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RFI-9256 OPERATION MANUAL





RF DESIGN & MANUFACTURING ENGINEERS

RFI-9256 Operation Manual

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Caution: Changes or modifications to this product not expressly approved by RF Innovations could void the user's authority to operate the equipment.

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1 Introduction

RFI-9256 Data Strike 3 Spread Spectrum Radio Modem

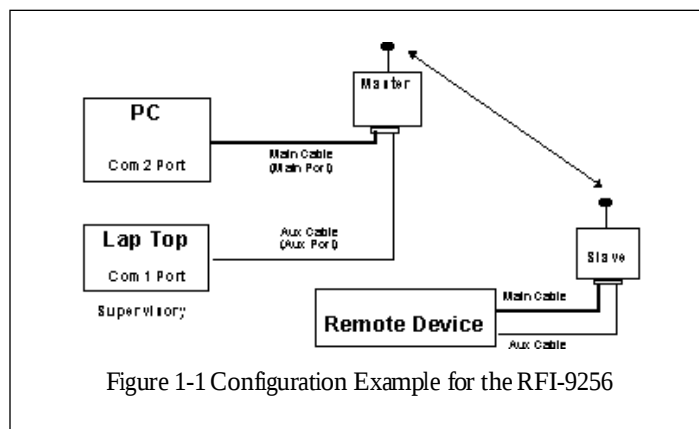
The *RFI-9256 Data Strike Series3* Spread Spectrum Radio Modem Transceiver will open up new lines of unparalleled high speed reliable data communications in hostile environments.

A Spread Spectrum Radio Modem has a wide band of frequencies allocated to it. The transceiver uses a pseudo-random code to hop throughout this frequency band sending packets of data at different frequencies. The receiver uses the same hopping code to synchronize and receive the data. This pseudo-random code allows many radio devices to share frequencies and operate on independent networks on the same frequency bands with negligible interference.

The RFI-9256 is essentially a full duplex radio modem capable of emulating a standard telephone modem. The units can be configured for several types of standard link formats, including point to point (Direct) where modems continually transmit to one another and point to multipoint dialup connections where one unit can talk to many units by the use of a dialing mechanism to address the units. There is also a protocol router mode, which can map protocol addresses to radios and forward the data to the correct unit. The radio modems come from the factory configured as point to multipoint dialup.

The modem unit can be connected to a PC, laptop or any RS-232 device (e.g. terminals), to display the inbuilt configuration menus or to directly control the operation of the modem via the inbuilt protocols. One special feature of the modem is the two RS-232 ports provided (Main and Auxiliary). This allows the user to monitor the operation of the radio whilst it is in communication with other units. Protocols on each port are mostly independent of each other hence you can have two different protocols running simultaneously.

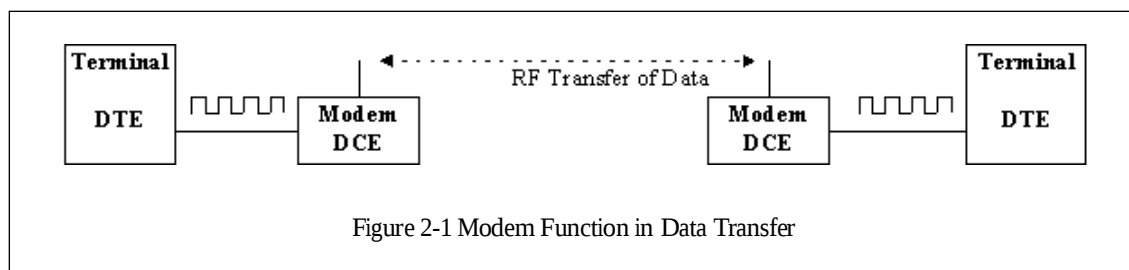
Figure 1-1 shows a possible configuration for a pair of RFI-9256 units. The local modem is generally configured as the Master and the remote/distant modem(s) as the Slave(s). It is the Master modems responsibility to synchronise communication with other Slave modems, meaning a Master can initiate communication with a Slave (and visa versa), but two Slaves or two Masters cannot communicate with each other as communication will not be synchronised.



The RFI-9256 provides two methods of configuration. There is a Menu System and/or a set of Hayes™ compatible AT Commands available through either the Auxiliary or the Main port. The menu system provides a user-friendly interface with prompts and the AT command set enables the user to automate the operation of the modem, by using scripts, and to dial remote units.

2 RS-232 Radio Modems

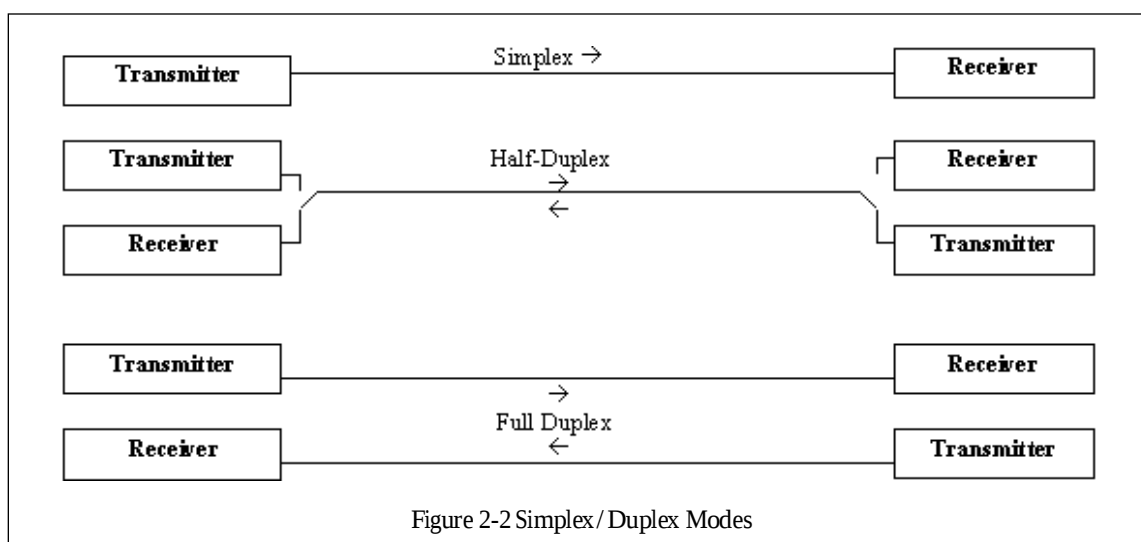
Communication systems cannot directly transport digital data without distortion affecting the signal. A device is required to 'transform' the digital signal into one that can be transported without distortion. A radio modem is a device used to convert serial digital data into a form that can be transmitted by Radio Frequency (RF). This is exactly like the landline modem except that it transmits its data down your phone line instead. The receiving modem 'transforms' the signal back into serial data. This is summarised in *Figure 2-1*.



Data is transferred in blocks or 'chunks'

The communicating modems must be synchronised so that they both recognise the beginning and end of the data blocks. Data transmitted in the RF path is typically sent in large blocks or packets, where many data bits represent a packet. The data on the Terminal or DTE/DCE end by comparison is sent asynchronous where start and stop bits are included in every block of 8 data bits. This decreases the amount of useful data inside each block

If data is transferred in one direction at one time only, it is known as Simplex Communication. If data is transferred in both directions at the same time, it is known as Duplex Communication and is divided into two systems, Half and Full. In Half Duplex Communication, data can only flow in one direction at a given time and in Full Duplex Communication data flows in both directions simultaneously. This is illustrated in *Figure 2-2*.



The RS-232 Standard

R

S-232 is a

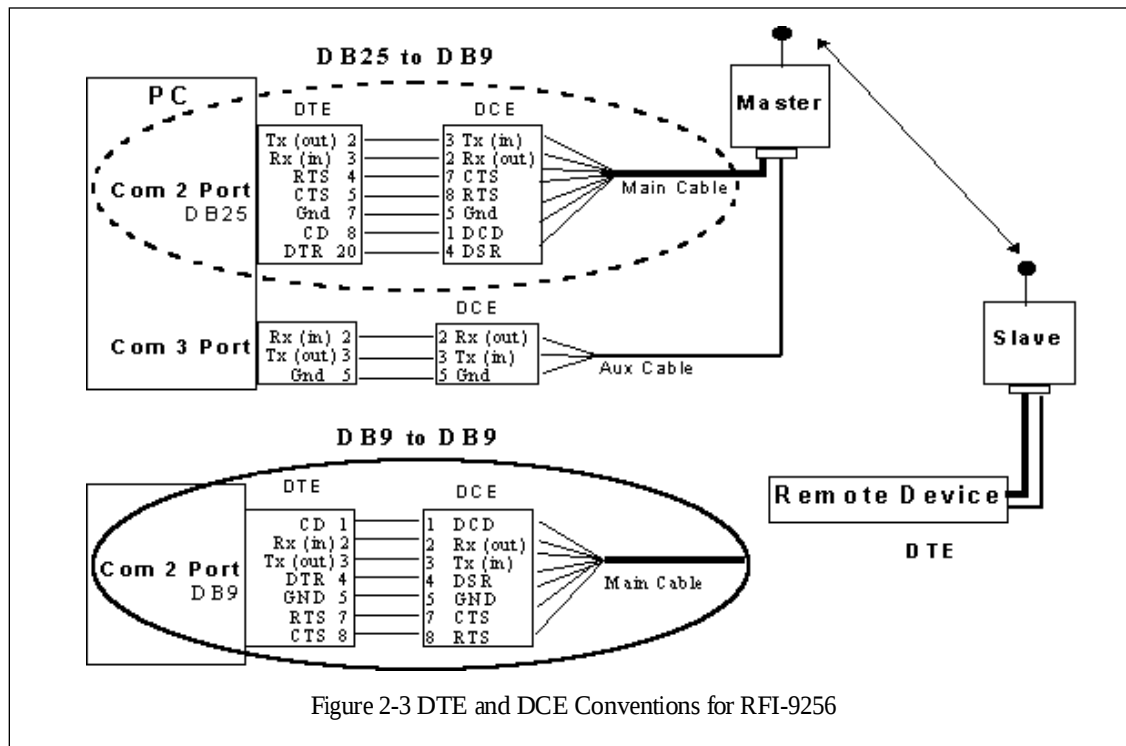
standard that defines the characteristics of point-to-point communication. It is suitable for transferring



serial, binary and digital data. Communication is generally asynchronous and full duplex. Reliable communication can be achieved up to 50 feet. The RS-232 transmitter sends logic 1 as -5 to -25 Volts and logic 0 as +5 to +25 Volts. The hardware handshaking lines are used for interactive device control. The lines used for handshaking are RTS (Ready to Send), CTS (Clear to Send), DTR (Data Terminal Ready) and DCD (Data Carry Detect).

DTE versus DCE Conventions

This is one of the most misunderstood areas of RS-232. DTE stands for Data Terminal Equipment, and DCE stands for Data Communications Equipment. DTE is typically either a dumb terminal or the serial port on a computer/workstation. DCE is typically a modem or other piece of data communications equipment. Where it gets confusing is when you start to talk about signal definitions and direction. For example, it's easy for someone to understand that when you transmit data, you send it **out**. However, when you talk in terms of the DCE, it becomes an **input**. This is because the specification was written from the perspective of the DTE end of the link. Another example is that the Receive Data signal is an **input** to DTE, but an **output** from DCE. Refer to *Figure 2-3* for a visual understanding. Radio modems can perform the function of both DTE and DCE



3 Installation

Basic steps can achieve a connection straight away but, if you require a more comprehensive setup then the information in the main data manual should be read. However, it is recommended that you set up a simple connection to gain familiarization with the units and their internal menu system.

Setting up for a connection

The following steps should be followed for setting up communication between a pair of wireless data transceivers received from the factory with factory default settings:

Connect the Main Ports of each radio modem to a serial port of a computer or device, using a suitable cable¹.

Run a suitable terminal package² or emulator (on the computer) using the following settings:

- Communications Settings (RS-232 Com Port)
 - Baud Rate: **19200**
 - Data Bits: **8**
 - Parity: **None**
 - Stop Bits: **1**
 - Flow Control: **No Flow**
- Terminal Settings
 - Emulator Mode: **None or Standard TTY**
 - Local Echo: **off**
 - LF to CR on incoming: **off**
 - LF to CR on outgoing: **off**

Fasten the antenna to the modem, ensuring that it is properly seated.

Make one of the modems a Master (by default they are Slave) and set its Rx address (modem's number) by doing the following:

- Connect the Local modem's Auxiliary Port to a COM port of a terminal.
- Hold Mode Select Button on the front panel of the unit to select **Mode 6 – config**. This will bring up the Configuration Menu on the terminal.
- Press 'R' to select the "Radio Configuration Menu".
- Press 'M' to set the unit to a Master.
- Press 'L' to set the Local Rx Address (modem's number)
- Press 'Esc' (escape) twice.
- Press 'Y' to exit the Menu.

At this point a Network Link will be established, and the Slave modem will have the NETWORK LINK and CARRIER DETECT LEDs activated and the POWER LED Flashing. The Master will only have a Flashing POWER LED.

¹ using an RFI pre-made cable [optional] or by a user constructed cable in accordance to the pin configuration in *Technical Specifications*

² If you don't have a terminal program that can be set to 19200 baud, you can download our shareware terminal program (RFI's InTerm) from the RF Innovations Web site (<http://www.rfinnovations.com.au/>).



Now configure the Device for a Radio Connection.

Point to Multipoint Connection

In Point-to-Multipoint communication, the master dials a slave or visa versa. Communication is then established between these two modems and is controlled by Hayes™ AT command set. This Mode is used when the master is required to communicate with more then one slave.

Both modems are configured point-to-multipoint by default.

Dial remote modem (it does not matter which modem dials)

- Type 'ATDT nnnnXX'
- nnnn - Receiving Modem's Address (number)
- XX - Extension Address of the port:
 - 00 for Main Port
 - 01 for Auxiliary Port
 - 92 for Remote Menu
 - 99 for Loop Back Port

This will establish a communications link. The front panel LEDs NETWORK LINK, CARRIER DETECT and ONLINE will be activated on both modems. Each modem will echo the message "CONNECT" onto the terminal.

The Rx (RECEIVE) and Tx (TRANSMIT) data LEDs will flash as information is passed. If both modems are connected to a terminal, information typed at the computer connected to one modem will be shown on the screen connected to the other.

Once communication is finished, hang-up the modem with the following sequence:

- Type '+++' on the terminal rapidly (within 1 second).
- Wait 1 second and the modem should echo "OK".
- Type 'ATH0'

Both modems should echo "NO CARRIER".

Point to Point Communication

Point-to-Point Communication is similar to a wire that directly connects two devices together for data transfer. Radio communication is established automatically and is transparent. This is used when data is to be sent between two devices only.

Set both modems to Point-to-Point Communication Mode by:

- Ensuring the Auxiliary Port of the modem is connected to a Com port and that the terminal package has the settings as in *Setting up for a connection* Step 1 on page 8.
- Hold Mode Select Button on the front panel of the unit to select **Mode 6 – config**. This will bring up the Configuration Menu on the terminal.
- Press 'R' to select "Radio Configuration Menu".
- Press 'P' to select Mode Point to Point (Direct).
- Enter receiving modem's address (20 by default).



- Press 'Esc' (escape) twice.
- Press 'Y' to exit³ Menu.

This will establish a communications link. The NETWORK LINK, CARRIER DETECT and ONLINE LEDs will be activated and the TRANSMIT and RECEIVE LEDs will flash as information is passed.

RFI-9256 Location

Placement of your RFI-9256 unit is likely to have a significant impact on its performance. A general rule-of-thumb is that the higher the placement of the antenna the better the communication link.

Antennas in close proximity are potential sources of mutual interference. Use the Radio Statistics to help identify potential problems. It is possible that slight adjustments in antenna placement (as little as 1 meter) may solve interference problems.

The radio modem should be placed away from computers, telephones, answering machines and other similar equipment. It is also advisable to keep units away from each other unless you synchronise their transmissions (see (1) *Special Controls Menu*, page 20).

Long RS-232 cable runs should be avoided in areas with frequent lightning activity or static electricity build-up. Nearby lightning strikes or elevated levels of static electricity may lead to voltage spikes on the RS-232 circuits with potential failure of the interface. RF Innovations supplies a range of external data interface converters for applications requiring long cable runs.

Using the External Antenna

The RFI-9256 has been designed to operate with the supplied antenna. The antenna should not be located within 20cm of where people may come in contact.

WARNING: Any antennas placed outdoors must be properly grounded. Use extreme caution when installing antennas and follow all instructions included with the antennas. The use of external antennas subjects the transceiver to greater exposure to direct lightning strikes.

³ The HayesTM commands will NOT work in Point-to-Point Mode by default.



4 Configuration

Your radio modem allows you to change several parameters to optimise its performance for a particular application. All adjustments can be made through a menu system or by the Hayes™ command set. A standard terminal program can be used to access the menu system, which eliminates the need for custom software or Dipswitch settings.

The menu invoked is displayed in *Figure 4-1*. The user can configure the Modem or obtain diagnostic and statistical information from the Radio. The changes made to the operation of the transceiver are stored in non-volatile memory to maintain the latest configuration even with loss of power.

```

***   MirOS Main Menu   (Version 2.0)   ***

XXXXX Version 1.23   Rev.B
Unit Name:
Unit is a: MASTER
Serial No: XXXXXXXXXXXX
Manufactured Date: DD/MM/YYYY

(R)   Radio Configuration Menu
(L)   Protocol Port Selection
(S)   Serial Port Configuration Menu
(M)   Modem and I/O Configuration Menu
(P)   Radio Personality Menu
(D)   Diagnostics Menu
(Esc) To Exit Menu

Enter Choice:

```

Figure 4-1 Main Menu



5 Using Front Panel Modes

The RFI-9256 has a unique front panel user interface that can be used to assess the Radio performance without any additional test equipment. A picture of the front panel is shown in *Figure 5-1* below. The interface is controlled by means of a small push button switch located on the front panel. A dual colour LED bar graph display is used to signal various settings to the user.

When the Modem is first turned on the display defaults to **Mode 1**. The Operational Mode is numbered down the left-hand side of the LED Display. In this mode, the purpose of each LED is indicated in the first column on the front panel (under the heading **Mode 1**), for example the top-most LED indicates the status of the Network Link. If the switch is pressed the display will change and indicate the current mode of operation by a RED LED. If the switch is held down longer than 1 second the Mode LED indicator will begin cycling through each mode. While the unit is in this cycling operation, the rate at which the mode selection cycles can be increased by pressing the button at a faster rate than the automatic toggle. Once the desired operational mode is reached then the switch can be released and after approximately one second delay the LED display will indicate the function for that mode.

Details of the scale for **Mode 2** (the receive signal power indicator mode) and **Mode 3** (the transmit power indicator mode) are also included on the front panel, under the respective headings.

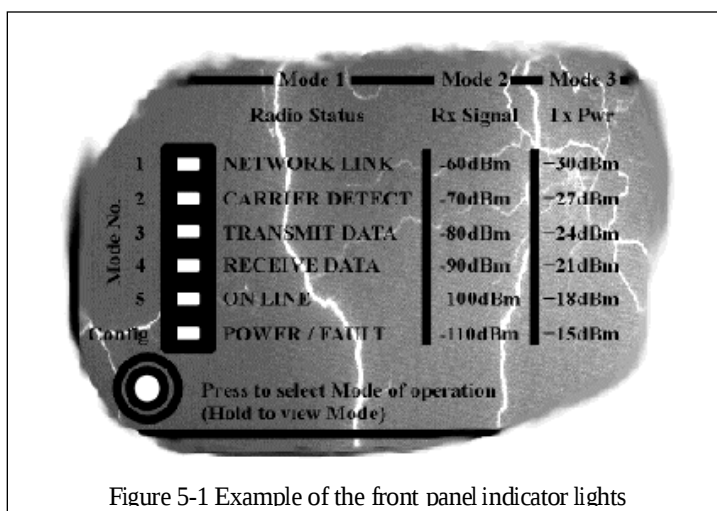


Figure 5-1 Example of the front panel indicator lights

Mode 1

The LED indicators in Mode 1 show the general flow of data and other radio characteristics. *Table 5-1* describes the front panel indicators in Mode 1.

LED NAME	MODE 1
NETWORK LINK	- Green - Modem has locked onto a signal from the same network. - Red - Modem has just lost link to the operational network and will drop out if the connection is not established within the required time (as set in software).
CARRIER DETECT	- Green - An RF carrier has been detected and contains valid information. - Red - An RF carrier has been detected and contains invalid information.
TRANSMIT DATA	RS232 Data is being moved out the RS232 port through either the main or auxiliary port (to the terminal).
RECEIVE DATA	RS232 Data is being received from the RS232 port from either the main or auxiliary port (from the terminal).
ONLINE	- Green - Data is being received from a remote modem that contains the receiving modems address. - Red - A data packet has been lost or has not been able to be sent to the remote modem (automatic ARQ function fail).
POWER	- Green - This indicator will flash on and off at one-second intervals to indicate the Radio internal functions are OK. - Red - This indicator will flash when the Modem has serious faults, such as channel synthesiser out of lock, low power or power supply problems, or software CRC errors. The user Fault event log can be used to find the cause of any intermittent problems (AUX port configuration).

