



FreeWave Technologies

Multipoint Diagnostics Program

User Manual

Version 2.08

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1 Introduction

This Diagnostics System allows you to monitor the performance of a FreeWave Technologies Multipoint* network. It helps you identify actual or potential problems, quickly and conveniently, with little or no interference to the normal operation of the network. It also allows you to change remotely most settings of any modem.



This Diagnostics System includes:

- A FreeWave Multipoint network
- A Computer running a Diagnostics Application
- A connection between the Diagnostics Computer and the Master modem.

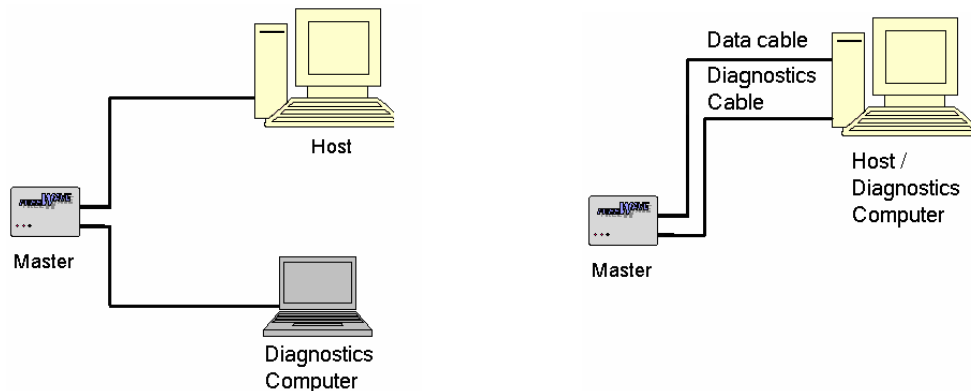
*) You may use this Diagnostics System in a Point-to-point network if you temporarily reprogram it as a Multipoint network.

2 Hardware set-up

To use this application, you need to a diagnostics computer able to access the FreeWave network.

2.1 Diagnostics Computer

The Diagnostics Computer may be an additional computer; or it may be the computer already connected to the FreeWave network's Master modem (as long as it has an extra RS-232 port available, and it can run this application simultaneously).



The diagnostics computer's operating system must be Windows ('95, NT 4.0 or later).

Obtain the Diagnostics application (DIAG208.exe) from FreeWave Technologies (either on a single 3.5" diskette or by e-mail).

Create a new folder (such as "FreeWave Diagnostics") on the Diagnostics Computer. Place the Diagnostic application in this folder. The Diagnostic application will also store certain files in this folder. You may want to create a shortcut to the Diagnostic application on the desktop.

2.2 Accessing the FreeWave Network

The Diagnostics Computer may access the FreeWave network Master modem in one of 4 ways:

- directly through the Diagnostics Port using RS232 (FGR series only)
- directly through the Serial Port using RS232 and a Y-adapter cable (DGR series only)
- through an Ethernet network using UDP/IP (FGR series Ethernet Modem only)
- through a Terminal Server and a network (LAN, Internet,...) using TCP/IP

2.2.1 Direct access through the Diagnostics Port (FGR series master)

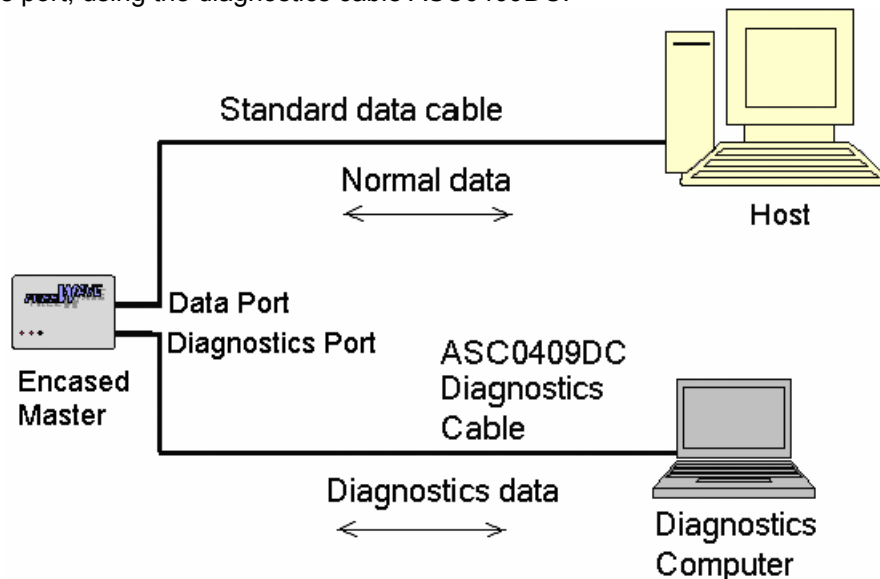
If the network's Master modem is a series FGR modem, you connect the diagnostics computer to its Diagnostics Port.

Note: do not confuse the Diagnostics Function with the Set-Up Mode. While the Set-up Mode may use the Diagnostics Port or the Data Port, the Diagnostics Function may only use the Diagnostics port.

Two different Diagnostics cables are available, one for encased modems, and one for board level modems. To acquire a diagnostics cable, contact FreeWave Technologies.

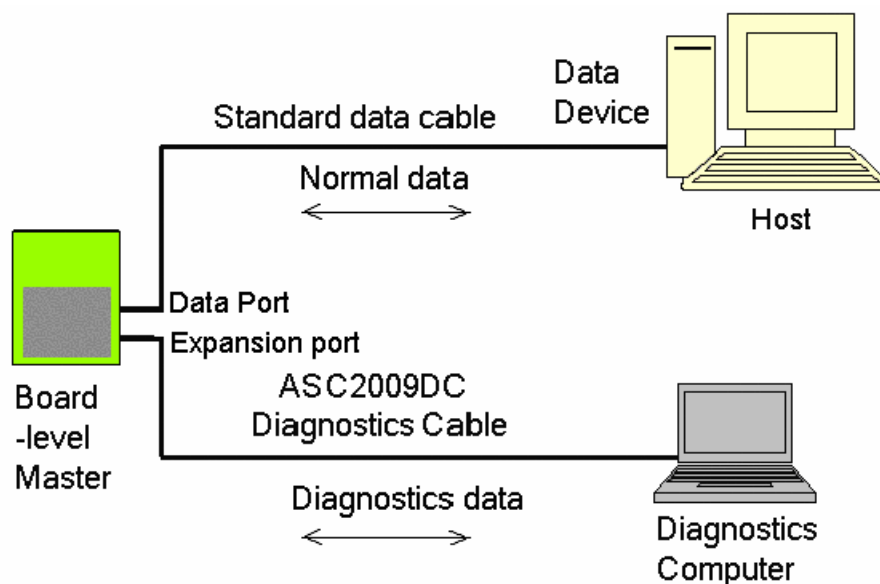
2.2.1.1 Diagnostics Cable for encased modem

For an encased FGR series Modem, the diagnostics connection is through its dedicated Diagnostics port, using the diagnostics cable ASC0409DC.



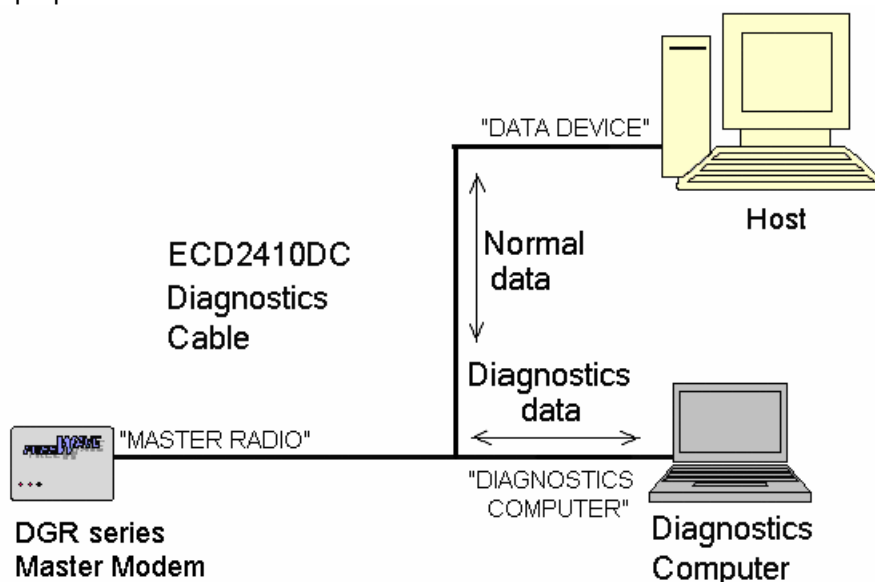
2.2.1.2 Diagnostics Cable for Board level modem

For a board-level FGR series Modem, the diagnostics connection is through an expansion port on the board, using diagnostics cable ASC2009DC.



2.2.2 Direct access through the Serial Data Port (DGR series master)

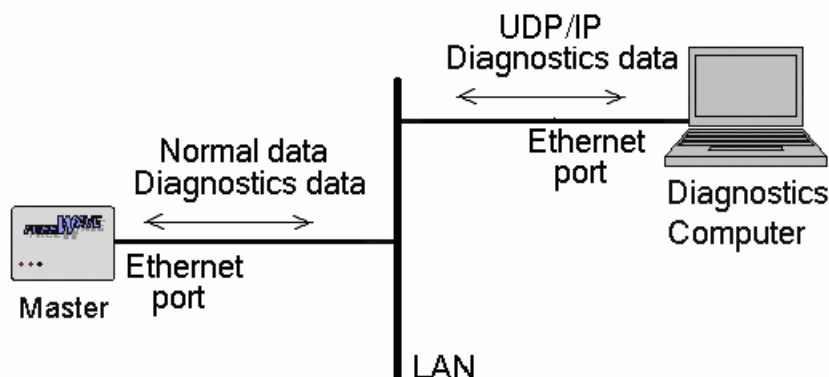
If the network's Master modem is a series DGR modem, you replace the standard data cable with a Diagnostics cable (ECD2409DC). This 'Y' adapter cable splits the normal data and the Diagnostics data that is present in the modem's Data Port. Labels on each end of the cable indicate the proper connections.



To acquire this diagnostic cable, contact FreeWave Technologies.

2.2.3 Direct access through an Ethernet network

The Diagnostics application can communicate directly with an Ethernet Master Modem through an Ethernet network (such as a LAN) or even over the Internet. Both the Master Modem and the Diagnostic computer must be connected to an Ethernet network, which typically is already the case when the Master Modem is an Ethernet model. You must assign the Ethernet Master Modem an IP address, just for diagnostic purposes (this is NOT the IP address of any device that communicates through the FreeWave network). In this case, the protocol used is UDP /IP (not TCP/IP), and no special cables are required.

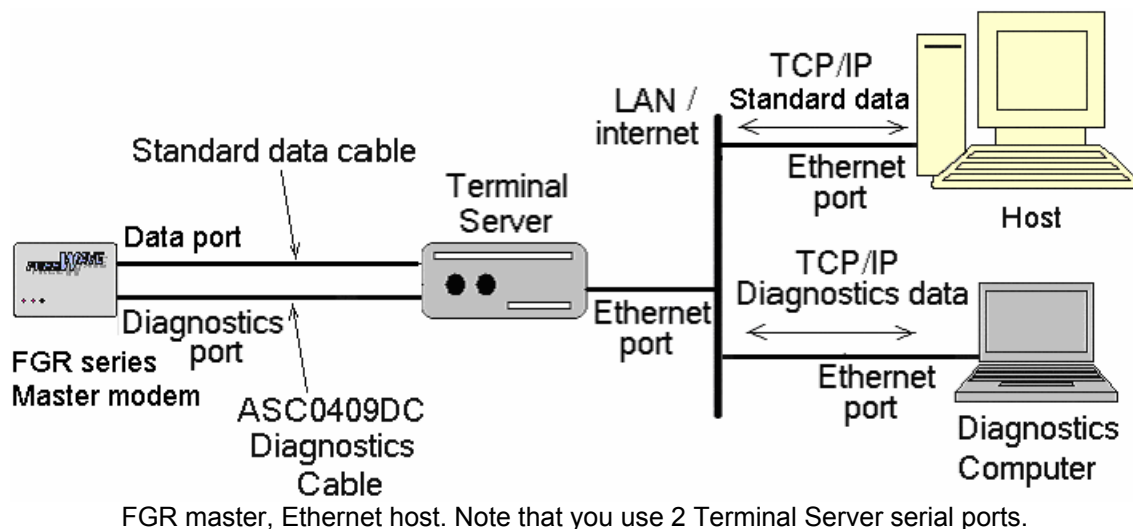
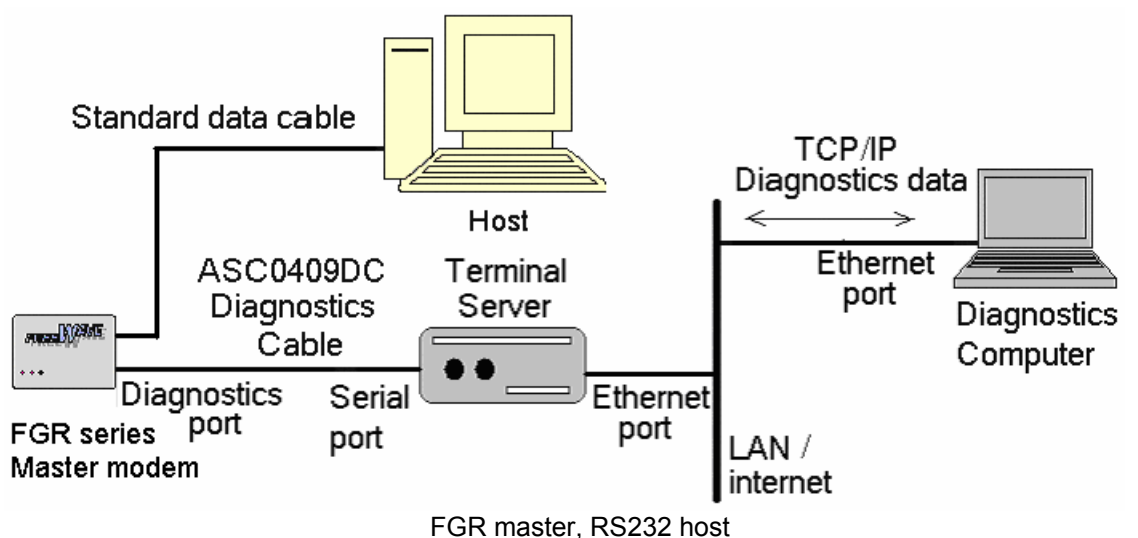


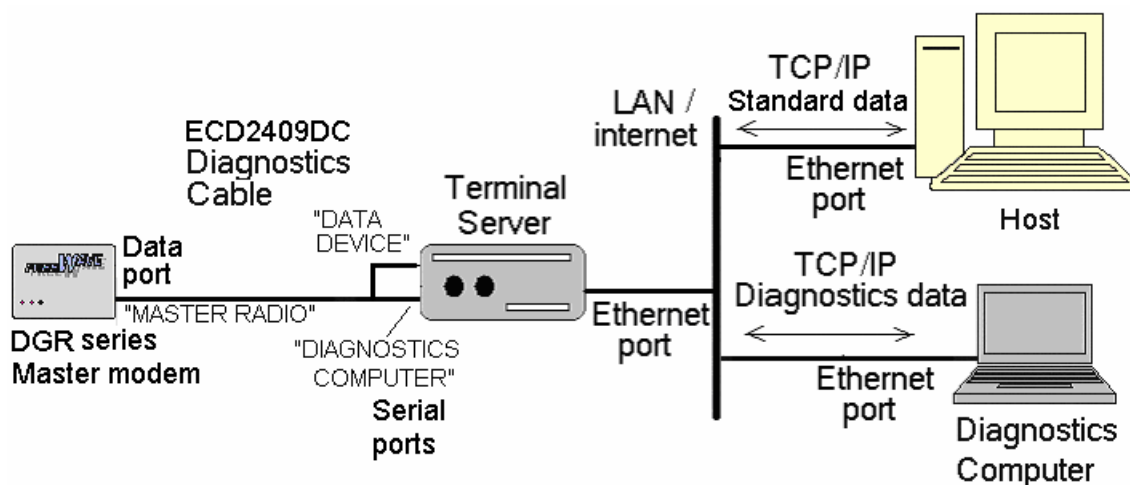
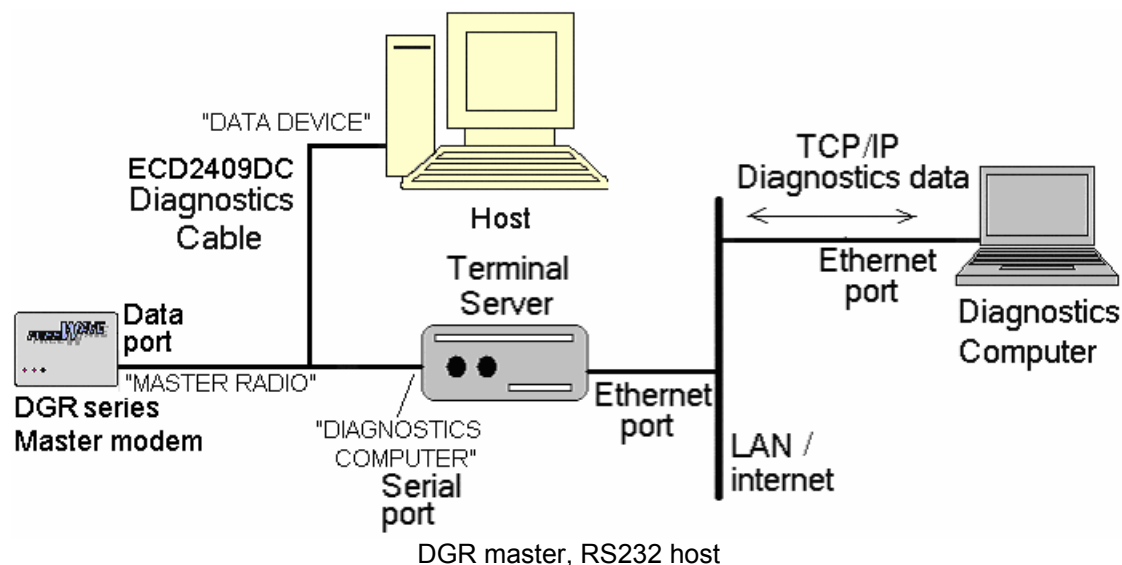
2.2.4 Indirect access through a Terminal Server

Even if the Master Modem is not an Ethernet model, you may still access it through an Ethernet network. You will need an additional device: a commercially available Terminal Server. This device is an Internet server with one or more RS232 serial ports on one end, and an Ethernet port at the other end. In this case, the Diagnostics Application uses the TCP/IP protocol (not UDP/IP).

