

Front Panel Operation



Switches

Select Switch

The 3 position switch (1 / Auto / 2) on the front panel provides the following functionality:

- Position 1: base station 1 is forced into operation
- Position Auto: changeover hardware will select the online base station
- Position 2: base station 2 is forced into operation

The select switch is also used to identify the target base station for configuration programming.

Adjacent to the select switch are two LEDs: These LEDs indicate the current active base station.

Select LED's

- Green - Auto Mode
- Red - Remote Force
- Amber - Local Force

2 Green Firmware Download

2 Amber Test Mode

2 Red Fatal Error - refer user manual

Reset Switch

This is a momentary close switch which when depressed will reset all LED alarm indications.

System Port

There are two system port connection points, one on the rear panel and one on the front panel. Both have the same functionality and can be used for local diagnostics, firmware front panel downloads and hot standby controller testing. To access the system port use the diagnostic/programming cable supplied.

Note: When connection is made to front panel system rear system port is disabled.

Alarm Status LEDs

There are 10 alarm LEDs on the front panel, five for base 1 and five for base 2. These LEDs provide a general indication of base station status. More detailed base station status information is available by using the diagnostic utility software.

The indicated alarms for each base station are:

Freq.	=>	Frequency Error
RxSig	=>	Receive Signal (RF) Error
Data	=>	Receive Data Error
TxPower	=>	Transmit Power (RF) Error
Supply	=>	DC Voltage Error

The status of each alarm is represented as follows:

Green	=>	No Error
Red	=>	Current (active) Error condition
Amber	=>	Recovered Error condition

Any active or recovered error LEDs will turn to green after the reset alarms switch has been pushed or remotely reset.

Part F - Operational Features

Multistream functionality (SID codes)

The E Series sends data messages in packets. A feature of the E Series is that an address can be embedded in each packet. This address is called the stream identifier code (SID).

By configuring a user serial port for a specific SID code, it is possible to steer messages to similarly configured ports between radio modems. In effect, it is possible to use the multiple serial ports available on the E Series, to enable multiple protocols to share the same RF channel. The SID codes also facilitate the use of other features such as TView diagnostics. Unique selective routing, repeating, and data splitting functions available in the radio modems configuration allow data steering and bandwidth management in complex systems.

See Part I - TView+ Management Suite - Programmer and Part J - TView Remote Diagnostics and Network Controller for details.

Collision Avoidance (digital and RFCD based)

Where multiple “un synchronised” protocols co-exist on a common “multiple access” radio channel, there is always a possibility that both “hosts” may poll different “remote” devices at the same time. If both devices attempt to answer back to the single master radio at the same time, it follows that a collision could occur on the radio channel.

To facilitate the operation of multiple protocol operation on the radio channel, a transparent collision management system has been implemented : See Part I - TView+ Management Suite - Programmer for details.

Digital Collision Avoidance System

If the “multiple access master” has been configured for full duplex operation, it is possible to use the inbuilt collision avoidance signaling system.

Once the master radio receives a valid incoming data stream from a remote, a flag within the “outbound” data stream is used to alert all other remote devices that the channel has become busy. Remote devices wishing to send data will buffer the message until the channel status flag indicates that the channel is clear. A pseudo-random timing value is added to the retry facility to ensure that waiting remotes do not retry at the same time.

RF Carrier Detect RSSI based Collision Avoidance

In half duplex systems, the receiver’s RF carrier detect is used to inhibit the transmitter whilst a signal is being received.

Digipeater Operation

A feature of the E Series radio modems is the ability to internally repeat data packets to provide stand alone repeater facilities without the need for external intelligence.

This is done by programming “SID Codes” to “Repeat” a stream or range of streams. Wizard templates can be used to simplify setup of this and other features.

See Part I - TVIEW+ Management Suite for details.

TVIEW+ Diagnostics

The E Series has an inbuilt remote configuration and diagnostics utility.

This facility allows transparent remote access to the key configuration and operating parameters of the radio.

See Part J - TView Remote Diagnostics and Network Controller for details.

Part G – Commissioning

Check DC power connector for correct voltage (10-16VDC) and polarity, BEFORE plugging in the power connector.