Table 5-1 LED Indicators Mode 1

Mode 2

When the RFI-9256 is in Mode 2 the display changes to a LED bar graph that indicates the RSSI (Received Signal Strength Indicator) value, the display has a resolution of 5dB. Intermediate steps are indicated by a RED display and whole numbers by a GREEN display i.e., the bottom two LEDs on green would indicate a received signal of -100dBm while a display of RED on the -100dBm level would indicate -105dBm. Table 5-2 below shows the scale RSSI according to the LEDs. Details are also shown on the front panel under the heading **Mode 2**. -60dBm is the strongest signal, and -110dBm the weakest. Any signal above -90dBm will result in a very strong signal, with high throughput. Weaker strengths will still transmit, but throughput may be affected.

LED NAME	MODE 2 (dBm)
NETWORK LINK	-60
CARRIER DETECT	-70
TRANSMIT DATA	-80
RECEIVE DATA	-90
ONLINE	-100
POWER	-110

Table 5-2 LED Indicators Mode2



Mode 3

When the RFI-9256 is in Mode 3 the display changes to an LED bar graph display that indicates the Transmitted RF power. The display has a resolution of 3dBm steps from a maximum output power of +30dBm or 1Watt using the RED LEDs. *Table 5-3*, below, show the relationship between the LEDs and the indicated output power (included on the front panel) under the heading **Mode 3**. This display is used as an indicator to show the current level of the transmitted RF power.

To meet Spread Spectrum Standards, the total power rating leaving the antenna is not allowed to radiate more than 1 Watt. The power settings, in the software, allow the user to adjust the power level to maintain the maximum possible EIRP. For example, if the user wishes to use a gain antenna, he/she must set the power level in the modem so the total power radiated by the antenna does not exceed the EIRP.

LED NAME	MODE 3 (dBm)
NETWORK LINK	30
CARRIER DETECT	27
TRANSMIT DATA	24
RECEIVE DATA	21
ONLINE	18
POWER	15

Table 5-3 LED Indicators Mode 3

Mode 4

When the RFI-9256 is in Mode 4 the display changes to a LED bar graph display that indicates the Temperature of the RFI-9256 Radio. The temperature is displayed using green LEDs for steps of 10°C from 10° to 60°C. *Table 5-4* below shows the radio temperature according to the LEDs on the front panel. When the unit is operating within the green area the radio is operating inside its operating window.

Temperatures above 65°C are displayed as a full red bar. Temperatures below 5° are displayed as a single red LED. These are both fault conditions.

LED NAME	MODE 4 (°C)
NETWORK LINK	60
CARRIER DETECT	50
TRANSMIT DATA	40
RECEIVE DATA	30
ONLINE	20
POWER	10

Table 5-4 LED Indicators Mode 4



Mode 5

When the RFI-9256 is in Mode 5 the display indicates the RS232 Port status. The user can then tell the logic states of the RS232 control lines, a red LED indicates +12volts(logic on) and a green -12volts or no connection (logic off). *Table 5-5*, below, shows the LED names and their equivalent function in Mode 5.

LED NAME	MODE 5
NETWORK LINK	DSR (input)
CARRIER DETECT	DCD (output)
TRANSMIT DATA	TX (RS232 data out of external port)
RECEIVE DATA	RX (RS232 data in from external port)
ONLINE	CTS (input)
POWER	RTS (output)

Table 5-5 LED Indicators Mode 5

Mode 6 (config)

When the display is set to Mode 6, the Configuration Menu options are available on the Auxiliary port at 19200,8,N,1. A terminal must be connected to the Auxiliary port with appropriate terminal software to communicate with the radio. A brief introduction to the menu command structure is given in the next section.

The LED display on the front panel is the same as **Mode 1**. To determine which mode a unit is at any time just press the button on the front panel.



6 Using Internal Menu Commands

The menu system was briefly described in *Configuration*. This menu provides the user with an interface that is controlled by the terminal device. It is here where configuration options are easily accessible. There are several methods of accessing the configuration menu. Note that some options do not come into effect until the menu system has been exited.

Accessing the Configuration Menu

METHOD 1: Front Panel Mode 6 (config)

The setup menu is invoked by:

- Connecting the Auxiliary Port of the RFI-9256 to any terminal program.
- Set the baud rate for that terminal to 19200, 8, N, 1.
- On the modem press and hold the front panel switch until **Mode 6 - config** is activated then release the switch.

METHOD 2: Local Hayes Command

If the front panel of the radio is inaccessible and the modem has a port configured as a Dialup then setup menu can be invoked by:

- Connecting either RFI-9256 Port configured as Dialup any terminal program.
- Ensure the terminal communications settings are the same as those set on the modem.
- Type the AT? Command.

METHOD 3: Remote Menu

If the modem itself is in accessible the setup menu can be invoked by:

- Dial the remote modem with port address 92, e.g. 'ATDT 2092'.

The internal menu, once invoked from **Mode 6 - config**, will display on the terminal screen as below in *Figure 6-1*.

```
***  MirOS Main Menu  (Version 2.0)  ***
```

```
XXXXX Version 1.23  Rev.B
```

```
Unit Name:
```

```
Unit is a: MASTER
```

```
Serial No: XXXXXXXXXXXX
```

```
Manufactured Date: DD/MM/YYYY
```

```
(R)   Radio Configuration Menu
(L)   Protocol Port Selection
(S)   Serial Port Configuration Menu
(M)   Modem and I/O Configuration Menu
(P)   Radio Personality Menu
(D)   Diagnostics Menu
(Esc) To Exit Menu
```

```
Enter Choice:
```

Figure 6-1 RFI-9256 Main Menu

(R) Radio Configuration Menu

The Radio Configuration Menu allows the radio's function within a network to be changed for different applications. The following menu in *Figure 6-2* is an example of what is displayed.

```
***  Radio Configuration Menu  ***
```

```
Unit is a MASTER
```

```
Network Address =    32
```

```
Rx Address      =    20
```

```
Hopping Pattern =     0
```

```
Point to Point Connection
```

```
(M)   Set unit as Master
(S)   Set unit as Slave
(N)   Set Network address
(L)   Set Local Rx address
(P)   Set ports as Point to Point Direct
(D)   Set ports as Point to MultiPoint Dialup
(R)   Set ports as Dialup Repeater
(1)   Special Controls Menu
(2)   Link Control Menu
(3)   Radio Characteristics Menu
(F)   Restore Factory defaults
(Esc) Previous Menu
```

```
Enter Choice:
```

Figure 6-2 Radio Configuration Menu



(M) Set unit as Master

In any communications link, at least one modem must be configured as a Master. The Master synchronises communications with other Slaves. When this function is selected the radio is configured as a master.

To change the modem to a Master, press (M).

(S) Set unit as Slave

In any communication link one unit must be set as a Master and the rest as Slaves. Slaves can initiate communication but follow the synchronisation of the Master. Modems are configured as Slaves, by default.

To change the modem to a Slave, press (S). Modems are configured as Slaves, by default

(N) Set Network address

The Network Address is the network identification number. Slaves synchronise with a Master that has the same Network Address. Radios ignore data originating from modems with another network address. The network address must be the same for every Radio on that particular network.

To change the Network Address, press (N). The following will be displayed:

Enter Network Address value (0-63): 32

The unit allows for up to 64 network addresses (0-63)⁴. The network address is 32 by default.

(L) Set Local Rx address

The Local Rx Address is used to identify individual modems within a point to multipoint network. Each Radio must have a unique address, otherwise more than one modem will answer when the address is dialed and destructive collisions will occur. Point to point communication does not use dialing, therefore both modems may have the same Rx number.

Radio units configured as Repeaters (see *Repeaters* on page 74) are often given the same Rx number. Radios in different networks can have the same Local RX Address.

To change the Rx Address, press (L). The following will be displayed:

Enter Rx Address value as (1-9999): 20

The unit allows for up to 9999 Rx addresses (1-9999). The Rx address is 20 by default.

(P) Set Mode Point to Point Direct

Point to point communication is used to for links between two devices only and is equivalent to having the units linked by a cable, effectively making the radios transparent. For more information see *Point to Point* on page 76.

To change the radio configuration to Point to Point, press (P). The following will be displayed:

⁴ Address 0 is special address and should not be used as it is reserved for special broadcast modes. Also the general address convention is that the Rx address of either a Base unit or a destination unit be a 4 digit number and repeaters are 2 digit numbers without zero prefixes.

Point To Point requires a Tx Address
Enter Tx Address value as (0-9999): 20

The Tx address is the address of the other unit. The Tx address is 20 by default.

(D) Set Mode Point to Multipoint (Dialup)

In this mode the Master unit will act the same as a Hayes™ telephone line modem, and may be used to dial out to any remote site. Repeaters can be used in this configuration and Slave devices can dial back to the Master as per normal Hayes™ modem conventions. For more information, see Section 9, page 76.

To change the radio configuration to Point to Multipoint, press (D). This is the default configuration.

(R) Set unit as a Dialup Repeater

A repeater regenerates a signal and is used to extend the distance between end point radios, it can be thought up as grabbing a parcel and passing it to someone else. Repeaters are in pairs (back to back) with one configured as a Master and one as a Slave. They are interlinked (by connecting the Main Ports of each) so that data can be transferred via their RS-232 ports. The Auxiliary I/O ports must also be interconnected to provide pass-through. See *Repeaters*, page 74.

The Dialup Repeater mode also enables a number stripping mechanism to allow repeaters to be chained in a network or connected to a PSTN modem. Each repeater Slave strips its own RX address from the dialed number sequence and then dials the radio or PSTN modem connected to the main port. See *Repeaters* on page 74.

The baud rates and other configuration issues are left to the users own discretion. Some parameters for communication are automatically preset but may be overridden, e.g., Hayes echo off and sync mode.

To change the radio configuration to Dialup Repeater, press (R).

(F) Factory Defaults

Sets the radio modem back with factory defaults.

(1) Special Controls Menu

When the antennas from more than one radio are placed within close proximity, the units must be synchronised so that they do not block the transmission of each other. Although the radios are individually configured to work within separate networks (with different hopping patterns, network addresses), they must transmit and receive information at the same time to prevent signal blocking. One modem must be configured as the sync output controller and the rest as sync output followers (note that a Slave unit cannot be set as a follower because it has to synchronise with the master on the network). This will synchronise transmission, however the frame size/length must be the same to enable synchronisation to work.

To change the Special Control parameters, press (1).

```

***   SPECIAL CONTROLS MENU   ***

Sync Mode = Output Sync Signal

(1)   Follow Sync Signal
(2)   Output Sync Signal
(3)   Repeater Sync Mode
(4)   No Sync Mode
(Esc) Previous Menu

Enter Choice:

```

Figure 6-3 Special Controls Menu

(1) Follow Sync Signal – To set a modem (Master Unit Only) to follow a synchronisation signal provided by another.

(2) Output Sync Signal – To set a modem (Usually a Master or a Slave repeater) to output a frame synchronisation signal.

(3) Repeater Sync Mode – To set a modem in a repeater setup (usually the Master repeater) to follow the synchronisation signal sent by the slave repeater in a repeater/follower fashion.

(4) No Sync Mode – To disable synchronisation mode.

(2) Link Control Menu

To change the Link Control parameters, press (2).

```

***   Link Control Menu   ***

Main Port: ARQ Retries = 50
Aux  Port: ARQ Retries = 50
Network fail timer = 5000ms
Online request timer = 1000ms

(A)   Number of retries for ARQ
(F)   Network fail timeout
(O)   Online requests timer
(B)   Backoff Retry Enable/Disable
(D)   Set to Defaults
(Esc) Previous Menu

Enter Choice:

```

Figure 6-4 Link Control Menu

(A) Number of retries for ARQ

The ARQ (automatic repeat request) controls the number of times the Radio Modem will try to resend a packet of lost information before it gives up. This can be set as high as 255 retries. Each Link/Port can be configured independently allowing for modes like broadcast to co-exist on the same modem, i.e., a broadcast mode would normal only retry 3-5 times. Default is 50 for both Main and Auxiliary ports.

To change the ARQ, press (A). The following will be displayed:

```
Enter Number of Tx Retries (0-255): 50
```

ARQ can be set from 0 to 255. It is 50 by default.

(F) Network fail timeout

The Network fail timeout controls the time the system waits when a signal is lost before attempting to re-synchronise. The NETWORK LINK LED on the front panel also indicates this loss. The default setting is 5000ms.

To change the Network fail timeout, press (F). The following will be displayed:

```

Network Fail Timeout value
Must be greater than Online Request timer
Timer value in milliseconds(100-30000): 5000

```

The value can be set from 100 to 30000 and must be greater than the online request timer. It is 5000 by default.

(O) Online requests timer

This timer controls the length of time between integrity checks on remote Slaves by the Master. This setting will affect the carrier detect LED on the front panel for the Master modem as data will only be returned from the Slave modems at the preset time interval. The default setting is used in a large system so that RF airtime is not wasted on the Slave to Master link, and the Master is not always tied up checking for Slave integrity. This setting is also used to keep the system alive when no data is being passed.

To change the ARQ, press (A). The following will be displayed:

```
Online requires a timer value, which must be
less than the Network fail timer = 5000ms
Timer value in milliseconds(40-5000): 1000
```

The value can be set from 40 to 5000 and must be less than the Network fail timer. It is 1000 by default.

(B) Back Off Retry Enable/Disable (Slaves only)

This function is mainly for scenarios where you wish to connect to several slave radios simultaneously from a Master or where there is possibility of multiple slaves trying to dial or send protocol data to a single Master/Base radio.

To change, press (B). This will toggle Enabled/Disabled. The default is disabled.

(D) Set to Defaults

Sets the parameters back to their defaults.

(3) Set Radio Characteristics

To change the Radio Characteristics parameters, press (3).

```
***   Radio Characteristics Menu   ***

Hopping Pattern =      0
Power setting = 20 dBm
RSSI trigger level = -110
Frame Time = 20 milliseconds
Max Tx bytes per frame = 113
Bias is Disabled

(H)   Hopping Pattern Sequence
(P)   Tx Power Menu
(R)   RSSI trigger level
(F)   Frame Time Menu
(B)   Directional Bias Menu
(Esc) Previous Menu

Enter Choice:
```

Figure 6-5 Radio Characteristics Menu

(H) Hopping Pattern Sequence

There are 32 (0-31) hopping patterns available. The hopping pattern determines how the modem hops through the frequency spectrum when transmitting (and receiving) data. Radio Modems on alternate hopping patterns will reduce interference from each other and maximise system throughput.

To change the Hopping Pattern, press (H). The following will be displayed:

```
Enter Hopping Pattern Number (0-31): 0
```

There are 32 hopping patterns available (0-31). It is zero by default

(P) TX POWER MENU

The Tx Power allows the 'transmit' power to be changed. *Figure 6-6* below shows what output power levels are available. System engineers should use the minimum amount of power consistent with maintaining a solid data link. This will minimize the amount of interference between units and other equipment. Also the total output from the Antenna should not be more than 1 watt E.I.R.P (30dBm) noting that your antenna may provide gain and your cables and connectors produce a loss.

```

***    Tx Power Menu    ***

Power setting: 20 dBm

(0)    0 dBm
(1)    10 dBm
(2)    20 dBm
(3)    25 dBm
(4)    30 dBm
(5)    OFF
(Esc) Previous Menu

Enter Choice:

```

Figure 6-6 Tx Power Menu

(R) RSSI trigger level – This value can be set between -120dBm and -50dBm. The RSSI trigger level is only used by a slave modem when the unit first looks to lock onto the operating network. Different values are used to enable the slave to better reject noise when first acquiring network link. The factory setting is optimal for most circumstances. Increase RSSI in situations where the signal strength of noise is unusually high.

To change the RSSI trigger level, press (R). The following will be displayed:

Enter RSSI trigger value as dBm (-120 to -60): -110

The value can be between -120 to -60 dBm. It is -110dbm by default

(F) FRAME TIME MENU

This function changes the maximum length (in time) of each packet frame. If a frame was 8ms long, then there is less data transferred per frame than would be transmitted in a 35ms size frame. The throughput of data will decrease as the frame size decreases. The frame length also controls the data latency. The factory default is 20ms. The 5ms frame time is only available in Point-to-Point Mode. *Figure 6-7* shows the frame size menu.

```

***   Frame Time Menu   ***

Frame Time = 20 milliseconds

(1)    5 milliseconds
(2)    8 milliseconds
(3)   10 milliseconds
(4)   15 milliseconds
(5)   20 milliseconds
(6)   25 milliseconds
(7)   30 milliseconds
(8)   35 milliseconds
(Esc) Previous Menu

Enter Choice:

```

Figure 6-7 Frame Time Menu

(B) DIRECTIONAL BIAS MENU

Also known as the Frame Bias. This function is for systems that require high throughput in a single direction. For example audio, video and Internet applications. This option allows an air speed rate of approximately 115kbps in one direction and approximately 9600bps in the other. Modems must be configured so that they have complimentary (opposite) bias configurations. This is shown in *Figure 6-9*. *Figure 6-8* shows the menu that is displayed.

```

***   Directional Bias Menu   ***

Directional Bias is Disabled

(0)    Outgoing/Upload
(I)    Incoming/Download
(D)    Disabled
(Esc) Previous Menu

Enter Choice:

```

Figure 6-8 Directional Bias Menu

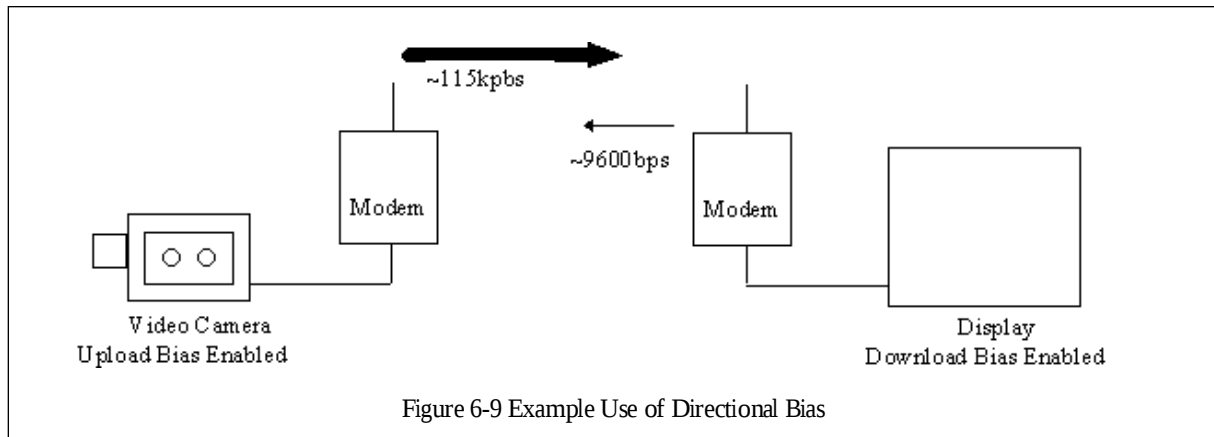


Figure 6-9 Example Use of Directional Bias

(L) Protocol Port Selection (Link/Port Protocol Menu)

The following menus allow the user to select common protocols to be used between RS-232 devices connected to the radio modems.

```
*** Protocol Port Selection ***

Main Port: Protocol Type: Point to Point
Aux Port: Protocol Type: Point to Point

(M) Main Port
(A) Aux Port
(Esc) Previous Menu

Enter Choice:
```

Figure 6-10 Protocol Port Selection

- **(M) Main Port** – Select to change the protocol on the Main Port.
- **(A) Aux Port** – Select to change the protocol on the Auxiliary Port.

After the port has been selected the user then enters the Link/Port Protocol Menu (*Figure 6-11*). From this menu the user can assign a new protocol to the port that has been selected and configure it using the two submenus available.

```
*** Link/Port Protocol Menu ***

Main Port: Protocol Type: Point to Point

(P) Protocol Selection Menu
(C) Configure Protocol Menu
(Esc) Previous Menu

Enter Choice:
```

Figure 6-11 Link/Port Protocol Menu

(P) Protocol Selection Menu

```

***   Protocol Selection Menu   ***

Main Port:  Protocol Type:  Point to Point

(P)   Point to Point
(B)   Broadcast
(D)   Hayes Dialup
(M)   Modbus
(H)   Honeywell
(3)   DNP3
(T)   TDE
(X)   Disabled
(Esc) Previous Menu

Enter Choice:

```

Figure 6-12 Port Selection Menu

(P) Point to Point

For more information see *Point to Point* on page 76. In this mode link control parameters and Timers can be set. (see *Protocol Configuration Menu* on page 27)

(B) Broadcast

This mode allows data to be broadcast from a Master to multiple slaves. The messages are not ARQ'ed (acknowledged) by the slave radios so data integrity is not guaranteed on data being sent from the Master to Slaves but data being sent by Slaves to Master is ARQ'ed in the normal manner. The Master still utilises the ARQ retry setting (see (2) *Link Control Menu* on page 20) and will resend each packet to the Slaves by this number. The slaves will automatically discard duplicate messages so the only configuration issue is the ARQ settings must be adjusted for reasonable performance (1 to 5) retries. Both Master and Slave units must be set to the broadcast protocol for them to coexist properly.