You will need to obtain a Diagnostics Cable from FreeWave to send diagnostics from the Master to the Terminal Server.

These 4 examples show the connections for either FGR or DGR series master modems, and for hosts connected either directly to the Master, or through the LAN/Internet.





Later, you'll enter the IP address of the Terminal Server in the "Chg IP Address" menu of the Diagnostics Application. Afterwards, the Diagnostics Application will ask you for a port number; you will enter the number of the Terminal Server's port to which you connected the Diagnostics cable (the "Diagnostics Computer" end of the Y cable).

2.3 Limitations

Only modems whose firmware is at least at level 5.63 (900 MHz) or 1.58 (2.4 GHz) will support diagnostics. (Certain features require even later firmware versions, as noted in this manual).

While FreeWave modems will operate in the network regardless of the revision level of their firmware, this application will be able to access, monitor and remotely set-up only modems whose firmware supports diagnostics. Otherwise, this application will be limited to displaying the serial numbers of such modems. Also, this application cannot access modems (even if they support diagnostics) through repeaters whose firmware does not support diagnostics.

In the field, you may update the firmware of any 2.4 GHz modem and any 900 MHz modem with serial number 571-0001 and higher. You will need to send older modems back to FreeWave for a hardware upgrade. Contact FreeWave Technologies for more information.

In DGR series modems, the Data Port includes both normal data and diagnostics data; it does so by using the RS232 data lines (RXD, TXD) to transfer normal data, and three RS-232 control lines to transmit diagnostic data. These lines are: Carrier Detect (CD or DCD), Clear to Send (CTS) and Data Terminal Ready (DTR). Most applications running on the host computer do not use these 3 lines, so they will continue to have access to the normal data from the Master. If your application does use any of these 3 control lines, you will not be able to run diagnostics at the same time as you are transferring normal data through the network.

This is not an issue with FGR series modems, which include a dedicated Diagnostics port.

While running diagnostics on a network has little or no effect on it, we strongly recommend that you interrupt the normal data flow in a modem before using the Diagnostics Application to change any of the modem's settings.

3 Modem set-up

3.1 Set-up the Master

To use diagnostics, you must set-up the Master directly through its Set-up mode.

- Ensure that the packets have at least 32 bytes
- Tell it that it has repeaters (only for DGR series masters)
- Turn on diagnostics and set a polling rate
- Assign it an IP address (if using UDP/IP)

3.1.1 Invoke the Set-Up mode

Connect a terminal to the Master modem (see the Main Manual for more information on this). Invoke the set-up mode (in most cases, you do this by pressing the "Set-up" button; else, see the Main Manual for details on how to do this with your particular modem).

The terminal will show the Main Menu.

```

                                MAIN MENU
                        Version 5.77 10-26-2001
                        Standard Hop Table
                Modem Serial Number 906-4439

(0)  Set Operation Mode
(1)  Set Baud Rate
(2)  Edit Call Book
(3)  Edit Radio Transmission Characteristics
(4)  Show Radio Statistics
(5)  Edit MultiPoint Parameters
(6)  TDMA Menu
(8)  Chg Password
(Esc) Exit Setup
```

3.1.2 Ensure that the packet is big enough

Diagnostics require that the packet size be at least 32 bytes. The modem calculates the minimum packet size from the "Min Packet Size" and the "RF Data Rate" settings. (See the Main Manual for a complete discussion on this.)

To check this, from the Main Menu, press '3' on the terminal ("Edit Radio Transmission Characteristics")

The terminal will show the "Radio Parameters" menu.

```
RADIO PARAMETERS

WARNING: Do not change parameters without reading manual

(0)  FreqKey          5
(1)  Max Packet Size  8
(2)  Min Packet Size  9
(3)  Xmit Rate        1
(4)  RF Data Rate     2
(5)  RF Xmit Power    9
(6)  Slave Security   0
(7)  RTS to CTS       0
(8)  Retry Time Out  255
(9)  Lowpower Mode    0
(Esc) Exit to Main Menu
```

Note the value of the "RF Data Rate" setting (item 4).

Then note the value of the "Min Packet Size" setting (item 2). With an "RF Data Rate" of '2' the "Min Packet Size" value must be '3' or more. With an RF rate of '3' the "Minimum Packet Size" value must be '6' or more.

If you need to increase the minimum packet size, press '2" on the terminal ("Min Packet Size").

NOTE: If you change this setting, you must also change it in all the other modems in the network, and you must connect a terminal directly to those modems to do so (you can't do this over the network using the Diagnostics Computer).

The terminal will show the "Min Packet" menu.

```
Enter Min Packet (0-9)
```

Enter '3' (if the "RF Data Rate" is '2') or '6'(if the "RF Data Rate" is '3').

Press "Esc" to return to the "Main Menu".

3.1.3 Set the number of repeaters (DGR series Master only)

Whether or not there are repeaters in the network, for timing purposes you must tell a DGR series Master that there are repeaters. (An FGR Master will automatically know to change the timing when Diagnostics are turned on, so you don't need to change this setting.) (Changing this setting in any other modem has no effect.)

To do so, from the Main Menu, press '5' on the terminal ("Edit Multi-Point Settings")

The "Multi-Point Settings" menu will appear.

MULTIPOINT PARAMETERS		
(0)	Number Repeaters	1
(1)	Master Packet Repeat	2
(2)	Max Slave Retry	9
(3)	Retry Odds	9
(4)	DTR Connect	0
(5)	Repeater Frequency	0
(6)	NetWork ID	0255
(7)	Reserved	
(8)	MultiMasterSync	0
(9)	1 PPS Enable/Delay	255
(A)	Slave/Repeater	0
(B)	Diagnostics	0
(C)	SubNet ID	Disabled
(D)	Radio ID	Not Set
(Esc)	Exit to Main Menu	

Press '0' to select the " Number Repeaters" menu.

Enter Number of Parallel Repeaters in Network(0-9)

Code	Function
0	There are no Repeaters in this network
1	There is at least 1 Repeater in the network

Even though the menu asks you to enter a number up to 9, the Master will interpret any number between "1" and "9" as "there is at least 1 Repeater in the system".
The factory default is "1" (there are Repeaters).

Press '1'.

3.1.4 Set the Diagnostics rate

Now you need to specify the rate at which the Master reports to the Diagnostics Computer. This rate is inversely proportional to the value ('1' to '63') entered in the "Diagnostics" menu. With a setting of '1', the Master reports after every slot (that is, every time it hops to another channel). This results in a lot of data. Normally, the Master and the Diagnostics Computer are connected directly, so that's not a problem. However, if they are connected through some other sort of a link, that link's throughput may be insufficient. In that case, increase this setting to reduce the rate at which the Master reports to the Diagnostics computer. With the maximum setting('63'), the update rate is slow, but the link is not stressed.

You set the Diagnostics rate in the Master. (This setting has no effect in any other modem.)

To do so, from the "Multi-Point Settings" Menu, press 'B' to select the " Diagnostics " menu.

Enter the Diagnostics Rate(0-63)

Code	Function
0	Diagnostics mode off
1	Diagnostics data sent every slot
2	Diagnostics data sent every other slot
n	Diagnostics data sent every nth slot
63	Diagnostics data sent every 63rd slot

The factory default is "0" (Diagnostics Off).

Press '1', or whatever rate you want, then press Enter.

3.1.5 Assign an IP address

If you are going to access the Diagnostics of an Ethernet Master Modem directly through UDP/IP, you will need to assign it an IP address. NOTE: this IP address is only for diagnostics, and is unrelated to the IP address of any device connected to the network.

From the Main Menu select "Set Operation Mode" ('0').

From the Operation Mode menu, select "Ethernet" ('F').

Form the Ethernet menu, select "IP Address" ('4').

Enter the IP address that you'll use to access diagnostics.

Later, you'll enter this address in the "Chg IP Address" menu of the Diagnostics application.

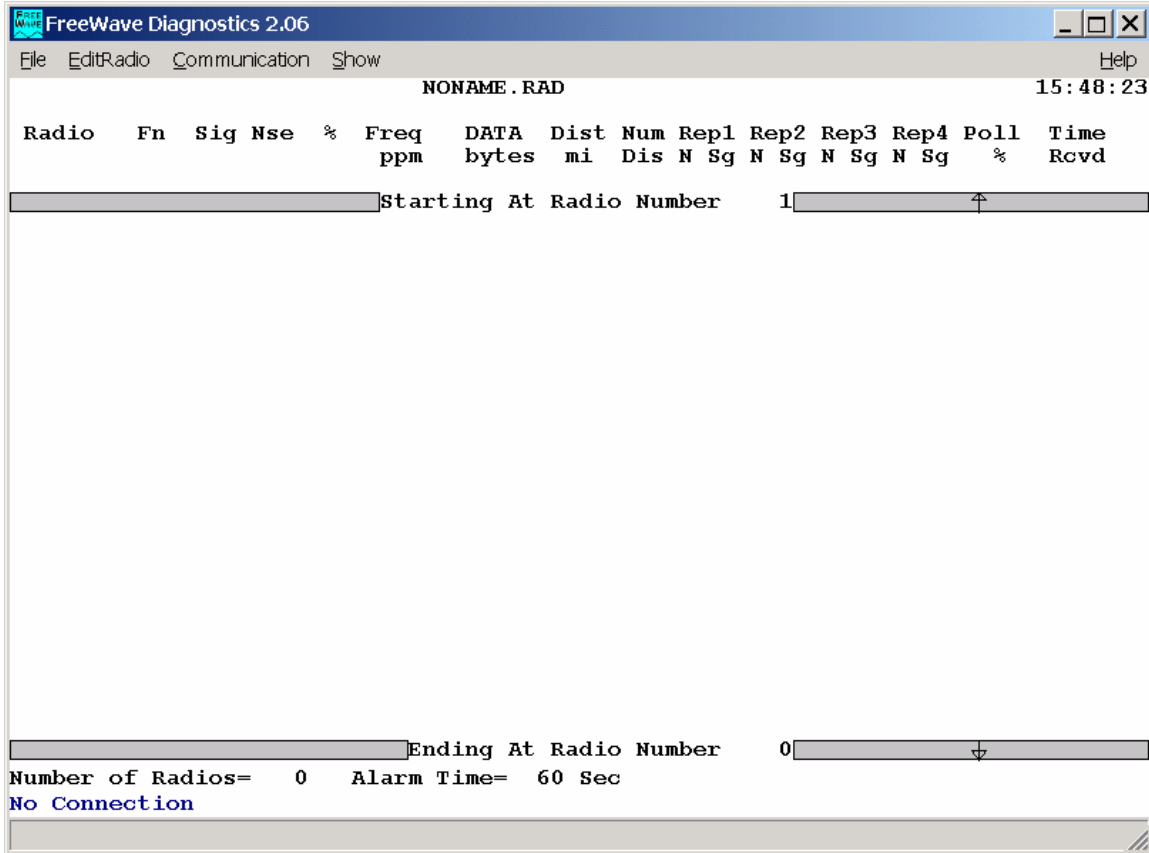
See the Ethernet addendum for more information.

3.2 Set up the other modems in the network

If you changed the Master's "Min Packet Size", you must duplicate that setting in the other modems in the network, through their Set-Up mode (this requires a direct connection to the modem: it can't be done over the network from the Diagnostics Computer). Instructions on invoking the Set-up mode and changing the "Min Packet Size" setting are in the previous section.

4 Communications set-up with the Master

In the Diagnostics computer, start the Diagnostics application (DIAG208.EXE). It will start from "Screen 0", with no diagnostics data and with the message "No Connection" (bottom left).



So you must establish a connection between the Diagnostics Application and the Master modem.

As mentioned, the Diagnostics Computer may access the Master modem in one of 3 ways:

- directly through Serial Ports using RS232
- directly through an Ethernet network using UDP/IP (Ethernet Master Modem only)
- indirectly through a Terminal Server and a network (LAN, Internet,...) using TCP/IP

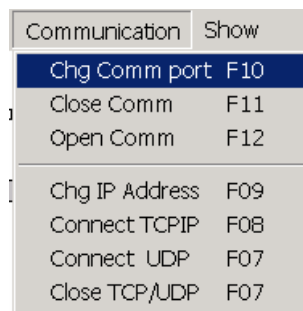
This is how you set up the Diagnostics application for each method.

4.1 Direct access through Serial Ports

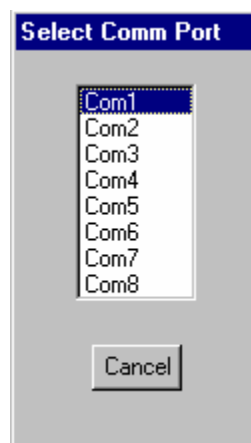
To access the FreeWave network through a Serial Port (Data Port or Diagnostics Port), you need to:

- Connect the Master Modem to the Diagnostics computer using a Diagnostics cable;
- Select the Serial Port to which you connected the Diagnostics cable;
- Open that Serial Port.

The Diagnostics Computer can use any of its Serial Ports (COM1 to COM8). The default is COM1. You can change the port with the "Communication" / "**Chg Comm Port**" menu.

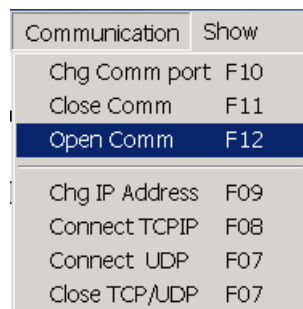


A dialog opens. The presently selected port is highlighted.

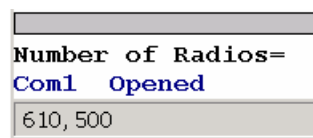


Select the Serial Port, or press "Cancel" to retain the previous selection.

Then, open the port with the "Communication" / "**Open Comm**" menu.



The bottom right corner of the screen changes to:



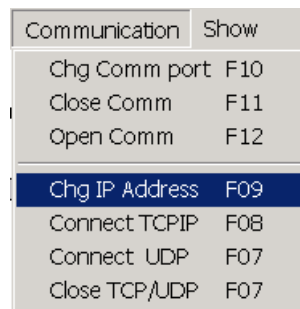
This doesn't necessarily mean that the Diagnostics Application has established communications with the Master modem. If it does so, you'll see that the Application starts filling "Screen 0" with a list of the modems in the network.

4.2 Direct access through an Ethernet network

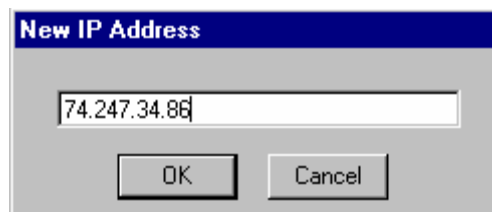
To access an Ethernet Master Modem directly, you need to:

- Assign an IP address to the Master Modem (described in the "Software Set-up" section above)
- Connect the Master Modem to the Ethernet network
- Connect the Diagnostics Computer to the Ethernet network
- Have the Diagnostics Computer create a connection to the Internet (this application will not create an Internet connection)
- Specify the IP address of the Master Modem
- Start the UDP/IP connection

Specify the IP address of the Master Modem with the "Communications"/"Chg TCIP Address" menu.

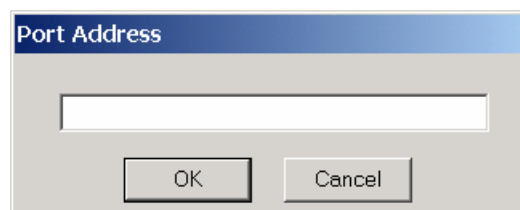


A dialog opens.



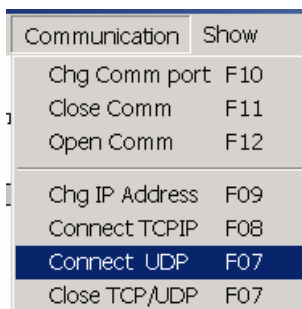
Enter the new IP address of the Master Modem and click "OK".

A new dialog opens.



Just click "OK" (the Master Modem doesn't use a Port Number).

Establish the IP connection with the "Communications"/"**Connect UDP**" menu.



This Application will try to establish the connection for about one minute. During that time, the Application stops responding to your actions. If the IP connection is not established within this time-out period, the Diagnostic Application restarts responding to your actions, and the "No Connection" message remains on the screen.

If the connection is established, the Application displays the IP address in the lower left corner of the screen.



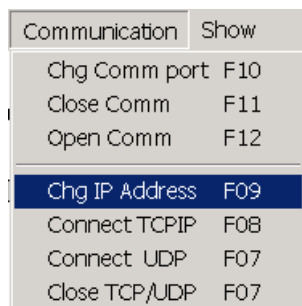
The Application saves the IP (Internet Protocol) settings when you save the Network file (see "Saving the Network List").

4.3 Indirect access through a Terminal Server

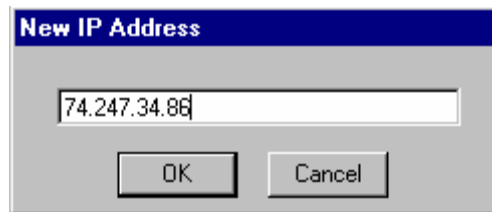
To access the Master Modem through a Terminal Server, you need to:

- Connect the Master Modem to the Internet through the Terminal Server.
- Connect the Diagnostics Computer to the Internet
- Have the Diagnostics Computer create a connection to the Internet (this application will not create an Internet connection by itself)
- Specify the IP address of the Terminal Server;
- Specify the port number of the Terminal Server;
- Start the TCP/IP connection

Specify the IP address of the Terminal Server with the "Communications"/"Chg TCIP Address" menu.

