



*Manufacturers of Process
Controls and Instrumentation*

Instruction Manual

Model: *MTS-XXX*

Function: *Modular Telemetry System*

- Module:
- XXX=8DI: 8-Channel Digital Input*
 - XXX=8DO: 8-Channel Digital Output*
 - XXX=4AI: 4-Channal Analog Input*
 - XXX=4AO: 4-Channel Analog Output*
 - XXX=PWR: Power Distribution*
 - XXX=RAD: Radio Communication*
 - XXX=4DIO: 4-Channel Digital Input & Output*

RF Band: *902-928 MHz, 1W*

Serial #: _____

(If special or required)

For Technical Assistance And Questions Call
USA: (231) 788-2900 CANADA: (905) 660-5336

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After seven (7) months from the original date of shipment, products cannot be returned for restocking.

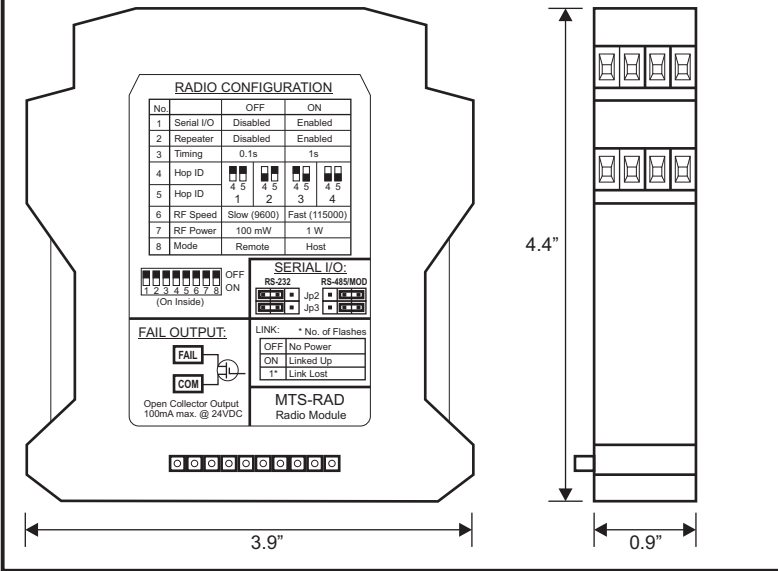
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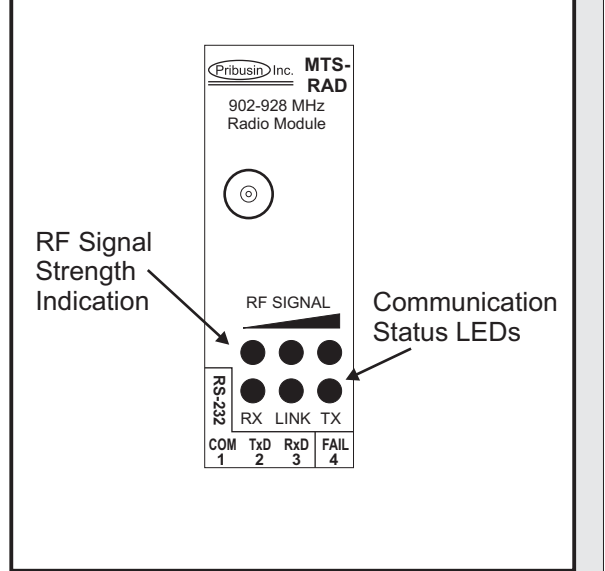
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MTS-RAD