(H) Hayes Dialup

For more information see (R) *Radio Configuration Menu* on page 17.

In this mode Hayes Command Controls can be set. (see (M) *Hayes Command Control Menu* on page 32)

(M) Modbus⁵

The protocol decoder reads data from the assigned serial port and processes it as a Modbus RTU protocol. The decoder conforms to the Modbus timing to determine beginning and ending of packets. The address is extracted and checked against a routing table (see *Route Managing* on page 28). If a destination radio can be located in the table then the packet is immediately forwarded to the remote radio. Data will continue to be passed to the destination radio until the protocol decoder has found an "End of Packet" as determined by the Modbus timing specifications.

Modbus protocol only supports a single byte destination address that only allows 255 radios to be addressed.

⁵ Because of the structure of the ModBus protocol, it does not support Peer-to-Peer networking

In this mode the routing table, packet timer and link control parameters and Timers can be set (see *Protocol Configuration Menu* on page 27).

(H) Honeywell

This is a Honeywell protocol. Honeywell protocol works similar to Modbus in the protocol decoding and routing except packets are of specific size so there is no need for a packet timer.

In this mode the routing table, and link control parameters and Timers can be set (see *Protocol Configuration Menu* on page 27).

(3) DNP3

This is the FT3 Frame format (LPDU).

In this mode the routing table, and link control parameters and Timers can be set (see *Protocol Configuration Menu* on page 27).

(T) TDE

This is an Introl Systems protocol.

In this mode the routing table, and link control parameters and Timers can be set. (see *Protocol Configuration Menu* on page 27).

(X) Disabled

Disables any transmission of data though the selected port to a remote radio. No protocol or mode is assigned. The port can still receive and output data sent from a remote radio but cannot reply.

NOTE: The configuration menu will still be accessible on the AUX port.

Protocol Configuration Menu

If a protocol is configurable then this menu will display the available options relevant to the protocol selected. For example, *Figure 6-13* shows a configuration menu for a port, which is assigned to the Hayes Dialup protocol. The discussion of the protocol dependant configuration menus will be in *Protocol Configuration Menus*.

```

***   Configure Protocol Menu   ***

Main Port:  Protocol Type:  Hayes Dialup

(M)   Hayes Command Control Menu
(P)   Tx (Out) Packetiser Timer
(L)   Link Control Menu
(Esc) Previous Menu

Enter Choice:

```

Figure 6-13 Hayes Dialup Example of the “Configure Protocol Menu”

(P) Tx (Out) Packetiser Timer

The packet timer is used to in conjunction with Modbus protocol. When no data has been received from a remote modem for the Packet Timer duration then current cache of data is then passed out the serial port.

To change the Tx (Out) Packetiser Timer value, press (P). The following will be displayed:

```
Tx (Out) Packetiser Timer requires a timer value or 0 to disable
Enter Timer value in milliseconds (0-1000): 0
```

The value can range from 0 to 1000ms. It is 0ms by default and corresponds to disabled.

(R) Remote Address

This option only appears when the point-to-point protocol is selected. The remote address option allows the user to change the Tx Address of the remote unit. In a point-to-point communication this value needs to be set to correctly maintain a link between two modems.

To change the Remote Address, press (R). The following will be displayed:

```
Point to Point requires a Tx Address
Enter Remote Tx Address (0-9999): 20
```

The value can range from 0 to 9999. It is 20 by default.

(L) LINK CONTROL MENU

Please refer to (2) *Link Control Menu* on page 20.

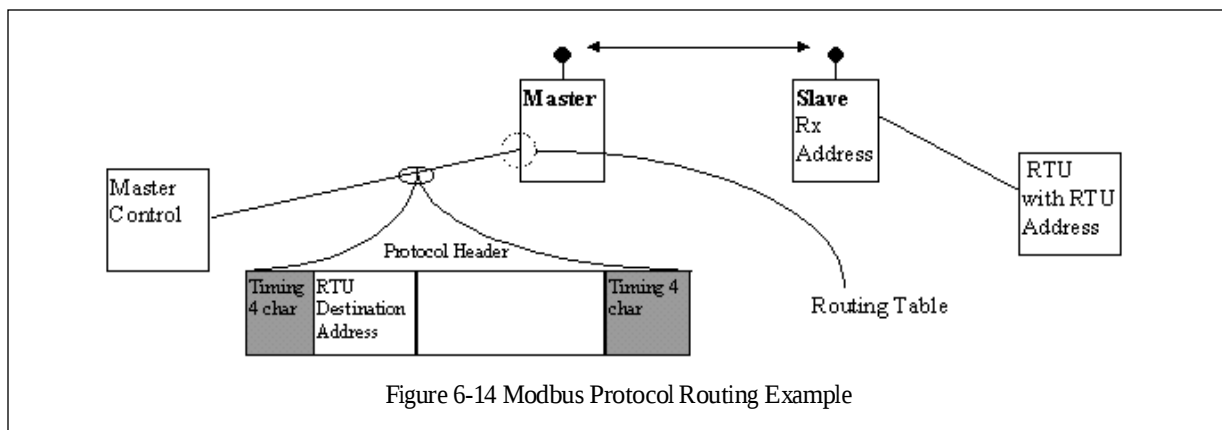
Protocol Configuration Menus

Depending on the protocol the user has selected, a different menu (or no menu) will be available for selection. The following sections also contain background information to help the users understand the functionality of some protocols.

ROUTE MANAGING

Protocol Decoding/Router The protocol decoder for the packet protocols such as Modbus, DNP3 etc, allows a system of extracting the destination RTU address from the protocol and then mapping it to radio RX addresses. If a system contained a number of RTUs connected to a base unit then the Master/Base unit could decode the RTU address of each slave and convert it to a remote slave Rx address. RTU is an acronym for Remote Terminal Unit.

The Rx Address is the address of the RFI modem. Each modem must have an address so that it can determine whether the RF data received (through its antenna) was intended for it or not. The RTU address is the address of the device attached to the modem. This is analogous to dialing a telephone that has a PC attached. The telephone has its own number, which must be dialed, yet the PC also has an IP address. The RTU address is part of the protocol header sent from the Master Control to the RFI-9256 along the RS-232 link. It is up to the Routing Table to determine to which radios Rx Address the data must be sent to in order for the correct RTU to receive the information. These ideas are demonstrated in the following figure, using the Modbus protocol.



Route Types

Default Route - This route is mostly used by Slaves and is probably a must have entry for any Slave in a protocol network. This route only requires the Rx address of the destination radio. This route is used when no other route can be matched in the routing table.

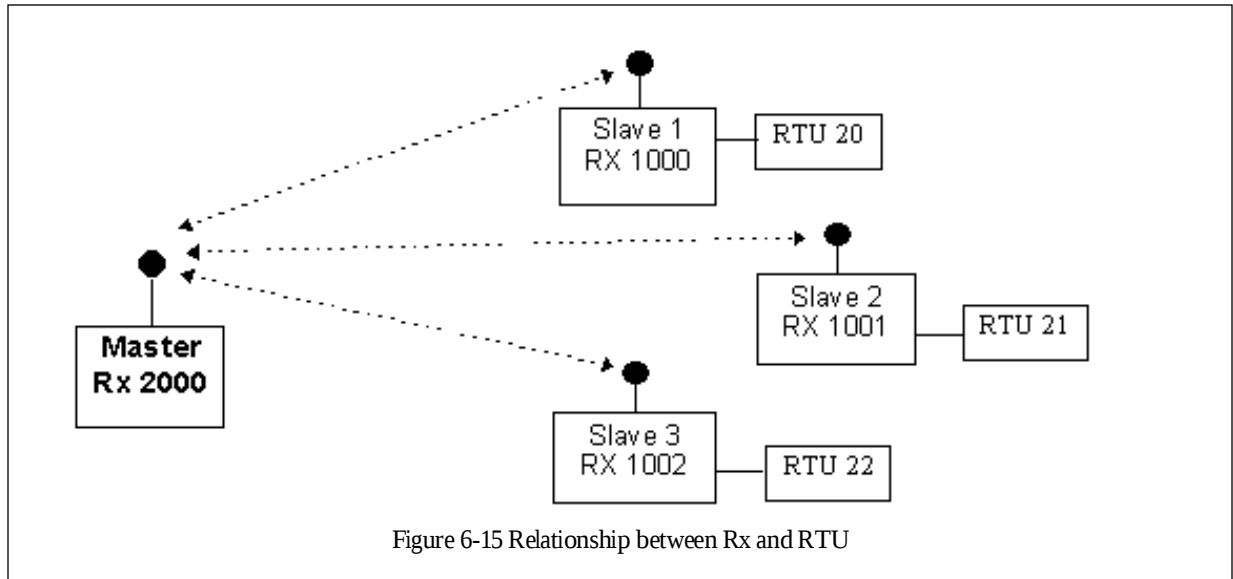
Single Route - This route explicitly maps an RTU address to a radios Rx address. It is the highest privilege in a routing table.

Mapped Route - This route maps a relationship between RTU addresses and radios Rx addresses. This is a very efficient method of describing a network providing the RTUs and radios can be numbered sequentially and has some correlation. This route configuration requires an RTU address to be assigned as the base for the route and an RTU address to define the range of addresses to be used by the route. It also requires the slave Rx address associated with the RTU address used as the base. The algorithm works as described in the next paragraph.

The decoder subtracts RTU base address from the newly decoded RTU address the result acts as an offset that is added to the Rx (Radio) address that was assigned as base address. For example if a following diagram was entered in the router then the base RTU address would be **20** and the range

could be **23** or more the Radios Rx address would be **1000**. When the decoder sees RTU address **21** it subtracts it from the base RTU that would leave **1** this result is added to the Rx address would be Rx address **1001** (RTU 21).

Range Route - This route mode routes any RTU address between a range of addresses to a single Radio Rx address. It requests a start address for the range of RTU address, an end address and an Rx address of the destination radio.



(R) ROUTE MANAGER MENU

This menu is for route-able protocols such as Modbus, Honeywell, DNP3 or TDE. If a new protocol is assigned to a port then any previous route settings for that port are removed. Please refer to *Route Managing* on page 28 for information regarding routing.

```

***   Route Manager Menu   ***

Main Port:  Protocol Type:  Modbus
Used Space   :      0
Free Space   :    106

Total Routes :      0
Single Routes :      0
Mapped Routes :      0
Range Routes  :      0
No Default Route

(A)   Add Route
(D)   Delete Route
(X)   Delete All Routes
(L)   List All Routes
(T)   List Routes by Type
(Esc) Previous Menu

Enter Choice:

```

Figure 6-16 Route Manager Menu

(X) Delete All Routes

This option is used to delete all routes in the routing table for the selected port.

To delete all routes, press (X). The following will be displayed:

Are You Sure ? (Y/N)

Select 'Y' if you want to delete all routes and 'N' to abort.

(L) List All Routes

In *Figure 6-17* is an example of a Route table in a Master/Base Radio configuration. Slave/RTU radios usually do not require an extensive routing table but should always have a Default Route configured. The following is the definitions for the table headings:

- IDX is the individual route identifier.
- Route Type is the function of the route (*Route Types* on page 29 for definitions)
- Route Source is the address that is found in the protocol packet and therefore the intended destination of the packet.
- Destination Radio is the radio that the packet is sent to.



Idx	Route Type	Route Source	Destination	Radio
0	Single Route	Address 10	--> Dest.	9000:00
1	Single Route	Address 12	--> Dest.	9020:00
2	Single Route	Address 16	--> Dest.	9050:00
3	Mapped Route	From [20 to 30]	--> Base	2000:00
4	Mapped Route	From [50 to 60]	--> Base	4200:00
5	Range Route	From [80 to 120]	--> Dest.	6000:00
6	Range Route	From [130 to 150]	--> Dest.	7000:00
7	Default Route	All Other	--> Dest.	4000:00

Press Any Key to return

Figure 6-17 Route Table Listing

(A) Add Route

When adding a route, the route type menu (*Figure 6-18*) is initiated. Please refer to *Route Types* on page 29 for a definition on the routes available.

```

***   Route Type Menu   ***

(D)   Default Route
(S)   Single Route
(M)   Mapped Route
(R)   Range Route
(Esc) Previous Menu

Enter Choice:

```

Figure 6-18 Route Selection Menu

(D) Delete a Route

When this option is selected the route type menu (*Figure 6-18*) is brought up to select the type of route to be deleted. Once a route type is selected all the routes of that type is listed and the IDX (route identification number) is used to select the desired route to delete.

(L) List Route by Type

When this option is selected a route type menu (*Figure 6-18*) is brought up to select the type of route to be listed. Once a route type is selected all the routes of that type is listed.

(M) HAYES COMMAND CONTROL MENU

The Hayes Command Control Menu allows the user to change Hayes compatible responses and response codes. For example, it is here in this menu the user can toggle the echo on/off and set the escape sequence character, etc.

```

***   Hayes Command Control Menu   ***

Main Port: Hangup on DTR Dropped, Echo is ON, Response is ON
Escape character = + Escape guard time = 1000(ms)
Connect Timeout  = 10000(ms)

(C)   Connect Timeout
(X)   Escape character (ie +)
(G)   Escape guard time
(H)   Hangup on DTR (low)
(Z)   Hangup on DTR Dropped
(L)   Local on DTR (low)
(I)   Ignore DTR
(E)   Echo (ON/OFF)
(R)   Modem returns response codes (ON/OFF)
(D)   Set to Defaults
(Esc) Previous Menu

Enter Choice:

```

Figure 6-19 Hayes Command Control Menu

(C) Connect Timeout

This is the wait time for “CONNECT”, which is the time the radio will wait for a valid connection.

To set the Connect Timeout, press (C). The following will be displayed:

Connect Timeout value in milliseconds (0-60000): 10000

This time can be set between 100-30000ms. The default is 10000ms

(X) Escape character (ie +)

Allows the escape character to be changed. This is the character that is used in the escape sequence to hang-up the modem. The escape sequence consists of the escape character being typed three times, with a set communication-free periods of time before and after the sequence.

To set the Escape Sequence Character, press (X). The following will be displayed:

Enter new escape character: +

The default is ‘+’.

(G) Escape guard time

The escape guard time is the time before and after the escape sequence has been entered that no activity is allowed on the data line. Otherwise the escape sequence will be ignored.

To set the Escape Guard Time, press (G). The following will be displayed:

Escape guard time value in milliseconds (50-10000): 1000

The range of values allowed is between 50 and 10000ms. The default is 1000ms.



(H) Hangup on DTR (low)

The DTR is an RS-232 signal used to indicate to the modem whether the local terminal is ready to communicate. This option, and the following three, tells the modem what to do when the DTR signal drops to low. Hang-up on DTR (low), is used to disconnect the call from a slave device when DTR drops to low.

(Z) Hangup on DTR Dropped

Hang-up on DTR dropped is used to disconnect call from a slave device when DTR changes from a high to a low.

(L) Local on DTR (low)

When DTR is low the modem goes into local mode. This is equivalent to typing the escape sequence. Once the unit is local it stays local until the online command (ATO) is used.

(I) Ignore DTR

Select this option when the user requires the DTR signal to be ignored.

(E) Echo (ON/OFF)

Toggles the echo setting between on and off every time it is selected. This controls the RS232 data responses. When toggled off, (while in local command state) the character typed at the terminal will not be echoed back to the screen.

(R) Modem returns response codes (ON/OFF)

This toggles whether the modem returns response codes or not and is used to suppress codes that are sent from the Modem such as the CONNECT response.

(D) Set to Defaults

Restores factory defaults for the selected port (see *Factory Defaults* page 88 for settings).

(A) ADVANCED FUNCTIONS MENU

This menu only appears when the Point-to-Point Protocol is selected. The packetiser system is a mechanism to group or bundle data to avoid inter character or inter-packet delays induced by delays in communication and the network traffic.

On selection of the menu, the user will be requested the remote Tx Address before the menu will appear. The following will be displayed:

```
Point to Point requires a Tx Address
Enter Remote Tx Address (0-9999): 20
```

The Tx address is 20 by default.

The menu that appears is shown in *Figure 6-20*.

```

***   Advanced Functions Menu   ***

Main Port:  Packet Timers: OutPut = Disabled, Input = Disabled
Main Port:  Rx Buffer Limit = 1024

(T)    Tx (Out) Packetiser Timer
(R)    Rx (In) Packetiser Timer
(L)    Rx Buffer Limit

(Esc)   Previous Menu

Enter Choice:

```

Figure 6-20 Advanced Functions Menu

(T) Tx (Out) Packetiser Timer

This selection allows a Packet timer value to be set. The modem will send a bundled packet of information out through the serial Tx port when no data has been received for this period of time.

To change the Tx (Out) Packetiser Timer value, press (T). The following will be displayed:

```

Tx (Out) Packetiser Timer requires a timer value or 0 to disable
Enter Timer value in milliseconds (0-1000): 0

```

The value can range from 0 to 1000ms. It is 0ms by default and corresponds to disabled

(R) Rx (In) Packetiser Timer

The Rx Packetiser prevents data from being sent to the remote modem until the timeout period has expired. Each character received on the Rx serial input resets this timer. This clumps the data together in the buffers so that each RF frame buffer is completely filled. It helps protocols such as MODBUS because they cannot tolerate inter-character delays. It can also help reduce latencies and increase efficiency of slow frame rates.

To change the Rx (In) Packetiser Timer value, press (R). The following will be displayed:

```

Rx (In) Packetiser Timer requires a timer value or 0 to disable
Enter Timer value in milliseconds (0-1000): 0

```

The value can range from 0 to 1000ms. It is 0ms by default and corresponds to disabled

(L) Rx Buffer Limit

The Rx Buffer Limit allows you to control how full the internal buffer should get before it triggers the flow control. Depending on the size of the packets of data being sent to modem, certain values of the Buffer Limit might improve the modem's performance when dealing with data from the serial ports.

To change the Rx Buffer Limit value, press (R). The following will be displayed:

```

Enter Rx Buffer Limit (16-1024): 1024

```

The value can range from 16 to 1024 bytes. It is 1024 bytes by default.

(S) Serial Port Configuration Menu

The Port Selection Menu, shown in *Figure 6-21*, lets the user select the desired modes of operation of each of the two serial ports and shows their current settings.

```

***   Port Selection Menu   ***

Main Port:  19200 Baud, No Parity, 8 Data, 1 Stop, No Flow
Main Port:  Packet Timers: OutPut = Disabled, Input = Disabled
Aux  Port:  19200 Baud, No Parity, 8 Data, 1 Stop, No Flow
Aux  Port:  Packet Timers: OutPut = Disabled, Input = Disabled

(M)    Main Port
(A)    Aux  Port
(Esc)  Previous Menu

Enter Choice:

```

Figure 6-21 Port Selection Menu (Serial)

- **(M) Main Port** – Select to change the serial port settings on the Main Port.
- **(A) Aux Port** – Select to change the serial port settings on the Auxiliary Port.

Once the desired port is selected the serial port settings menu in *Figure 6-22* is displayed. This menu is the same for both ports.

```

***   Serial Port Configuration Menu   ***

Main Port:  19200 Baud, No Parity, 8 Data, 1 Stop, No Flow
Main Port:  Packet Timers: OutPut = Disabled, Input = Disabled
Main Port:  Rx Buffer Limit = 1024

(B)    Baud Rate Menu
(F)    Flow Control Menu
(N)    No Parity
(E)    Even Parity
(O)    Odd Parity
(1)    One Stop Bit
(2)    Two Stop Bits
(7)    Seven Bit Data
(8)    Eight Bit Data
(A)    Advanced Functions Menu
(D)    Set to Defaults
(Esc)  Previous Menu

Enter Choice:

```

Figure 6-22 Serial Port Configuration Menu

(N) No Parity / (E) Even Parity / (O) Odd Parity

These selections change the parity used for the serial connection. When a selection is made it is displayed in the menu but not implemented until the menu is exited.

To select the Parity simply press the corresponding letter.

(1) One Stop Bit / (2) Two Stop Bits

These selections change the number of stop bits used in the serial connection. When a selection is made it is displayed in the menu but not implemented until the menu is exited.

To select the Stop Bits, simply press the corresponding number.

(7) Seven Bit Data / (8) Eight Bit Data

These selections change the number of data bits used in the serial connection. When a selection is made it is displayed in the menu but not implemented until the menu is exited.

To select size of the data within a packet, press the corresponding number.

(D) Set to Defaults

This selection restores factory defaults for the selected serial port (see *Factory Defaults* page 88 for settings).

(B) Baud Rate Menu

The baud rate can be changed to several different speeds. When selected the following menu shown in *Figure 6-23* is displayed. Both ports use the same menu however the ports are configured independently.

```

***   Baud Rate Menu   ***

Main Port: Baud Rate = 19200

(0)    115200
(1)    57600
(2)    38400
(3)    19200
(4)    9600
(5)    4800
(6)    2400
(7)    1200
(8)    600
(9)    300
(A)    110
(Esc)  Previous Menu

Enter Choice:
```

Figure 6-23 Baud Rate Menu

To select a baud rate select the corresponding number (or character) beside the speed. The default baud rate is 19200.