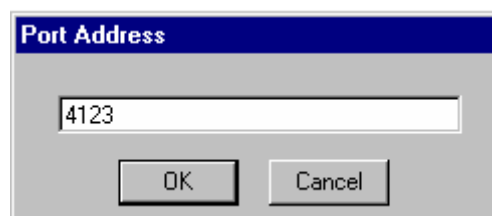


A dialog opens.



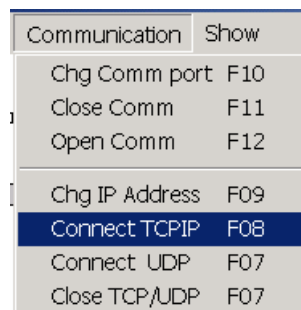
Enter the new IP address of the Terminal Server and click "OK".

A new dialog opens.



Enter the port number of the Terminal Server to which you connected the diagnostics data and click "OK". (If you are using a "Y" diagnostics cable, that is the port to which you connected the end labeled "Diagnostics Computer".)

Establish the IP connection with the "Communications"/"Connect TCPIP" menu.



This Application will try to establish the connection for about one minute. During that time, the Application stops responding to your actions. If the IP connection is not established within this time-out period, the Diagnostic Application restarts responding to your actions, and the "No Connection" message remains on the screen.

If the connection is established, the Application displays the IP address in the lower left corner of the screen.



The Application saves the IP (Internet Protocol) settings when you save the Network file (see "Saving the Network List").

5 Managing the Network List

5.1 Adding modems to the list

The Diagnostics Application prepares a list of the modems in the network automatically.

You may also retrieve a network list from a file that you saved previously.

And you may add, edit or delete modems manually.

Note that, once a modem is included in the list, it will not be automatically removed from it. If you remove a modem from the network, you may also want to remove it manually from the list.

5.1.1 Adding a modem automatically

Once the Diagnostics Application has established a connection with the Master Modem, it begins compiling a list of the modems in its network automatically. As it finds a modem, it adds that modem to its Network List, in the order that it finds them. As it discovers that a modem is a Repeater, it assigns it a "R #" number, in the order that it finds them. It also assigns all the modems a default name: "New Modem".

The Application finds modems in two ways:

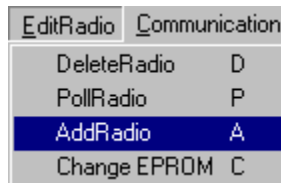
- If a modem happens to communicate within the network, the Diagnostics Application notices it and it to the list
- If you selected "Random polling", the Diagnostics Application keeps on generating random Serial Numbers and asks the Master to call them. If a modem by that Serial Number happens to be in the network, and it responds to the call, the Diagnostics Application notices it and it to the list. This allows the Diagnostics Application to eventually find any modem that is capable of communicating with the Master.

The Diagnostics Application starts in the "Random polling" mode. Random Polling is an inefficient way to poll the network's modems, because there are 10,000,000 possible Serial Numbers, and the network has relatively few modems. So, once the list of modems is complete, it is far better to just poll the modems that are known to be in the network by selecting the "Sequential Polling" mode.

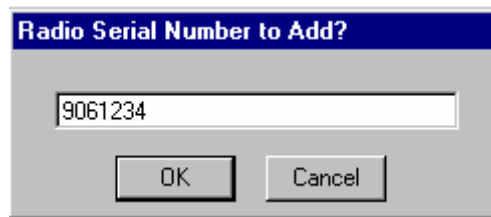
5.1.2 Adding a modem manually

You may add to the Network List a modem that wasn't discovered automatically by the Application. You must know its Serial Number.

Select the "EditRadio" / "AddRadio" menu, or press 'A' on your keyboard.

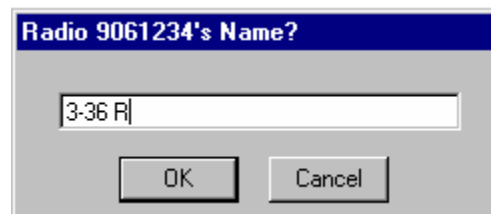


A dialog opens.



Enter the modem's seven-digit Serial Number. Do not enter any other character (such as spaces or hyphens) or this application will truncate the number.
Click OK.

A second dialog opens.

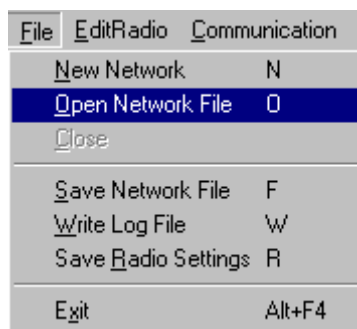


Optionally, enter a name for the modem, up to 8 characters long (any character is OK).
(This name is purely for your convenience.)
Click OK.

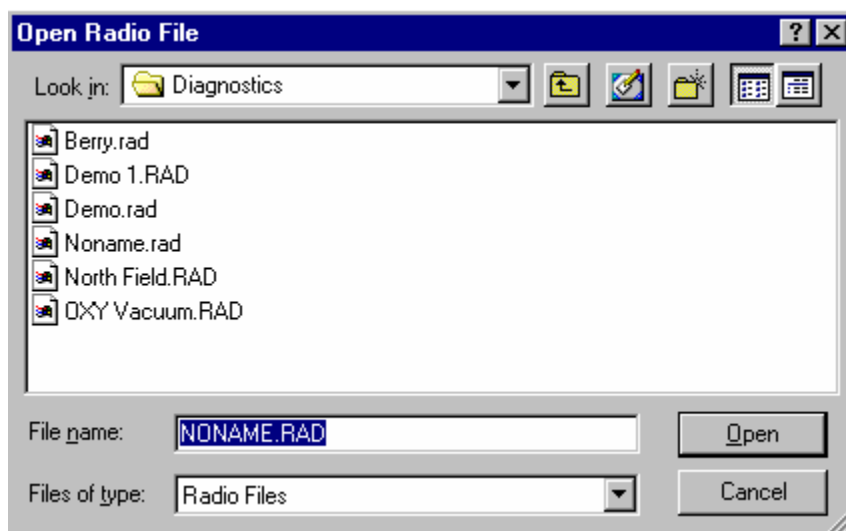
5.1.3 Retrieving a Network List

If you previously saved a Network List, you may retrieve it (instead of letting the Diagnostics Application create the list from scratch). This has the advantage of being faster and it keeps you from having to re-enter the modems' names. This also retrieves the IP (Internet Protocol) settings.

Select the "File" / "Open Network File" menu or press alt-F-O. (Despite what the menu says, pressing 'O' doesn't work).



The Windows' standard Open File dialog opens.



Find and select and open the Network List file you want, using standard Windows methods. (If you type the file name, you don't need to enter the ".rad" extension.)

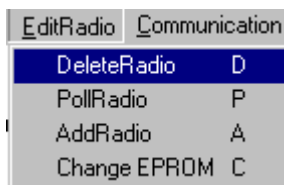
5.2 Editing a modem's name

The only data about a modem that you can edit is its name. You do need to know the modem's Serial Number. Follow the same procedure used to add a modem, and enter the new name.

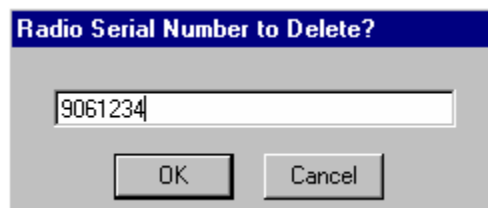
5.3 Deleting a modem

If you remove a modem from the network, the Diagnostics Application will not automatically remove it from the Network List. Instead, you must remove it manually. To do so, you do need to know the modem's Serial Number.

Select the "EditRadio" / "DeleteRadio" menu, or press 'D' on your keyboard.



A dialog opens.



Enter the modem 's seven-digit Serial Number. Do not enter any other character.

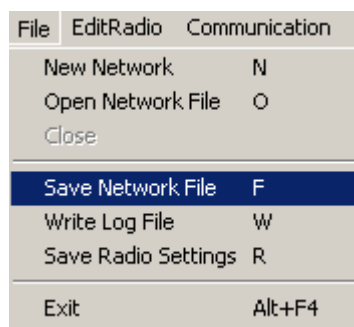
Click OK.

The Application removes that modem from the Network List.

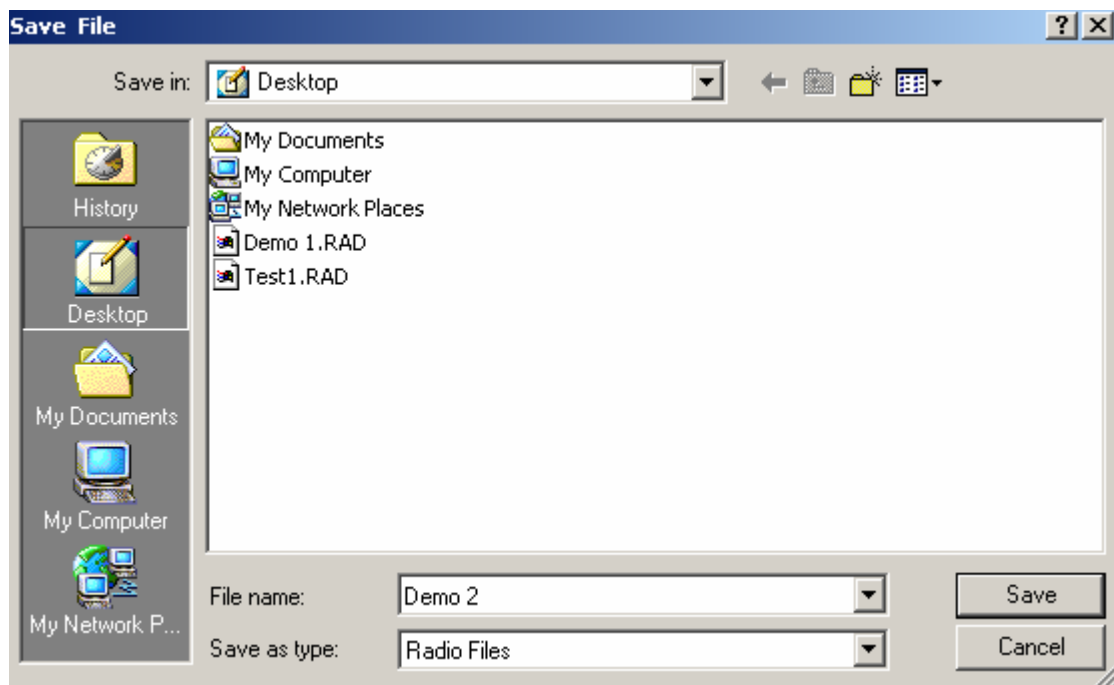
5.4 Saving the Network List

Once the Network List of modems is complete, you may save it. You will then be able to retrieve the Network List the next time you need to analyze the same network. This has the advantage of being faster and you won't have to re-enter the modems' names. This also saves the IP (Internet Protocol) settings.

Select the "File" / "Save Network File" menu or pressing 'F' on your keyboard or alt-F-S (Note: despite what the menu says, it's 'S', not 'F!').



The Windows' standard Save File dialog opens. Come-up with a name for the network and use it as this file's name. Save the Network List file using standard Windows methods (it's not necessary to enter the ".rad" extension).



6 Gathering and saving Data

The Diagnostics Application gathers data from the modems in the network through polling. Specifically, it gives the Master Modem the Serial Number of a modem to call. If the modem with that Serial Number is accessible by the Master, the Application asks it about its settings, performance and conditions.

6.1 Polling method

There are 3 polling methods: Random, Sequential and manual.

Initially, the Application polls random Serial Numbers; this allows the Diagnostics Application to eventually find any modem that is capable of communicating with the Master. Random Polling is inefficient because there are 10,000,000 possible Serial Numbers, and the network has relatively few modems. Once the Network List is complete, it is far better to just poll the modems that are known to be in the network through Sequential Polling.

In either case, you may manually poll a specific modem, if you know its Serial Number.

6.1.1 Random Polling

There is no menu item for this option. Instead, you select Random Polling by pressing 'R' on your keyboard.

The application will poll all the possible Serial Numbers, randomly.

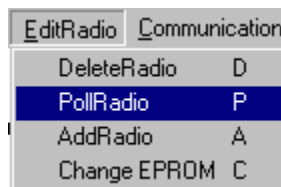
6.1.2 Sequential Polling

There is no menu item for this option. Instead, you select Sequential Polling by pressing 'S' on your keyboard.

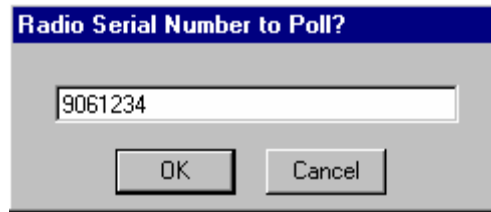
The application will poll all the modems in the Network List, sequentially.

6.1.3 Manual Polling

Select the "EditRadio" / "PollRadio" menu or press 'P' on your keyboard.



A dialog opens:



Enter the modem 's seven-digit Serial Number. Do not enter any other character (such as spaces or hyphens) or this application will truncate the number.
Click OK.

The Application will poll that specific modem.

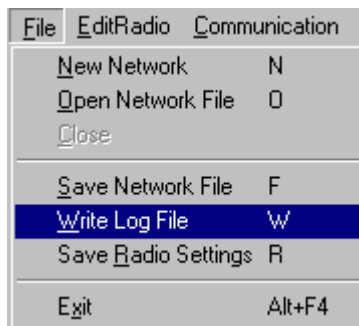
6.2 Saving data

The Diagnostics Application saves files with logs of the networks performance.

6.2.1 Generating a Diagnostics Log

When first opened, this Application creates a "Current.log" file (replacing any such file that may have already been present). Every minute, the Application automatically logs events and diagnostics data into this file.

You may also create a file with a snapshot in time of that log: select the "File" / "Write Log File" menu or press 'W' on your keyboard or alt-F-W.



The Application will create a "xxxxxxx.log" file with that snapshot. The name of the file is based on when the snapshot was taken (month, day, hour, minute). For example, the file 09072146.log was created at 21:46 (9:46 PM) on September 7.

You can open these files with any text editor or word processor. The following example of a log file was opened in WordPad.

```

Diagnostics Version 2.02
C:\Diagnostics\ABC North Meters.RAD
08-30-2001 12:22:21 9388

Modem      Name  Fn      ID  Rev  Temp  VTG  RCD  Sig  Nse  %  Freq  Data  Dist  Num  Rep1  Rep2  Rep3  Rep4  Poll  Time
          C      V      C      C      C      C      C      C      C      C      C      C      C      C      C      C      C      C      C      C
          C      V      C      C      C      C      C      C      C      C      C      C      C      C      C      C      C      C      C      C

9065064      M      73  33  15.0      25      21665      12:22:21

9065365 1-25RSTV S      9999 73  30  6.0 LHL  38  14  62  -0.2  744  3.6  0  0  39      33  12:22:19
9065065 32S      R 1  9999 73  29  14.5 LHL  67  28  96  -0.8  768  6.4  4  0  76      96  12:22:19
9065364 1-36RSTV S      9999 73  32  6.0 LHL  72  22  95  -0.5  768  4.2  0  0  72      89  12:22:20
9065385 2-36RSTV S      9999 73  31  5.9 LHL  60  19  90  -0.2  768  3.3  0  0  57      88  12:22:20
9065363 1-3GSTV S      9999 73  31  6.0 LHL  67  20  99  0.7  0  4.3  4  1  59      88  12:22:21
9065108 28R      R 2  9999 73  36  14.9 LHL  68  19  98  0.9  37878 4.8  0  0  83      88  12:22:15
9065368 4-33SSTV S      9999 73  32  6.0 LHL  79  19  100  0.2  0  3.2  5  1  74      81  12:22:09
9065371 3-32SSTV S      9999 73  32  6.0 LHL  82  22  100  0.4  0  4.0  7  1  73      79  12:22:16
9065372 3-35SSTV S      9999 73  25  6.0 LHL  74  24  100  -0.4  0  5.7  7  1  67      92  12:22:16
9065373 2-25RSTV S      9999 73  32  6.0 LHL  84  25  100  -0.4  0  4.8  0  1  76      95  12:22:17
9065362 2-35RSTV S      65  73  33  6.0 LHL  77  26  97  0.1  38224 1.6  0  0  75      92  12:22:17
9065366 2-27RSTV S      9999 73  27  6.1 LHL  86  28  100  -0.2  0  3.1  0  2  68      89  12:22:18

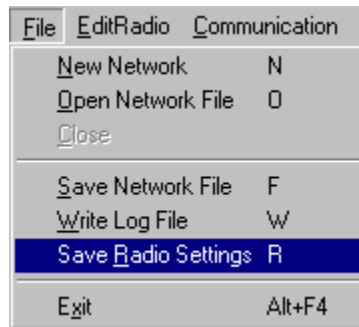
```

Number Modems= 12

6.2.2 Saving Modem Settings and plot data

You can save the settings of the presently selected modem, and the data gathered from it over time, into a file.

Select the "File" / "Save Radio Settings" menu or press alt-F-R (Note that pressing 'R' on the keyboard doesn't work). The application will switch to Screen 2.



This Application will create a file named "yyyyyy.dat" where "yyyyyy" is the serial number of the selected modem. If you are in Screen 0 or 1, that's the modem that is at the top of the modem list. (Since the Master is above the list, you can't save the Master's settings from Screen 0 or 1.)

You can't open these files by double-clicking them because of the unfortunate choice of extension (".dat") which is reserved by Windows. Instead, you must open them from within a text editor.

This is an example of such a file opened in Notepad.

