Non-inverting RS-422 data OUT line
3	Z	Out	Out-	Inverting RS-422 data OUT line
4	A	In	In+	Non-Inverting data INPUT pin
5	B	In	In-	Inverting data INPUT pin
6	GND	-	Ground	Connect to earth ground.

Configuring for RS-422 Dual-State (Duplex Communications)

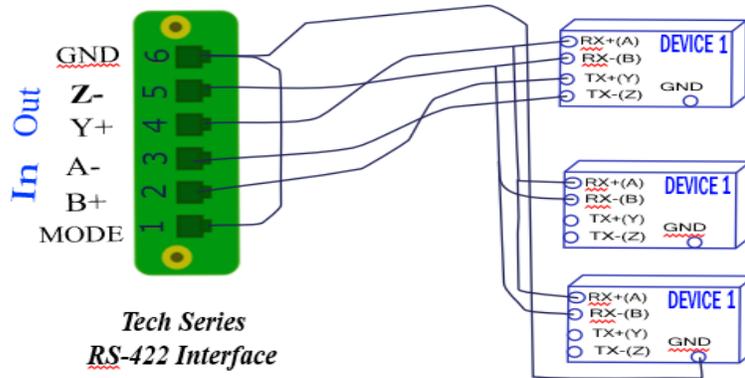
The Tech Series enclosure will auto-detect the 422 Tech Series board and set all necessary parameters to enable RS422 communication. The Tech Series hardware connector is identical to the RS485 version.

Raveon's RS-422 I/O circuit uses 3.3V logic to drive the lines, and the RS422 pins are ESD protected to $\pm 15\text{kV}$ and 7kV human body model. Output is tri-state (0, 1, and Open circuit). Tri-State is used for full duplex communications.

RS-422 installations typically have a termination resistor across the Input and the Output lines. A value of 150 ohms should work in most applications.

Connect Pin 1 (MODE) to ground to enable the *Full Duplex Dual-State* operation.

RS-422 Duplex Comm (*Duplex to One Device*) TX to Many Devices



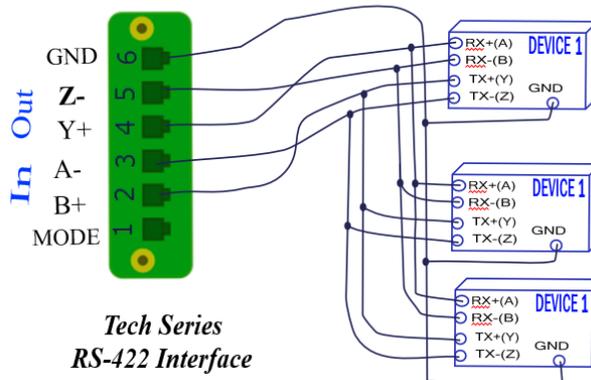
Configuring RS-422 Tri-State (Simplex Communication).

To put the RS422 into a tri-state mode, do not connect pin 1 (MODE) to anything. Leave it disconnected or set to 3.3V.

When the MODE pin is open or at 3.3V, the TX driver is in a tri-state mode, so communications is Half Duplex, meaning the device cannot receive data when it is sending data. 1-2mS after it sends out data, it can start receiving inbound data.

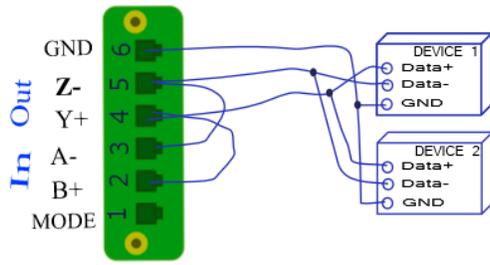
If you want to use RS-485 *Simplex Tri-State* outs, Order the RS422 version of the Tech Series panel, and use it in your system. RS-422 4-Wire Tri-State operates the same as RS-485 4-Wire Tri-State.

RS-422 Simplex (*Simplex to/from many Devices*)



As you can see, the MODE pin is not grounded, which is correct for simplex. If you want, you can wire up the RS-422 Simplex to act like an RS-485 2-wire.