(F) Flow Control Menu

This option allows you to select the type of flow control between the modem and local device. Flow Control is used to prevent data loss from a buffer overflow. The modem and terminal must use the same type of flow control. The type of flow control is selected when the menu option is chosen. This is shown in *Figure 6-24* below. The main port and auxiliary port are configured independently however the auxiliary port does not support hardware flow control.

```

***   Flow Control Menu   ***

Main Port:  No Flow

(H)   Hardware Flow (RTS/CTS)
(S)   Software Flow (XON/XOFF)
(N)   No Flow
(Esc) Previous Menu

Enter Choice:

```

Figure 6-24 Flow Control Menu

(A) Advanced Functions Menu

For menu options please refer to *(A) Advanced Functions Menu* on page 34.

(M) Modem and I/O Configuration Menu

The Modem Configuration Menu in *Figure 6-25* below allows the lower levels of the modem's operations to be configured according to user specific requirements. The selections available from this menu are shown below. This section is designed to mimic a Hayes™ compatible modem.

```

***   Modem And I/O Configuration Menu   ***

(H)   Hayes Command Control Menu
(D)   DCD Control Menu
(R)   RTS Control Menu
(A)   Auxiliary I/O Port
(Esc) Previous Menu

Enter Choice:

```

Figure 6-25 Modem Configuration Menu

If handshaking (flow control) is enabled on the serial ports then the corresponding control lines will not be available within this menu selection, i.e. if hardware is enabled on the Main port then (1) DCD Control Menu will not be available.

(H) Hayes™ Command Control Menu (Port Selection Menu)

The Hayes Commands are a lower level of communication (then the menu system) between a modem and device. These commands allow the RFI-9256 to emulate a landline telephone modem. Details of the Hayes™ commands are in section 7. The Port Selection Menu appears before the Hayes Command Control Menu so the user can select the port to apply the changes to.

```

***   Port Selection Menu   ***

Main Port: Hangup on DTR Dropped, Echo is ON, Response is ON
Escape character = + Escape guard time = 1000(ms)
Connect Timeout = 10000(ms)
Aux Port: Echo is ON, Response is ON
Escape character = + Escape guard time = 1000(ms)
Connect Timeout = 10000(ms)

(M)   Main Port
(A)   Aux Port
(Esc) Previous Menu

Enter Choice:

```

Figure 6-26 Modem Port Selection Menu

- **(M) Main Port** – Select to change the Hayes Command settings on the Main Port.
- **(A) Aux Port** – Select to change the Hayes Command settings on the Auxiliary Port.

The menu options for the Hayes Command Control Menu are the same as those previously mention. Please see *(M) Hayes Command Control Menu* on page 32

(D) DCD Control Menu

DCD (Data Carrier Detect) is used for flow control. The following menu in *Figure 6-27* allows the DCD signal⁶ to be asserted by one of the following conditions. Each time a selection is made between (0) and (8) that function becomes the DCD MODE.

This menu is not available if the Auxiliary port handshaking (flow control) is set to hardware.

⁶ Valid control conditions for DCD are ON (active) = + 12volts / OFF= - 12volts as per RS232 conventions.

*** DCD Output Control Menu ***

DCD MODE: ONLINE controls DCD

- (0) ONLINE controls DCD
- (1) NETWORK LINK controls DCD
- (2) CARRIER DETECT controls DCD
- (3) Remote DSR controls DCD
- (4) Local DSR controls DCD
- (5) Remote CTS controls DCD
- (6) Local CTS controls DCD
- (7) DCD Always ON
- (8) DCD Always OFF
- (9) DCD disabled
- (Esc) Previous Menu

Enter Choice:

Figure 6-27 DCD Output Control Menu

(0) ONLINE controls DCD

DCD is active when the radio unit is ONLINE.

(1) NETWORK LINK controls DCD

DCD is active when the NETWORK LINK is active.

(2) CARRIER DETECT controls DCD

DCD is active when a valid carrier signal is detected from another radio.

(3) Remote DSR controls DCD

DCD is active when a remote radio's DSR input line is active.

(4) Local DSR controls DCD

DCD is active when the local radio's DSR input line is active.

(5) Remote CTS controls DCD

DCD is active when a remote radio's CTS input line is active.

(6) Local CTS controls DCD

DCD is active when the local radio's CTS input line is active.

(7) DCD Always ON

DCD is always set to ON.

(8) DCD Always OFF

DCD is always set to OFF.

(9) DCD disabled

DCD control has been disabled.



(R) RTS Control Menu

RTS (Request to Send) is used in flow control. The following menu in *Figure 6-28* allows the RTS signal⁷ to be asserted by one of the following conditions.

This menu is not available if the Aux port handshaking is set to hardware.

```

***   RTS Output Control Menu   ***

RTS MODE: RTS Always ON

(0)   ONLINE controls RTS
(1)   NETWORK LINK controls RTS
(2)   CARRIER DETECT controls RTS
(3)   Remote DSR controls RTS
(4)   Local DSR controls RTS
(5)   Remote CTS controls RTS
(6)   Local CTS controls RTS
(7)   RTS Always ON
(8)   RTS Always OFF
(9)   RTS disabled
(Esc) Previous Menu

Enter Choice:

```

Figure 6-28 RTS Output Control Menu

(0) ONLINE controls RTS

RTS is active when the radio unit is ONLINE.

(1) NETWORK LINK controls RTS

RTS is active when the NETWORK LINK is active.

(2) CARRIER DETECT controls RTS

RTS is active when a valid carrier signal is detected from another radio.

(3) Remote DSR controls RTS

RTS is active when a remote radio's DSR input line is active.

(4) Local DSR controls RTS

RTS is active when the local radio's DSR input line is active.

(5) Remote CTS controls RTS

RTS is active when a remote radio's CTS input line is active.

(6) Local CTS controls RTS

RTS is active when the local radio's CTS input line is active.

⁷ Valid control conditions for RTS are ON = +12volts, OFF = -12volts as per RS232 conventions.

(7) RTS Always ON

RTS is always set to ON.

(8) RTS Always OFF

RTS is always set to OFF.

(9) RTS disabled

RTS control has been disabled.

(A) Auxiliary I/O Port

This menu configures the auxiliary Input/Outputs described in section *Auxiliary Input/Output Port* on page 79. The following menu in *Figure 6-29* shows the options available.

```

***   Auxiliary I/O Config Menu   ***

Sample Time = 500 (ms)
Aux I/O follows remote = Disabled

(D)   Aux I/O Direction Menu
(P)   Powerup defaults Menu
(S)   Sample Rate
(F)   Aux I/O follows remote
(E)   Enable/Disable Aux I/O
(Esc) Previous Menu

Enter Choice:

```

Figure 6-29 Auxiliary I/O Control Menu

(S) Sample Rate

This allows the sampling time of the I/O port to be changed.

To change the Sampling Rate, press (S). The following will be displayed:

Update Timer value in milliseconds (8-5000): 500

The sampling time can be set between 8ms and 5000ms (5seconds). The default is 500.

(F) Auxiliary I/O Follows Remote

This allows the I/O port to be controlled by another radio. This is used when data needs to be passed from one radio to another for control applications.

Every time it is selected the function is toggled to either Aux I/O follows remote = Enabled, or Aux I/O follows remote = Disabled. Default is disabled

(E) Enable/Disable Auxiliary I/O

Whenever this key is pressed the Auxiliary Remote setting toggles between ON and OFF. When OFF the Aux I/O will not operate and the power up defaults will not be in operation.

(D) AUX I/O DIRECTION MENU

Selecting this option allows the I/O line to be toggled between being either an input or an output. The following menu in *Figure 6-30* is displayed when it is selected.

```

***   Aux I/O Direction Menu   ***

Input:  7  6  5  4  3  2  1  0
        1  1  1  1  1  1  1  1

BIT      MODE
(0)      INPUT
(1)      INPUT
(2)      INPUT
(3)      INPUT
(4)      INPUT
(5)      INPUT
(6)      INPUT
(7)      INPUT
(Esc)    Previous Menu

Enter Choice:

```

Figure 6-30 Auxiliary I/O Bit Set Menu

The I/O pin is toggled between input and output when its corresponding bit number is selected. The first line of the display shows the current status of the I/O control.

(P) POWERUP DEFAULTS MENU

Selecting this option allows the power up states of the I/O lines to be configured. If an I/O line is set as an input then it cannot be configured to be high or low at power up, since it is a high impedance input. Therefore, the status will not change when the I/O port numbers are selected. The settings are toggled between low and high every time the I/O port number is selected. An example of the menu is shown in *Figure 6-31*.

*** Powerup Defaults Menu ***

```

BIT      MODE
(0)      N/A
(1)      N/A
(2)      N/A
(3)      N/A
(4)      N/A
(5)      N/A
(6)      N/A
(7)      N/A
(Esc)    Previous Menu

```

Enter Choice:

Figure 6-31 Aux I/O Power-up Menu

(P) Radio Personality Menu

The personality menu is shown below in *Figure 6-32*. It is used to set the name, the menu password, the customer security ID and other personality options.

*** Radio Personality Menu ***

```

Unit Name:
Time: 08:36:55
Menu Password is Disabled
Security Code is Disabled
Menu Timeout is 15 minutes

(U)    Set Unit Name
(P)    Set Menu Password
(R)    Remove Menu Password
(S)    Set Security Code
(D)    Delete Security Code
(T)    Set Current Time
(M)    Set Menu Timeout
(Esc)  Previous Menu

```

Enter Choice:

Figure 6-32 Radio Personality Menu

(U) Set Unit Name

This selection allows the name of the unit to be set. This can help identify each unit on the network by name, location, number or function.

(P) Set Menu Password

This selection allows the menu password to be changed. Therefore an unauthorised person cannot enter the menu system and change the radio's settings.



(R) Remove Menu Password

This selection removes the password used to access the radio's menu. With the password removed the password protection is disabled.

(S) Set Security Code

This selection allows the user to set the security code. The security code protects the users radio network from interference from other networks using RFI-9256 modems. The code is a 32bit (9 digit) number, which allows 0 to 4294967295 combinations.

(D) Delete Security Code

This selection allows the user to delete the security code

(T) Set Current Time

This allows the real time clock's time to be set. Allow the RFI-9256 doesn't contain a true real time clock it can maintain a fairly accurate notion of time.

(M) Set Menu Timeout

This allows the user to select the amount time a menu remains idle before it is closed. Default is 15 minutes.

(D) Diagnostics Menu

The diagnostic Menu shown in *Figure 6-33* is used to test functions of the Radio Modems performance.

```

***   Diagnostics Menu   ***

(S)   Display Status
(E)   Event Log Menu
(T)   Test Indicator LEDs
(N)   Show channel signal/noise
(L)   Show Stats/Logging
(M)   Test Link Margin
(1)   Statistics Menu
(2)   Display Tasks
(3)   Display Links
(Esc) Previous Menu

Enter Choice:

```

Figure 6-33 Diagnostics Menu

(S) Display Status

This function gives a summary of the information regarding the configuration of the radio. The following table in *Figure 6-34* gives an example of what information is shown when this function is enabled.

```

----- STATUS -----
Unit Name:
Serial Number: 010141CF1297
Manufactured Date: 21/02/2000
RFI-9256 Version 1.22 Rev.A Australia
Build Date: Oct 20 2000 Time: 11:59:59
Unit is a MASTER
Point to Multipoint Dialup Connection
Network Address = 32
Rx Address = 20
Hopping Pattern = 19
Power setting = 30 dBm
RSSI trigger level = -60
Frame Time = 35 milliseconds
Max Tx bytes per frame = 221
Bias is Disabled
UNLOCKED
RSSI = 0 Noise floor = -137
Temperature = 42.5c
CRC32 = 715FA77A of size 127892 bytes
CRC check Correct

Press Any Key to return

```

Figure 6-34 Unit Status Display

(T) Test Indicator LEDs

Selecting this function starts a test of the front panel LEDs. This is a visual test and the LEDs must be observed while this test is in progress. It simply turns the LEDs on and off operating using all the colours in a predefined sequence.

(N) Show channel signal/noise

When this function is selected, a table in *Figure 6-35* is displayed showing the signal and noise levels for each channel used within that hopping pattern. The following table is an example of what is displayed. The reading on the signal row is the RSSI (received signal strength indicator in dBm) of the radio for each channel the unit operates on. If a '??' is displayed as the signal value then there wasn't a recent sample for that channel.

Channel	1	2	3	4	5	6	7	8	9	10	11
Signal	-098	-099	-097	-126	-100	-104	-095	-102	-099	-098	-103
Noise	-122	-120	-124	-126	-123	-124	-131	-126	-122	-128	-129
Channel	12	13	14	15	16	17	18	19	20	21	22
Signal	-123	-104	-098	-095	-100	-103	-102	-097	-099	-095	-099
Noise	-123	-123	-128	-128	-123	-123	-122	-123	-125	-127	-125
Channel	23	24	25	26	27	28	29	30	31	32	33
Signal	-096	-104	-102	-099	-096	-098	-100	-127	-105	-103	-100
Noise	-125	-122	-129	-128	-132	-120	-127	-127	-132	-122	-130
Channel	34	35	36	37	38	39	40	41	42	43	44
Signal	-102	-096	-100	-097	-099	-103	-102	-097	-095	-101	-105
Noise	-130	-125	-121	-127	-125	-120	-127	-121	-125	-130	-125
Channel	45	46	47	48	49	50	51				
Signal	-101	-104	-097	-099	-102	-098	-096				
Noise	-124	-121	-125	-125	-128	-120	-128				
Average signal = -95											
Average noise = -112											
Press Any Key to continue or ESC to quit											

Figure 6-35 Example of a Channel Signal/ Noise Log

(L) Show Logging

This function is the same as the in the Radio Statistics Menu explained previously.

(M) Test Link Margin

This function displays the average signal and average noise the radio modem is measuring.

If the unit is configured as a Master then it will require an address of the Slave.

Enter Remote Tx Address value (0-9999):

When selected, a test is started, and the following message is displayed.

The test output is the same as that shown below. The Diagnostic menu is then displayed again.

Testing Link Margin - Please Wait

(2) Display Tasks

The Tasks, which are displayed below in *Figure 6-36* are assigned to the radio's controller when they are enabled. These tasks are performed at predetermined times by the controller and do not affect the transfer of data. It is an indication of the amount of work the controller is doing. Tasks are added or removed from the list as functions are enabled or disabled by the user.

Idx	Timer	Handle	Param	Task Name
0	0	100	0	Serial Flow MAIN
1	10	101	0	Front Button
2	10	102	0	Front Panel
3	10	103	0	Modem Ctrl
4	10	104	0	AltComm Status
5	5	105	0	Hayes Modem MAIN
6	5	106	1	Hayes Modem AUX
7	10	107	0	Online Status
8	1	108	0	Link Layer
9	10	117	0	Console
10	12	118	0	Main Menu

Press Any Key to return

Figure 6-36 Tasks Display

(3) Display Links

This display is for diagnostics only.

The Links display shows the current status of communication connections to the Radio. An example of the Dialup Link display and Point-to-Point Link display is in *Figure 6-37*.

Idx	LocSrc	LocExt	DestSrc	DestExt	DestAddr	State	Link Name
0	0	0	0	0	1000	5	MAIN Dialup

Idx	LocSrc	DestSrc	DestAddr	State	Link Name
1	1	1	1001	3	AUX PtoP

Press Any Key to return

Figure 6-37 Links Display

- Idx is the Index Number is used internally but indicates the number of links.
- LocSrc is the local port number that is the source/destination for the data.
- LocExt is the extension that has been dial if a remote has dialed this unit.
- DestSrc is the remote port that is the source/destination for the data.
- DestExt is the extension that this unit has dialed.
- DestAddr is the remote unit address.
- State is the state of the link (i.e. idle, active).
- Link Name is the name assigned to the link. It reflects the mode of operation for that link.

The source/destination ports are one of three ports, the main, auxiliary or the virtual port. The virtual port is an internal port used by the radio to communicate through the menus.



(F) Fault log menu

The following menu in *Figure 6-38* shows the logging menu which is for general debugging information used only by RFI or to obtain feedback from a customer.

```

***   Log Manager Menu   ***

Log Level = Debug Information

(V)   View Log
(L)   Set Logging Level
(C)   Clear Log
(Esc) Previous Menu

Enter Choice:

```

Figure 6-38 Fault Log Menu

(V) View Log

Used to actually view the debugging information supplied by the radio modem.

(C) Clear Log

Used to clear the logging file so new data can be logged for debugging purposes.

(L) SET LOGGING LEVEL

Selected to change the type of information logged by the radio modem for display when using the (V) command as shown below in *Figure 6-39*.

```

***   Log Level Menu   ***

Log Level = Debug Information

(0)   Errors Only
(1)   Warnings and Errors
(2)   Status Information
(3)   General Information
(4)   Debug Information
(Esc) Previous Menu

Enter Choice:

```

Figure 6-39 Log Level Menu

(1) Statistics Menu

As the Modem operates in its normal modes it builds up a picture of how well it is operating in any given environment and keeps track of the statistics for that operation. The user may access these statistics



and use them to accurately predict the link performance, data throughput or other operational parameters. The following menu *Figure 6-40* shows the functions available.

```

***   Statistics Menu   ***

(N)   Show channel signal/noise
(L)   Show Stats/Logging
(P)   Reset Physical Layer Logging
(S)   Reset Serial Logging
(Esc) Previous Menu

Enter Choice:

```

Figure 6-40 Statistics Menu

(N) Show channel signal/noise

This function is exactly the same as in the Radio Statistics Menu explained previously.

(L) Show Stats/Logging

This function shows the statistics relating to the quality of the data throughput and information regarding the performance of both serial ports. The following table in *Figure 6-41* is an example of what is shown when this function is selected.

```

Frame count      =    63972  Empty Frames =    63972
Good packets     =         0  Bad packets  =         0
Lost packets     =         0  Retries      =         0
Good Headers     =         0  Bad Headers  =         0
Lost Frame Lock  =       255  Low RSSI   =         0
Data Sent        =   187693  Data Recv  =   187693
Rx Overflows     =         0  Rx Overruns =         0
Tx Overflows     =         0  Busy waits =         0
-----
MAIN: Tx =   187693  Rx =   187693
Rx Errors =         0  Overflow =         0  Overrun =         0  Framing =         0
Tx Errors =         0  Overflow =         0
AUX:  Tx =    90600  Rx =        531
Rx Errors =         0  Overflow =         0  Overrun =         0  Framing =         0
Tx Errors =         0  Overflow =         0

Press Any Key to return

```

Figure 6-41 Logging Screen

(P) Clear Physical Layer Logging

This function simply clears the physical layer logging information from memory.

(S) Clear Serial Layer Logging

This function simply clears the serial layer logging information from memory.

7 The Hayes™ Compatible AT Command Set

The RFI-9256 supports many Hayes™ compatible commands and command sequences, this enables users and operators to fully control and operate the Radio Modem and in most cases emulate land line or phone modems for their communication needs. Some commands are implemented for completeness only and do not perform any function.

The Hayes™ commands may be entered manually through a terminal or automated through dialer programs and scripts. Most commands, with exception of the ‘%’ register (*Table 7-5*) and Connection Commands (*Table 7-3*), may be concatenated into a single command string. Commands or command strings must be terminated with a Carriage Return <CR> code produced by the Enter key. AT Commands may be used if the terminal attached to the modem will not understand the menu system, for example a PLC terminal. In addition to the modem configuration, AT Commands are used to dial and hang-up the remote modem for Point to Multipoint Communication.

The AT Commands

The AT commands are a group of special commands recognised by your modem. These commands derive their name from the letters AT, which are used to prefix commands. Before continuing:

- Run your communications software and enter local mode (or terminal mode) at 19200-baud, 8 bit data, No parity, One stop bit and no flow control or handshaking. If these values have been changed for the modem then the communications software needs to be set the same as the unit it is communicating to.

The Attention Code

An **AT** (sometimes known as the **AT**tention code) usually precedes all commands being sent to the modem. It is used to gain the modem’s attention, informing it that you are about to send a command. For example:

- Type the command: ATI2 <CR>

Your modem’s firmware identity message will appear on your terminal screen. If you type I2 only, your modem will not respond.

You may enter the attention code in all upper case, or all lower case letters, such as: **AT** or **at**

Multiple Commands

You may place multiple modem commands after an AT provided the total number of characters does not exceed 255. For example, a valid command to display the modem’s internal temperature twice is:



- Type in the command: `ATI9I9 <CR>`

An AT is not required in front of the second I9 command⁸. You only need one attention code for each command line. To make this command more readable, you can add spaces between the two commands:

- Type in the command: `AT I9 I9 <CR>`

The modem will execute the command as if the spaces are not there.

Port Selection Modifier

Unlike conventional modems the RFI-9256 has two serial ports. Each can be configured independently. So to allow access and configuration of alternative ports a modifier may be appended to the end of the command string.

This modifier is a colon followed by a port number from 0-1. For example **‘:00’** would be port 00 also called the Main port, **‘:01’** would be the Auxiliary port.