Power-up

Upon power up, the radio will self test and shortly after the green power LED will be displayed.

Failure of the power LED to light indicates no power, or failure of the fuse due to incorrect polarity or over-voltage.

Other failure such as fatal internal errors will initiate error modes indicated by a flashing sequence of all LEDs red, followed by one or more green LED's to indicate the nature of the failure (see Part E – Getting Started: LED Indicators and Test Outputs).

LED Indicators

Will depend on the system architecture. If the device is a remote site receiving a base station with a constant carrier, then the RXSIG/ SYNC LED should be green to indicate healthy reception of the wanted signal.

If the site has been configured as a constantly transmitting base station, then the PWR/TX LED should show red.

In other types of systems, TX and RX bursts would be indicated by the RX or TX LED's as above.

Data flow to and from the user ports is indicated by the TXD/RXD LEDs for each port.

(See Part E – Getting Started: LED Indicators and Test Outputs.)

Data Transfer Indications

Bi-colour LEDs are provided to indicate RS232 data being transmitted and received on each data port. A RED flash indicates a byte (or bytes) of incoming data from the serial line which will be transmitted to air, and a green flash indicates a byte of data received "off air" being released onto the serial line.

If data is being sent to the radio modem and the Data LED does not flash RED, this may indicate a wiring or configuration problem. Check that the TX and RX data lines are correctly wired (see Part E – Getting Started: LED Indicators and Test Outputs).

Also check that character set and parity settings (i.e. N,8,1 etc) are set identically at the terminal and the radio modem. Note that some incorrect settings of the character set parameter can still produce transmittable data, even though the data will not be understood by the application.

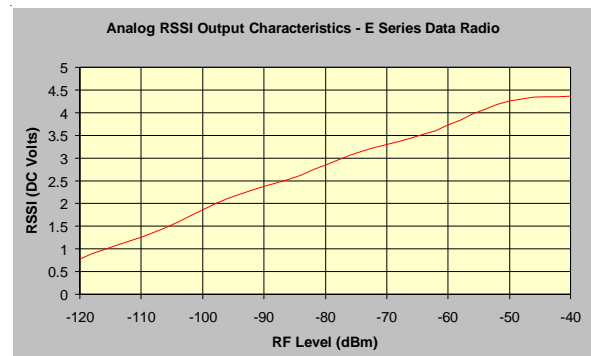
Antenna Alignment and RSSI Testing

Once the RXSIG LED is lit, it is possible to confirm RX signal strength and align a directional antenna by monitoring the RSSI output.

This DC voltage appears at Pin 9 of Port B.

A ground reference can be obtained from chassis ground or Pin 5 of Port A or B.

The chart below shows Pin 9 voltage as it relates to signal strength.



Link Establishment and BER Testing

Once communications has been established, it is possible to confirm the packet error rate performance of the radio path, and thus estimate the BER figure.

There are a number of tools provided to do this. The easiest is to use the "indicative packet error test" provided within the TVIEW+ Diagnostics under "statistical performance tools". Alternatively, it is possible to use hyper terminal, or other packet test instruments or PC programs to run end to end or perform "loopback" testing.

Please note that when using a "loopback plug" some understanding of the packetising process is necessary, since each "test message" must be carried in a single packet for meaningful results to be obtained.

Note also that in PTMP systems, allowance must be made for collision potential if other data is being exchanged on the system.

VSWR Testing

VSWR testing is achieved using specialized VSWR testing equipment, or a "ThruLine" power meter that measures forward and reverse power.

VSWR is the ratio between forward and reflected transmitter power, and indicates the health and tuning of the antenna and feeder system.

VSWR should be better than 3 to 1, or expressed as a power ratio, <6dB or no more than 25%. To activate the radios transmitter for VSWR testing, use:

- a) An RTS loop
- b) A system port PTT plug

Part H – Maintenance

Routine Maintenance Considerations

The E Series hardware itself does not require routine maintenance. However all radio products contain crystal frequency references, and the stability of these crystals changes with time. The effect of this is that the product will slowly drift off frequency, and eventually it will require re-calibration. E Series radios are designed with high quality, low drift specification references, to ensure a long maintenance free lifespan. The length of this lifespan will depend on the severity of temperature extremes in the operating environment, but is normally 3–5 years. Extended frequency drift can be detected using TVIEW+ Diagnostics “Freq error” parameter.