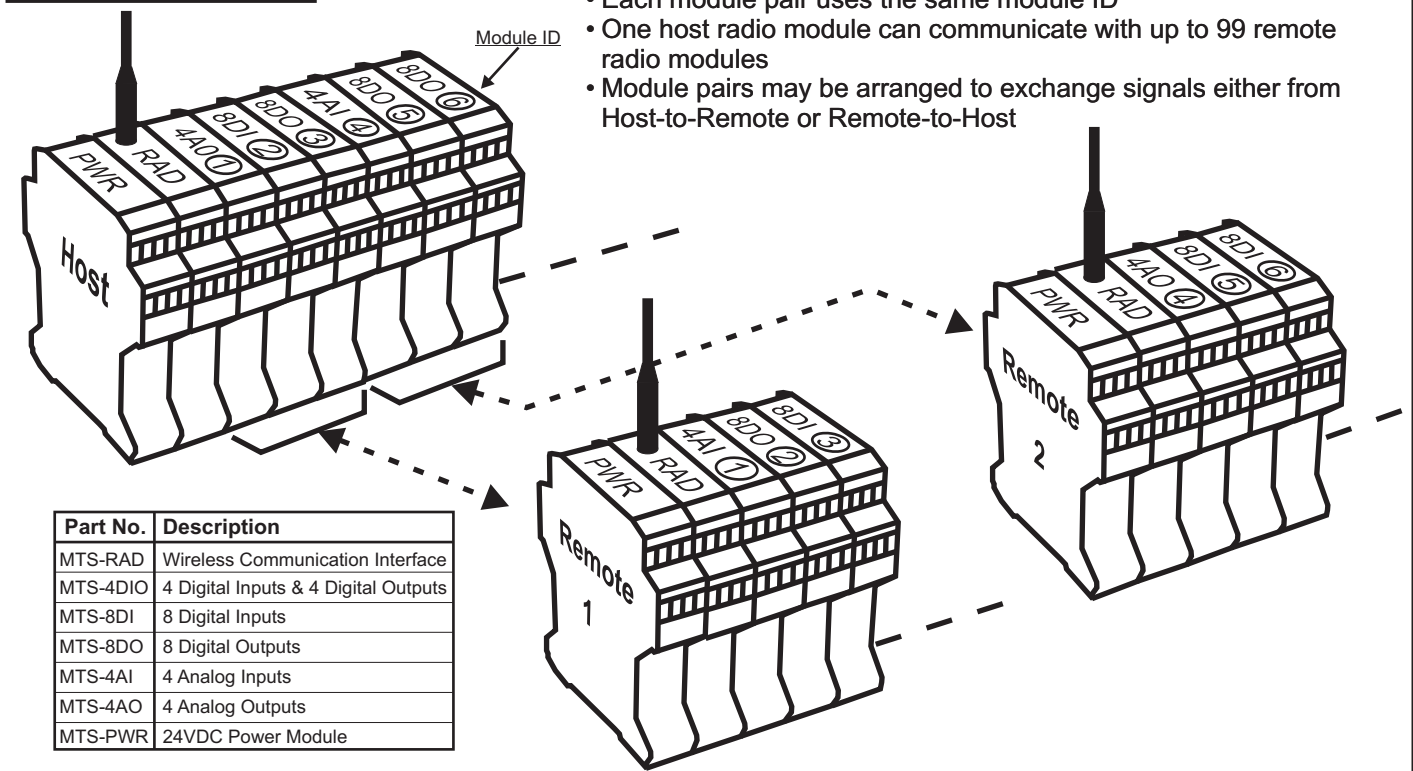
Module Dimensions:



Top View:



System Example:



Manufactured By:



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 743 Marquette Ave.
 Muskegon, MI 49442
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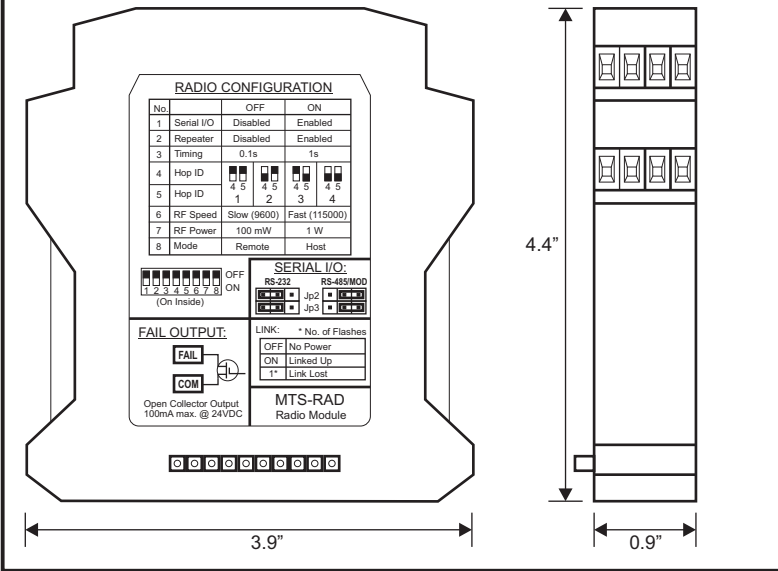


CANADA:

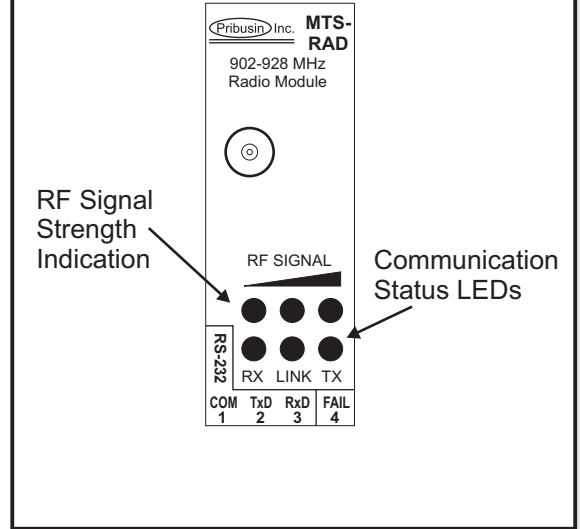
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MTS-RAD

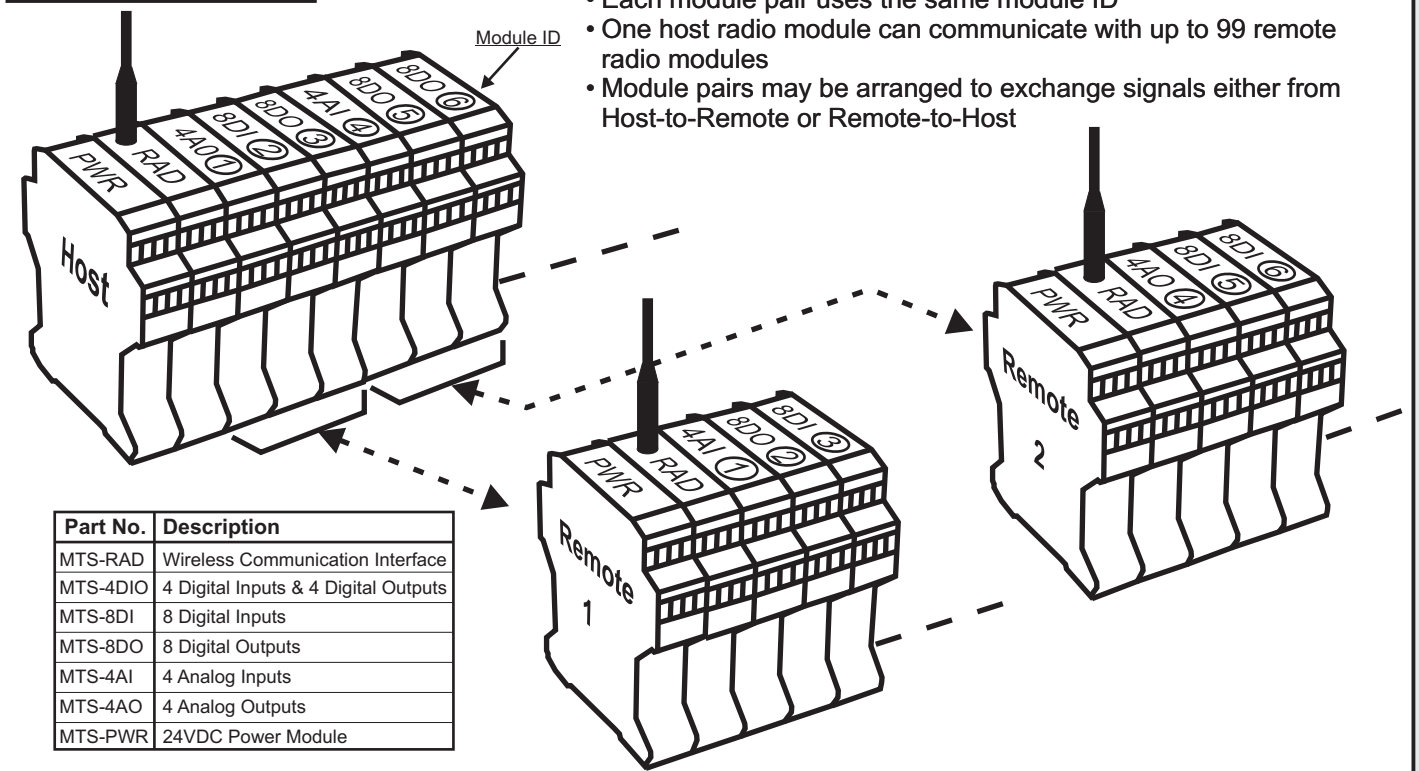
Module Dimensions:



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MTS-RAD Functional Description:

The MTS-RAD is a wireless communications module that operates in the 902-928 MHz license-free ISM band. It serves as the communications link between two or more 'stacks' of MTS-XXX input and output modules.

Power and communication signal connections are achieved via the integral connector at the bottom of the module. Assembling a stack of several MTS modules on a DIN Rail and sliding them together is all that is required to interconnect I/O modules with the communications or power module.

Topology:

There are two types of topologies that can be achieved with the MTS system: 1) Point-to-Point and 2) Point-to-Multi-Point. In a Point-to-Point system there is only one host stack and one remote stack. Each module on the host stack has a direct counterpart module on the remote stack. In a Point-to-Multi-Point system there is one host stack and two or more remote stacks. While the host stack holds one type of module, the counterparts to the host stack modules may be on any one of the remote stacks. The way that the modules link to one another is by their Module ID.

Hop Tables:

The MTS radio uses spread-spectrum frequency-hopping radios that never occupy a single frequency channel for more than 250msec. To keep the radios synchronized, they use an internal frequency hop table to jump to subsequent channels in unison. Each radio can use one of four different hop tables. This allows several MTS systems to coexist in close proximity without interfering with one another.

RSSI Indication:

The MTS-RAD has a 3 LED signal strength indicator that can be used to assess the quality of the RF signal that was received from another MTS-RAD. This indicator shows the received signal strength by the radio and thereby takes into account the receiving radios' antenna system as well as the transmitting radios' antenna system. In the case of poor signal strength both the receiving and sending systems must be carefully examined.

MTS-RAD Installation:

Physical Mounting:

The MTS-RAD module easily snaps onto standard 35mm top-hat style DIN rail for mounting. Each module has a 10-position interconnect bus near the base that provides power and inter-module communication. Once modules are snapped onto the DIN rail they simply slide together and connect via their integrated interconnect bus. See figure 1 below for an illustration.

To remove a module, slide it off the end of the DIN rail or insert a screwdriver into the slot of the retaining clamp at the base of the module and push the screwdriver towards the module – now lift it out.

WHEN ASSEMBLING A STACK OF MODULES OR ADDING OR REMOVING A MODULE MAKE SURE POWER TO THE WHOLE STACK IS OFF.