- Typing in the command: `ATS80:01 <CR>`, would connect the port to the auxiliary port of the remote unit addressed 80 (Rx = 80).

The Escape Sequence

When there is no communications link established to a remote modem, and you issue commands, all dialogue is occurring between your computer and the local modem. This situation is known as Local Command State.

When you connect to a remote modem, dialogue is occurring between your computer and the remote modem (or what is connected to the remote modem). This is known as On-line State. Once a modem enters on-line state, it assumes all the data you send it is to be sent on to the remote modem, so it ignores any AT commands you give it.

To force the modem to return to local command state, enter an escape sequence. An escape sequence consists of a one second delay, three characters (default is ‘+’) typed rapidly and another one-second delay. For example if you dial a remote modem:

- Type: `ATDT 2000 <CR>`

If the remote modem connects then the local modem will enter the ‘on-line’ state and your terminal will display the message **CONNECT**.

Now try to view the modem’s firmware identity code:

⁸ There are some commands that cannot be linked as multiple commands. These commands have to appear on their own and are outlined in the tables on page 70.

● Type: AT12 <CR>

Your command will be ignored. This is because the modem assumes you are typing characters to be sent to a remote system.

Now type an escape sequence. Do not type any characters for one second, type +++ rapidly and wait another full second. The modem responds with an OK message.

You may now view the modem's firmware identity.

● Type: AT12 <CR>

The H0 command is used to hang-up and end the test.

● Type: ATH0 <CR>

Unlike the other commands, you should not type AT before the escape sequence, or type a carriage return after it. Instead, wait a full second before you type the escape sequence and then a full second after typing it. As soon as the modem returns to local command state, it will respond with the message: OK

This waiting period before and after the escape sequence is called the *Escape Sequence Guard Time*. This allows the modem to distinguish the escape sequence from the normal flow of information between modems.

You can change the character used for the escape sequence by changing the value of 'S' Register 2.

You can change the length of the escape sequence guard time by changing the value of 'S' Register 12.

Response Codes

Your modem is capable of telling you, with on screen messages, what it is doing. These messages are known response codes or result codes, and you will see them from time to time.

For example:

After a command is successfully executed, the response is: OK



After a connection is established, the response is: CONNECT

Dialing

The AT commands may be used to initiate dialing with the modem.

The **D** (Dial) command is used to initiate a telephone call. The most basic form of the **D** Command is:
ATD number

Where the number is the telephone number you are dialing.

Having set your communications software for 19200 bps operation:

● Type: ATD1234 <CR>

Your modem dials the number '1234'. You may substitute this number for the number of any remote modem.

If your modem receives a character from your computer while dialing is being performed, it immediately hangs up, sends a NO CARRIER response message to the computer and returns to local command state.

After a few seconds the message, CONNECT appears on the screen.

If a NO CARRIER message appears, your modem has not been able to make a connection. Check your communications software is set for 19200 bps operation and your modem is correctly connected to your computer.

To hang up the modem, type an escape sequence (+++). The modem responds with an OK message.

● Type: ATH0 <CR>

The modem hangs up.

Hanging Up

The H0 command is used to hang up the modem. After you have finished communicating with another modem you must hang up your modem.

Similarly, you must hang up the phone after calling another person. If you don't, no one will be able to call you.

To hang up your modem:

● Type: ATH0 <CR>



The modem will return an OK response message⁹.

Configuring the Modem

Your modem allows you to tailor its operating parameters to suit your own particular requirements. The modem uses S Registers to alter the configuration profile. Each S Register contains a decimal value to represent a time delay, an ASCII character or the modems phone number (the interpretation of each value differs with each S Register).

The modem allows you to save the contents of the S Registers and certain communication settings in non-volatile memory (**&W**). This means the entire configuration profile will be retained after you have switched your modem OFF.

The modem also has factory default settings stored internally, allowing you to change the communication settings and S Register values and then recall the factory default configuration profile stored in your modem when you originally purchased it. The factory defaults have been selected so most users will be able to make immediate use of their modem, with minimum changes.

You may restore your modem to its factory defaults at any time:

● Type: AT&F <CR>

Viewing the Current Configuration

The **&V** command allows you to view the current configuration of your modem. When you issue the **&V** command, your modem sends a list of the current AT command and S Register settings to your computer.

⁹ If you are getting no response it is likely to be because local command state has not been entered. See *The Escape Sequence*.



Modem Commands

AT? Menu Mode

This command allows you to use a menu system to configure the modem. There are many extended modes of operation only available from the menu, the protocol settings for example. After you exit the menu through the Escape key the modem will return to the command mode. This menu command is more versatile than the one brought up by the front panel button because it works for any serial port settings (as long as the modem and terminal software have the same settings).

ATD Dial

This command allows you to dial a telephone number. The basic dialing command is:

ATDXXXX:YY

ATD followed by the remote modem Rx address (XXXX) and port number (YY).

For Example:

To dial the number 2356 78

● Type: ATD2356 78 <CR>

You may use hyphens or spaces. They will be ignored by the modem, but they will make it easier to read the command line.

For example:

● Type: ATD 2356-78 <CR>

☞ D command must be the final command on a command line.

ATE Echo

The E command allows you to select whether the characters you type at your keyboard (while in the local command state) will be echoed back to your computer screen by the modem.

Command	Description
ATE0	Disable local command state echo
ATE1	Enable local command state echo

ATH Hang Up

The H command forces the modem to hang up.

Command	Description
ATH0	Hang up

ATI Information

To display various information about your modem including its firmware version.

Command	Description
ATI	Display Modems Firmware ID
ATI0	Display numeric identity code (UNIMODEM PnP response)
ATI1	Display CRC 32 Firmware checksum value
ATI2	Display ERROR or OK for the CRC Firmware checksum
ATI3	Display firmware revision level
ATI4	Display firmware revision/build date
ATI5	Display Modem Manufacture Date
ATI6	Display Modem Serial Number
ATI7	Display Modem Identification String.
ATI8	Display Get Connect Type
ATI9	Display Internal Temperature in Deg C
ATI10	Display Offline time in milliseconds
ATI11	Display Average RSSI value
ATI12	Display Average NOISE value
ATI13	Display Get current port ID
ATI14	Display Link Status

ATO Return to On-Line State

The **O** command enables you to return to on-line state from local command state.

When you are on-line (connected to a remote computer), anything you type is sent on to the remote computer. If you want to send commands to your modem, you must return to local command state by typing the escape sequence (+++). When you are ready to return to on-line state, use the **O** command.

☞ The **O** command must be the last command on the command line.

Examples

- Type: '+++', your modem will return to local command state.
- Type: ATO <CR> Your modem will return to on-line state.

ATQ Quiet (Suppress Response Codes)

Your modem has a variety of messages or response codes that it sends in response to various commands. Examples of these codes are the OK and CONNECT messages. The **Q** command allows you to switch these messages on and off.

If you switch the messages off, no response codes will be displayed on your screen — with the exception of responses from the ATSn? Command and AT&V command.

Command	Description
ATQ0	Send response codes to the screen
ATQ1	Do not send response codes to the screen



ATV Verbal Response Codes

Your modem can display either verbal or numeric response codes in response to various commands. The **V** command enables you to select which type of response codes you want displayed.

See Table 7-6 for a full list of the response codes supported by your modem.

Command	Description
ATV0	Numeric response codes
ATV1	Verbal response codes

See Also

ATQ Quiet (Suppress Response Codes)

ATW Delayed Response

To support software that cannot cope with the high connection establishment speed of the radio then this option allows the response to be delayed for 1 second before returning the CONNECT response.

The **W** command enables you to select which type of response speed you want.

Command	Description
ATW0	Fast Response Mode
ATW1	Slow Response mode

AT&C Controlling Data Carrier Detect

DCD is an RS-232 signal used to indicate to the computer that remote modem is ready to communicate. The **&C** command is used to tell the modem how it will control the DCD output.

Command	Description
AT&C0	DCD is always asserted (the computer assumes the remote modem is ready to communicate).
AT&C1	DCD follows the online produced by a connection to a remote modem.
AT&C2	DCD follows the DSR from a remote modem



AT&D Controlling Data Terminal Ready

DTR is an RS-232 signal used to indicate to the modem whether your local computer is ready to communicate. The **&D** command is used to tell the modem how it will react when the DTR signal goes low.

Command	Description
AT&D0	The modem ignores the DTR signal and acts as if it is asserted (the modem assumes the computer is ready to communicate).
AT&D1	If DTR is lowered, the modem returns to local command state (as if an escape sequence has been typed).
AT&D2	The modem hangs up, returns to local command state if DTR has been asserted (high) and then goes low (transition).
AT&D3	The modem hangs up, returns to local command state whenever DTR goes low. The modem with this configuration must have DTR asserted before dialing or answering or an immediate hang-up may occur.

AT&F Restore Factory Defaults

Your modem comes with factory default settings for all communications settings and S Registers. The **&F** command enables you to restore the factory default values.

You must use the **&W** command if you wish to save the factory default values to non-volatile memory, and thus preserve these values when you switch the modem off.

Command	Description
AT&F0	Restore basic modem interface to factory defaults.
AT&F1	Restore radio and modem interface to factory defaults.

See Also

AT&V View Active Profile

AT&W Store Active Profile

AT&G Exclusive Port Control

Since this is a dual port radio there are times when a program may require exclusive control of a radio.

This command prevents or blocks the opposite port from being able to dial out. The opposite port will be presented with a BUSY response whenever it dials. You should restore the port to multi-port operation after hanging up from the remote radio or at the end of session. The G2 option give a port priority so that if the opposite port has already established a connection then that connection will be immediately disconnected when the port with priority issues a dial command.

Command	Description
AT&G0	Multi Port operation.
AT&G1	Exclusive port operation.
AT&G2	Priority use of this port.



AT&K Flow Control

The **&K** command enables you to select the type of flow control used between your modem and the local computer. You may want to do this to prevent possible data loss resulting from buffer overflow.

Using flow control guarantees that data buffers in your modem and computer won't overflow. Your modem and your terminal or computer must be using the same type of flow control.

Command	Description
AT&K0	Flow control disabled
AT&K3	RTS/CTS (hardware) flow control. The modem and computer use the CTS (Clear to Send) and RTS (Request to Send) signals on the RS-232 serial connection to control data flow.
AT&K4	XON/XOFF (software) flow control. The modem and computer use the XON and XOFF characters (DC1 and DC3) to control the flow of data.

AT&V View Active Profile

The **&V** command allows you to view many of the modem settings. These values correspond to S register and other commands that were saved into the modem's non-volatile memory and used as power up defaults.

Command	Description
AT&V	Display All Registers (Except I registers).
AT&V1	Display I registers - Information.
AT&V2	Display S registers only.
AT&V8	Display current links.
AT&V9	Display Fault/Diagnostics Log.

AT&W Store Active Profile

The **&W** command allows you to save the modem settings and submit serial communications settings. These values will be saved into the modem's non-volatile memory and used as power up defaults. Not all changes require the **&W** command, the ones that do are outlined in the AT command tables on page 70.

Command	Description
AT&W	Save general modem configuration data
AT&W1	Submit serial port configuration

'S' Register Commands

To set the value of an S Register the command is in the form:

ATSr=**n** – where **r** is the register and **n** is the value to be placed in the S Register.

The value of the S Register can be read with the ATSr? Command where r is the register.

Examples

- Type: ATS2=64 <CR> Sets S Register 2 with a value of 64
- Type: ATS51? <CR> Displays S Register 51 with the Unit Address (Phone number).

ATS0 Rings Before Answer

Supported for compatibility only, reports OK.

ATS2 Escape Character

Range: 0-255	Default: 43 (the + character)
--------------	-------------------------------

'S' Register 2 contains the ASCII values of the character that form the escape sequence.

The default value for this register is 43. The modem will recognise three + characters (+++) as the escape sequence.

Examples

- ATS2=36 - Recognises three dollar symbols '\$\$\$' characters as the escape sequence
- ATS2=45 - Recognises three minus '---' characters as the escape sequence

See Also

ATS12 Escape Sequence Guard Time.

ATS7 Wait for Carrier

Range: 1-60 s	Default: 10 s
---------------	---------------

S Register 7 contains a value, in seconds, equivalent to the length of time the modem will wait for a carrier signal after dialing. If a carrier is not detected within the time specified in this register, the modem will hang up and return a NO CARRIER message.

Examples

- ATS7=20 Wait up to 20 seconds for a connection

ATS12 Escape Sequence Guard Time

Range: 0-10000 ms	Default: 990 ms
-------------------	-----------------

The *Escape Sequence Guard Time* is the time delay required immediately before and after entering an escape sequence.

For your modem to distinguish the escape sequence from ordinary data, there must be a period of silence both before and after the escape sequence is entered. If the *Escape Sequence Guard Time* is one second and the escape sequence character has been defined as '+', for the modem to recognise an escape sequence you must maintain silence on the line for one second, then type '+++' in rapid succession, and then maintain another second's silence.

The guard time is in units of milliseconds (or 1/1000 of a second).

- 'S' register 12 is also used to time the period between the escape sequence characters as they are typed. If the period between the first and second escape characters or second and third escape characters being entered is greater than the value in S Register 12, the modem will not recognise the escape sequence.

Examples

- ATS12=990 Maintain silence on the line for 0.99 seconds before and after entering the escape sequence

See Also

ATS2 Escape Character

ATS21 Set Security Code

Range: 0-4294967295	Default: 0 (Disabled)
---------------------	-----------------------

Set the Network Security Code for this modem.

ATS30 Inactivity Time out

Supported for compatibility only, reports OK.

ATS40 Packet Timer

Range: 0-1000 ms	Default: 0 (Disabled)
------------------	-----------------------

Sets the Packet timer in number of milliseconds. Enter 0 to disable.



ATS41 Number of retries for ARQ

Range: 0-255	Default: 50
--------------	-------------

Set the number of retries ARQ Link control parameter.

ATS42 Network fail timeout

Range: 100-30000 ms	Default: 5000 ms
---------------------	------------------

Set the Network fail timeout parameter.

ATS43 Online requests timer

Range: 0-30000 ms	Default: 1000 ms
-------------------	------------------

Set the Online request timer parameter.

ATS44 Hopping Pattern Sequence

Range: 0-31	Default: 0
-------------	------------

Set the Hopping Pattern Sequence parameter.

ATS45 Max TX Power

Range: 0,10,20,25,30 dBm	Default: 20 dBm
--------------------------	-----------------

Set the Maximum Transceiver output power parameter.

ATS47 Frame Time

Range: (5),8,10,15,20,25,30,35 ms	Default: 20 ms
-----------------------------------	----------------

Set the Frame Time parameter

ATS48 Frame Bias

Range	Description
0	Disable
1	Outgoing/Upload
2	Incoming/Download

Set the Frame Bias parameter.

Default: 0 (Disabled)

ATS50 Network Address

Range: 0-63	Default: 32
-------------	-------------

Set the Network Address parameter.

ATS51 Unit Rx address

Range: 0-9999	Default: 20
---------------	-------------

Set Unit Local Rx Address parameter (Phone number).

ATS52 Unit Tx address

Range: 0-9999	Default: 20
---------------	-------------

Set Remote Tx Address parameter (Phone number). This is only applicable if the unit is switched to Point-to-Point mode.

ATS60 Set Logging Level

Range	Description
0	Errors Only
1	Warnings and Errors
2	Status Information
3	General Information
4	Debug Information

Set Fault/Debug logging level.

Default: 3

ATS61 Set UNIX Date/Time

Range: 0-2147483647	Default: 0
---------------------	------------

Set the time in seconds since 1970

ATS62 Set System/Log Timer

Range: 0-86400000	Default: 0
-------------------	------------

ATS70 Set Port Protocol Type

Range	Description
0	Disabled
1	Point-to-Point
2	Broadcast
3	Hayes Dialup

Default: 3

ATS80 Get Local Auxiliary I/O Hex data

Range: 0x00-0xFF (0-255)	Default: 0x00
--------------------------	---------------

Get/Set the 8 bit auxiliary I/O port

ATS81 Get Remote Auxiliary I/O Hex data

Range: 0x00-0xFF (0-255)	Default: n/a
--------------------------	--------------

Get/Set the bit direction of the 8 bit auxiliary I/O port of the remote radio. You must already be connected to a remote radio either by dialing and returning to local command mode or by having the opposite port having already established a connection to a remote by dialing or in a point-to-point mode.

ATS82 Get Auxiliary I/O Direction Mask

Range: 0x00-0xFF (0-255)	Default: 0x00
--------------------------	---------------

Get/Set the bit direction of the 8-bit auxiliary I/O port on the radio that you are connected to.



ATS83 Set Auxiliary I/O Power-up Default

Range: 0x00-0xFF (0-255)	Default: 0x00
--------------------------	---------------

Get/Set the power defaults for the 8 bit auxiliary I/O port.

ATS84 Set Auxiliary I/O Sample Timer

Range: 8-5000 ms	Default: 500 ms
------------------	-----------------

Get/Set the sample timer for the 8 bit auxiliary I/O Port sample timer.

ATS90 Set DCD control

Range	Description
0	ONLINE controls DCD
1	NETWORK LINK controls DCD
2	CARRIER DETECT controls DCD
3	Remote DSR controls DCD
4	Local DSR controls DCD
5	Remote CTS controls DCD
6	Local CTS controls DCD
7	DCD Always ON
8	DCD Always OFF
9	DCD disabled

Sets the DCD Control of a Serial Port.

Default: 0

ATS91 Set RTS control

Range	Description
0	ONLINE controls RTS
1	NETWORK LINK controls RTS
2	CARRIER DETECT controls RTS
3	Remote DSR controls RTS
4	Local DSR controls RTS
5	Remote CTS controls RTS
6	Local CTS controls RTS
7	RTS Always ON
8	RTS Always OFF
9	RTS disabled

Set the RTS Control of a Serial Port.

Default: 0

ATS100 Set Port baud rate

Range: 300,600,1200,2400,4800,9600,19200,38400,57600,115200	Default: 19200
---	----------------

Set the Baud Rate of the Main Serial Port.

● Must be used in conjunction with the AT&W1 command.

ATS101 Set Port parity

Range	Description
0	No Parity (default).
1	Odd Parity
2	Even Parity

Set the Parity of the Main Serial Port.

● Must be used in conjunction with the AT&W1 command.

Default: 0

ATS102 Set Port data bits

Range	Description
7	Seven Bit Data
8	Eight Bit Data

Set the Data Bits of the Main Serial Port.

- Must be used in conjunction with the AT&W1 command.

Default: 8

ATS103 Set Port stop bits

Range	Description
1	One Stop Bit
2	Two Stop Bits

Set the Stop Bits of the Main Serial Port.

- Must be used in conjunction with the AT&W1 command.

Default: 1

ATS104 Set Port flow control

Range	Description
0	No Flow Control
1	Software (XON/XOFF) Flow
2	Hardware (RTS/CTS) Flow

Set the Flow Control of the Main Serial Port.

- Must be used in conjunction with the AT&W1 command.

Default 0

'%' Register Commands

The % Registers usually store string values and data entry must be terminated with a Carriage Return <CR>. String values may contain spaces but will have leading and ending spaces removed. The % Register commands **cannot** be concatenated, each must be terminated with the <CR>.

To set the value of an % Register the command is in the form:

AT%r=**n**

where **r** is the register and **n** is the value to be placed in the % Register.

The value of the % Register can be read with the AT%r? command where r is the register.

AT%20 Set Unit Name

Set the Unit Name for this modem.

Range: 16 alphanumeric characters.

Default: Blank

AT%22 Set Menu Password

Set the Menu Password for this modem. If the password is already set then this command will not change it. You must first remove the password via the menu. Or reset the modem to factory defaults.

Range: 12 alphanumeric characters.

Default: Disabled

AT%62 Set RTC Date/Time

Set the time of day in seconds since midnight.

Range: 0-86400

Default: 0

Other Commands

There are more AT commands available on the RFI-9256, too many to list in descriptive form. The other commands can be found in the tables on page 70.