Generally, recalibration is achieved by replacing the radio in the field with a spare, and returning the radio to a service centre for re-calibration and specification testing at moderate cost.

Routine maintenance should be performed on external equipment subject to greater environmental stresses including antennas, RF feeder cables, backup batteries and cooling fans (if required). This maintenance should include testing of site commissioning figures such as received signal strength, VSWR, P/S voltage etc.

SECTION 2

Part I – TVIEW+ Management Suite - Programmer

Part J – TVIEW Remote Diagnostics and Network Controller

Part K – Appendices

Part L - Support Options

Part I – TVIEW+ Management Suite - Programmer

Introduction

This manual covers the installation and operation of the E Series TVIEW+ Management Suite which incorporates 3 utilities:

- Programmer for configuration of the radio RF parameters, system parameters and data ports
- Diagnostics* for real-time monitoring and logging of radio performance parameters
- Firmware Update for loading new firmware releases into the radio data modem

All utilities can be run on any IBM compatible computer running Windows 95® and above. This section describes use of the programmer and firmware Update utilities in detail. Users should refer to the separate Diagnostics section for information about this utility.

The programmer is used to set configuration parameters within the ER450 data radio modem and EB450 base station. The utility permits configuration of modems connected directly to the PC as well as over the air to a remote unit. Configuration parameters can be saved to a disk file for later retrieval, or used for clone programming of other modems.

All configuration parameters are held in non-volatile memory (NVRAM) on the Data Radio Modem. Configuration is fully programmable via the Systems Port using the programming adaptor and cable supplied. Disassembly of the unit is not required for any reason other than for servicing.

The diagnostics utility permits monitoring and logging of radio performance parameters for both E Series* as well as D Series* data radio modems and base stations. It supports homogeneous systems of radios as well as mixed systems of both E and D series radios.

The firmware update utility permits field upgrade of the firmware in an ER450 data radio modem, EB450 base station and EH450 hot standby unit connected directly to the PC. A special serial adaptor cable is required to be connected to Port B to load firmware into the unit.

** Requires the optional DIAGS Network Management and Remote Diagnostic Facility to be installed - per radio.*

Installation

Unit Connection

Programmer and Diagnostics Utilities

The unit is connected to the PC using the supplied DB9-RJ45 adaptor cable (part no. TVIEW+ Cable) for local configuration changes or diagnostic monitoring. The cable should be connected to the RJ45 System Port of the unit and a valid PC serial port (eg: COM 1) DB9 connector.

(See Part E - Getting Started: Communications Ports)

Firmware Update Utility

The unit to be updated with firmware connects to the PC using the DB9-DB9 adaptor (part no. DRPROG). The cable should be connected to the DB9 Port B connector on the unit and a valid PC serial port (See Appendix C for details) DB9 connector.

Software

Please take a moment to read this important information before you install the software.

The installation of this Software Suite is a 2 step process.

Step 1 completes the typical installation of the TVIEW+ Management Suite and will install the Programming Software together with the E Series Documentation.

Step 2 installs the Diagnostic Software and is optional. This step is only required if your radios have Remote Diagnostics enabled.

STEP 1: Installation - TVIEW+ Management Suite

Note: If a previous version of the TVIEW+ Management Suite has been installed on your PC, you must uninstall it via Control Panel "Add/Remove Programs".

- Close down all other programs currently running.
- Place the CD-ROM in the drive on the PC.
- Using Windows Explorer locate the files on the CD-ROM.
- In Windows Explorer double click on the file called TVIEW+_ (Version#)_install.exe
- After the installer starts follow directions.

STEP 2: Installation - TView Diagnostic Software (Optional)

Note: If a previous version of the “TView WinDiags” software has been installed on your PC, you must uninstall it via Control Panel “Add/Remove Programs”.

- Close down all other programs currently running.
- Place the CD-ROM in the drive on the PC.
- Using Windows Explorer open the “Diagnostics” directory on the CR-ROM.
- Double click on the file called setup.exe
- After the installer starts follow directions.