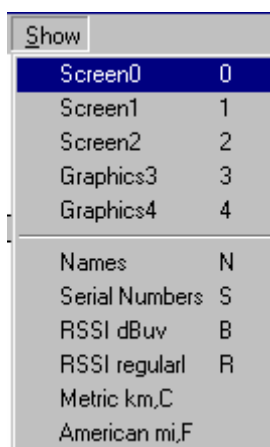
```
Remote Modem Setup Settings
Modem Number 0 Serial 9065064 NAME:MASTER
0 Modem Mode 2
1 Baud Rate 48
2 Baud High Byte 0
3 RS232 Mode 16
4 MODBus RTU 255
5 Retry TimeOut 255
6 Xtal Tune 53
7 SlicerThreshold 144
8 Frequency 131
9 Freqkey 5
10 Max Packet Size 8
11 RF Data Rate 3
12 Min Packet Size 9
13 Xmit Power 255
14 RTS/CTS Control 0
15 Hop table size 112
16 Number Repeaters 1
17 Master Repeat 2
18 Max Slave Retry 9
19 Retry Odds 9
20 DTR Connect 0
21 Repeater Freq 0
22 LowPower 255
23 PPS Enable 255
24 Slave/Repeater 255
25 Master Sync 255
26 Network ID High 2
27 Network ID Low 232
28 SubNet ID 255
29 Modem ID High 255
30 Modem ID low 255
31 Freq Table 0
32 Diagnostics 0
33 Modem ID Super 255
```

7 Interpreting the Data

This application uses five separate screens to display diagnostics data. These screens provide comprehensive monitoring of all modem network settings including automatic logging of data from each modem in the network. Screen 2 also allows you to change the operating settings of any modem in the network from the Master modem.

- "Screen 0" and "Screen 1" report the performance of all the modems in the network.
- "Screen 2" display the settings of a given modem and allow you to change them.
- "Graphics 3" plots the performance of a given modem over time
- "Graphics 4" plots the conditions of a given modem over time

Select a Screen with the "Show" menu, or simply type its number on the keyboard.



7.1 Identifying Modems

In the following discussion you need to understand that there are as many as six ways of identifying a particular modem.

- Serial number (such as "123-4567"), a unique number permanently assigned to each mode at the factory.
- Radio ID (such as "1234") which you may assign to a modem, for your own convenience (not necessarily a unique number).
- Name (such as "Repeater 2"). which you may want to define within the Diagnostics Application.
- Modem Number (a.k.a: "Radio Number") (such as Modem # 0, which is the Master, and Modem #1, which is listed in the top-most line in Screens '0' and '1'). The Diagnostics Application assigns this number sequentially, as it discovers modems, and as you manually enter modems in it.
- Repeater Number (such as "R 3", which is the 3rd Repeater in Screens '0' and '1'). The Diagnostics Application assigns this number sequentially, as it discovers that a modem is a Repeater.
- Repeater Order (such as "Rep1"; when the Diagnostics Application shows the record of a given Slave, it places in the "Rep1" field the Repeater Number of the Repeater that is directly linked to that Slave).

Of these, only the Serial Number and the Radio ID are actually physically located in a modem. All the others exist only within the Diagnostics Application, and are exclusively for use of that application.

This can be very confusing! Yet, if you can master this, it will let you use the full power of the Diagnostics Application.

For example:

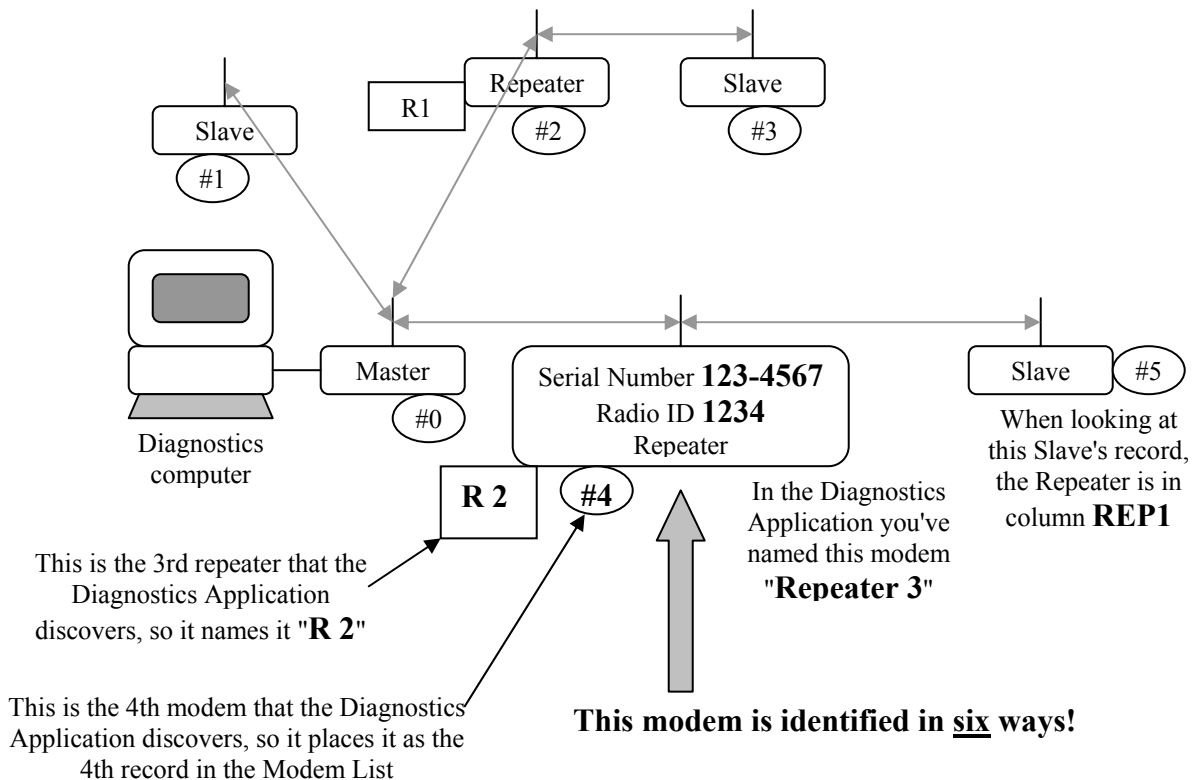
You have a modem to which the factory assigned the Serial Number of **"123-4567"**, and into which you stored the Radio ID of **"1234"**. You program this modem as a Repeater and place it in service within a Network. It is directly linked to the Master and to a Slave.

You start the Diagnostics application, which discovers this modem after discovering 3 other modems (plus the Master), so it assigns it the Modem Number '4' and displays its record in the 4th line of the Modem List in Screens '0' and '1'.

Within the Diagnostics Application, you name this modem "**Repeater 3**".

The Diagnostics Application realizes that another modem is a Repeater, then it realizes that this modem is a Repeater too, so it calls it **"R 2"**.

In the Diagnostics Application, in the list of modems, you look at the record for the Slave #5. In the "**Rep1**" column, you see that the Slave uses this modem as a repeater.



This modem is identified as:

- Serial Number **123-4567**
- Radio ID **1234**
- in the **Rep1** column of modem #5
- **"Repeater 3"**
- **"R 2"**
- **#4** in the Modem List

7.2 Selecting display preferences

The Diagnostics Application gives you a few choices for its displays.

7.2.1 Displaying Modem Serial Numbers or Names

In Screens 0 and 1 you have a choice of displaying the modem's Serial Numbers or the names you assigned to them.

Use the 'N' key on your keyboard to toggle between the two displays.

To display Serial Numbers, select the "Show" / "Serial Numbers" menu (warning: pressing 'S' doesn't work: as a matter of fact, 'S' has a totally different function!)

Show	
Screen0	0
Screen1	1
Screen2	2
Graphics3	3
Graphics4	4
Names	N
Serial Numbers	S
RSSI dBuv	B
RSSI regular	R
Metric km,C	
American mi,F	

To display names, select the "Show" / "Names" menu (Note: pressing 'N' doesn't do what the menu implies; instead, pressing 'N' toggles between "Serial Numbers" and "Names").

Show	
Screen0	0
Screen1	1
Screen2	2
Graphics3	3
Graphics4	4
Names	N
Serial Numbers	S
RSSI dBuv	B
RSSI regular	R
Metric km,C	
American mi,F	

7.2.2 Selecting Signal Units

In Screens 0 and 1, the units for Signal Strength and Noise Level are either standard (just as they would be displayed in the Modem's Statistics Menu), or in dB μ V.

Note that the units in Screen 3 are standard (you can't display dB μ V in that plot).

Select the "Show"/"RSSI regular" menu to select standard units.

Show	
Screen0	0
Screen1	1
Screen2	2
Graphics3	3
Graphics4	4
Names	N
Serial Numbers	S
RSSI dB μ V	B
RSSI regular	R
Metric km,C	
American mi,F	

Select the "Show"/"RSSI dB μ V" menu to select dB μ V units.

Show	
Screen0	0
Screen1	1
Screen2	2
Graphics3	3
Graphics4	4
Names	N
Serial Numbers	S
RSSI dB μ V	B
RSSI regular	R
Metric km,C	
American mi,F	

7.2.3 Selecting Imperial ("American") Or Metric Units

In Screens 0 and 1, the units for Distance and Temperature are either Imperial ("American"), or metric.

Note that Screen 4 displays temperature in Celsius (that plot can't display Fahrenheit).

Select the "Show"/"Metric km,C" menu to select metric units (distance in Kilometers, temperature in degrees Celsius).

Show	
Screen0	0
Screen1	1
Screen2	2
Graphics3	3
Graphics4	4
Names	N
Serial Numbers	S
RSSI dBuv	B
RSSI regular	R
Metric km,C	
American mi,F	

Select the "Show"/"American mi,F" menu to select Imperial ("American") units (distance in miles, temperature in degrees Fahrenheit).

Show	
Screen0	0
Screen1	1
Screen2	2
Graphics3	3
Graphics4	4
Names	N
Serial Numbers	S
RSSI dBuv	B
RSSI regular	R
Metric km,C	
American mi,F	

7.3 Reading Screen 0

Diagnostic Screen 0 reports the RF performance of each individual radio link in the network.

FreeWave Diagnostics 2.02a

File EditRadio Communication Show Help

NONAME.RAD 11:40:22

Master	Fn	Sig	Nse	%	Freq ppm	DATA bytes	Dist mi	Num Dis	Rep1 N	Rep2 Sg	Rep3 N	Rep4 Sg	Poll %	Time Rcvd
9064692 M			10			0								11:40:22
Starting At Radio Number 1														
9041280 S		74	19	99	1.5	71	0.7	0	0	60			100	11:40:18
9066569 S		56	15	99	1.5	101	0.7	0	0	54			97	11:40:19
9060510 R 1		68	17	99	2.6	99	0.7	0	0	58			99	11:40:20
9064441 S		70	14	100	-0.3	106	0.7	0	1	79			100	11:40:21
Ending At Radio Number 4														
Number of Radios= 4 Alarm Time= 60 Sec Sequen 1 Slot= 60														
Com1 Opened Num= 20 Type= 3 Value=-3456														
303, 67														

7.3.1 Network file

This is the name of the file (and its path) from which the present network info was taken. Typically, you give each network a name. When you set-up this application to monitor that network, you can then save your work in a file, and typically you would use that network's name as the file name.

For a new, unsaved network, this application displays "NONAME.RAD".

7.3.2 System Clock

This is the present time of day.

7.3.3 Master modem line

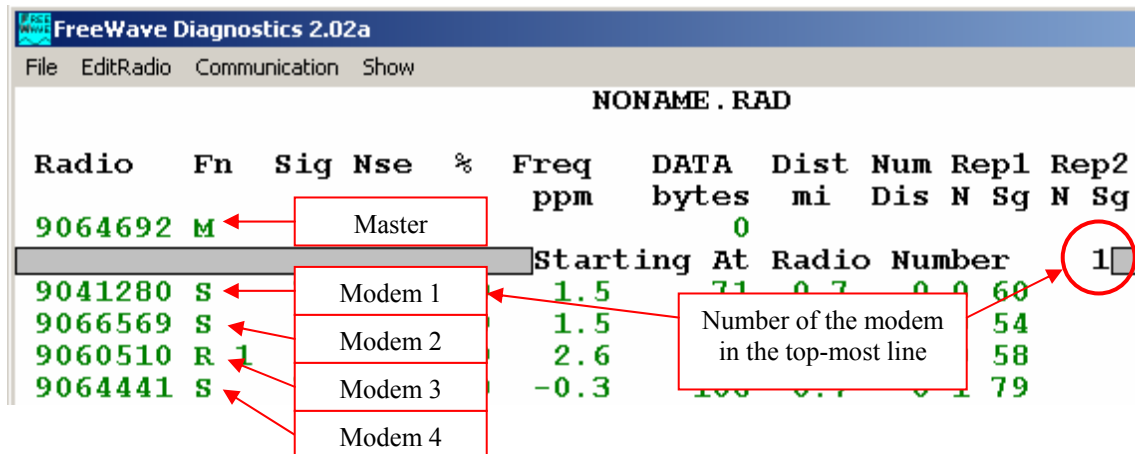
This screen displays a line for each modem it monitors. The top-most line, above the bar, is for the Master Modem. This line displays fewer items than the other lines, as a lot of the data are relative to the Master, so are meaningless in the context of the Master itself.

7.3.4 List of modems

Below the bar is a list of all the modems other than the Master. Just below the bar is a line for what we'll refer to as modem number 1; below that is a row for modem 2; etcetera. The modems are listed in the order that this application detected them, or in the order you entered them by hand.

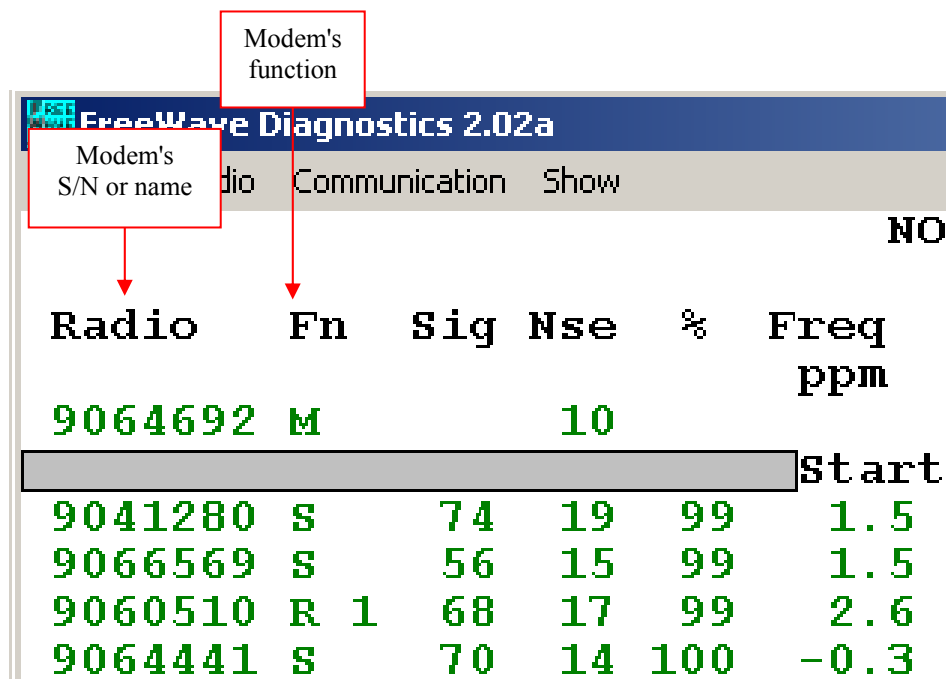
7.3.5 Scroll bars

Two bars at the top are buttons that let you scroll up the list on modems. Similarly, two bars at the bottom are buttons that let you scroll down. The Master modem line remains in place (it is not scrolled). When the list is scrolled all the way down, the top-most line is for modem number '1'. Else, the text in the middle of the top scroll bar tells you the number of the modem in top-most line.



Up to 33 modems plus the master modem may be displayed on a single page of Screen 0. Scroll bars at the top and the bottom of the page allow the modem list to be scrolled up or down to display additional modems. The upper scroll bar contains the message "Starting At Modem Number" followed by the network number of the modem listed immediately below the upper scroll bar. The lower scroll bar contains the message "Ending At Modem Number" followed by the network number of the modem immediately above the lower scroll bar. The modem list may be scrolled up or down by moving the mouse pointer to either scroll bar and clicking on the bar. The display may also be scrolled up or down by pressing the up or down arrow keys on the keyboard.

The following discussion describes the items in each modem's line.



FreeWave Diagnostics 2.02a

Modem's S/N or name Modem's function

Radio Fn Sig Nse % Freq
ppm

9064692 M 10 NO

Start

9041280	S	74	19	99	1.5
9066569	S	56	15	99	1.5
9060510	R 1	68	17	99	2.6
9064441	S	70	14	100	-0.3

7.3.6 Modem's Serial Number or Name ("Radio")

This is the Serial Number or the name of the modem. Press the 'N' key to toggle between the two display modes, or use the "Show"/"Names" and "Show"/"Serial Numbers" menus to select which one is displayed. When the applications itself finds a modem, it names it "New modem". See Paragraph 3.7 <<<<< for instructions on renaming modems.

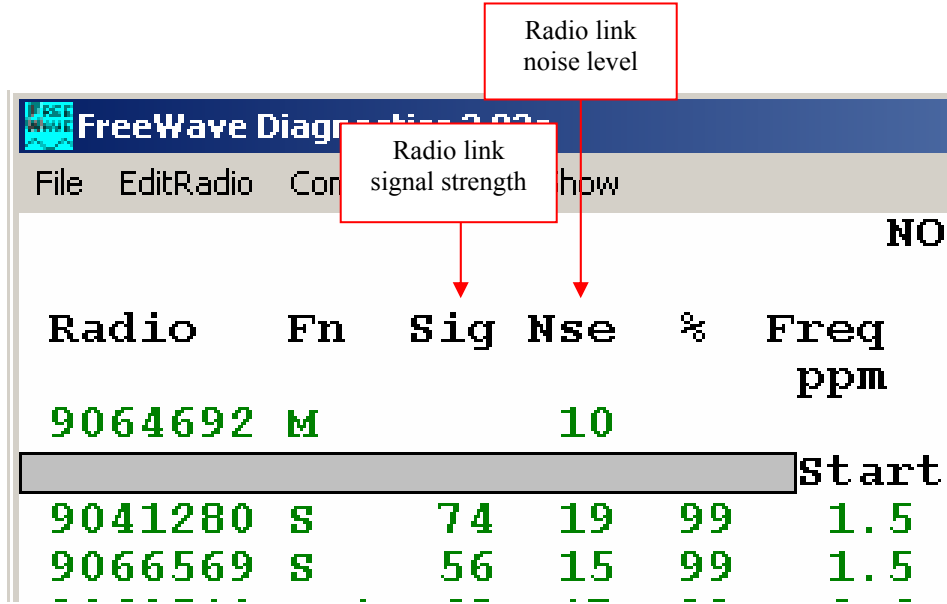
Modem names and serial numbers are saved in the network file.