Command	Description	L	&W	Command	Description	L	&W
?	Help / Menu	✕		&F	Hayes™ only defaults		
E0	Echo OFF		✕	&F1	Set Factory defaults		
E1	Echo ON		✕	&G0	Multi modem ports		
L0	Lowest speaker volume			&G1	Exclusive use by this port		
L1	Low speaker volume			&G2	Priority use of this port		
L2	Mid speaker volume			&K0	No flow control		
L3	Highest speaker volume			&K3	Hardware RTS/CTS flow control		
M0	Speaker off			&K4	Software XON/XOFF flow control		
M1	Speaker on when connecting			&L0	Set Modem to SLAVE mode		
M2	Speaker on			&L1	Set Modem to MASTER mode		
Q0	Response ON		✕	&M0	Set Ports to Point to Point		✕
Q1	Response OFF		✕	&M1	Set Ports to Multipoint Dialup		✕
V0	Numeric response codes		✕	&M2	Back To Back Repeater		✕
V1	Verbal response codes		✕	&M2	Dialup Repeater		✕
X0	Set to basic response codes		✕	&S0	Sync Mode Off		
W0	Fast Response			&S1	Sync Mode - Input (Follow)		
W1	Delayed Connect Response			&S2	Sync Mode - Output		
X4	Set to extended response codes		✕	&S3	Sync Mode - Repeater		
Z	Initialise (power on reset)			&T8	Warm Start - Reset		✕
&A0	Auxiliary I/O Disable			&T9	Cold Start - Reset		✕
&A1	Auxiliary I/O Enable			&V	View current profile		✕
&A2	Auxiliary I/O Follows Remote			&V0	View all basic Hayes register information		✕
&C0	DCD always on			&V1	View all 'T' Register profile information		✕
&C1	DCD follows Online			&V2	View all 'S' register profile information		✕
&C2	DCD Follows remote DSR			&V8	View Current Links		✕
&D0	Ignore DTR		✕	&V9	View Logging		✕
&D1	Go local on DTR low		✕	&W	Write All Configuration		✕
&D2	Hang-up on DTR high to low transition (dropped).		✕	&W1	Submit Serial Port Configuration.		✕
&D3	Hang-up if DTR low		✕				

Table 7-1 General Commands

Table 7-1 Notes	
✕ in L	Command must be last on the command line
✕ in &w	&w must follow for changes to take effect
Bold	Defaults
Gray	For Compatibility only (no function)



Command	Description	Command	Description
I	Firmware ID	I7	Modem ID
I0	UNIMODEM PnP response	I8	Get Connect Type
I1	Return CRC 32 Firmware checksum	I9	Internal Temperature in Deg C
I2	CRC Firmware checksum Error or OK	I10	Offline time in milliseconds
I3	ROM Revision	I11	Average RSSI
I4	ROM Date	I12	Average NOISE
I5	Manufacture Date	I13	Get current port ID
I6	Modem Serial Number	I14	Get Link Status

Table 7-2 Information Commands

Command	Description
A	Answer
D	Dial number
DT	Dial number using tone
H	Hang-up modem
H0	Hang up modem
O	Go Online
O0	Go Online

Table 7-3 RFI-9256 Connection Commands

Table 7-3 Notes

The connection commands must appear as the last command on a line.

Command	Description	&W	&W1	Command	Description	&W	&W1
S0	Rings before answer 0 disables	✗		S52	Remote Tx Address (Point to Point)		
S2	ESC character	✗		S60	Logging Level		
S6	Wait for Dial Tone Timeout			S61	UNIX Date/Time seconds since 1970		
S7	Wait for Carrier Timeout	✗		S62	System/Log Timer in milliseconds		
S12	ESC guard time	✗		S70	Port Protocol Type		
S21	Set Security Code			S80	Local Auxiliary I/O		
S30	Inactivity Time out	✗		S81	Remote Auxiliary I/O		
S39	Rx (In) Packetiser Timer			S82	Auxiliary I/O Bit Mask (Direction)		
S40	Tx (out) Packet Timer 0 to disable			S83	Auxiliary I/O Bit Power up default		
S41	Number of retries for ARQ			S84	Auxiliary I/O Sample Timer		
S42	Network fail timeout			S90	DCD control		
S43	Online requests timer			S91	RTS control		
S44	Hopping Pattern Sequence			S100	Port baud rate	✗	✗
S45	Max TX Power			S101	Port parity	✗	✗
S47	Frame Time in milliseconds			S102	Port data bits	✗	✗
S48	Do Set Frame Bias			S103	Port stop bits	✗	✗
S50	Network Address			S104	Port flow control	✗	✗
S51	Unit Rx address						

Table 7-4 'S' Register Commands

Table 7-4 Notes

✗ in &w1 &w1 or &w must follow for changes to take effect

✗ in &w &w must follow for changes to take effect

Gray For Compatibility only (no function)



Command	Description	S
%20	Set Unit Name	×
%22	Set Menu Password	×
%62	Set RTC Date/Time (HH:MM:SS)	×

Table 7-5 '%' Register Commands

Table 7-5 Notes

The % register commands are single line commands and cannot be concatenated together with other commands.

Num	Verbal	Description
0	OK	Command accepted
1	CONNECT	Connection established
2	RING	Incoming call detected
3	NO CARRIER	Carrier not detected
4	ERROR	Command error
7	BUSY	The dialed number or extension is busy
8	NO ANSWER	Extension not supported
255	FAULT	Protocol or other error

Table 7-6 Response Codes



8 Dialup Networking

The RFI-9256 provides several features to allow networking, dual port control and remote configuration. The RFI-9256 has 2 independent serial ports that can be used in communication.

Extension Numbers

To allow access to internal and external ports the modem provides extension numbers. These extension numbers work like an internal PABX where the user appends a two-digit extension number to the destination radios dial string. The radio has several preset extension numbers as in the following table:

Extension Number	Description
00	MAIN Serial Port
01	AUX Serial Port
91	Virtual Hayes Connection
92	Remote Menu Connection
93	Remote Logger Connection
99	Loop-back Connection

Table 8-1 Extension (Port) Numbers

The MAIN and AUX port extensions allow the dialing Modem to select which port it wants to connect through.

The Virtual Hayes connection provides an interface for automated or scripted configuration and management of the radio.

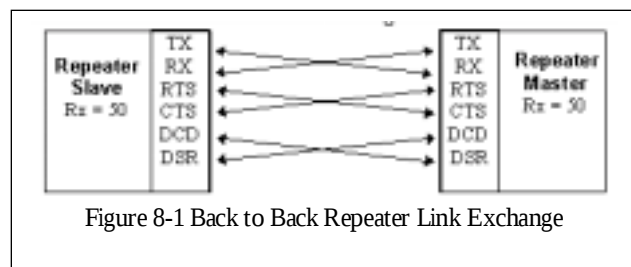
The Remote Menu connection provides the user with a friendly interface into a remote radio. This interface has restrictions to prevent the user from accidentally changing the radio specific attributes that could break the connection.

The Remote Logger connection dumps the currently stored event/fault log. Must be disconnected with a Hayes hang-up sequences.

The Loop-back connection echoes any data entered and allows you to diagnose link quality.

Repeaters

To provide simple network functionality the RFI-9256 provides a several Repeater modes and uses a number analysis system.



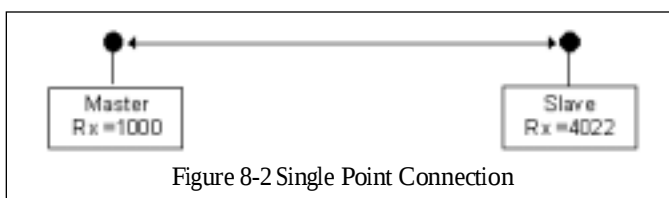
The Back-to-Back Repeater mode configures the Main serial port and removes its control from the Serial Configuration Menu. To connect the modems for repeater operation the Main ports of each modem must be fully connected so that all the serial lines are exchanged.

This mode also has the option of synchronising the Slave and Master for increased performance, to do this pin 10 of each Radio can be linked to pin 10 of the opposite Radio Modem.

The numbering system requires the following rules:

- All Repeater radios must only have a two digit Rx Address (unit id).
- All “End Point” radios should use a full four-digit Rx address (unit id) and will require a mandatory two-digit extension number.

For example a destination “End Point” radio’s Rx address may be 4022 and required port may be the MAIN port, which is extension 00, so the End Point number would be 402200 (6 digits in total).



To dial a connection to MAIN port (Ext 00) on radio **4022** would be:

ATDT **402200**

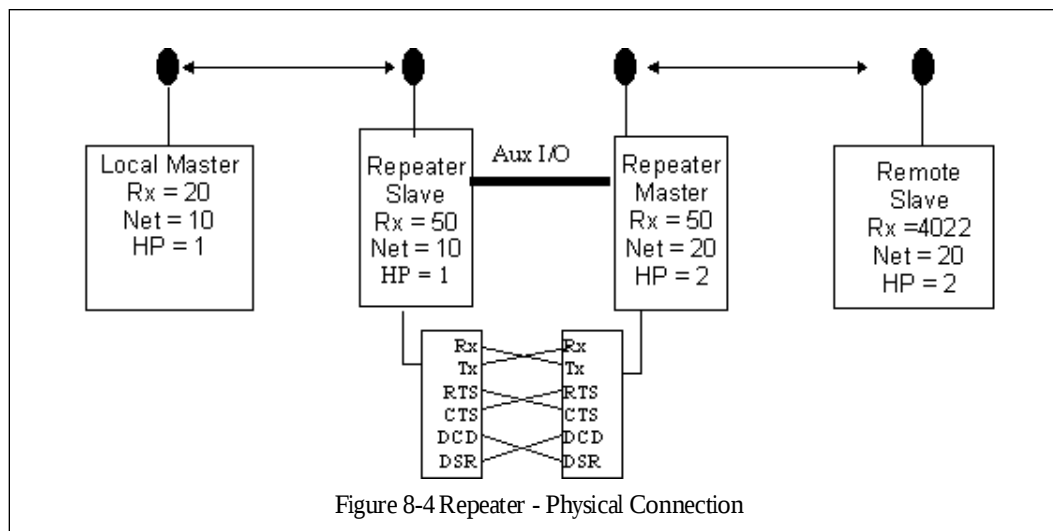
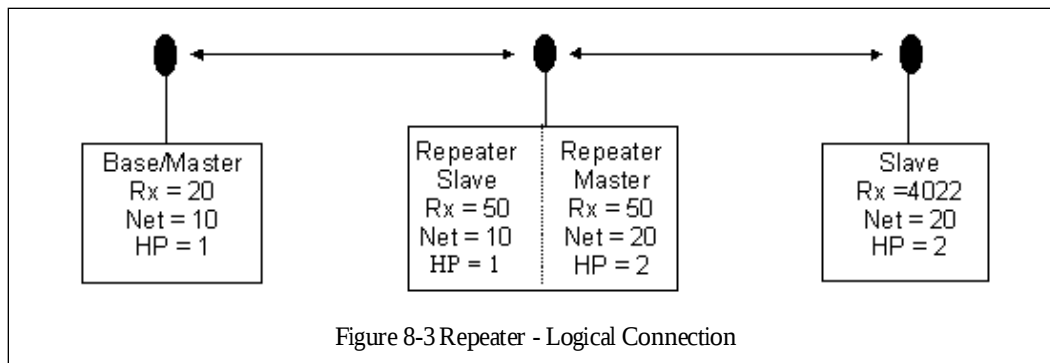
To dial a remote menu (Ext 92) connection on radio **4022** would be:

ATDT **402292**

To dial through a back-to-back repeater the repeater Rx address will be prefixed to the dial string. In the example the user is dialing a menu extension (Ext 92) on the remote slave “End point” radio (radio 4022) using repeater 50.

ATDT **50402292**

This simple numbering system allows several repeaters to be concatenated and allows repeaters to branch to other repeaters in a tree like formation.

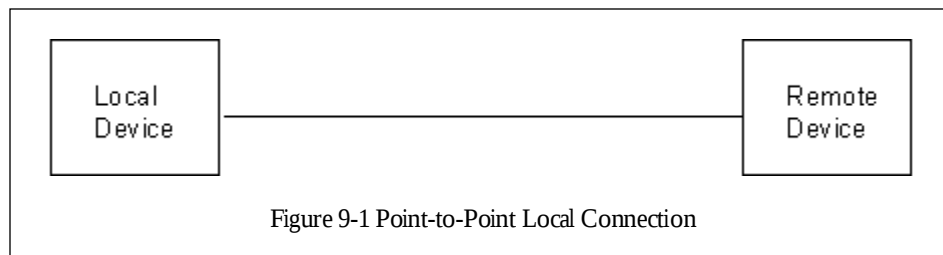


9 Establishing Communication Links¹⁰

Point to Point

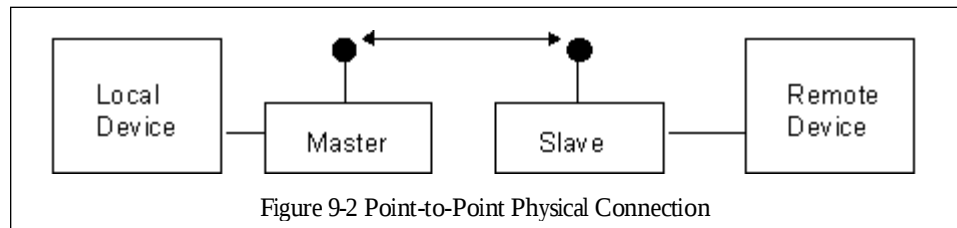
The RFI-9256's versatility allows data communication links to be established using a variety of different configurations. This, in turn, makes it possible to extend the range of RFI-9256's and get around obstacles.

Figure 9-1 and Figure 9-2 show the most common and straightforward link, a master communicating to a slave in a dedicated link. Both radios should be set to point to point (direct).



Once selected, and the menus have been exited, this mode automatically connects the modems and establishes a communication link.

Communication is **no longer** controlled by the AT commands. In this mode the units are always connected and the NETWORK LINK LED and ON LINE should always be ON. The CARRIER DETECT LED is used to indicate the link quality, by the ratio of green to red (if the LED is green 100% of the time, the link is perfect). The CARRIER DETECT LED on the slave will always indicate the link quality. On the Master the link quality is indicated more accurately when it is running a Margin Link Test.



Point to Multipoint Dial connection

A point to multipoint dial connection behaves just like a telephone line modem. By using the ATDT command followed by the number of the slave, the slave will then be connected to the master. This allows two RFI-9256 radio modems to look like a direct telephone line connection. Only one slave can be connected to the master at any one time in this mode, but the master can communicate with any slave within its network. For this mode to be enabled the radio's in the network must be configured as point to multipoint (dial) modems.

¹⁰ This section is concerned with the **logical** configuration and set up of networks.

Point to Point Repeater

Radios may be wired as back-to-back repeaters, to extend the range of a point-to-point system. The modems are not configured as repeaters (in the menu they configured in Point to Point Mode) but are wired together as back-to-back repeaters.

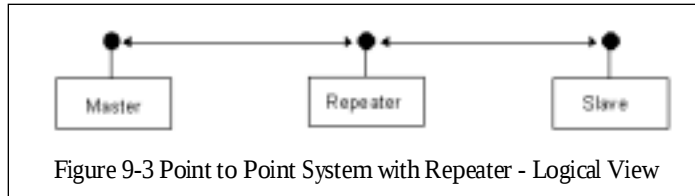
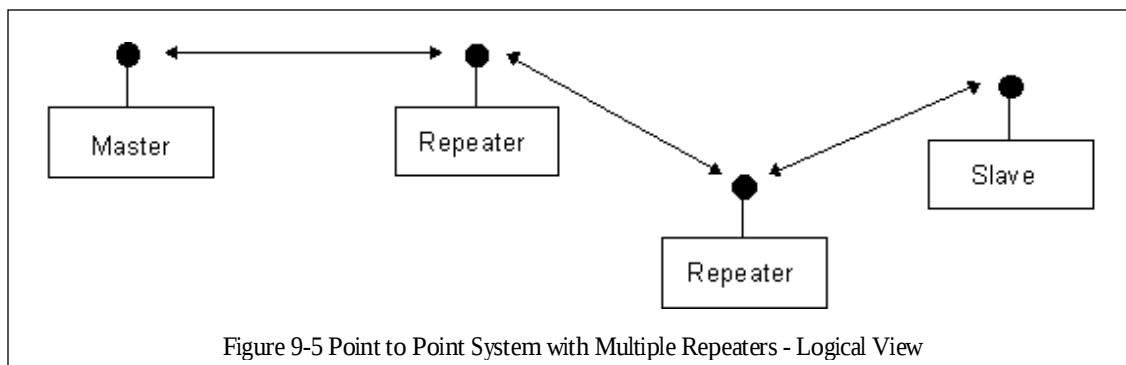
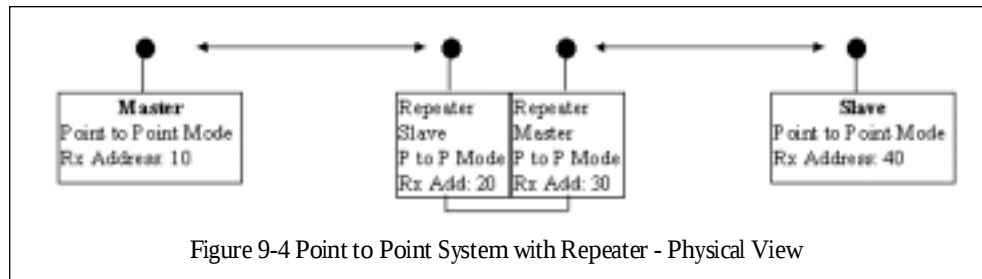


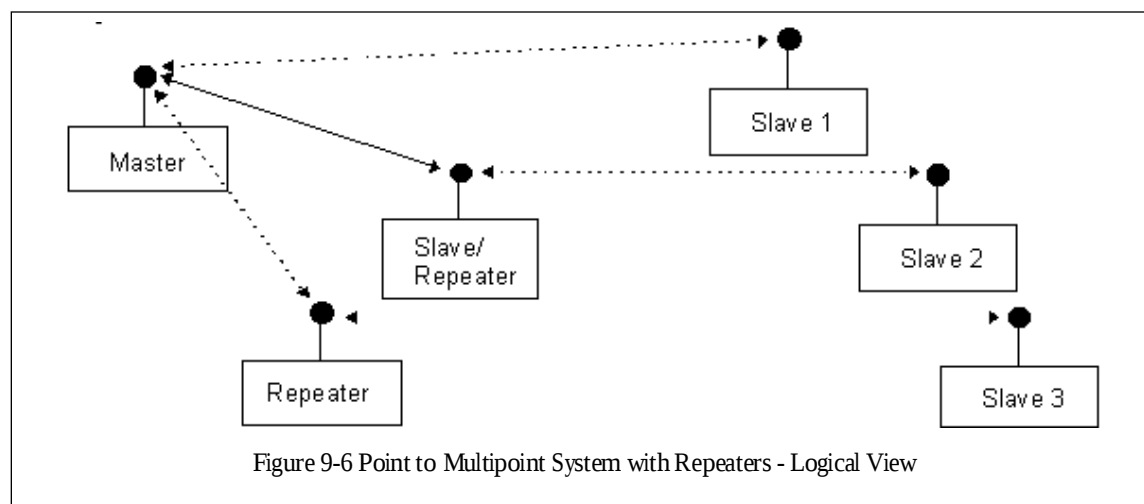
Figure 9-3 and Figure 9-4 depict how a link might be set up using a repeater. The repeater may be sitting on a hilltop or other elevated structure to link the master to the slave. In this configuration it may be desirable to use Yagi antennas to extend the range between the Repeater and either or both the Master and Slave.

Figure 9-5 shows a link with two repeaters between the master and slave. With two repeaters there is clearly more flexibility in getting around obstacles and greater total range is possible. Once again, it would be desirable to use external omni-directional antennas with the repeaters, and attaching a Yagi to the master and slave would increase the range of the link. When two repeaters are used there is no further degradation in the RF speed of the link, only the data latency is affected.



Point to Multipoint (+Repeater)

In *Figure 9-6* a setup is shown where a master routinely calls a number of slaves at different times. The master is communicating with a transceiver designated as a repeater/slave that is connected to a remote instrument in the field. Since this instrument is placed in an elevated location, the transceiver may also be used as a repeater when it is not used as a slave. At any time the master may call any of the slaves, establish a connection, and retrieve and send data. Note, point to multi-point (Dialup) is the only mode available when the radio is configured (using the menu) as a repeater.



10 Auxiliary Input/Output Port

The Auxiliary I/O Port has 8 digital I/O lines. These pins are not associated with the Main or Auxiliary serial ports, but are used as logical bit inputs or outputs to the modem. These lines are individually configurable as inputs or outputs and their default state can be configured to preset their power-up state.

The I/O ports can be controlled both remotely and locally through software or by following each other as if directly connected by wire.

- **Software control** – works by submitting Hayes ‘S’ register commands to the local radio or dialing a remote radio’s virtual port and submitting the commands to it. The Hayes ‘S’ register commands allow you full access to configure and control the 8 I/O lines. To software control an Auxiliary port the ‘Enable/Disable Auxiliary I/O’ in the ‘Auxiliary I/O Port Menu’ must be disabled.

- **Input/Output control** – Is the configuration of each of the 8 digital I/O lines as either an input or an output. The configuration can be done via the menu.

- **Power-up Output Defaults** – allows you to preset the state (High/Low) of an output line when the radio is first powered up. This prevents devices that are attached to the radios I/O from being unintentionally enabled.

- **Sample Rate control** – Used to balance the performance of the RFI-9256 between fast updates from the I/O device for one application and fast serial data throughput for another application. Fast sample rates below 15ms may degrade serial data throughput when trying to obtain serial data transfer rates of faster than 50,000 bits per seconds.

- **Auxiliary I/O Follows Remote** – To allow a radio’s outputs to follow the inputs of another radio the Aux I/O follows remote must be enabled. When two radios are connected for communication in either a point to point mode or dialup mode, they may also exchange each others input information and thus reflect the results on their outputs. They must be configured so that the pins that are the input in one radio are the output on the other. For example, in *Figure 10-8*, when the modems are connected, flipping the switch connected to pin number 21 in the Remote Modem will activated the output LED connected to pin 21 in the Local modem. Similarly, Flipping the switch connected to pin 7 on the Local Modem will change the status of the relay attached to pin 7 on the remote modem.