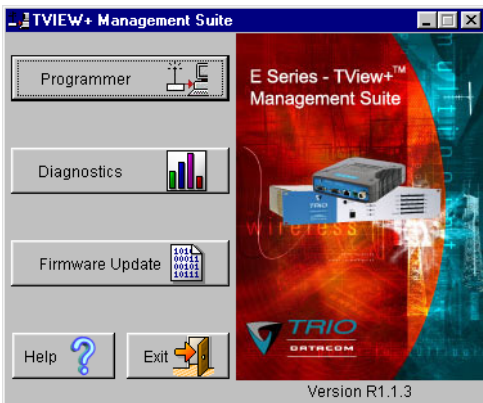
Other:

The current E Series Manuals are supplied and installed as part of the TVIEW+ Management Suite installation in Adobe Acrobat format.

Adobe Acrobat Reader is provided on the CD-ROM for installation if required.

TVIEW+ Front Panel

When started the TVIEW+ front panel appears. The larger buttons permit each of the three utilities to be started. The diagnostics button may be greyed out if this utility has not been installed or found in the correct file directory. Access to local help and an exit facility are provided by the remaining 2 buttons.



Programmer

Main Window

When first started the programmer is in file mode as indicated by the mode field at the bottom right of the panel shown below. In this mode it is possible to open a previously saved configuration file, or configure various programming options and save the configuration to a file.

Note: Modulation type is not available in this mode.

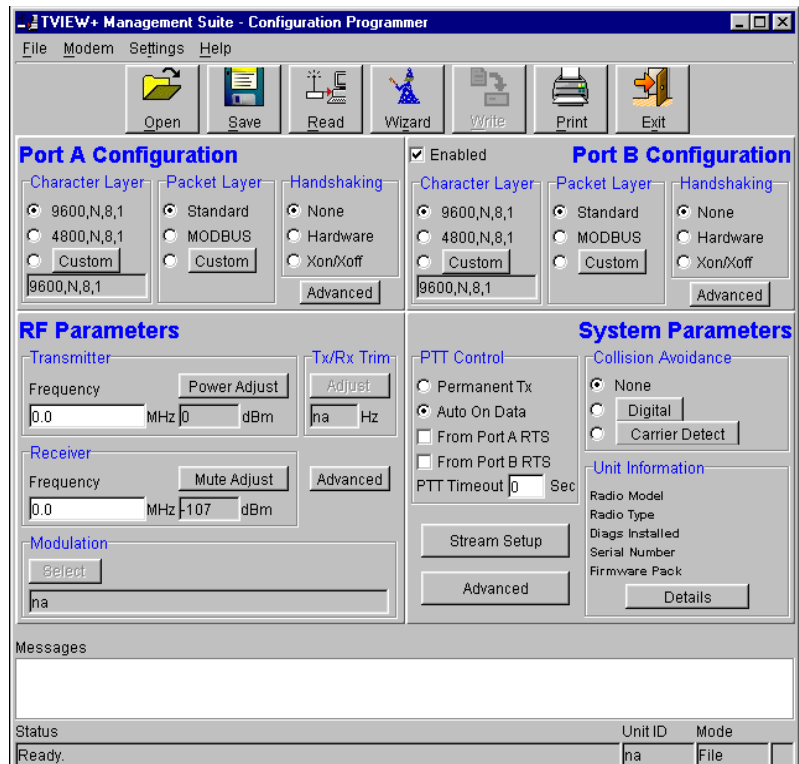
To commence programming a unit (radio remote or base station) a session must first be established by using the “READ” function. This function reads the current configuration from the unit and displays it in the main window. The “mode” displays changes to local or remote depending on the type of session selected at the read function. Several options in the main window may be blanked out until a session has been established with a unit.

Note: Changing any item on the menu will in general not take effect until data is written back to the unit using the “WRITE” function.