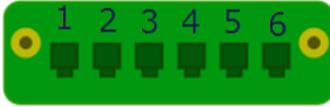
RS-422 Simplex like an RS-485 2-wire



*Tech Series
RS-422 Interface*

3.6. GPIO [G]

Uses the same IO connector as the RS-485, and has serial IO and general purpose IO functions that are software configurable. The pin-numbers on this connector are different than the RS-485 pin-out.



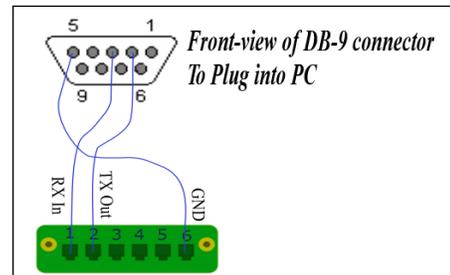
Pin #	Name	Direction	Function	Level / Specification
1	RX	In	Serial data Input	RS232
2	TX	Out	Serial Data Output	RS232
3	IO0	I/O	I/O Pin 0	Configurable General Purpose IO (GPIO). Available Modes: A, C, E
4	IO1	I/O	I/O Pin 1	Configurable General Purpose IO (GPIO). Available Modes: A, C, D, E
5	IO2	I/O	I/O Pin 2	Configurable General Purpose IO (GPIO). Available Modes: A, C, D, E
6	GND	-	Ground	Connect to earth ground.

The GPIO pins have a variety of IO mode options. They are configured with the **IOPIN** command. The configuration codes for the various modes are:

- A Digital Input bit.
- B Digital output bit. (Not supported in GPIO mode)
- C Open drain MOSFET output.
- D DC switched power output.
- E Analog; voltage input

An RS232 serial cable can be connected to pins 1, 2, and 6 to configure the internal radio modem and the MIMIC mode features. Here is a wiring diagram for an RS232 DB9 connector to be wired to the GPIO connector.

Or contact Raveon to have the device pre-configured when it is purchased.



SCADA and Telemetry Use

The GPIO is an ideal interface for wireless SCADA and Telemetry systems. It can operate as a Remote Terminal Unit (RTU) which saves cost in your system. The Tech Series radio modems support MODBUS RTU communication messages, so Telemetry systems can utilize MODBUS messages to read and manage the GPIOs. See application note AN234 for details on how MODBUS is incorporated into these

Tech Series modems. AN230 has detailed information about the MODBUS communication protocol.

Configuring

The radio will auto-detect the GPIO board and set all necessary parameters to enable it. By default, the IO pins are set to digital inputs.

Summary of Input and Output functions.

IO pins 3, 4, and 5 can be configured with built-in commands to be either digital inputs, digital outputs, analog inputs, switched DC power output, open-drain outputs.

Digital Input Specifications:

Low-level input voltage:	Less than 0.5V
High-level input voltage:	Greater than 2.2V
Input resistance:	5K-10K pull-down resistance.

Digital Output Specifications:

Low-level Output voltage:	Less than 0.5V
High Level Output Voltage:	3.0 - 3.3V
Output resistance:	250 ohms

Open Drain Output Specifications:

Low-level Output voltage, on:	0V to 0.5V drawing less than 2.1A.
Open drain off leakage resistance	500uA, 0-5V, < 1mA 5-20V.
High Level Output Voltage, off:	0 - 20V
Output resistance, on:	<250 milliohms to ground

Switched DC power output: (IO1 and IO2) IO0 does not have this capability.

Output voltage, on:	Same as DC input, 90%-100%.
Maximum Output Current	2.0 amps
On state internal resistance	100-250mOhms.
Maximum reverse input voltage when off	DC input + 150mV
Off output off leakage resistance	5-200uA
High Level Output Voltage, off:	Same limit as RF board within the M21 enclosure.
Output resistance, on:	<25 0 milliohms

to ground

Analog Input Specifications:

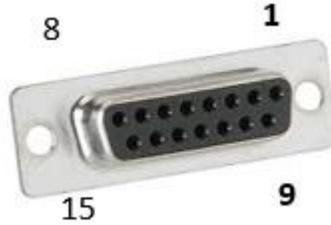
Low-level input voltage:	0V
High-level input voltage:	Vin -1.0V. Vin is the voltage powering the Tech Series product.
Input resistance:	220K.