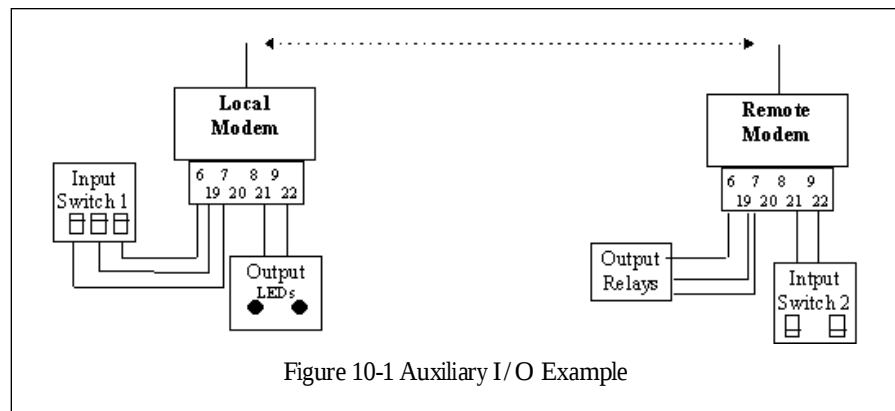


Figure 10-1 Auxiliary I/O Example

A Firmware Compatibility

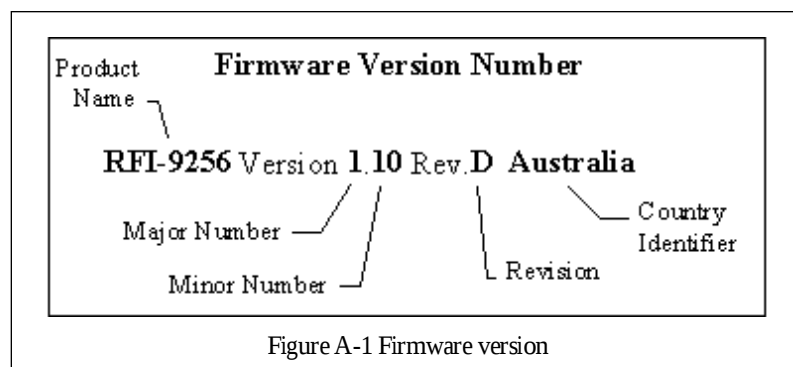
The version numbering scheme

The RFI-9256 products contain a firmware version string. This version information provides some information regarding compatibility with other firmware versions.

Product Name: Identifies the modem hardware type such as RFI-419, RFI-9256 or RFI-156.

Major and Minor Number: The major number generally reflects the hardware compatibility of the firmware but may be incremented if the firmware has had a major overhaul. The minor number is incremented as new suites of functionality have been added or when changes have been made which render the firmware incompatible with previous versions. Combined they are the version number.

Revision: The revisions reflect bug fixes or minor changes that don't render the system incompatible.



Country: Firmware with versions with different country identifiers, are always incompatible with their air interface. This is due to the frequencies and hopping sequences that they use. Each country has its own spectrum allocation and laws governing radio spectrum usage.

Compatibility Types

There are several different aspects of compatibility:

Hardware compatibility.

Hardware compatibility is the compatibility of the firmware with the radio's hardware, such as processor, transceiver and revisions of the PCB. This is usually indicated by the 'Major version number' or by the product name.

Air interface compatibility (AI)

The ability for radios of different versions to still communicate. This is related to the air interface protocols, RF frequencies, modulation methods and channels hopping mechanisms. Firmware with the same Major and Minor revision numbers are always Air interface compatible. A difference in the Minor number may indicate some Air interface incompatibility in some modes.

Feature Compatibility (F)

Each version of the firmware usually contains additional features such as protocols, enhancements such as security coding and changes to the user interface. Modems with different versions of firmware may be still compatible provided that features of the newest version modem are not utilized.

Version Inter-Compatibility Guide

The following firmware versions are for the RFI-9256 Data Strike Series 3 Radio.

Firmware Version	1.08		1.09 Rev A-D		1.10 Rev A-D		1.11 Rev A		1.20		1.21		1.22 Rev A		1.23	
	AI	F	AI	F	AI	F	AI	F	AI	F	AI	F	AI	F	AI	F
1.08	✓	✓	✓	60%	✗	✗	✗	✗	✗	✗	✗	✗	-	-	-	-
1.09 Rev A - D	✓	60%	✓	✓	✗	✗	✗	40%	✗	40%	✗	40%	-	-	-	-
1.10 Rev A - D	✗	✗	✗	✗	✓	✓	90%	80%	✗	80%	✗	80%	-	-	-	-
1.11 Rev A	✗	✗	✗	40%	90%	80%	✓	✓	✗	80%	✗	80%	-	-	-	-
1.20	✗	✗	✗	40%	✗	80%	✗	80%	✓	✓	✗	80%	-	-	-	-
1.21	✗	✗	✗	40%	✗	80%	✗	80%	✗	80%	✓	✓	-	-	-	-
1.22 Rev A	-	-	-	-	-	-	-	-	-	-	-	-	✓	✓	90%	90%
1.23	-	-	-	-	-	-	-	-	-	-	-	-	90%	90%	✓	✓

Table A-1 Compatibility of Firmware and Versions

Table Key	
✓	Compatible
✗	Incompatible
-	Not Available
%	Compatibility



B Diagrams

- The diagram in *Figure B-1* (next page) shows the dimensions of the mounting holes on the RFI-9256 radio.
- The diagram in *Figure B-2* (next page) is a cable assembly diagram for the RFI-9256. The two communication ports are output via DB9 connectors and supply power to the radio.





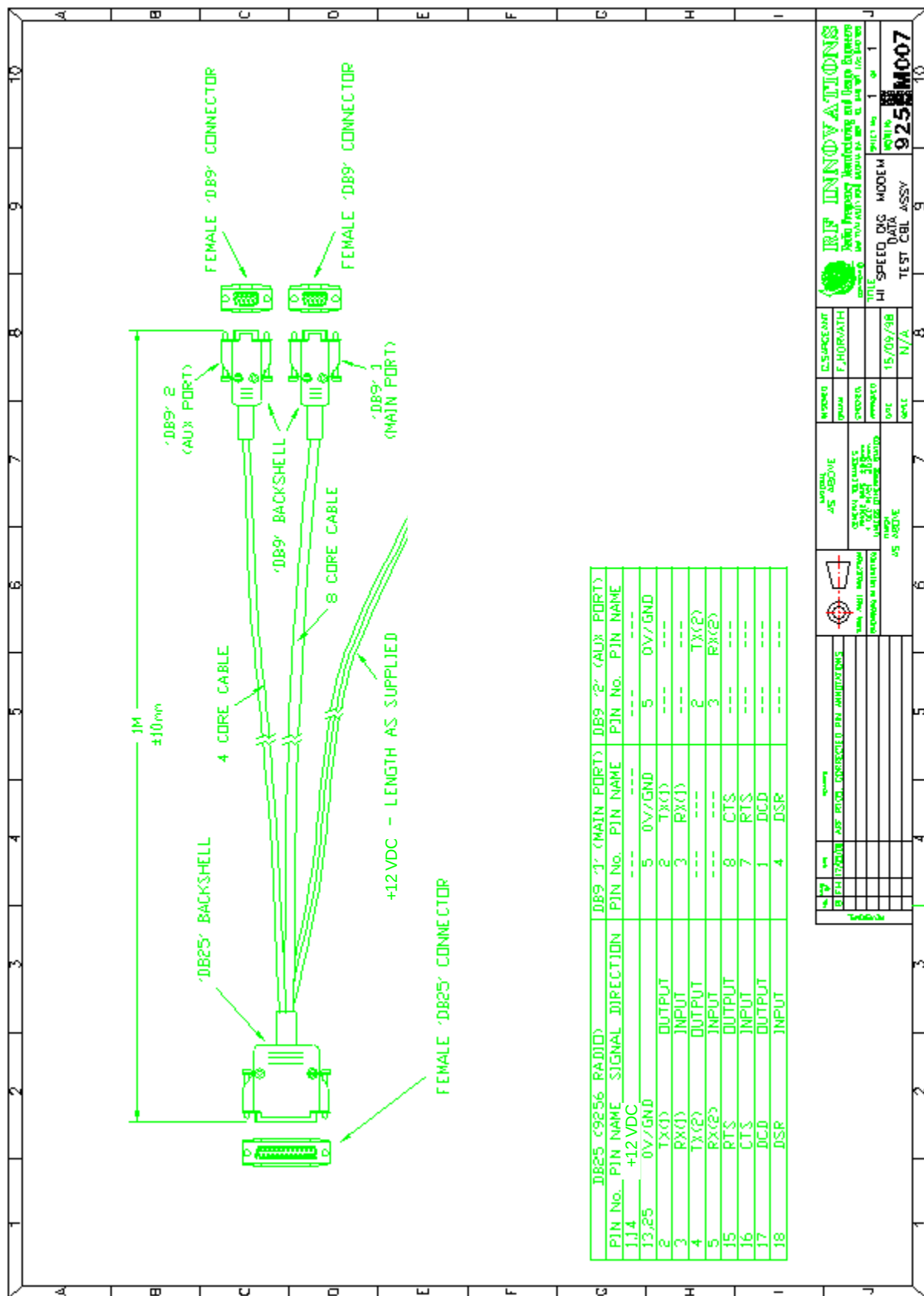


Figure B-2. Cable assembly details for interfacing to the RFI-9256 radio

C Technical Specifications

Radio Specifications

Specifications	
Range [†]	Up to 30 km point to point
RS-232 Data Rates	110 baud - 115.2 K baud
RS-232 Interface	Asynchronous, full duplex
System Gain	135dB
Minimum Receiver Decode Level	-108 dBm @ 10-4 raw BER -100 dBm @ 10-6 raw BER
Operating Frequency	902-928 MHz (USA) 915-928 MHz (Australia)
Modulation Type	Spread Spectrum, GFSK
Spreading Code	Frequency Hopping
Hop Patterns	32 (user selectable)
Output Power	1mW - 1 Watt (+30 dBm)
Error Detection	32 Bit CRC with packet retransmit (ARQ)
Antenna	Special BNC to RFI supplied antenna
Power Requirements	9.0 to 28.0 VDC (negative ground)
Power Consumption	350 mA Transmit 200 mA Receive 150 mA Average (normal data loading)
Connector	DB25 male (power and data combined)
Unit Address (Network ID)	User programmable
Operating Modes	Point-to-Point Point to Multipoint Dial (Hayes™) Back to Back Repeater Protocol Router Custom
Operating Environment	-10°C - +60°C
FCC Identifier	P5M9256TRX
ACA Identifier	N161

Table C-1 RFI-9256 Radio Specifications

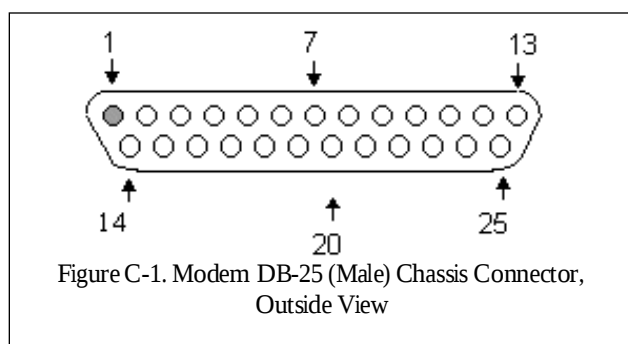
[†] The RANGE is dependent upon the antenna used and the environment, a typical range calculator is available to download from the RFI WEB site (<http://www.rfinnovations.com.au/>).



Pin Assignments

PIN NO. & FUNCTION	PIN NO. & FUNCTION
1 +12V input	14 +12V input
2 Transmit Data Out (TXD)main port	15 RTS Out (main port)
3 Received Data In (RXD)main port	16 CTS In (main port)
4 Transmit Data Out (TXD)Aux port	17 RS232 control Out (DCD) ¹
5 Received Data In (RXD)Aux port	18 RS232 control In (DSR) ¹
6 I/O control 7 [†]	19 I/O control 6 [†]
7 I/O control 5 [†]	20 I/O control 4 [†]
8 I/O control 0 [†]	21 I/O control 1 [†]
9 I/O control 2 [†]	22 I/O control 3 [†]
10 Analog input 2 (Tx Sync) [†]	23 Analog input 1
11 Analog input 0 [†]	24 I ² C Expansion (data) [™]
12 I ² C Expansion (clock) [™]	25 GND
13 GND	

Table C-2 Modem RS-232 Interface Connector Functions



Power supply Notes

The power supplies used to power Radio Modems should have sufficient current rating and ripple rejection, typically <500mVRMS of power supply noise can be tolerated. The Modems contain a built in thermal fuse that will open the circuit in the event of any over current conditions, over temperature or reverse polarity. Power supplies used should be capable of at least 1amp continuous current.

¹ RS232 control line functions are dependant upon device program options and can be used as flow control on the Aux Port.

[†] I/O controls and Analogs are 0-5V high impedance (4K7 Ohms) Consult RFI.

[™] Consult RFI for expansion options.

EIA Standard RS-232-C Pin Assignments

RS-232 DB-25 Pin Assignments

PIN	Name	D T E	D C E	Function
1	FG			Frame Ground
2	Tx			Transmitted Data
3	Rx			Received Data
4	RTS			Request To Send
5	CTS			Clear To Send
6	DSR			Data Set Ready
7	SG			Signal Ground
8	DCD			Data Carrier Detect
9				Positive DC Test Voltage
10				Negative DC Test Voltage
11	OM			Equalizer Mode
12	(S)DCD			SEC Data Carrier Detect
13	(S)CTS			SEC Clear To Send
14	(S)Tx			SEC Transmitted Data
	NS			New Sync
15	TC			Transmitted Clock
16	(S)Rx			SEC Received Data
	DCT			Divided Clock Transmitter
17	RC			Receiver Clock
18	DCR			Divided Clock Receiver
19	(S)RTS			SEC Request To Send
20	DTR			Data Terminal Ready
21	SQ			Signal Quality Detect
22	RI			Ring Indicator
23				Data Rate Selector
				Data Rate Selector
24	(TC)			EXT. Transmitter Clock
25				Busy

Table C-3 DB-25 RS-232 Pin Assignments

RS-232 DB-9 Pin Assignments

PIN	Name	D T E	D C E	Function
1	DTR			Data Terminal Ready
2	Rx			Received Data
3	Tx			Transmitted Data
4	DCD			Data Carrier Detect
5	SG			Signal Ground
6	DSR			Data Set Ready
7	CTS			Clear To Send
8	RTS			Request To Send
9	N/A			

Table C-4 DB-9 RS-232 Pin Assignments



D Factory Defaults

This section describes the factory defaults for the menu options of the radio.

Radio Configuration

- Unit is a Slave
- Network Address = 32
- Rx Address = 20
- Unit is in point to multipoint dialup mode

Special Controls Menu

- Sync mode = OFF

Link Control Menu

- ARQ retries = 50
- Network fail timer = 5000ms
- Online request time = 1000ms
- Back off Retry is disabled

Radio Personality Menu

- Hopping Pattern = 0
- Power setting = 20 dBm
- RSSI trigger level = -110
- Frame Time = 20 milliseconds
- Directional Bias is disabled.

Protocol Port Selection

- Hayes Dialup for both ports

Serial Port Configuration Menu (settings are the same for both ports)

- 19200 Baud
- No Parity
- 8 Data bits
- 1 Stop bit
- No Flow Control
- Packet Timer Disabled



Modem and I/O Configuration Menu

HAYES COMMAND CONTROL MENU (settings are the same for both ports)

- Hang-up on DTR dropped.
- Echo is ON
- Response is ON
- Escape character = +
- Escape guard time = 1000 (ms)
- Connect timeout = 10000(ms)

DCD CONTROLS

- DCD follows online

RTD CONTROLS

- RTS disabled.

AUXILIARY I/O

- Auxiliary I/O enabled.

Radio Personality Menu

- Unit name is blank (unit has no name)
- Menu Password is disabled
- Security code is disabled
- Menu timeout is 15 minutes.

Diagnostics Menu

- Log level = General Information



E Troubleshooting

 *“I have two transceivers, one configured as a master and the other as a slave. When they are plugged in, the POWER LED indicates they are receiving power, and yet they will not LINK. Why not?”*

There are many reasons why two modems will not LINK. First of all, make sure that the two modems have the same ‘Network Address’, ‘Hopping Pattern’, ‘Frame Time’ and finally, the same protocols (all these settings can be changed in the menu interface). If any one of these is different you will not get a LINK between the modems.

Point-to-Multipoint Dialup Connection: If you are using the Hayes TM AT commands to connect to other modems make sure you include the extension number in the dialing command. For example, if you want to connect to the Slave modem with ‘Local Rx Address’ 4022 from the Master modem with ‘Local Rx Address’ 20, you would execute the following command:

“ATDT402200” - where ‘ATDT’ is the Hayes TM command ‘4022’ is the slaves address and ‘00’ is the extension number.

This will connect the Master modem with the Main Port of the Slave modem.

Point-to-Point Connection: If you have a Point-to-Point Connection then you have to make sure that the ‘Remote Tx Address’ corresponds to the ‘Local Rx Address’ of the other modem. For example, if the Master is configured with ‘Local Rx Address’ of 20 and the Slave with its ‘Local Rx Address’ equal to 4022, the Master would have its ‘Remote Tx Address’ set to 4022 and the Slave’s ‘Remote Tx Address’ set to 20. In order to set the ‘Remote Tx Address’ you have to select ‘Point-to-Point Connection’ in the ‘Radio Configuration Menu.’

Final Notes: If all else fails, you can restore the modems to their factory defaults by selecting the option in the ‘Radio Configuration Menu’ and set up the connection by following the steps in *Installation* at the beginning of this manual. If you require a specialized connection please contact your supplier for further assistance.

 *“I am able to link to a remote unit within line of sight when the Transceiver I have is outside. However, as soon as I walk inside with it I lose the link, even if I place the Transceiver by the window which faces the remote unit.”*

Many modern buildings use energy efficient glass that wreaks havoc on RF signals. This glass contains a metal film that is very effective in blocking all radio waves. If your situation is as described above the preferable solution is to install an antenna outdoors.

 *“My transceivers have established a solid connection as indicated by the LEDs, yet the application I am running is not transmitting and/or receiving data correctly.”*

A quick acid test in a situation like this is to try to get the application up and running using an RS-232 null modem cable before deploying the RFI-9256 in the field. The RFI-9256 essentially functions as a null modem cable. If the application will not work with a hard wire connection then it will not work with the RFI-9256, and the problem lies within the application or other hardware (such as the computer serial ports or flow control).



☞ “I have used the RFI-9256 with several different PC’s and portables using very similar settings, yet I have noticed that the Transceivers range is reduced considerably when I am using certain computers. Why is this?”

It is possible that certain laptop and desktop computers, which you are using, emit interference that is detrimental to the RFI-9256’s operation. Try moving the RFI-9256 as far away from the computer as the cable connected to it will allow, this should reduce the impact of interference from the computer.

☞ “I have the RFI-9256 set up between two computers and have been unsuccessful in my attempts to establish a link using LapLink.”

There is a function LapLink supports that allows it to automatically change the baud rates during connections. As the RFI-9256 does not support automatic baud rate changing, the effects of LapLink changing its baud rate will cause the connection to fail. If you are uncertain whether it is LapLink or the radio modem itself, try establishing a link using a terminal package such as RFI’s InTerm. If the link succeeds, then it is LapLink causing the problem and unfortunately there is no documented solution for it.

☞ “I have tried to access the menu via the RFI-9256 front panel (Mode 6 – config) but I get no menu on my terminal program.”

To resolve this problem, it is best you double-check the settings of firstly the cable connection, then the terminal program you are using (e.g. RFI’s InTerm) and finally the settings of the radio modem itself.

Step 1: Make sure you have the Auxiliary port of the modem connected to your PC. The menu system is designed to pop on the Auxiliary port NOT the Main port.

Step 2: As a rule of thumb, accessing the menu via the Front Panel Modes ALWAYS sets the Auxiliary port’s baud rate to 19200bps. Make sure you have the following terminal settings:

- Communications Settings (RS-232 Com Port)
 - Baud Rate: **19200**
 - Data Bits: **8**
 - Parity: **None**
 - Stop Bits: **1**
 - Flow Control: **No Flow**
- Terminal Settings
 - Emulator Mode: **None or Standard TTY**
 - Local Echo: **off**
 - LF to CR on incoming: **off**
 - LF to CR on outgoing: **off**

Step 3: There is no reason why ANY settings of the radio modem should affect the ability to access the Menu via the Front Panel Modes. If you still cannot access the menu, check to see whether the cable you are using is faulty or not. Finally, if you still cannot access the menu please call your supplier.



 *“My Terminal or communications program is losing characters.”*

First check that the flow control settings on the terminal or communications program match the settings on the radio. If they both have hardware handshaking enabled then check if you have an S3 based video card. This card often conflicts with your serial ports. To solve this you have to disable (or minimize) the ‘video acceleration’ feature of the card. Please contact your local PC distributor for further assistance.