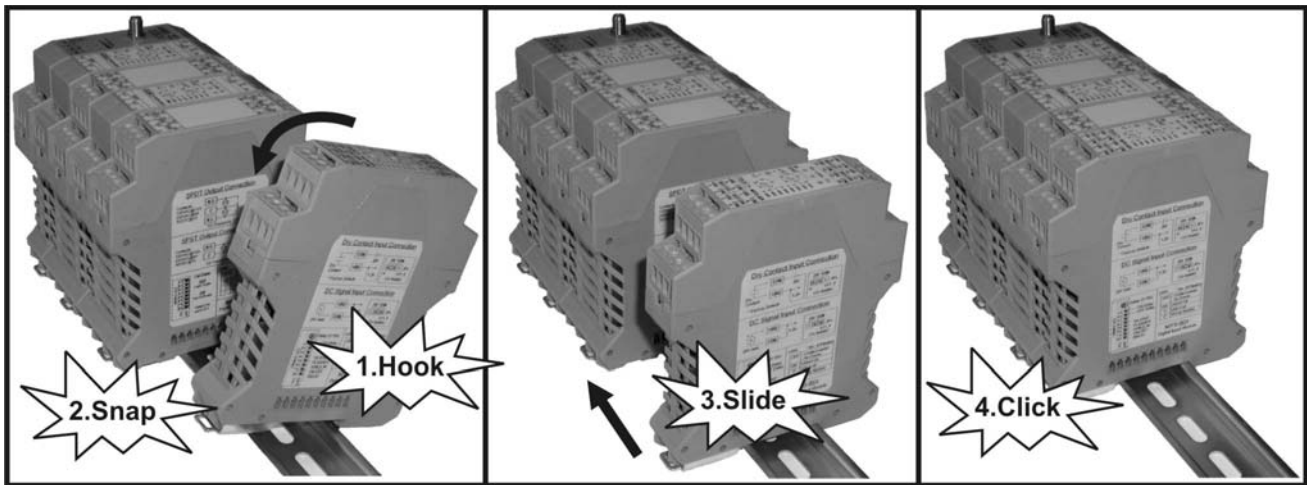


Figure 1

Wiring:

To facilitate easy installation, all terminals are plug-in style and can be removed for wiring purposes. Figure 2 shows the arrangement of the RS232 serial link and the Fail output.

The RF connector on the MTS-RAD is an SMA Reverse Polarity bulkhead style connector (male). Only approved antennas may be connected to the MTS-RAD

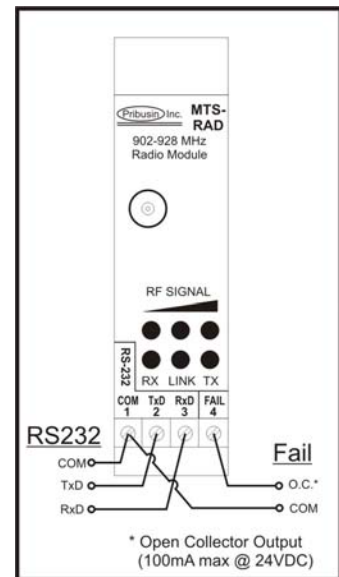


Figure 2

MTS-RAD Configuration:

To configure some functions of the MTS-RAD it is necessary to remove the circuit board and cover assembly from the enclosure body. When doing so, make sure that you adequately protect yourself against static electricity buildup by wearing proper grounding straps.