7.3.7 Modem's function ("Fn")

This is the function of the modem within the network.

M Master Modem
S Slave Modem
R n Repeater Modem (n is a number assigned by this application).

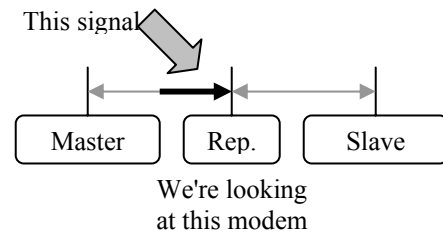
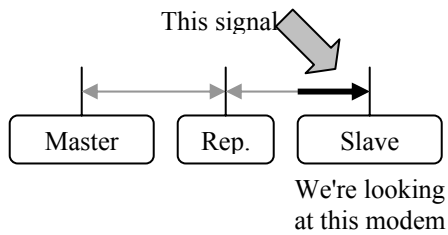
This application automatically assigns a number to each repeater. The numbers are assigned in the order that the Diagnostic application detects each repeater. Although a modem may be programmed to be a repeater, it will be indicated as a slave until the Diagnostic application detects other modems that are linked through it into the network.



Radio	Fn	Sig	Nse	%	Freq ppm
9064692	M		10		
9041280	S	74	19	99	1.5
9066569	S	56	15	99	1.5

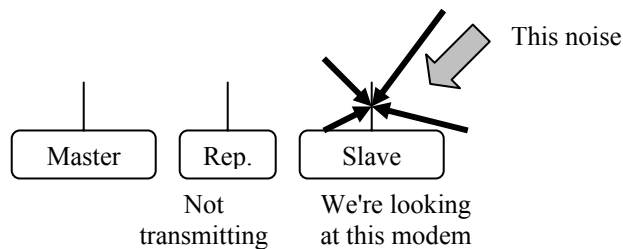
7.3.8 Radio link signal strength ("Sig")

This is the strength of the signal that this modem receives. For repeaters, this refers just to its radio link towards the Master. The units are either standard (just as they would be displayed in Modem Statistics Menu), or in dBμV. Use the "Show"/"RSSI regul" and the "Show"/"RSSI dBuv" menus to select the units. For reliable modem performance under all conditions, the signal level should be at least 40 (in standard units). (RSSI = Received Signal Strength Indicator.)



7.3.9 Radio link noise level ("Nse")

This is the average level of the noise that this modem receives when the modem(s) to which it's linked are not transmitting. The units are the same as for the signal strength. For reliable modem performance under all conditions, this value should be at least 20 (in standard units) below the signal strength reading. If the difference is less than 20, this application displays this value in red.



The screenshot shows the 'FreeWave Diagnostics 2.02a' application window. The menu bar includes 'File', 'EditRadio', 'Communication', and 'Show'. The title bar reads 'NONAME . RAL'. Below the menu bar is a table with the following columns: 'Radio', 'Fn', 'Sig', 'Nse', '%', 'Freq', 'DATA', and 'I'. The first row of data is highlighted in green and shows '9064692 M', '10', and '0'. Below this is a grey bar with the text 'Starting At'. The next two rows of data are in green and show '9041280 S' with values '74', '19', '99', '1.5', '71' and '9066569 S' with values '56', '15', '99', '1.5', '101'. The last row is in red and shows dashes. Red boxes and arrows point from the text labels 'Receive success Rate' and 'Radio frequency error' to the '%' and 'Freq' columns respectively.

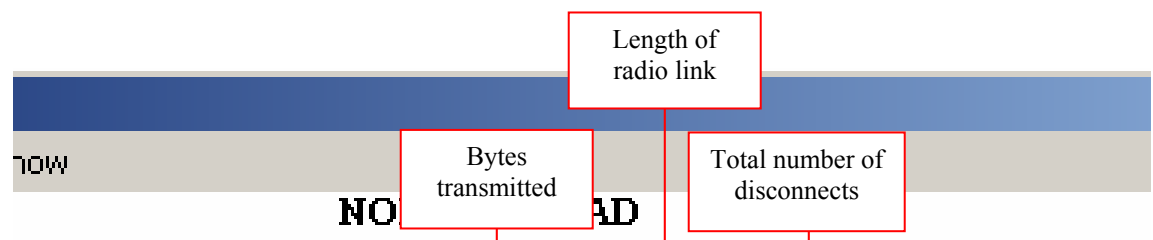
Radio	Fn	Sig	Nse	%	Freq ppm	DATA bytes	I
9064692	M		10			0	
Starting At							
9041280	S	74	19	99	1.5	71	
9066569	S	56	15	99	1.5	101	
-	-	-	-	-	-	-	-

7.3.10 Receive success rate ("%")

This is the percentage of data packets that this modem successfully received on the first try. If this modem is a repeater, this refers to the radio link towards the Master. This value should be at least 75%. If it's less than 75%, the application highlights this value in red.

7.3.11 Radio frequency error ("Freq ppm")

This is the error of the modem's radio frequency with respect to the Master. This value should be within ± 10 ppm. If this value exceeds ± 5 ppm, this application will highlight it in red. If all the values are biased in one direction, chances are that it's the Master that is off!



se	%	Freq ppm	DATA bytes	Dist mi	Num Dis	Rep1 N Sg	Rep2 N Sg
10			0				
Starting At Radio Number 1							
19	99	1.5	71	0.7	0 0	60	
15	99	1.5	101	0.7	0 0	54	
17	99	2.6	99	0.7	0 0	58	
14	100	-0.3	106	0.7	0 1	79	

7.3.12 Bytes transmitted ("DATA bytes")

This is the number of bytes that this modem generated itself and transmitted (since this application started monitoring this modem). Since plain Repeaters do not generate data themselves, but just repeat data from another modem, for them this count is '0'. However, if this modem is a Repeater/Slave, this count is just for the data that it transmitted while operating as a Slave.

The above is true for modems whose firmware is 5.72 and newer. If the firmware of the Master is older than that, then this count is only shown for modems directly connected to the Master. If the firmware of a repeater is older than that, then this count is for the all the data it transmitted, regardless of whether it was retransmitted from another modem or it was generated locally as a Repeater/Slave.

7.3.13 Length of radio link ("Dist")

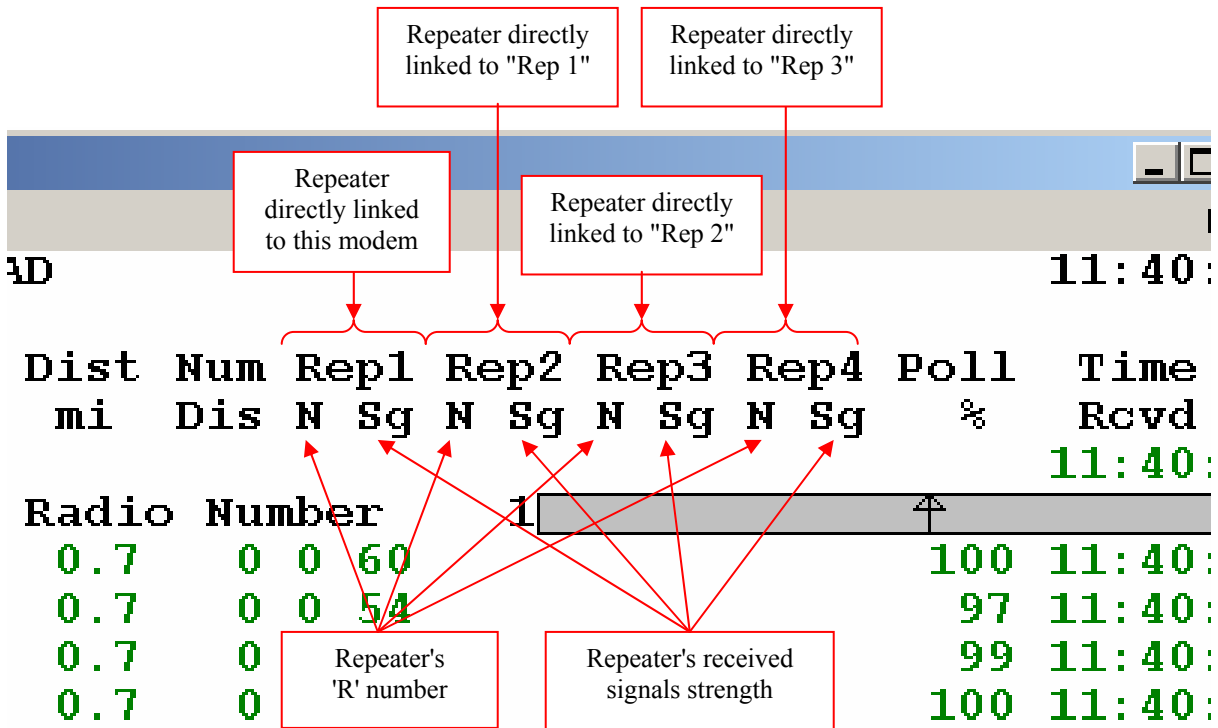
This is the distance between this modem and the modem to which it is directly linked. So, if this modem is linked directly to the Master, this is the distance to the Master. Else, this is the distance to the first repeater that it uses. Distances greater than 1 km are typically accurate to within 30 meters. Shorter distances are not reported accurately. The units are km or miles; use the "Show"/"Metric km/C" menu to select km, and the "Show"/"American mi/F" menu to select miles.

7.3.14 Total number of disconnects ("Num Dis")

This is the total number of times that this modem lost its connection to the network (since this modem was turned on or since its Set-up mode was ended).

A disconnect may be due to:

- a poor radio link path,
- temporary removal from operation of any modem in the complete path,
- using this application to change some other modem's setting.



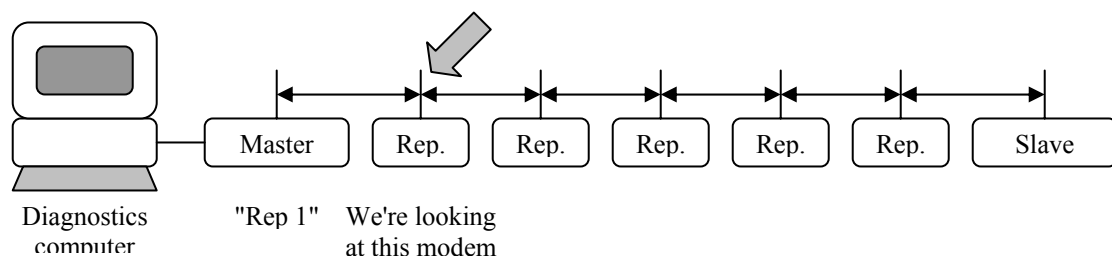
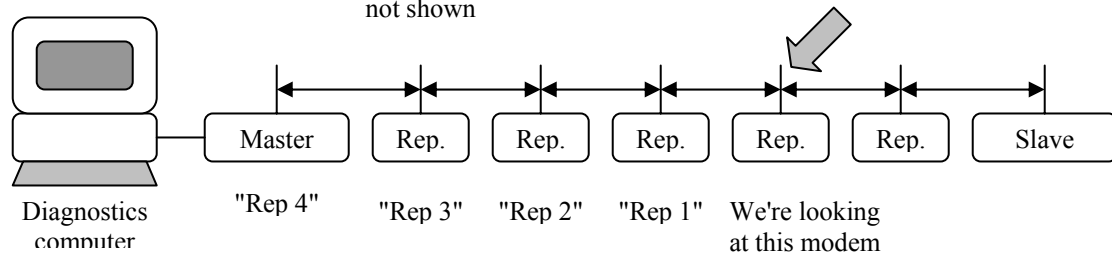
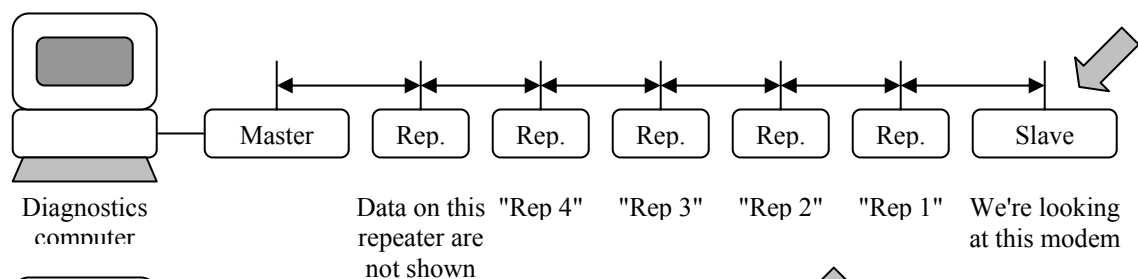
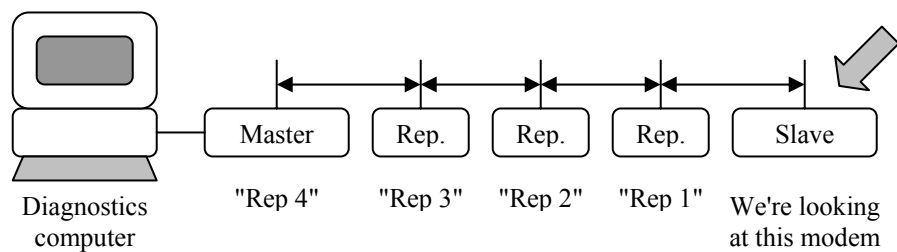
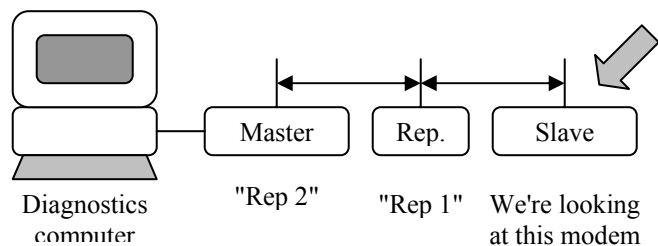
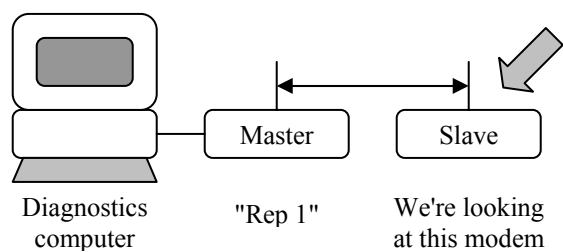
7.3.15 Repeater info ("Rep n" "N" "Sg")

This is the path that this modem uses to communicate with the Master. "Rep 1" refers to the modem (Master or repeater) to which this modem is directly linked. "Rep 2" is the repeater (not the master) to which "Rep 1" is directly linked, and so forth. Use this table to see what each column refers to.

# of repeaters	"Rep1"	"Rep2"	"Rep3"	"Rep4"
0	Master			
1	Repeater			
2	Rep. closest to slave	Other rep.		
3	Rep. closest to slave	2nd rep.	3rd rep.	
4	Rep. closest to slave	2nd rep.	3rd rep.	4th rep.
5+	Rep. closest to slave	2nd rep.	3rd rep.	4th rep.

Up to 4 modems are shown (the 4 modems "closest" to this modem). You can still see the rest of the path: first see which modem is listed under the "Rep 4" column (say it's "R 7"); then, in the "Fn" column, find that repeater ("R 7" in this example); that line will show you the rest of the path, from that repeater, towards the Master.

The next drawings show some examples of networks and how they may be numbered.



Each "Rp n" column has 2 items: "N" (number) and "Sg" (signal).

"N":

This is the number of the next repeater down the path. For example, 'N' = '3' means that if you look for whichever modem has "R 3" in the "Fn" column, you'll see the complete information about that modem. 'N' = '0' refers to the Master (in the top line, just above the scroll bars).

Please don't confuse repeater "R 3" with "Rep 3": repeater "R 3" is the 3rd repeater that this application happens to have found, while "Rep 3" is the 3rd modem down the path, from this modem towards the Master.