3.7. FIO [D] Flexible IO

The Tech Series FIO Flexible IO version of the RV-M21 and RV-M22 series radio modems is ideal for SCADA and telemetry. Here is a summary of the standard FIO features. If you need other IO features or additional IO, please contact Raveon sales personnel.

The FIO connector on the product is DB15 female.

The IO modes FIO pins can be set to are: **A**: Digital TTL Input, **B**: Digital TTL Output, **C**: Open Drain MOSFET output. Please see the following table to see which FIO ports can be used for which IO modes.

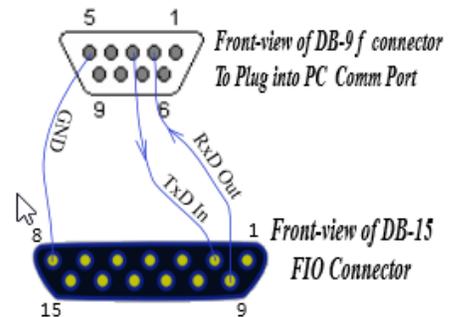


Pin #	Name	Direction	Function	Level / Specification	GPIO Modes this pin can be configured as:
1	VIN		DC Voltage Input		
2	TxD	In	Serial Data Input. Data to TX or command inputs.		
3	OD0	Out	Open Drain Out		C
4	IO0	I/O	I/O Pin 0 (digital bit 0)	Digital IO pin. Input or output.	A, B
12	IO1	I/O	I/O Pin 1	Digital IO pin. Input or output.	A, B
5	IO2	I/O	I/O Pin 2	Digital IO pin. Input or output.	A, B
13	IO3	I/O	I/O Pin 3	Digital IO pin. Input or output.	A, B
6	IO4	I/O	I/O Pin 4	Digital IO pin. Input or output.	A, B
14	IO5	I/O	I/O Pin 5	Digital IO pin. Input or output.	A, B
7	IO6	I/O	I/O Pin 6	Digital IO pin. Input or output.	A, B
15	IO7	I/O	I/O Pin 7	Digital IO pin. Input or output.	A, B
9	RxD	Out	RX serial data output.	RS232	
10	VDIG		Digital Voltage	The internal IO port voltage regulator outputs its voltage on this pin.	A, B, C, D, E
8, 11	GND	-	Ground		

An RS232 serial cable can be connected to pins 1, 2, and 6 to configure the internal radio modem and the MIMIC mode features. Here is a wiring diagram for an RS232 DB9 connector to be wired to the FIO connector.

Built in commands allow users to setup the FIO as they desire. Contact Raveon sales to have the device pre-configured when it is purchased.

The FIO input pins' state is measured and recorded every 50mS, and the status in the input state registers is updated at this interval.



SCADA and Telemetry Use

The FIO is an ideal interface for wireless SCADA and Telemetry systems. It can operate as a Remote Terminal Unit (RTU) which saves cost in your system. The Tech Series radio modems support MODBUS RTU communication messages, so Telemetry systems can utilize MODBUS messages to read and manage the FIOs. See application note AN234 for details on how MODBUS is incorporated into these Tech Series modems. AN230 has detailed information about the MODBUS communication protocol.

Summary of Input and Output functions.

IO pins 4, 5, 6, 7, 12, 13, 14, 15 can be configured with built-in commands to be either digital inputs, digital outputs.

Digital Input Specifications:

Low-level input voltage:	Less than 0.5V
High-level input voltage:	Greater than 2.2V
Input resistance:	Floating, > 2K resistance.

Digital Output Specifications:

Low-level Output voltage:	Less than 0.5V
High Level Output Voltage:	3.0 - 3.3V
Output resistance:	330 ohms.