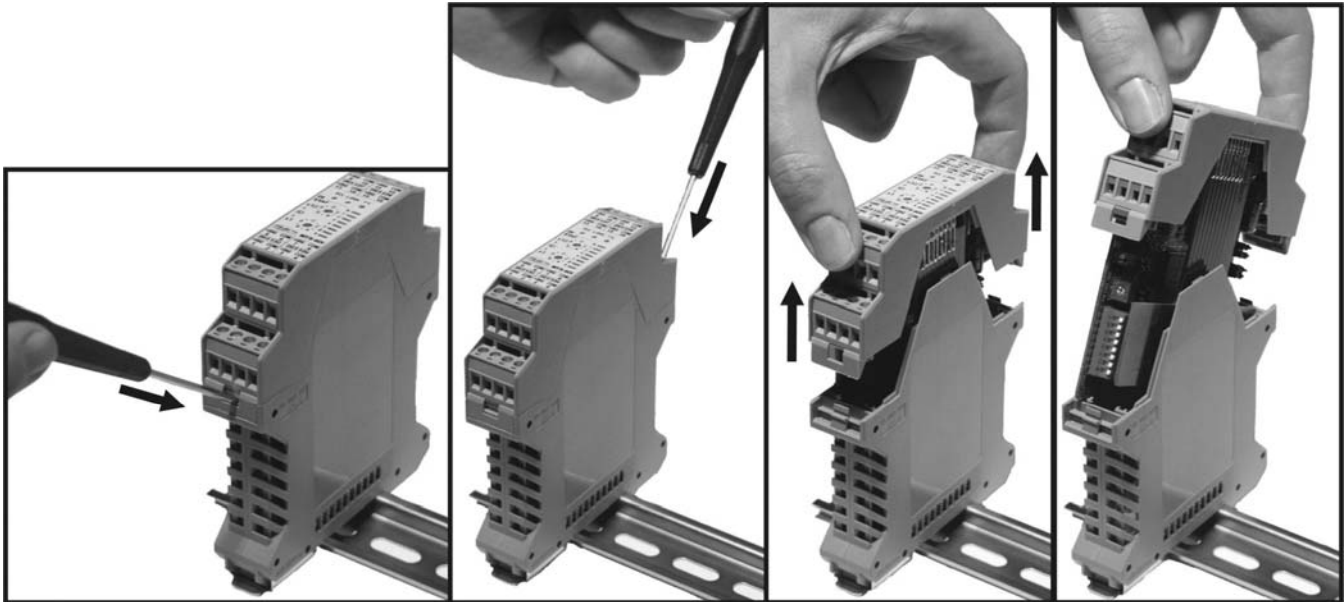


Figure 4

Figure 4 shows how to open the MTS enclosure. **Before proceeding, make sure all power is turned off to the MTS stack.** Using a small screwdriver, push in the two locking tabs on either side of the MTS just below the lower terminal plug. This unlocks the cover. Gently pull on the cover away from the enclosure body until the circuit board is free of the enclosure. Make the necessary adjustments and replace the cover and board assembly in the same orientation as it was removed. Be sure not to accidentally rotate the assembly by 180° when re-inserting it into the enclosure body. When inserting the lower end of the circuit board(s), make sure the board(s) slides into the guide-rails on the inside of the enclosure. Gently push on the top cover until it is firmly seated and the locking tabs click in place.

Host or Remote Mode:

Each MTS system must have one stack designated as the Host Stack and all others designated as Remote Stacks. Whether a stack is a Host or Remote type is determined by the MTS-RAD module. If DIP switch 8 is ON then the MTS-RAD and all of its attached modules function as the Host Stack. If DIP switch 8 is OFF (default) then the MTS-RAD and all of its attached modules function as a Remote Stack.



Mode	SW1-8	
Remote	UP	
Host	DOWN	

Figure 5

RF Output Power:

The MTS-RAD can be operated at one of two RF output power levels: 100mW or 1000mW (1Watt). DIP switch 7 is used to select the radio output power. If DIP Switch 7 is OFF (default) then RF output power is 100mW. If DIP Switch 7 is ON then RF output power is 1000mW (1W).



RF Output Power	SW1-7	
100 mW	UP	
1 W	DOWN	

Figure 6

CAUTION: FCC regulations stipulate a 36 dBm Effective isotropically-radiated power (EIRP) power requirement. Users implementing antenna gain greater than 6.0 dB must compensate for the added gain with cable loss. When operating at 1 W power output, the sum (in dB) of cable loss and antenna gain shall not exceed 6.0 dB.