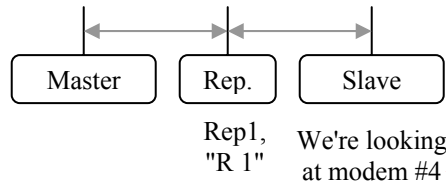
FreeWave Diagnostics 2.02a

File EditRadio Communication Show

NONAME . RAD 11:4

Radio	Fn	Sig	Nse	%	Freq ppm	DATA bytes	Dist mi	Num Dis	Rep1 N Sg	Rep2 N Sg	Rep3 N Sg	Rep4 N Sg	Poll %	Tim Rcv
9064692	M		10			0								11:4
Starting At Radio Number 1														
9041280	S	74	19	99	1.5	71	0.7	0 0 60					100	11:4
9066569	S	56	15	99	1.5	101	0.7	0 0 54					97	11:4
9060510	R 1	68	17	99	2.6	99	0.7	0 0 58					99	11:4
9064441	S	70	14	100	-0.3	106	0.7	0 1 79					100	11:4

"N" of Rep 1" is 1,
so "Rep 1" must be modem "R 1"



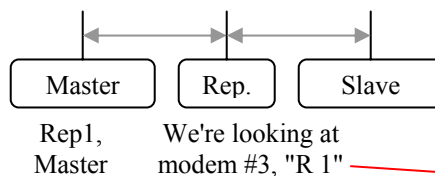
FreeWave Diagnostics 2.02a

File EditRadio Communication Show

NONAME . RAD 11:4

Radio	Fn	Sig	Nse	%	Freq ppm	DATA bytes	Dist mi	Num Dis	Rep1 N Sg	Rep2 N Sg	Rep3 N Sg	Rep4 N Sg	Poll %	Tim Rcv
9064692	M		10			0								11:4
Starting At Radio Number 1														
9041280	S	74	19	99	1.5	71	0.7	0 0 60					100	11:4
9066569	S	56	15	99	1.5	101	0.7	0 0 54					97	11:4
9060510	R 1	68	17	99	2.6	99	0.7	0 0 58					99	11:4
9064441	S	70	14	100	-0.3	106	0.7	0 1 79					100	11:4

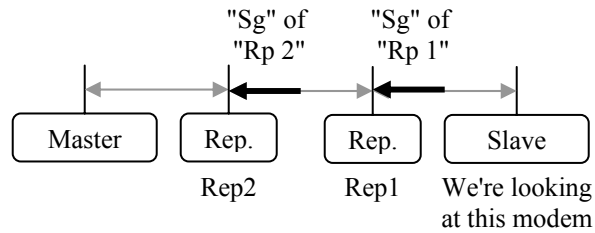
"N" of Rep 1" is 0,
so "Rep 1" must be the Master

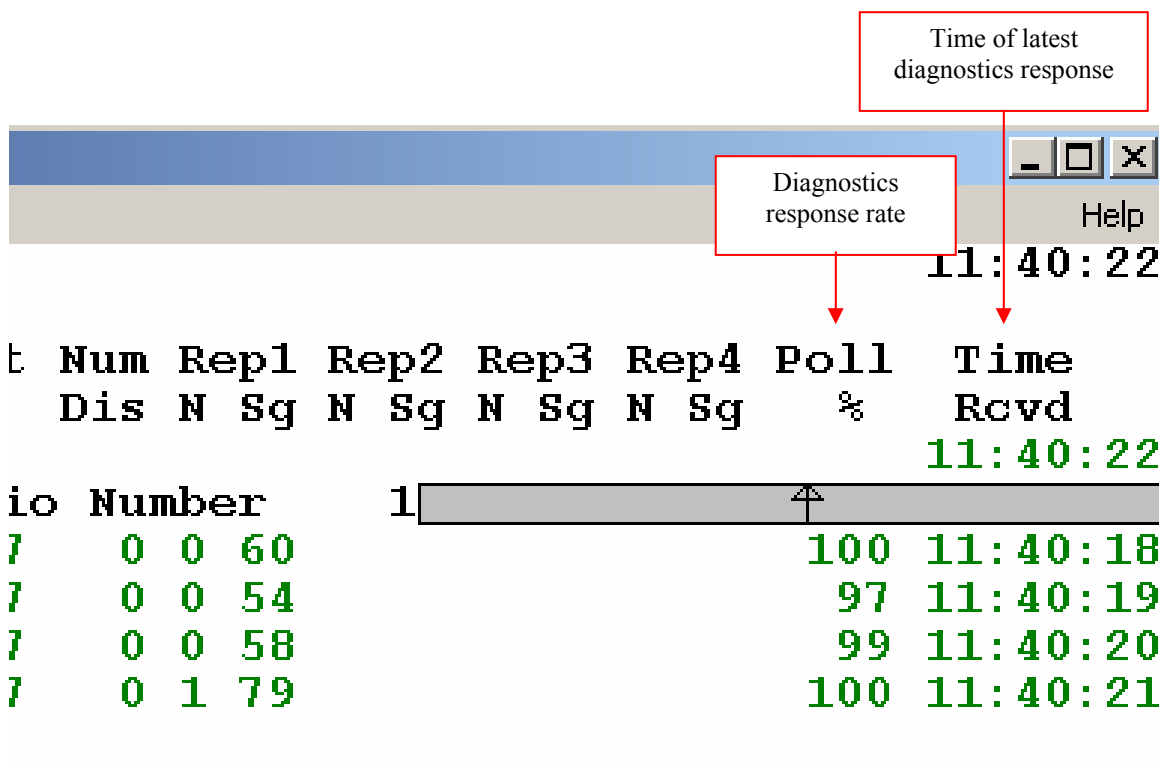


In the example above, serial number 906-0510 has been detected as a repeater and assigned repeater number "R 1". Serial number 906-4441 is linked into the network through repeater "R 1" as shown in the Rep1 column. All of the other modems in the network, including repeater "R 1", are connected directly to the master as indicated by the '0' in their Rep1 column.

"Sg":

This is the signal strength received by the next modem down the line (towards the Master). So, in the "Rep 1" column is the strength of the signal that the "Rep 1" modem receives from this modem. And, in the "Rep2" column, this is the strength of the signal that the next modem receives from repeater "Rep 1".





The screenshot shows a window titled "Help" with a table of modem diagnostics data. Two red boxes with arrows point to specific columns: "Diagnostics response rate" points to the "Poll %" column, and "Time of latest diagnostics response" points to the "Time Rcvd" column.

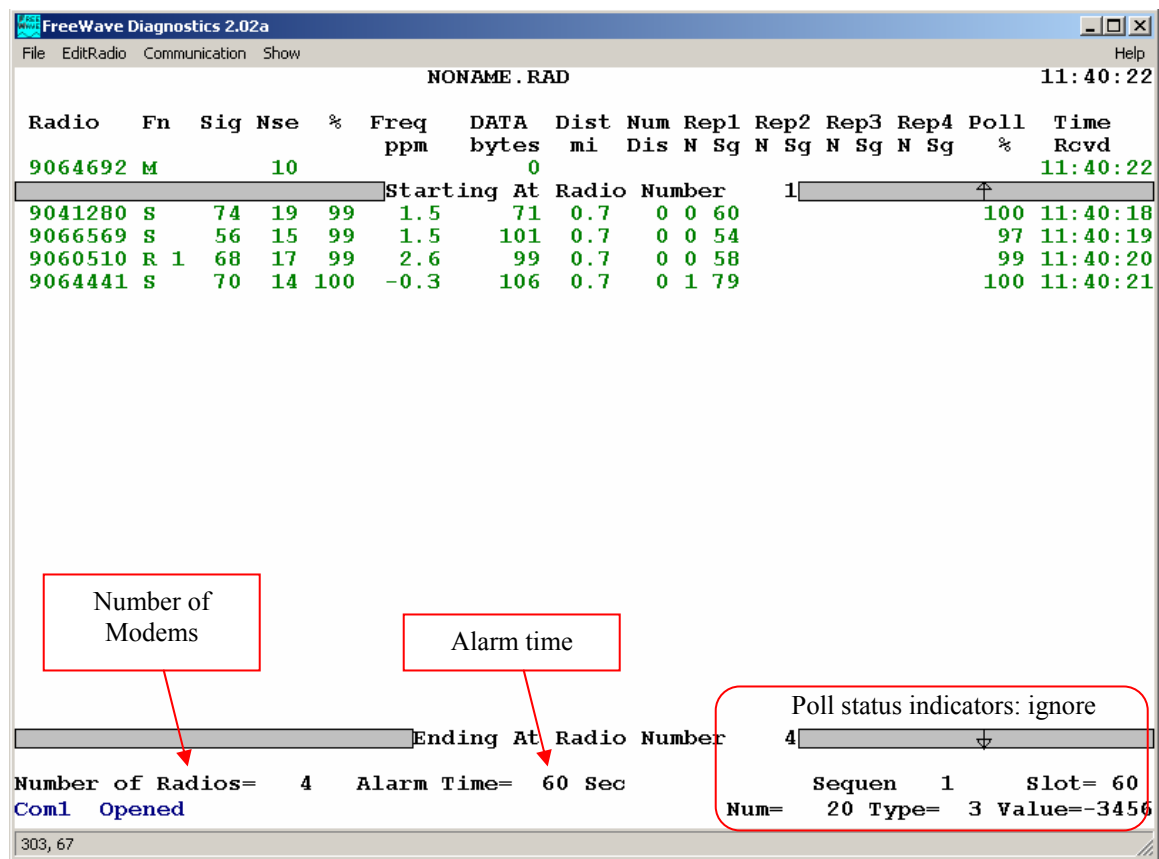
	Num	Rep1	Rep2	Rep3	Rep4	Poll	Time
	Dis	N	Sg	N	Sg	N	Sg
						%	Rcvd
io Number	1						
	7	0	0	60		100	11:40:18
	7	0	0	54		97	11:40:19
	7	0	0	58		99	11:40:20
	7	0	1	79		100	11:40:21

7.3.16 Diagnostics response rate ("Poll %")

This is the percentage of the time that the modem reported back diagnostics data when polled. If the modem is used to transmit a lot of data as part of its normal operation, it will have less time to respond to the Master polling it for diagnostics data; in that case, the diagnostics response rate will decrease. If this value is 0, it may be because this modem is disconnected from the network.

7.3.17 Time of latest diagnostics response ("Time Rcvd")

This is the time (measured using the System Clock) when this modem last replied to diagnostics polling. If the lag in response exceeds the Alarm Time (see "Alarm Time" below, paragraph 6.1.19), the application highlights this value in red.



7.3.18 Number of Modems ("Number of Radios")

This is the total number of modems in the list, not counting the Master. (Remember that a modem may be listed even if it is no longer in the network, as modems must be deleted from the list manually.)

7.3.19 Alarm Time

This is the maximum acceptable time without a diagnostics response from a given modem (see "Time of latest diagnostics poll" above, paragraph 6.1.17). After that time, the application highlights in red that modem's "Time Rcvd" time. The default is 60 seconds. Use the '+' and '-' keys of your computer's numeric keypad to change this value.

7.3.20 Poll Status Indicators

The counters and indexes displayed on the lower right corner of the display are troubleshooting indicators for use by FreeWave Technologies. They serve no purpose in the Diagnostic application other than to provide an indication that the program is running correctly. One of the indicators will display Random or Sequen depending on the polling method that is active, either random or sequential. The number display next to the indicator indicates where the diagnostic program is in the polling process. If Sequen is displayed, the number indicates which modem number in the list is currently being polled.

7.4 Reading Screen 1

This screen is very similar to "Screen 0". It provides additional information about the modems, such as the status of their data port lines (RS-232 only) and information on their operating environment. Some fields in this screen are the same as in "Screen 0", so this section describes only the fields that are unique to "Screen 1". (For information on the other fields, see Section 6.1.)

tics 2.02	Firmware rev.					Supply voltage.
unication Show					Modem temperature	
Modem ID						
NONAME . RAD						
ID	Rev	Freq ppm	Data bytes	Dist mi	Temp F	VTG V
30207	79		0		91	14.9
Starting At Radio Number						
30207	73	1.8	71	0.8	84	13.7
30207	73	1.4	101	0.7	86	13.1
29968	79	2.6	99	0.7	86	13.5
29953	79	0.1	106	0.7	88	14.9

7.4.1 Modem ID ("ID")

This is the modem ID that was set with this modem's Set-Up mode ("multipoint settings" menu, 'D' sub-menu). You may use this number to identify the modem's site or to track a device connected to it. The default is 65535.

7.4.2 Firmware Revision ("Rev")

This is an indirect indication of the version of the firmware installed in this modem. Freewave technical support can convert this number to the actual revision level.

7.4.3 Modem temperature ("Temp")

This is the operating temperature of this modem. The units are degrees Celsius (default) or Fahrenheit; use the "Show"/"Metric km/C" menu to select Celsius, and the "Show"/"American mi/F" menu to select Fahrenheit. All FreeWave modems are 100% tested for operation over a temperature range of -40 C to +75C (-40F to +167F).

7.4.4 Supply voltage ("Vtg")

This is the supply voltage of this modem, in Volts.

Temp	VTG	RTS	CTS	DTR	Polls Rcvd	Time Rcvd
F	V					
91	14.9					14:11:17
do Number		1				
84	13.7	L	H	L	1968	14:11:17
86	13.1	L	H	L	1956	14:11:13
86	13.5	L	H	L	1999	14:11:14
88	14.9	L	H	L	1996	14:11:15

7.4.5 State of RS232 port lines ("RTS", "CTS", "DTR")

These are the states of the RTS, and DTR inputs and the CTS output of this modem's Data Port. 'H' means a high state (~ 10 V, asserted, logic '0') and 'L' means a low state (~10 V, deasserted, logic '1'). Note that in inverted-TTL models, this screen reports '0' if the line is high (5 V) and viceversa.

In RS485 modems only the state of the DTR input is reported.

In Ethernet modems there are no such inputs, so these reports are meaningless.

7.4.6 Number of diagnostics requests received ("Polls Rcvd")

This is the total number of replies to diagnostic polling that the master received from this modem, since this application started. (Remember that, in a multipoint network, a master may miss some messages from another modem.)

7.5 Reading Screen 2: "Remote Radio Setup Settings"

This screen displays a single modem's settings and allows you to edit them.

FreeWave Diagnostics 2.02a
File EditRadio Communication Show

E:\Documents and Settings\Demolab\Desktop\D16:06:18R

Remote Radio Setup Parameters

Serial Number		Name	
9060510		Rep 1	
0 Modem Mode	7 Repeater	17 Master Repeat	2
1 Baud Rate	24	18 Max Slave Retry	9
2 Baud High Byte	0 BaudRate= 19200	19 Retry Odds	9
3 RS232 Mode	0 8,N,1	20 DTR Connect	0
4 MODBus RTU	255 Disabled	21 Repeater Freq	0 Disabled
5 Retry TimeOut	255	22 LowPower	255 Disabled
6 Xtal Tune	60	23 PPS Enable	255 Disabled
7 SlicerThreshold	150	24 Slave/Repeater	0 Enabled
8 Frequency	131	25 Master Sync	255 Disabled
9 Freqkey	5	26 Network ID High	255
10 Max Packet Size	8	27 Network ID Low	117 Network ID= 117
11 RF Data Rate	3	28 SubNet ID	16 Xmit= 1 Rcv= 0
12 Min Packet Size	9	29 Radio ID High	0
13 Xmit Power	255 Setting is 9	30 Radio ID low	37 Radio ID= 37
14 RTS/CTS Control	0 Disabled	31 Freq Table	0
15 Hop table size	112	32 Diagnostics	255
16 Number Repeaters	1	33 Super ID	0

Radio Number 2

Number of Radios= 4 Alarm Time= 60 Sec Update 10 Random 152 Slot= 34

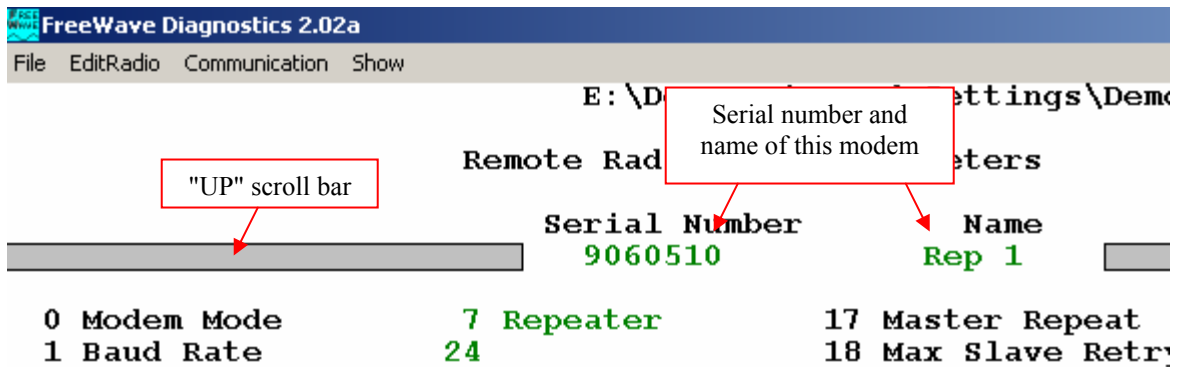
Com1 Opened

Note: If the firmware version of the Master is earlier than 5.68 (900 MHz) or 1.60 (2.4 GHz), you will not be able to view or edit its settings with this application.

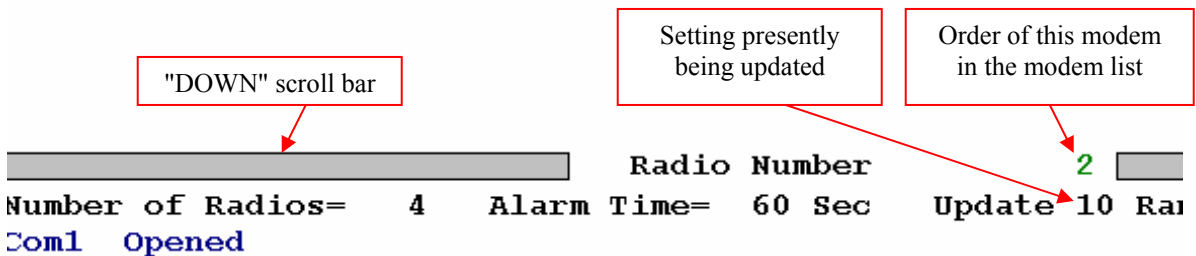
7.5.1 Selecting a particular Modem

To select another modem, scroll through the modem list, either by clicking on the gray scroll bars, or by pressing the diagnostics computer keyboard's "up" and "down" arrow keys. When you reach either end of the list, it restarts from the opposite end.

At the top, this screen displays the Serial Number of this modem, and the name you gave it.

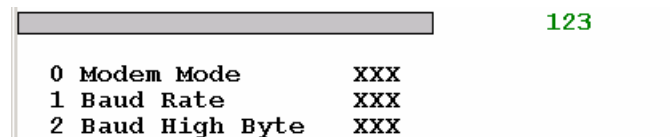


At the bottom, this screen displays the order of this modem within the modem list (of the previous screens). Specifically, '0' refers to the Master.

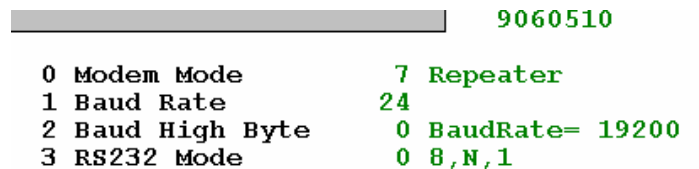


7.5.2 Settings' display

Initially, this application uses "XXX" for the value of each setting.



Then, as the modem reports a setting, the application displays its value.