The procedure to follow for normal programming of unit is:

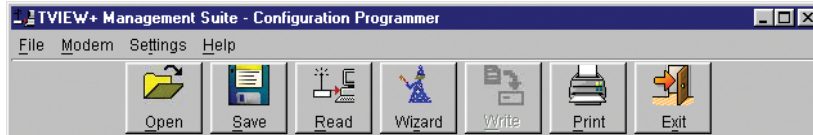
- Read unit
- Configure parameters (or Open a previously saved configuration file)
- Write unit

Several modems of the same radio type can be programmed with the same configuration using the clone facility described in Clone Mode. It is important to note that when using this facility the cloned radio should be of the same type to ensure it does not operate outside its capability.



Pull Down Menus and Toolbar Buttons

The items on the pull-down menus can be selected either directly with a mouse or using the ALT key in combination with a HOT KEY (eg ALT-F to select the file menu). Several of the functions within each menu are also available on the toolbar (click once to select).



File Menu

The file menu allows the user to load (open) or save configuration data as well as to quit the program. The files are saved with an “.cfg” file extension

Open (also available on the toolbar)

This function is used to load an existing configuration file that can be used to directly program the radio or to use as a starting point to edit configuration parameters. Note that a session must be established with the unit by initially reading the configuration parameters from the unit prior to being written to a unit.

If in file mode the modulation type will not be displayed. If in local/remote mode and a file that was saved from local/remote mode is opened, then modulation type will be imported and used, but only if it is valid for the connected hardware. If not then the units read modulation type will be used.

Save (also available on the toolbar)

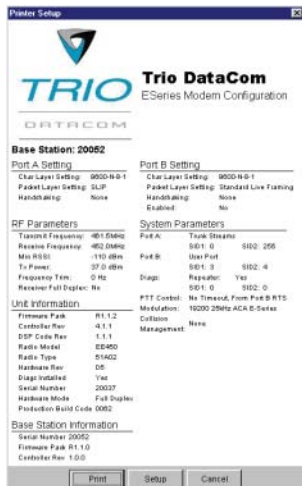
This function is used to save the current configuration parameters to a file for future recall.

If in “file mode” only basic RF, Port and System parameters are saved and re called. If in local/remote mode then modulation type is saved and re called.

Print (also available on the toolbar)

This function prints out the configuration data to the default printer in a standard format. There are no options for this item.

This should be used if a complete record is required for site/unit configuration. Firmware/Modulation/Diags/Hardware type are all printed.



Exit (also available on the toolbar)

This function terminates the program. The user is requested to confirm this selection before exiting the application.

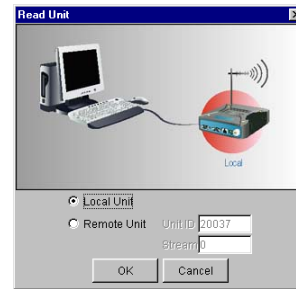
Modem Menu

This radio menu allows configuration data to be read from and written to the unit (remote radio or base station) using the selected PC serial port connection (see Settings menu). The action of reading the configuration establishes a session with the unit.

Communications is maintained with the unit to ensure that the session remains open. If the session has been lost due to data transmission errors or disconnection of the programming cable it will need to be re-established to ensure any updated configuration is written successfully to the unit.

Read (also available on the toolbar)

This function establishes a session with the unit, reads configuration data from the unit and displays it in the programmer main window. When selected a dialogue window appears prompting the user to choose whether the unit to read is local (connected directly to the serial port or remote (connected over the air to the unit connected to serial port). Unit no. (serial no.) must be entered and the stream SID code is “on” (default =0)). After configuration data is read from the unit it is available for editing and writing back to the unit or saving to a file. The progress of data transfer to or from the unit is indicated by a message window as well as a rotating indicator in the bottom right hand corner of the main window.



Write (also available on the toolbar)

This function writes configuration data displayed in the main window to the unit and reboots the unit. When selected a dialogue window appears prompting the user to confirm whether to proceed. A progress indicator in the bottom right hand corner of the main window is displayed while data is being read. This selection is only available if a session has been previously established and maintained with the unit.



This dialog provides a facility for reversing any remote configuration changes and reverting to the previous configuration.

Select "No" to send a command to the unit to accept the new configuration changes and to close the session. Select "Yes" to send a command to the unit to cancel the new configuration changes and to close the session.