4. GPIO and FIO Commands and Configuration

Application Note AN234 has more information about how to use the Tech Series Radios for SCADA Applications. Here is a summary of the information.

For many SCADA systems, the Tech Series GPIO interface is the ideal interface to monitor remote devices or control them. The ones with serial interfaces such as RS-232, USB, and RS485 can be connected to a SCADA controller or HMI to communicate with a remote Tech Series radio modem that has the GPIO interface.

4.1. SCADA and Telemetry Commands

The following commands are powerful SCADA and telemetry features in Tech Series devices.

Command	Command Description	Parameters	Default Settings
ATS330	ATS310 B SSSS Read or Configure the Pulse Counter . B is the bit number (0-15) that is being configured or read. SSSS is the integer value to set it to. Set SSSS to 0 to reset the counter to 0. For example, ATS300 4 0 will reset bit 4 (5 th bit) to 0.	B: 0 - 15 SS: 0 - 65536	0
ATS331	ATS310 B SSSS Read or Configure a Reset Time used to reset the bit's Pulse Counter to 0. B is the bit number (0-15) that is being configured. SSSS is the interval number of seconds that the transition counter (pulse counter) will be reset to 0. Set SSSS to 0 to disable this feature on the bit, and never automatically reset the counter.	B: 0 - 15 SS: 0 - 65536	0
ATS332	ATS310 B SSSS Read or Set an UP Timer . UP Timer is the number of milli-seconds an input is UP (digital 1). UP Timer ticks up B is the bit	B: 0 - 15	0

	number (0-15) that is being read or configured. SSSS is the new integer timer value.	SS: 0 - 65536	
ATS333	ATS310 B SSSS Read or Configure a Down Timer . Down Timer is the number of milli-seconds an input is Down (digital 0). Down Timer ticks up B is the bit number (0-15) that is being read or configured. SSSS is the new timer value if you want to change it.	B: 0 - 15 SS: 0 - 65536	0
CALADC	CALADC X V.VV Used for calibrating the ADC input. By default it is 1V per V, but users may recalibrate for other scaling factors. V.VV is the voltage input in mV. X is the input pin number 0 through... CALADC 1 2.50 calibrates using input 1 to measure the current voltage as 2.5V. All inputs are then re-calibrated.		
ADCMV	ADCMV xxxx Get/ set the ADC resolution. The value is mV per 100 ADC steps on the internal ADC converter. 1140 would mean an ADC value of 200 is 2.28V.		
GOUT	GOUT Get the output bit register in hexadecimal format. Example: will return 00C3 if bits 0, 1, 14, 15 are set(1) and all other clear (0).	Returns Hex value, 16 bits max.	
GVOLT	GVOLT X Get/read the voltage on an input X.	Returns floating point, 3 decimal places. .	
GIO	GIO – Get the status of Output bit, Input bits and Analog values		
GINP	GINP Get the input bit register in hexadecimal format. Example: will return 00C3 if bits 0, 1, 14, 15 are set(1) and all other clear (0).	Returns Hex value, 16 bits max.	
CBIT	CBIT XX Clears output bits, XX is hexadecimal format. Any bit in x set to 1 will cause the same output bit in the modem's output register to be cleared to 0. No bits get set. X=C3 to set bits 0, 1, 14, 15. To read the output bit register, enter CLRBIT with no parameter or better to use GETOUT command.	0-FF	
SBIT	SBIT XX Sets output bits, XX is hexadecimal format of the bits being set. Any bit in x set to 1 will cause the same output bit in the modem's output register to be set. No bits get cleared. X=C3 to set bits 0, 1, 14, 15. To read the output bit register, enter SETBIT with no parameter or better to use GETOUT command.	0-FF	0
TBIT	TBIT XX MMM Sets output bits for a specific time, XX is hexadecimal format of the bits. Any bit in x set to 1 will cause the same output bit in the modem's output register to be set. MMM is in mS. 1000=one second, 60000=one minute,...To set bit #3 to 1 for 250mS: TBIT 4 250 After the time expires, the bits that was st in XX is cleared to 0.	0-FF 2 – 4000000000 (2mS – 1100hours)	
CNTTM	CNTTM B SS Configure a timer to reset the bit's binary counter. B is the bit number (0-15) that is being configured. SS is the interval number of seconds that the transition counter will be reset to 0. Set SS to 0 to never automatically reset the counter.	B: 0 - 15 SS: 0 - 65536	
IOPIN	IOPIN XX M Set the GPIO bits on the Tech Series GPIO front panel to inputs or outputs. XX parameter are the hexadecimal representation of the pins being configured. M is the mode for the XX pins. Mode M values: A :Digital TTL Input, B :Digital TTL Output. C :Open Drain MOSFET output, D :DC Power switch output. E :Analog Input X :Unused pin.	XX=Hex 00-FF M=(A,B,C,D)	7 (Digital Inputs)