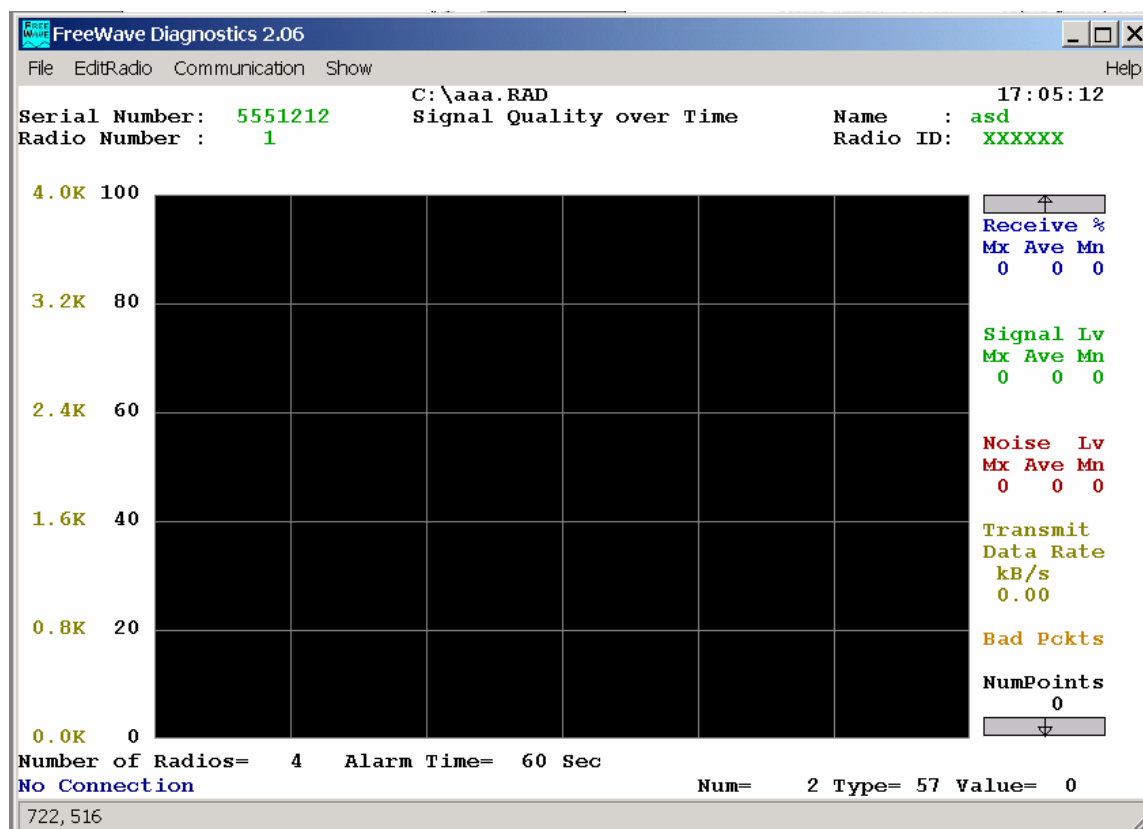


This process is slower if the network is transferring a lot of data. You can request that this modem reports its settings more rapidly by pressing 'P' on the diagnostics computer keyboard.

Each setting is marked with a number, 0 to 33. (This screen handles only the most important 34 settings.) At the bottom right, this screen shows which setting is presently being updated.

7.6 Reading Screen 3, Signal Quality over Time

This Screen displays a rolling graph of the performance over time of a single modem.

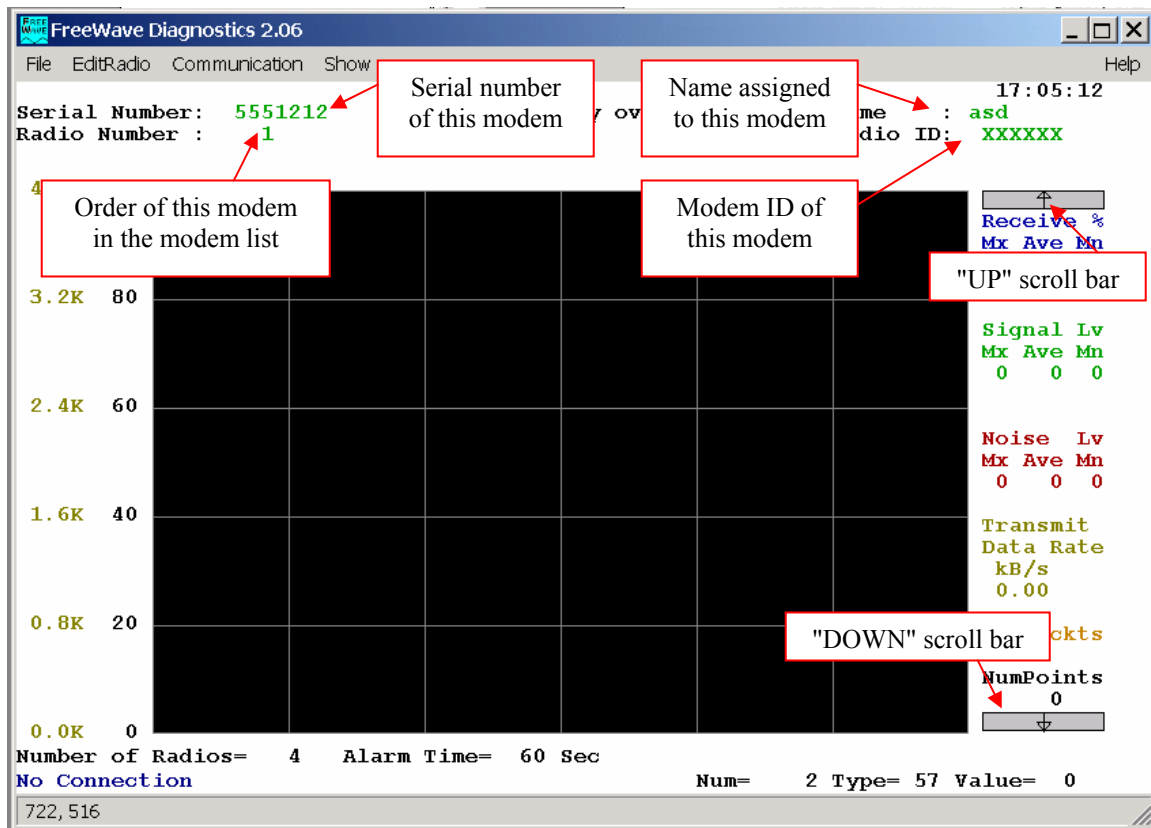


7.6.1 Selecting a particular Modem

To select another modem, scroll through the modem list, either by clicking on the gray scroll bars, or by pressing the computer "up" and "down" arrow keys. When you reach either end of the list, it restarts from the opposite end.

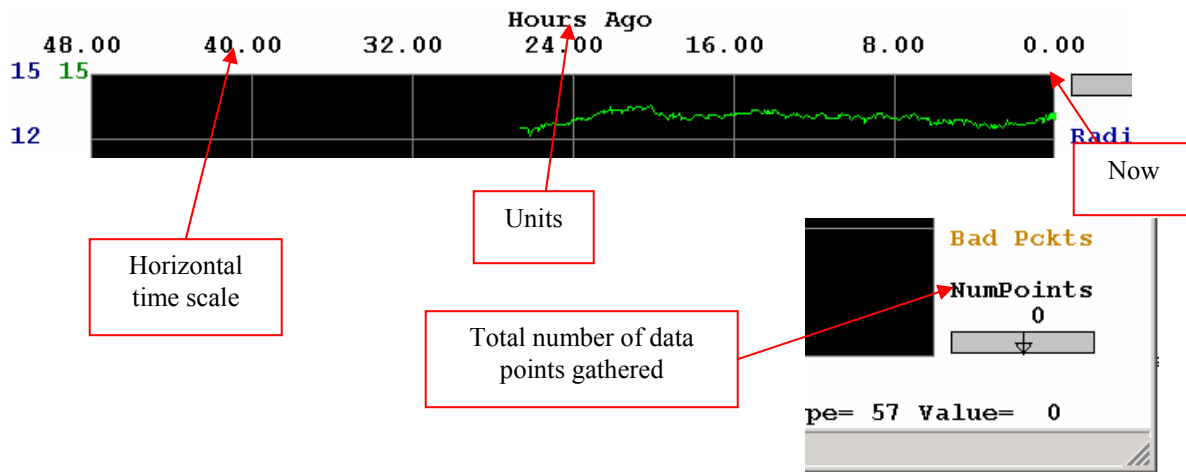
At the top left, this screen displays the Serial Number of this modem, and the order of this modem within the modem list (of the '0' and '1' screens). Specifically, '0' refers to the Master.

At the top right, this screen displays the name you to this modem, and its Radio ID.



7.6.2 Horizontal time scale

This application starts gathering data when you first start it. It displays this data starting from the right edge, and then rolls to the left. The right edge of the graph is always "now". Each time the traces reach the left end, the application changes the horizontal time scale by a factor of 2, so that all the data are displayed in a single screen. The numbers at the top of the graph indicates the horizontal time scale (in minutes or hours); '0' is on the right, because that's always 0 hours (or minutes) ago.

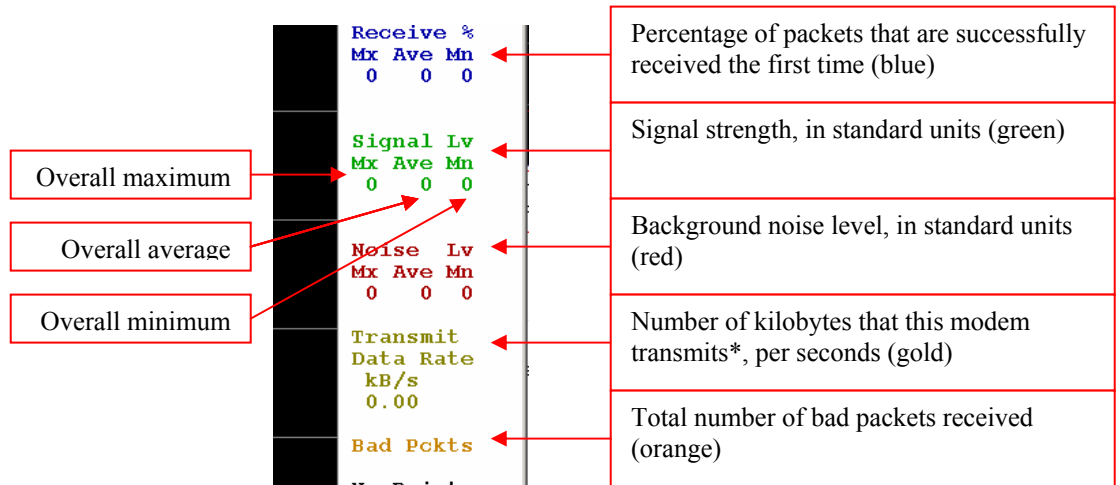


7.6.3 Variables displayed

The graph plots 5 variables:

- "Receive %": the percentage of packets that are successfully received the first time
- "Signal Lv": the signal strength, in standard units (dBμV is not available)
- "Noise Lv": the background noise level, in standard units
- "Transmit Data Rate": the number of kilobytes that this modem transmits*, per seconds
- "Bad Pckts": portion of packets received that are bad

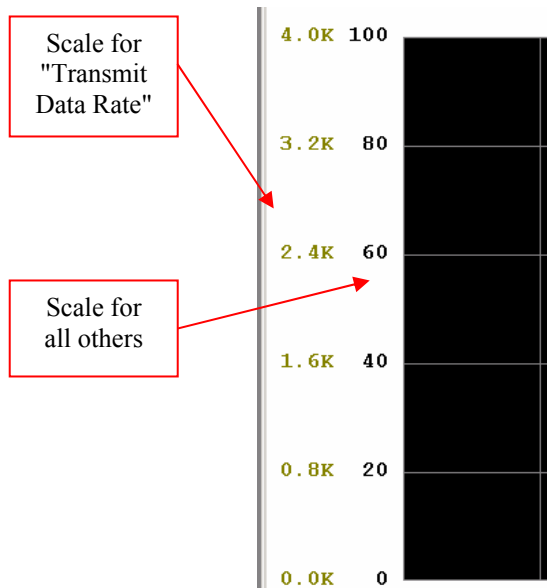
*) For repeaters, this is only that data that is locally generated (non-zero only when a Slave/Repeater is operating as a Slave). Repeaters with older firmware include also the data that they repeat.



The first 3 variables display the overall minimum, maximum and average.

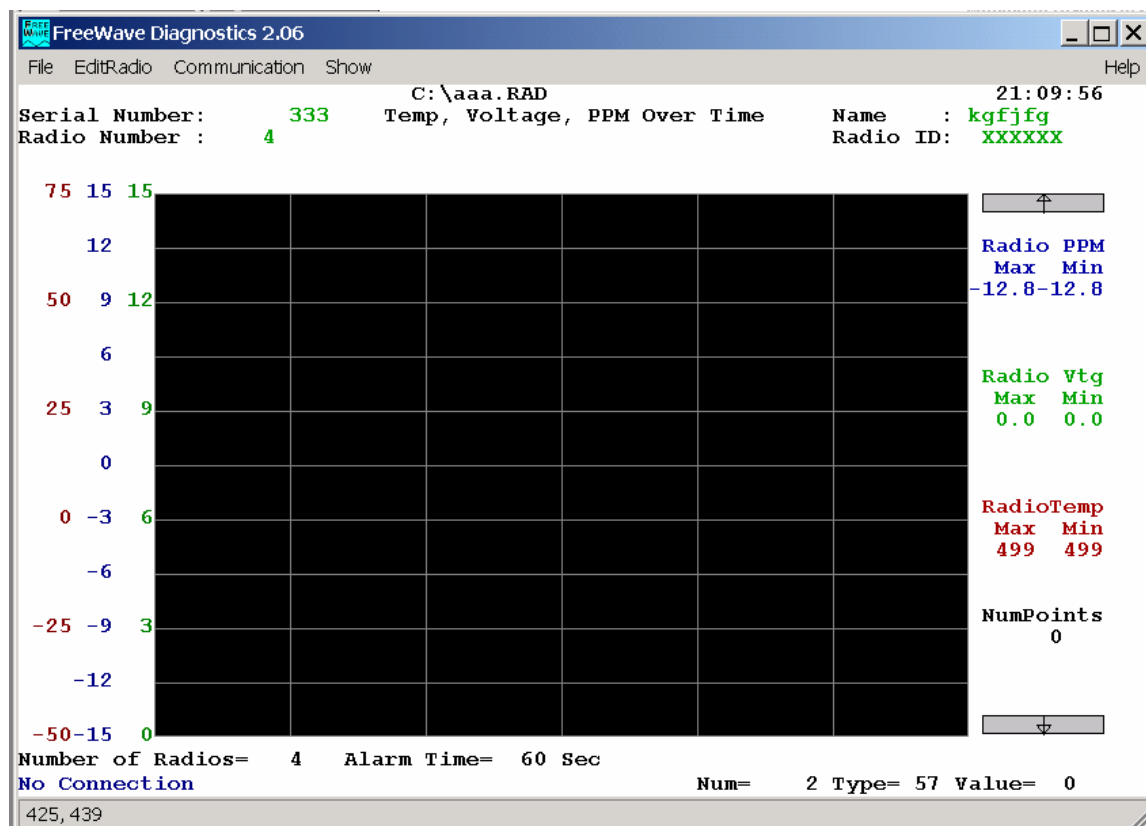
7.6.4 Vertical scale

The graph has 2 vertical scales. The gold colored scale ("0.0K " to "4.0K") is for the Transmit Data Rate. The black scale ("0" to "100") is for all the other variables.



7.7 Reading Screen 4: "Temp, Voltage, PPM Over Time"

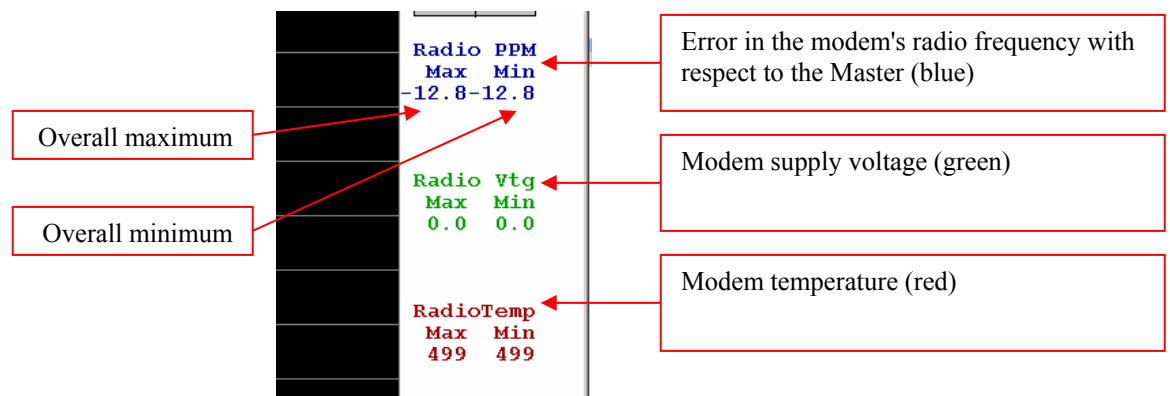
This Screen displays a rolling graph of the operating parameters over time of a single modem. It is mostly identical to the previous screen, except for the variables that it plots. This section describes only those differences. For information on the rest, see the previous section.



7.7.1 Variables displayed

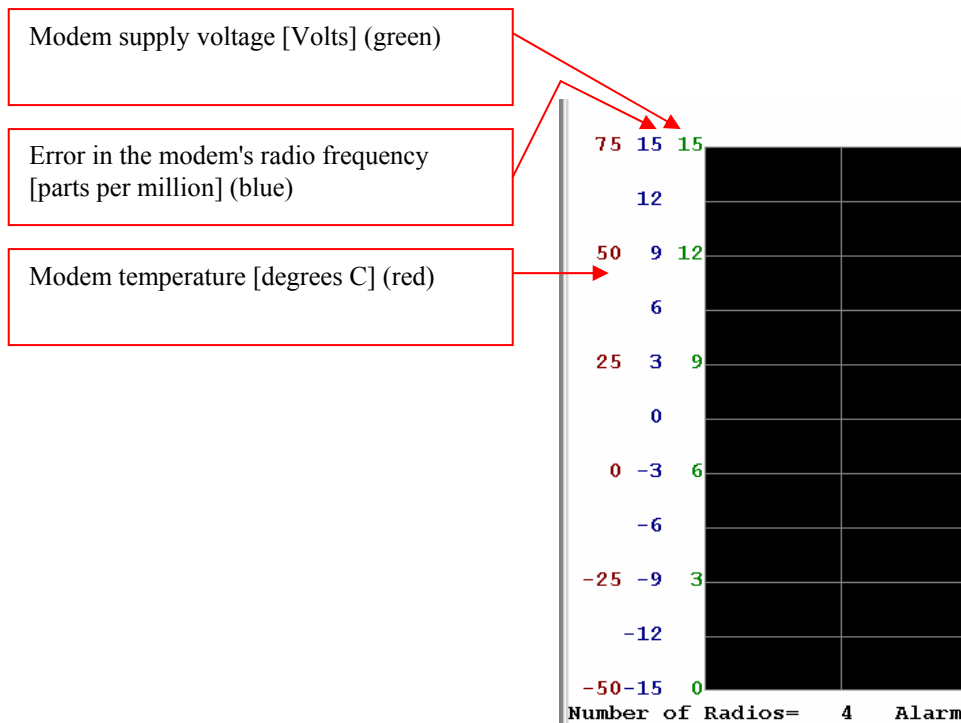
The graph plots 5 variables:

- "Radio PPM": Error in the modem's radio frequency with respect to the Master [ppm]
- "Radio Vtg": the voltage of the modem's power supply [Volts]
- "RadioTemp": the temperature of the modem [C]



7.7.2 Vertical scale

The graph has 3 vertical scales. The green scale (0 to 15) is for the voltage of the modem's power supply [Volts]. The blue scale (-15 to 15) is for the error in the modem's radio frequency [parts per million]. The red scale (-50 to 75) is for the temperature of the modem [degrees Celsius].