The configuration settings will revert to their previous values if the data communications circuit with the unit has been interrupted after the new changes have been made, but before they have been verified, as just described, then the unit will automatically discard the new changes. A "Timeout Error" message will appear in the event of such an interruption and the programmer will revert back to file mode.

After configuration data has been written the session with the unit is closed and the programmer goes back to file mode

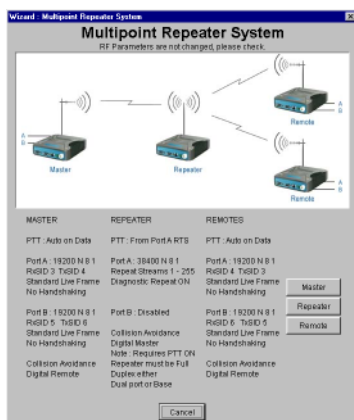
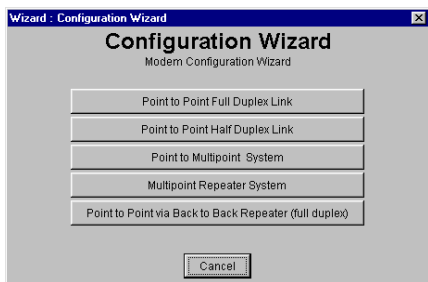
NOTE: In general any change made on the programmer screen must be written to the unit using this function before it becomes permanently stored. Changes to Power Adjust, Mute Adjust and Tx/Rx Trim however do take immediate effect to permit a tuning capability prior to being permanent stored.

Cancel Session (also available on the toolbar)

This function closes the session with unit and puts the programmer back into file mode. All configuration changes are discarded including changes to Power Adjust, Mute Adjust and Tx/Rx Trim.

Wizard (also available on toolbar)

This function permits the user to select standard configurations after the configuration from a unit has been read or a file opened. The user is prompted via a series of dialogue windows to select the desired configuration that can then be written to the unit (remote radio or base station).



Clone Mode

This function permits writing of the same configuration data to several units. This feature is normally used for configuring data radio modems connected locally. The procedure is:

- Read the configuration from the first unit
- Configure the parameters (or Open a previously saved configuration file)
- Select Clone Mode (Modem menu)
- Write the configuration to the first unit
- The changes will take effect when repowered
- Connect the next unit
- Write the next unit which establishes a session and recognises the unit serial number and type, and then configures the unit
- Repower the unit for changes to take effect
- Repeat the last 3 steps for the remaining units.

Settings

This menu permits selection of the PC serial port (COM1 to COM4) to be used for communications with the unit. COM1 is the default selection and if a different port is to be used it must be set before establishing a session by reading the configuration from a unit. Whilst a session is established with a unit this menu can not be accessed.

Help

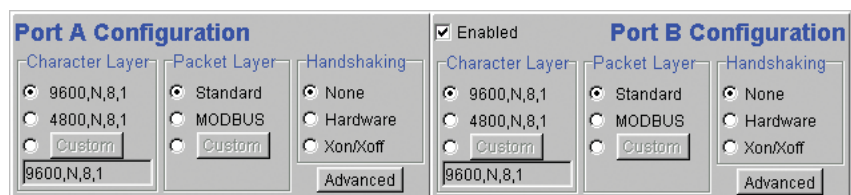
This menu permits selection of help information using the Contents key. Warnings regarding use of the programmer software using the Warnings key and version detail using the About key.

Port A and Port B Configuration

Data from these two user ports is multiplexed for transmission over the air. Each port can be configured separately for the Character layer (Data speed, number of data bits, number of stop bits, parity), Packet layer and Handshaking (flow control). Port B must be enabled if required by setting the check box at the top of its configuration section.

if Port B is off, the 16K memory is split equally between Port A Rx/Tx buffers (ie: 8K & 8 K). If Port B is on, then the 16K is split equally across Port A & B Rx/Tx buffers (ie: 4K, 4K, 4K & 4K).

The following description is common to both ports.