The Tech Series SCADA features support custom “safe zones” and alert you automatically if the sensor detects conditions outside of that range. Some safe zone settings can report: On, OFF, XX number of transitions, pulses per second, pulses per minute.

Application Note AN234 has details on how the Tech Series modems can be used as Remote Terminal Units (RTUs) and a Slave devices. There are many SCAD and Telemetry features to look into:

1. How to configure the IO pins

2. How to use TTL digital IO, switched DC out, open collector, analog input, voltage inputs, internal sensors...
3. How to read and set parameters.
4. How to configure the device for Pulse Counting.
5. How to setup alert thresholds for automatic reports.

5. *RV-M22 and RV-M21 series products Warranty*

Limited One Year Warranty

If within 12 months from date of purchase, this RV-M21 Tech Series Product fails conforms to Raveon Technologies Corporation's (the Company) published specifications for the model purchased due to a defect in material or workmanship, Raveon Technologies Corporation will repair or replace it, at Raveon's sole discretion. This warranty is extended to the original purchasing end user only and is not transferable. Any claim for breach of warranty must be brought to the Company's attention within such twelve (12) month period and the Product must be returned for action on any such claim within twelve (12) months from the date of purchase. Within a reasonable period of time after a claim, the Company will correct any failure of the Product to conform to specifications or any defect in materials or workmanship, or replace the Product, or at its option provide a full refund of the purchase price. A repaired or replaced Product is warranted for 90 days from the date of return shipment to the buyer, or for the balance of the original warranty period, whichever is longer. These remedies are the buyer's exclusive remedies for breach of warranty.

This warranty does not apply to: (a) product damage caused by accident, dropping or abuse in handling, acts of God or any negligent use; (b) units which have been subject to unauthorized repair, opened, taken apart or otherwise modified; (c) units not used in accordance with instructions; (d) damages exceeding the cost of the product; (e) batteries; (f) the finish on any portion of the product, such as surface and/or weathering, as this is considered normal wear and tear; (g) transit damage, initial installation costs, removal costs, or reinstallation costs; (h) damage due to lightning, floods, fire, or earthquakes (i) any product, components or parts not manufactured by the Company (j) defects caused by failure to provide a suitable installation environment for the Radio; (k) damage during shipment; (l) that the Product will be free from any claim for infringement of any patent, trademark, copyright or other proprietary right, including trade secrets.

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No employee of the Company, or any other party is authorized to make any warranty in addition to those made in this document. This warranty limits the Company's risk and allocates the risks of product failure between the Company and the buyer. This allocation is recognized by both parties and is reflected in the price of the goods. The buyer acknowledges that it has read this warranty, understands it, and is bound by its terms. This limited warranty is governed by the laws of the State of California, without reference to its conflict of law provisions or the U.N. Convention on Contracts for the International Sale of Goods.

Warranty service is available by mailing postage prepaid to:

***Raveon Technologies Corporation
2320 Cousteau Court
Vista, CA 92081 - USA***

To obtain warranty service, include a copy of the original sales receipt or invoice showing the date, location, and price of purchase. Include a written description of the problem with the product, a phone number and name of person who may be contacted regarding the problem, and the address to where the product should be returned.

Products repaired under warranty will typically have their program memories erased and reset to factory default settings.