8 Editing the Modem's Settings

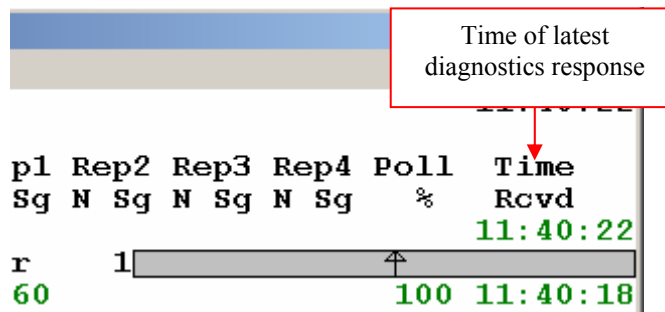
You can change the selected modem's settings through Screen 2.

You can only change one setting at a time. We strongly recommend that you interrupt the normal data flow through a modem while changing any of its settings.

8.1 Strategy

You should stop using that modem to transfer data until you're done editing its settings. That's because the modem disconnects itself from the network when you do that. Afterwards, if the modem is able to reestablish the link, it will do so automatically.

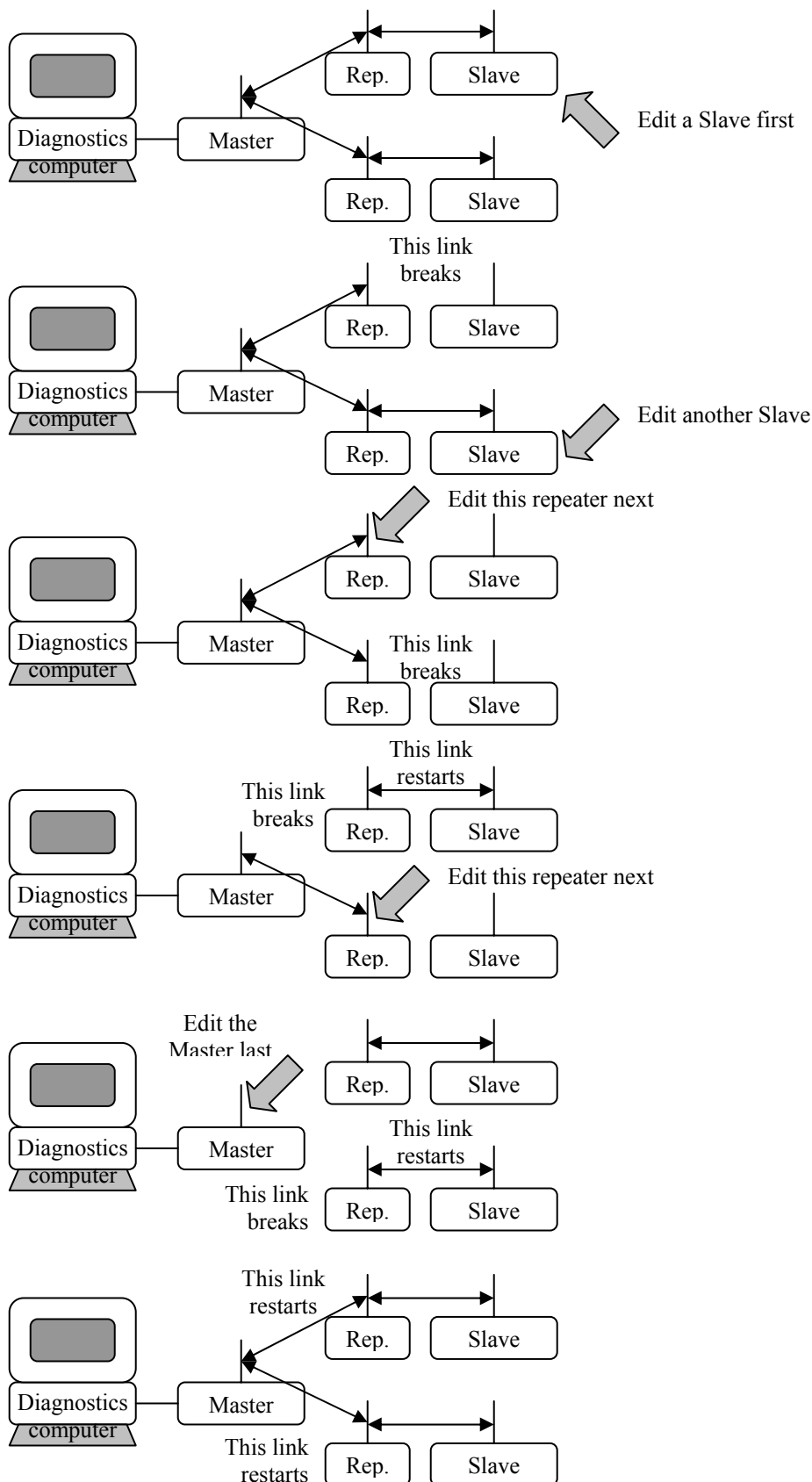
Tip: To see whether or not a modem is connected, go to Screen 0 and look at its "Time Rcvd" field, to see how long it's been since the modem sent diagnostics data.



p1	Rep2	Rep3	Rep4	Poll	Time
Sg	N	Sg	N	Sg	%
r	1				
60				100	11:40:18

You should verify that a change has been successful before you do another change.

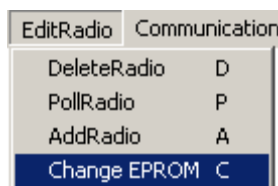
Certain settings must match in the whole network, so you must change them in every modem in the network. Start from the Slaves, and work your way inward toward the Master; if you went the other way you wouldn't be able to reach the "outer" modems to change their settings. Verify each change before attempting to change a different setting.



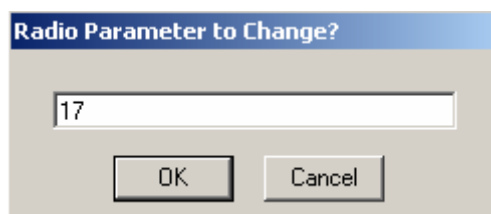
8.2 Changing a Modem's Settings

To change a setting in a modem, use Screen 2 and select that modem (using the arrow keys on your keyboard, or clicking the scroll bars).

Select the "EditRadio" / "Change EPROM" menu (or press the 'C' key).

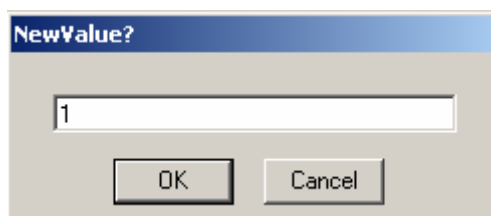


A dialog appears.



Enter the number of the setting you want to edit (0 to 33) and click "OK".

A new dialog appears.



Enter the new value of the setting and click "OK"

8.3 Details about the Settings

Changing these settings is similar to changing them through a modem's "Set-Up" mode, with following differences.

- This application only lets you see and edit 34 of the modem's settings.
- These settings are all available from a single screen (instead of a hierarchy of menus)
- Three of these settings are not editable and are not reported in the "Set-up" mode.
- You enter the Radio ID with 3 bytes instead of 4 decimal digits.
- Some settings appear different in this Application than they do in the Set-up menu

Please refer to the Main Manual for an explanation of the significance of each setting displayed in this screen, and what values are acceptable for each setting.

8.3.1 Risky changes

Changing certain parameters through this application is somewhat risky, as you may not be able to reestablish communication and therefore you may not undo a change (as you could if you had direct access to the modem through its "Set-Up" mode).

0 Modem Mode	XXX	17 Master Repeat	XXX
1 Baud Rate	XXX	18 Max Slave Retry	XXX
2 Baud High Byte	XXX	19 Retry Odds	XXX
3 RS232 Mode	XXX	20 DTR Connect	XXX
4 MODBus RTU	XXX	21 Repeater Freq	XXX
5 Retry TimeOut	XXX	22 LowPower	XXX
6 Xtal Tune	XXX	23 PPS Enable	XXX
7 SlicerThreshold	XXX	24 Slave/Repeater	XXX
8 Frequency	XXX	25 Master Sync	XXX
9 Freqkey	XXX	26 Network ID High	XXX
10 Max Packet Size	XXX	27 Network ID Low	XXX
11 RF Data Rate	XXX	28 SubNet ID	XXX
12 Min Packet Size	XXX	29 Radio ID High	XXX
13 Xmit Power	XXX	30 Radio ID low	XXX
14 RTS/CTS Control	XXX	31 Freq Table	XXX
15 Hop table size	XXX	32 Diagnostics	XXX
16 Number Repeaters	XXX	33 Radio ID Super	XXX

8.3.2 Xtal tune / SlicerThreshold / Frequency

These 3 settings report data that are not editable and are not even reported in the normal "Set-up" mode. They are not described neither here nor in the Main Manual. They are only useful to a FreeWave Technologies technician.

```

- - - - -
6 Xtal Tune          60
7 SlicerThreshold    150
8 Frequency          131
9 Freqkey            5

```

8.3.3 Settings that appear different from the Set-UP menu

The following settings are the same as when using the Set-UP mode, but the numbers displayed are different. See the Main Manual for information of what these settings mean. Here we just describe how they are set differently from the Set-Up menu.

8.3.3.1 Baud Rate

Baud rate is set using two parameters: 1- Baud Rate and 2- Baud High Byte.

Baud Rate	Set-up Menu setting	Diagnostics setting	
		2- Baud High Byte	1- Baud Rate
1200	9	1	128
2400	8	0	192
4800	7	0	96
9600	6	0	48
19200	5	0	24
38400	4	0	12
57600	3	0	8
76800	2	0	6
115200	1	0	4
230400	0	0	2

8.3.3.2 RS232 Mode

Data Bits, Parity, Stop Bits	Set-up Menu setting	Diagnostics setting
8,None, 1	0	0
7,Even, 1	1	2
7, Odd, 1	2	3
8, None, 2	3	16
8, Even, 1	4	18
8, Odd, 1	5	19

8.3.3.3 MODBus RTU

MODBus RTU	Set-up Menu setting	Diagnostics setting
Enabled	1	0
Disabled	0	255

8.3.3.4 13 Xmit Power

Sets the radio RF output power. See Operator's Manual radio parameters menu.

Output power	Set-up Menu setting	Diagnostics setting
< 100 mw	1	39
	2	66
	3	93
	4	120
	5	147

	6	174
	7	201
	8	228
Full Power	9	255

8.3.3.5 RTS/CTS Control

RTS/CTS Control	Set-up Menu setting	Diagnostics setting
Enabled	1	255
Disabled	0	0

8.3.3.6 Repeater Freq

Repeater Frequency	Set-up Menu setting	Diagnostics setting
Enabled	1	255
Disabled	0	0

8.3.3.7 LowPower

Repeater Frequency	Set-up Menu setting	Diagnostics setting
Disabled	0	255
LEDs dimmed	1	1
LEDs dimmed, transceiver sleeps every other slot	2	2
LEDs dimmed, transceiver sleeps 2 of 3 slots	3	3
LEDs dimmed, transceiver sleeps number of slots corresponding to setting.	...	...
LEDs dimmed, transceiver sleeps 62 of 63 slots.	63	63

8.3.3.8 PPS Enable

PPS Enable	Set-up Menu setting	Diagnostics setting
Enabled	1	255
Disabled	0	0

8.3.3.9 Slave/Repeater

Slave Repeater	Set-up Menu setting	Diagnostics setting
Enabled	1	0
Disabled	0	255

8.3.3.10 Master Sync

Master Sync	Set-up Menu setting	Diagnostics setting
Enabled	1	0
Disabled	0	255

8.3.3.11 Network ID

Network ID	Set-up Menu setting	Diagnostics setting	
		High Byte	Low Byte
0 to 255	Network ID	255	Network ID
256 to 511	Network ID	0	Network ID - 256
512 to 767	Network ID	1	Network ID - 512
768 to 1023	Network ID	2	Network ID - 768
1024 to 1279	Network ID	3	Network ID - 1024
1280 to 1535	Network ID	4	Network ID - 1280
1536 to 1791	Network ID	5	Network ID - 1536
1792 to 2047	Network ID	6	Network ID - 1792
2048 to 2303	Network ID	7	Network ID - 2048
2304 to 2559	Network ID	8	Network ID - 2304
2560 to 2815	Network ID	9	Network ID - 2560
2816 to 3071	Network ID	10	Network ID - 2816
3072 to 3327	Network ID	11	Network ID - 3072
3328 to 3583	Network ID	12	Network ID - 3328
3584 to 3839	Network ID	13	Network ID - 3584
3840 to 4095	Network ID	14	Network ID - 3840

Note: Radios with firmware versions earlier than 5.68 (900 MHz) or 1.62 (2.4 GHz) will not accept Network ID values larger than 255.

8.3.3.12 SubNet ID

SubNet ID	Set-up Menu setting	Diagnostics setting
01h to FFh	01h to FFh	1 to 255

The Diagnostics Application requires you to enter this value as a decimal number. Slip the hex value that you would enter in the Set-Up Menu into two nibbles (that is, the two characters that for the hex number). For example, if the value you would enter in the Set-Up menu is "E3", the high nibble is 'E' and the low nibble is '3'. Use this table to convert the 2 nibbles to the corresponding decimal number.

		Receive Subnet ID (X : high nibble)															
Transmit Subnet ID (X: low nibble)		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
	0	N/A	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	1	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
	2	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
	3	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
	4	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
	5	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
	6	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111
	7	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127
	8	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143
	9	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159
	A	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
	B	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191
	C	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207
	D	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223
	E	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239
	F	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255

8.3.3.13 Radio ID

The Diagnostics Application lets you set any number below 2^{24} . While the modem's Set-up mode will display this entire number, it will only let you enter numbers up to 9999.

Radio ID	Set-up Menu setting	Diagnostics setting		
		Super Byte	High Byte	Low Byte
0 to 255	Radio ID	0	0	Radio ID
256 to 9999	Radio ID	0	$\text{INT}((\text{Radio ID} \text{ MOD } 65535) / 256)$	$\text{Radio ID MOD } 256$
10000 to 65535	Not available	0	$\text{INT}((\text{Radio ID} \text{ MOD } 65535) / 256)$	$\text{Radio ID MOD } 256$
65536 to 16777215	Not available	$\text{INT}(\text{Radio ID} / 65535)$	$\text{INT}((\text{Radio ID} \text{ MOD } 65535) / 256)$	$\text{Radio ID MOD } 256$

Unfortunately, the way you set-up this number through the Diagnostics Application is awkward, as you must enter it one byte at a time, using 3 entries:

- Super byte: "33 Radio ID Super".
- High byte: "29 Radio ID High".
- Low byte: "30 Radio ID Low".

Each entry takes a value between 0 and 255.

$$\text{Radio ID} = 65535 * \text{Super byte} + 256 * \text{High byte} + \text{Low byte}.$$

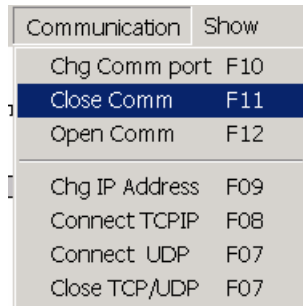
8.3.3.14 32 Diagnostics

Diagnostics	Set-up Menu setting	Diagnostics setting
Enabled	1 to 63	1 to 63
Disabled	0	255

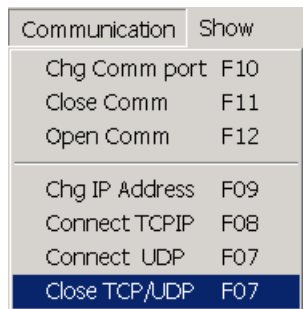
9 Ending the session

When done, you need to end the communication with the Master.

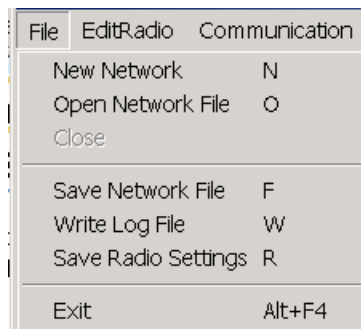
If the communication was directly through the serial port, close the port with the "Communication" / "Close Comm" menu.



If the communication was directly through an Ethernet Network (either TCP/IP or UDP/IP), close the connection with the "Communication" / "Close TCP/UPD" menu.



Quit the application with the "File" / "Exit" menu or press alt-F4 or alt-F-X.



10 Troubleshooting

To run the diagnostic program, make sure that:

- The network is Point-to-multipoint.
- The Diagnostics computer is able to access the FreeWave network
 - either through its Master (through a Diagnostics Cable)
 - or through the Internet.
- The Diagnostics application (DIAG208.EXE) is installed and running on the Diagnostic computer.
- The Diagnostics setting in the Master modem is set to a value between 1 and 63, inclusive.
- For DGR series masters, the Number of Repeaters setting in all the modems is set to 1.