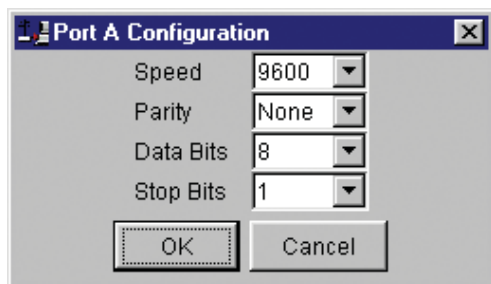


Character Layer

There are two standard formats and a custom format that can be selected by checking the appropriate control button to the left of the description. The standard formats are:

- 9600,N,8,1 (data speed = 9600 bps, no parity, 8 data bits, 1 stop bit)
- 4800,N,8,1 (data speed = 4800 bps, no parity, 8 data bits, 1 stop bit)

A non-standard format can be selected via the Custom button that displays a dialogue box to permit selection of data speed, parity, number of data bits and stop bits. Once selected the OK button should be used to complete the selection. The custom selection is also displayed in the main window below the Custom button.



Packet Layer

There are two standard configurations and a custom configuration which can be selected by checking the appropriate control button to the left of the description. There are essentially two basic modes of operation for the packet assembler and disassembler (PAD). The first is where the PAD operates in a standard mode with data received at the port being immediately sent over the radio channel. The second is a store and forward or delayed mode where whole data packets are received from the port before being sent over the radio channel. In both cases data is sent over the radio channel in variable length frames and delineation of these frames is dependent on the configuration selected as well as the characteristics of the data stream received at the data port.

The packet layer configuration options which can be selected are:

Standard (live framing)

With standard live framing data received from the host by the modem is immediately placed into a frame and transferred onto the radio channel. This avoids placing "store and forward" delays in the data transmission.

If a stream of characters is received by the modem, then several characters at a time may be placed into the same frame. The number of characters in the frame depends mainly on the respective baud rates of the user port and the primary channel baud rate of the modem, as well as the level of overheads experienced on the radio channel and the user data stream.

For example a constant stream of 300 baud user data placed onto a 9600 baud channel will result in 1 character per frame being transmitted. If the user baud rate was lifted to 9600,N,8,1 with a continuous data stream, then the frame size would settle to about 16 characters plus 32 overhead bits. If collision avoidance is enabled as master the average frame size will increase to 32 characters plus overhead bits.

The number of data bits associated with the user data stream will also have an effect on the average size of a frame. For instance the number of stop bits, and number of data bits per character.

The system designer must choose the best compromise of all the above items to ensure the most efficient method of data transmission.

Note: The first character is always packetized and sent by itself regardless of all the above variables.

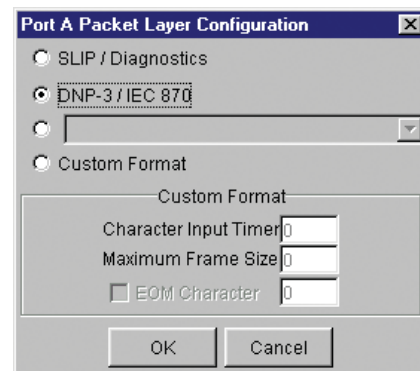
Modbus

This selection configures the PAD driver with options automatically set to implement the MODBUS protocol. eg: 5 mSec timer.

Custom

Other configurations of the PAD driver can be selected via the Custom button which displays a dialogue box to permit selection of several configuration options as follows:

SLIP / DIAGNOSTICS



SLIP is a well known protocol for transferring binary data packets over a data link. Each data packet is delineated by <FEND> characters, and a substitution mechanism exists that allows these characters to be included in the data packet. Appendix B describes the SLIP protocol which is used extensively in UNIX(tm) based systems, and is closely associated with TCP/IP networks.

The diagnostics controller package uses the SLIP protocol to communicate between base station and remote modems.

DNP-3 / IEC870

This selection configures the PAD driver to implement the DNP-3 Protocol and IEC870 Protocol.

Pull Down Menu Selection

The PAD driver can be configured for a number of vendor specific protocols by selecting the desired option.

Custom Format

This selection permits PAD driver to be configured in a variety of ways and requires a greater understanding of the system design.