 *“The data I receive on my terminal package is corrupted, i.e. I receive rows of ‘weird’ characters and receive only certain characters.”*

This is a symptom of miss-matched baud rates. If you do not have the same baud rate settings in your terminal package as the settings of your modem, the PC’s communication port will not interpret the data correctly and send it to the terminal package corrupted.

The problem could be at the opposite end of the radio link. For example, if there is a device attached to a remote modem, and the baud rate of the device and modem do not match, you might experience a similar problem.

F Glossary

A

Alphanumeric

Roman Letters (alphabetic) and Arabic numbers (numeric).

ARQ

Automatic Request Repeat - A form of error correction that uses retries to correct bad packets of data.

ARQ Retries

The number of times the radio modem will try to send a packet of lost information before it gives up.

ASCII

American Standard Code for Information Interchange. Pronounced as-kee. A code by which alphanumeric, punctuation and control characters, commonly found on computer keyboards, are each assigned a unique value between 0-127 (decimal).

Asynchronous

A data transmission in which the time between characters may vary. Characters are delimited by start and stop bits.

Attention Commands (AT Commands)

A group of commands created by Hayes™ that are recognised by the modem and that begin with AT (or at).

Attenuation

The loss of power through transmission equipment, lines or other communication devices.

Auto answer

A modem capability that allows it to automatically pick-up.

Auxiliary Port (Aux Port)

Port connected to 3-wire modem cable. Cable contains Rx, Tx and ground wires. Only supports software flow control (no hardware flow control).

B

Bandwidth

The range of signal frequencies that are accepted or passed by a circuit or network.

Base Frequency

The frequency band occupied by a signal in its original or un-modulated form.

Baud

This term represents the number of discrete signaling events per second. If each signal element has more than one bit associated with it then this will not be the same as BPS. Compare with bit rate. Also called Baud Rate.

Binary

A number system with a base of two, using the digits 0 and 1. Commonly used in computers since the values 0 and 1 can easily be represented as OFF and ON in electrical circuits.

Bit

The smallest piece of information in a binary number system. The word stands for Binary digit.

Bit rate

The speed at which bits are transmitted, usually expressed as bits per second (BPS).

Block

Group of characters treated as a unit for the purpose of data transmission.

BPS

An acronym for Bits Per Second. Transmission rate of binary numbers (bits).



Bridge

Joins dissimilar networks and converts protocols such that data can be passed between them. For example, a bridge may allow data to be passed from a TCP/IP network to a ISDN network.

Buffer

Temporary storage area used to compensate for a difference in the rate of data flow into and out of a device.

Byte

A group of 8-bits that specifies a single character. See also Bit.

C

Carrier signal

The base frequency that is modulated by another signal containing information to be transmitted.

Carriage Return (CR)

The enter key on a keyboard. Causes the cursor to move to the beginning of the next line.

Carrier Detect (CD)

An RS-232 interface signal from the modem to a terminal or personal computer indicating that the modem is receiving a signal from a remote modem. See also DCD.

Character

A letter, number or other symbol contained in a message or used in a control function. See Byte and ASCII.

Clear to Send (CTS)

Control signal sent by the DCE to indicate that the DTE may begin a transmission.

Communications Link

When communication is established between modems, information can be passed between them. Signified on the RFI-9256 by both modems having Network Link, Carrier Detect and On-Line LEDs activated and the *receive* and *transmit* LEDs flash as data is sent.

Competing System

A Leased Line. For example X25, QPSX, ISPN.

Connection Commands

Commands that enable information to be passed between two modems, after a communications link has been established.

Connector

A physical devices, such as a plug, socket or jack, used to connect one hardware component of a system to another. A connector may also be called a port.

Console

Part of a computer system, usually a video display terminal, used by the operator to communicate with the computer. See terminal.

Contention

Condition arising when two or more devices try to transmit at the same time using the same channel.

Control Character

Any character assigned as ASCII numeric code less than the SPACE character. These characters are used to initiate a control function on the receiving device. Also a symbol you can create by pressing one of your computer's keys while holding down the Control key. These symbols are not usually printed, and are generally used to control screen formatting and cursor positioning.

Clear to Sent (CTS)

This signal is generated by a modem in response to RTS to indicate that a communications channel has been established and that data can be sent.

Cyclic Redundancy Check (CRC)

An error-detection technique in which a data validation value is mathematically derived from a block of data and transmitted at the end of the block. The receiving end re-computes the value and if it matches the value sent, the data is assumed to be valid (error-free). If not, the receiver notifies the transmitter that an error has occurred and the block is retransmitted.

D

Data

Any type of information, such as numbers, letters and symbols, that can be processed by a computer.

Data Bits

The actual characters being transmitted between two computers when asynchronous communications is being used. Usually 7 or 8 data bits are used. A normal byte has 8 bits. 7 data bits are used for ASCII/alphanumeric data.

Data Communications Equipment (DCE)

Equipment that is used to access a communications network. The DCE provides all the functions required to establish, maintain and terminate a connection, and provides the signal conversion required for communications between the Data Terminal Equipment (DTE) and the telephone network. With RS-232 connections, the modem is generally the DCE device while the computer or terminal connected to a modem is generally the DTE device. See also Data Terminal Equipment.

Data Compression

An encoding technique that provides for the transmission of fewer data bits without the loss of information. The receiving end expands the data received to its original form. For example, a ZIP file/drive, ARJ file formats, MPEG/JPEG and GIF formats.

Data Latency

Time delay between input stream and output data.

Data Set Ready (DSR)

An RS-232 control signal used to indicate the readiness of the DCE (Usually a modem) to accept data from the DTE (usually a terminal or computer).

Data Terminal Equipment (DTE)

The equipment, which provides the data source and/or receiving end of a data transmission link. The DTE may be a personal computer, a printer, and a front-end processor to a large mainframe computer or any other device that can transmit or receive data. With RS-232 connections the designation of DTE or DCE determines which device is responsible for generating certain control signals. See also Data Communications Equipment.

Data Terminal Ready (DTR)

An RS-232 control signal used to indicate the readiness of the DTE for data transmission.

DB9

A port connection used in RS-232 convention with 9 pins.

DB25

A port connection used in RS-232 convention with 25 pins.

DCD

An acronym for Data Carrier Detect. See also Carrier Detect.

Dedicated Line

A communications line, which is not dialed. Also known as a leased or private line.

Decibel (dB/dBm)

Unit of measure indicating the logarithmic ratio of output signal power to input signal power. dB is relative to Watts while dBm is scaled so that is relative to milliWatts.

Default

A value, action or setting that is automatically used by a computer system when no other explicit information has been given.

Demodulate

To recover the information being transmitted by a modulated signal. For example, a conventional radio receiver demodulates an incoming broadcast signal to convert it into sound emitted by a speaker. See also Modulate and Modem.

Dial Tone

A call progress signal returned by a telephone-switching machine to indicate that it is ready to accept a telephone number. ATDT (Hayes™ commands) supported for compatibility.

Dial-up

Establishing a temporary connection to a remote system or computer.



Digital Signal

A signal composed of discrete signal levels as opposed to the continuous signal levels of an analog signal.

DIP Switch

Acronym for Dual In-line Package. Options chosen by pushing a switch to one of two positions.

Distortion

Undesired change in a signal's original waveform resulting from the characteristics of the transmission circuits or other external influences.

Downloading

Refers to the transferring of software from a remote system to your computer.

DTE

An acronym of Data Terminal Equipment. See Data Terminal Equipment.

Dual Port Control

The ability of the RFI-9256 modems to communicate out of both the Aux and Main ports to either the Aux or Main port of the receiving modem.

Dumb Terminal

Terminals that do not contain an intelligent microprocessor and usually send data one character at a time.

Duplex Transmission

Independent, simultaneous, two-way transmission.

E

Echo

The re-transmission of characters received by either the modem or remote system back to the DTE.

EIRP

Effective Isotropic Radiated Power.

End Point Radio

Radios that are connected to the data device, such as SCADA/Acquisition/PC. As opposed to a repeater.

Escape Guard Time

The amount of time for which no activity is allowed on the data line before and after the sequence is entered, otherwise the escape sequence will be ignored.

Even Parity

Even parity refers to the addition of a 0 value or 1 value bit to the data bits which form a character to cause an even number of 1 value data bits to be sent. See also Parity.

Extension Numbers

The numbers that must be placed after the destination radio's number, to access the required port (internal or external). Only available in Point to Multipoint mode.

F

Fault Log

Contains a list of modem faults since the log was last cleared.

Firmware

Computer program stored permanently in Flash Memory.

Flash Memory

Non-volatile memory for storing programs and configuration data.

Flow Control

Controls the flow according to the readiness of the associated terminals to receive and transmit data. May be controlled with hardware or software.

Frame

See Block.

Frame Time

Specifies the maximum length of each packet frame (larger the time, the more information that can be contained within the frame).

Forward Error Correction (FEC)

Technique of transmitting additional information with the original data so that if small errors are detected the correct information can be recreated by the receiving end without requiring a retransmission.

Full Duplex

Data transmission, which allows data to flow in two directions at the same time.

G

Gateway

An electronic connection that joins similar networks together, for example IP to IP. Generally transparent to the user.

H

Half Duplex

Data transmission in which data may flow in either direction at one time, but not both directions simultaneously. Transmission direction is alternatively switched to allow two-way flow of data.

Handshake

A predetermined interchange of signals between two devices to establish conditions for a transfer of data.

Hang-up

Termination of the Communications Link. As with a normal phone call, the phone must be hung-up so that you can call and receive other calls.

Hang-up on DTR

Only available with the Main Port. If activated, will terminate the Communication Link when the Data Terminal Ready pin is low.

Hardware

The electronic or electro-mechanical devices in a computer system as opposed to the programs or software.

Hardware Handshaking

The use of special RS-232 signals to halt or commence the flow of data between two computers or terminals, between computers and modems or between facsimile machines. See also Software Handshaking, RTS and CTS.

Hayes™

Company that designed the AT commands.

Hertz (Hz)

Unit of frequency, one cycle per second.

Hopping Pattern

Pattern to which the modem jumps through the frequency spectrum as it transmits and receives information. There are 32 hopping patterns available, all modems that are to communicate with each other must have the same hopping pattern.

Host Computer

A computer that manages information for many terminals. A host computer may be mainframe, minicomputer or a microcomputer.

I

Input

Information transferred into a computer from some external source, such as the keyboard, a disk drive, a modem or a scanner. Also, the act or process of transferring such information.



Input/Output Device

A device that transfers information into or out of a computer.

Interface

A physical point of interconnection between two devices where electrical signal levels, timing, handshaking and pin numbers are defined. The devices, rules or convention by which one component of a system communicates with another.

Interference

Undesirable disturbances or distortions in a data transmission signal.

I/O

Input/Output. The transfer of information into and out of a computer.

K

Kermit

Kermit is a file transfer protocol developed for operating systems that could not support the XModem protocol.

L

Light Emitting Diode (LED)

A diode that glows when a current flows through it. Often used as an indicator light.

Link

A circuit or transmission path, including all equipment, between a sender and a receiver.

Local Echo

A method of communication in which your modem or software displays data locally on your screen, without relying on the host computer to echo the characters back.

Local Command State

Also called Terminal Command State. When a computer is communicating with a local modem. The local mode, assumes all commands are for it and acts on the AT commands. As opposed to being connected to a remote modem (see On-Line State).

Local Rx Address

4 digit phone number /address of the modem that you are dialing. Each modem, within a point to multipoint network, must have a unique Rx address, otherwise more than one modem will be dialed. Used when dialing a remote modem. In point to point communication, there is no dialing so it does not matter if both modems have the same Rx Address.

Log

List of information concerning the modem. See Fault Log, Physical Layer Log, and Serial Layer Log.

Loop-back

Directing signals back toward the source at some point in the communications path. Used in testing RFI-9256.

M

Main Port

Port connected to full RS-232 (7 wire) cable. Cable contains Tx, Rx, DCD, RTS, CTS, DTR, and ground. Allows hardware flow control (hardware handshaking).

Master

Active Modem that synchronises the slave modems to enable the transmission of information. Can communicate with all slaves in its network.

Modem

Modulator/Demodulator. A device to convert data from a computer or terminal into a form suitable for transmission across a telephone system.

Modem Returns Response Codes

Suppresses (when activated) the Response Codes, so that they are not displayed on the terminal.

Modem Eliminator

A usually passive device, which takes the place of a modem between a local terminal, which requires a modem, and a computer. Also called Null Modem.

Modulate

To modify or alter a signal so as to transmit information. For example, conventional broadcast radio transmits sound by modulating the amplitude or the frequency of a carrier signal. See also Demodulate and Modem.

Multiplex

To interleave or simultaneously transmit two or more messages on a single channel.

N

NAK

Negative Acknowledgment. This control character indicates that the last block transmitted was in error and that the receiver is expecting a re-transmission.

Network Address

If the modem is a master, then this is the network identification number. Slaves are synchronised by the master that has the same network address. A radio will ignore messages originating from radios with differing addresses. Must be the same for all radios within a network.

Network Fail Timeout

The length of time that the system will wait after a signal is lost before trying to re-synchronise.

Network Identification Number

See Network Address

Node

A point of interconnection on a circuit.

Noise

Random electrical signals introduced by components of the circuit or natural disturbances that can produce errors in transmission.

Non-Volatile Memory

Stores data/programs/configurations without the need for a battery backup. Will not be erased if there is a power failure. Nearly permanent.

Null Modem

See Modem Eliminator.

O

Odd Parity

Odd parity refers to the appending of a 0 or 1 value bit to the data bits of a character to ensure that an odd number of 1-value bits are sent. See also Even Parity and Parity.

Off-line

Describes the state of a connection as not in session or not currently connected. There is no communications link between the modems, system has not dialed.

On-line

Describes the state of a connection as in session and currently connected. The system has dialed and a communications link has been formed allowing the transfer of data. On-line LED on front of RFI-9256 is activated.

On-line Requests Timer

Controls the time between slave integrity checks by the master.

On-line State

When a Communications Link is established and dialogue is between your computer and a remote system. The local modem assumes that all information from your computer is to be sent on to the remote modem. All AT commands are ignored by the local modem but are acted upon by the remote modem. See also Local Command State.



On-line Time

The amount of time spent on-line with an information service.

P

PABX

Private Automatic Branch Exchange. An automatic switchboard for handling large concentrations of telephones (extensions).

Packet

Group of bits including data and control elements that are transmitted as a whole.

Packet Switched Network

System where messages are transmitted in packets, each individually addressed and routed through the network.

Packet Timer

Sends the packet of information when no information has been received for the specified length of time.

Parity

A simple method of error checking by which the number of data bits received are added together to ensure that the correct number have been received.

Password

Password protection for the menu to prohibit unauthorised menu access and the ability to alter the radio's settings. Consists of 12 to 18 Alphanumeric characters.

Peripheral (Peripheral Device)

A device, such as a video monitor, disk drive, printer or modem, used in conjunction with a computer. Often (but not necessarily) physically separate from the computer and connected to it by wires, cables or some other form of interface.

Physical Layer Logging

Shows the modem statistics relating to the quantity of data throughput.

Point-to-Multipoint Communication

One radio (the master) communicates with more than one slave, while each slave can only talk to the master. As opposed to Point-to-Point Communication.

Point-to-Point Communication

A connection between two points only. Communications established automatically with the RFI-9256 and is not controlled by the AT commands. As opposed to Point to Multipoint Communication..

Port

The point of connection, usually a physical connector, between a computer and a peripheral device, another computer or a network.

Propagation Delay

The time required for a signal to travel from one end of a circuit to another.

Protocol

A set of conventions controlling the timing and format of data communications between two pieces of communications equipment.

Public Switched Telephone Network (PSTN)

Telephone system providing circuit switching to many customers.

Pulse

An abrupt and relatively short change in voltage, either positive or negative resulting in the conveyance of data in a circuit.

R

RAM

Random Access Memory. RFI-9256 has 64k on board. See technical specifications page.

Received Line Signal Detector

See Carrier Detect.



Redundancy Check

Technique of error detection involving the transmission of additional data related to the message so that the receiving device can determine if the data transmitted is valid (error-free).

% Registers

Registers inside the modem that usually contain string values. Can be read and altered on a remote modem using a Communications Link. Examples include Unit Name, Security Code and Local Address.

Remote Configuration

The accessing of information from a remote radio and the ability to change the remote radio's attributes via a Communications Link.

Remote System

Another PC or network that can be communicated with via modem.

Repeater

Radio that receives and repeats the signal in a communications path, to extend the range between the End Point Radios. They do not act on the information, only pass it on.

Request to Send (RTS)

Control signal by the DTE to inform the DCE that it is ready to transmit data. When used for flow control between the DTE and the modem, this signal indicates to the modem that the DTE is ready to accept data. Used mainly in half-duplex communications.

Response Codes

Also called Result Codes. Screen messages that indicate what the modem is doing. For example, OK will appear when a command has been executed successfully.

RF Channels

Steps or intervals of frequency divisions in the 915-928MHz spectrum. 51 channels available.

Routing Table

A table that is used by the radios to convert packet addresses into radio addresses.

Router

Guides data through a network by the address of the data.

RS-232C

Frequently shortened to RS-232. A standard, which defines the physical and electrical interface between Data Communications Equipment and Data Terminal Equipment. The most commonly used interface between modems and computers. Also known as ITU-T V24.

RSSI Trigger Level

Signal threshold/trigger level in dBm. This is the level at which the radio decides what it is hearing is no longer noise.

RTS/CTS

Control characters for hardware handshaking.

RTU

Acronym for Remote Terminal Unit. Device attached to remote radio.

Rx

Abbreviation for Receive.

S

Security Code

4 digits, same as a PIN number. The code is known only to the user and protects the user from interference from other networks using RFI-9256 modems.

Serial Data

Data transmission in which each bit of information is sent sequentially through a single data path.

Serial Logging

Shows information regarding the performance of both serial ports.



Serial Port

Port that receives/transmits serial data. The RFI-9256 has two serial ports, the Main and Auxiliary (Aux) ports.

Simplex

Data communications in one direction only.

Slave

Passive modem. Requires a Master to synchronise timing to enable successful transmission. May initiate communication, but can only communicate with the Master.

Software

Computer program or set of computer programs held in storage, and loaded into RAM for execution.

Software Handshaking

A method of controlling the flow of data between two computers or terminals. Special control characters are sent from one terminal to the other in order to halt or recommence the flow of data. See also Hardware Handshaking.

Spread Spectrum Modem

Modem that operates within a frequency band (as opposed to operating at a single, fixed frequency), jumping through the frequencies according to the Hopping Pattern.

Spread Spectrum Standard

Standard that specifies the way in which the frequencies of the spread spectrum are to be utilised.

S Registers

Registers, inside the modem, which contains whole number values. These can be read and obtained from remote modems by using a communications link. Examples include Escape Sequence Guard Time, Number of Retries for ARQ.

Start Bit

When a character is transmitted asynchronously to another computer, a start bit always precedes the actual data. Seven or eight data bits, an optional parity bit and a stop bit will follow.

Stop Bit

The last bit or element transmitted in asynchronous transmission of a character to return the circuit to an idle state. One or two stop bits are sent at the end of each character of data.

Synchronous

A data transmission in which the time between characters is fixed by synchronising the transmitting and receiving communications equipment. The clock signal is typically derived from the data stream in order to maintain synchronisation.

T

Telecommunications

The transmission of information across long distances, such as over telephone lines.

Terminal

An input/output device consisting of a typewriter-like keyboard and a display device, used for communicating with a large computer. Any device capable of sending and/or receiving data over a communications channel.

Terminal Emulation

Refers to the type of ASCII terminal your software will imitate (the control characters used to perform certain screen and cursor movement tasks vary from one terminal to another).

Terminal Program

Also called Terminal Software, terminal package, and emulator. Computer program that deciphers the information received from the modem and send information to the modem as required.

Test Link Margin

Displays the average signal and noise the modem is measuring.

Text

The message portion of a data block in synchronous data transmissions.

Transmit Power

Power of signal emanating from the antenna. This should be the minimum required to maintain a solid data link.



Turnaround Time

The time required to, reverse the direction of transmission when operating in half duplex mode.

Tx

Abbreviation for Transmit.

U

UNIMODEM PnP Response

The unit response to a PnP (Plug and Play) query.

Unit Name

User defined name for radio. May be used to indicate radio position or other identifying feature.

Upload

Refers to sending files or text from the user's computer to another user.

V

Virtual Hayes Connection

Interface for communication with and management of a remote radio.

W

Wait Time for Connect

Time the radio will wait for valid connection, before indicating communication unsuccessful.

Whip Antenna

Small antenna (usually approx. 15 cm)

X

XModem

A communications protocol developed in the late '70s by Ward Christensen to perform error checking on data being sent between two computers. See Kermit.

XON/XOFF

Special control characters used to control the flow of data between your computer and a remote system. See Software Handshaking.

Y

Yagi Antenna

Directional antenna.

Z

ZModem

Designed to rectify limitations of previous models as well as providing support for hi speed, packet and network communication environments.