EIRP Calculation:

EIRP (dBm) = power of transmitter (dBm) – losses in transmission line (dB) + antenna gain (dB)

Where: power of transmitter = 30dBm @ 1W setting
= 20 dBm @ 100mW setting

CAUTION: This equipment is approved only for mobile and base station transmitting devices. Antenna(s) used for this transmitter must be installed to provide a separation distance of at least 30 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

RF Baud Rate:

The MTS-RAD can be operated at one of two RF transmission speeds: SLOW (9600 BAUD) or FAST (115,000 BAUD). DIP switch 6 is used to select the radio transmission speed. If DIP Switch 6 is OFF (default) then the RF speed is 9600 BAUD. If DIP Switch 6 is ON then the RF speed is 115000 BAUD.

RF BAUD Rate	SW1-6	
9600	UP	
115,000	DOWN	

Figure 7

Determining the best RF speed to use requires consideration of several factors:

- Slower RF speed increases transmission distance
- Faster RF speed reduces some types of interference

Only on-site testing will determine the best RF speed for any particular installation. Data throughput is affected only minimally by the RF speed because it is limited to 9600 BAUD.

RF Hop Tables:

The MTS-RAD uses one of four frequency hop tables. All MTS-RAD devices that are to communicate with one another must use the same hop table. Conversely, it is possible to have up to four different MTS systems operate within the same radio range by assigning each system to use a unique hop table.





Hop Table	SW1-4	SW1-5	
1	UP	UP	
2	DOWN	UP	
3	UP	DOWN	
4	DOWN	DOWN	

Figure 8

MTS-RAD Operation:

When an MTS system is first powered on, there is a brief time of inactivity (approx. 30 seconds) while the MTS-RAD modules discover which I/O modules are present in their stack. After the discovery period is over, the modules on the Host Stack will begin communicating with their counter part modules on a Remote Stack. Communication occurs one module at a time and in numerical order for all Module ID's present on the Host Stack. A careful observer can witness this by the TX (transmit) and RX (receive) lights on each module.

Link Status Light:

Once two MTS-RAD modules have communicated for the first time, they illuminate their Link lights to indicate that the modules have found each other and that a successful data exchange has taken place. This Link light will remain in a solid on state while communication between the two stacks continues to be successful.

The Link light will flash when there is a problem with the communication between the two modules. Several flashing sequences indicate the nature of the problem.

Link Status	Description
Off	Undiscovered or No Power
On	Linked with other Stack
1 Flash	Link with other Stack Lost

A **single flash** indicates that the module has lost communication with its counterpart module. Reasons for this include, but are not limited to:

Problem	Check
'Other Stack' lost Power	<ul style="list-style-type: none">• Verify power on 'Other Stack'• Check other Modules - Not likely if another Module from the 'Other Stack' is still communicating with a Module from 'This Stack'
Communication Module Bad on 'This Stack'	<ul style="list-style-type: none">• Check other Modules on 'This Stack' – Not Likely if any are still linked and communicating

The above table describes some scenarios that could result in lost communication. For further assistance please contact your local representative or Pribusin Inc.

Communication Fail Output:

In the event that the MTS-RAD loses communication it will indicate a communications link failure by the above mentioned Link Status Light and by activating its Fail Output. This output is an open-drain output capable of sinking 100mA at up to 24VDC. It can be used to signal to an operator or a PLC that there is a problem with the communication. The output will remain active while the communications link is lost. Once the link is re-established the output will de-activate. There is a 1 minute time delay from when the link is first lost until the output activates. This is to give the radios a chance to re-link in case the interruption was only temporary.

MTS System Overview:

This section describes the concept and operation of a typical MTS system. The example below uses two remote sites, labeled 'Remote 1' and 'Remote 2'. Following are important points to note when designing or installing an MTS system:

- Every MTS system has one Host Stack and one or more Remote Stacks
- Each stack consists of at least one power module (MTS-PWR), one communications module (MTS-xxx, see table below for xxx), and one or more I/O modules
- I/O modules are always paired (one input module and one output module)
- One module of each pair (either input module or output module) **MUST** be on the Host Stack
- Each module pair **MUST** use the same Module ID
- Modules may be arranged to send their signals from Host-to-Remote or Remote-to-Host depending on which stack the input and output modules are located

Figure 8 shows a typical two remote system with a mixture of I/O modules arranged in ways so that some modules send signals from the Host Stack to the Remote Stacks while other modules send signals from a Remote Stack back to the Host Stack.

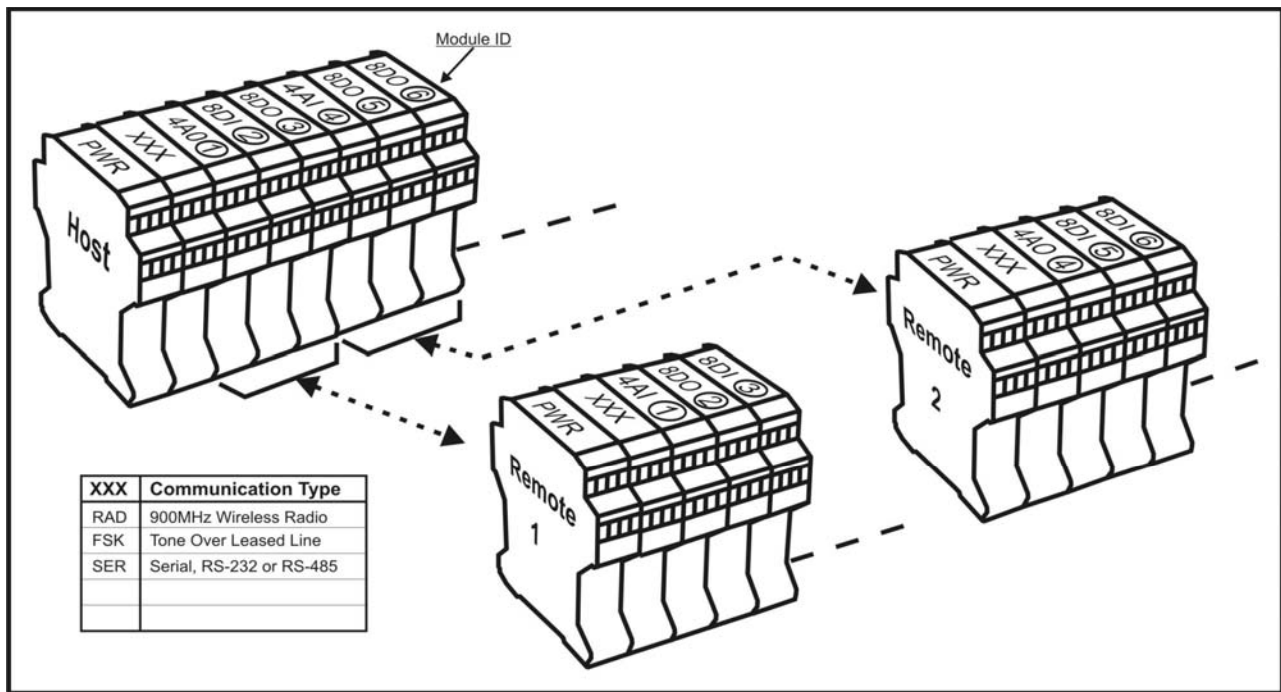


Figure 8

This table shows the modules that are currently available. Check our website at www.pribusin.com or with your local representative for the latest list of available modules.

Model No.	Description
MTS-RAD	900MHz Wireless Comm. Module
MTS-8DI	8 Channel Digital Input Module
MTS-8DO	8 Channel Digital Output Module
MTS-4AI	4 Channel Analog Input Module
MTS-4AO	4 Channel Analog Output Module
MTS-PWR	24VDC Power Module