For the modem to successfully transmit its packets (or frames) of data over the radio channel, it must be told on what basis to delineate data packets received at the data port. Once the end of a data packet has been received at the port the data frame is closed and transmission over the radio channel commences. Delineation of data packets can be configured to occur via any combination of:

- A predefined minimum time delay between packets received at the port. Typically the time delay would reflect the absence of a couple of characters in the data stream at the specified user port baud rate.
- Limiting the maximum number of characters which can be put in the data frame sent over the radio channel.
- Receipt of a selected end of message (EOM) character at the port. An ASCII carriage return (character 13) is often used for this purpose.

As each data frame to be transmitted over the radio channel has overhead data consisting of checksums and SID codes. The system designer must determine the best compromise between the ratio of overhead versus user data which depends on packet size and user data packet transmission latency.

The fields which can be configured are:

- **Character Input timer:** Set the input timer value in ms or enter zero to disable. Range 0 - 255.
- **Maximum Frame Size:** Set the maximum number of characters or enter zero to disable. Range 0 - 4095.
- **EOM Character:** Select the check box to the left of the description to enable and enter the EOM character as a decimal value. Range 0 - 255.

Handshaking

If the standard PAD is selected (i.e. any settings apart from SLIP/Diagnostics), then flow control can be either hardware handshaking, XON/XOFF protocol or none.

The XON/XOFF flow control is not possible when using either the SLIP/Diagnostics protocol.

The Handshaking section of the screen allows the selection of either of the handshaking methods as well as allowing handshaking to be disabled.

Details of the two handshaking methods are given below.

Hardware

The modem acts as Data Communications Equipment (DCE) and supplies to the host controller the following interface signals:

Data Set Ready	(DSR)
Data Carrier Detect	(DCD)
Clear To Send	(CTS)
Receive Data Output	(RXD)

The host controller must act as Data Terminal Equipment (DTE) and supplies to the modem the following interface signals :

Data Terminal Ready	(DTR)
Request To Send	(RTS)
Transmit Data Input	(TXD)

- DCD

DCD has several modes of operation. It is set to TRUE when data is being transferred from the modem to the host - RXD line active. The signal is asserted approximately 500ms before the start bit of the first character in the data stream and remains for approximately 1 character after the last bit in the data stream. The other modes of operation are dependent on the advanced settings.

- DSR

DSR is permanently set to TRUE.

- CTS

The CTS is a signal from the modem to the host informing the host that the modem is able to accept incoming data on the TXD line. It responds to the actions of the RTS line similar to the operation of a "standard" line modem.

The CTS is FALSE if the RTS line is FALSE. Once the RTS line is set to TRUE (signalling that the host wants to send some data to the modem on the TXD line), then the CTS will be set TRUE within 1ms, if the modem is capable of accepting more data.

The CTS line will be set to FALSE if the transmit buffer in the modem exceeds 4075 bytes, or the number of queued frames exceeds 29 to ensure that no overflow condition can occur.

- **RTS**

The RTS line is used for two reasons. The first is to assert the CTS line in response to RTS. The RTS line can also be used to key up the transmitter stage of the modem.

- **DTR**

The DTR line is used for flow control of data being sent from the modem to the host controller. When the host is able to accept data it sets this line to TRUE, and if data is available within the modem, it will be sent to the host. If the host cannot accept any more data, then it sets the DTR to FALSE, and the modem will stop all transmissions to the host.

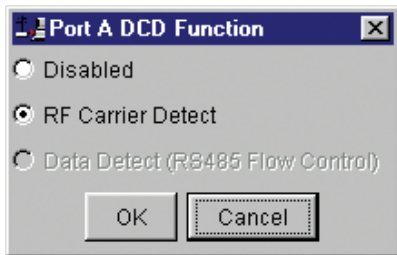
- **Xon/Xoff**

If the flow control mechanism is XON/XOFF then the modem uses the standard ASCII control codes of DC1 {^Q=11(Hex)=17(Dec)} for XON and DC3 {^S=13(Hex)=19(Dec)} for XOFF. The DTR input line is totally ignored.

NOTE: There is no substitution mechanism employed in the XON/XOFF protocol, so care must be taken when transferring binary data to ensure that invalid flow control characters are not generated.

Advanced

This button provides access to the advanced features of the port configuration. When selected a dialogue box appears which permits selection of the source for the port DCD output signal.



Disabled

This selection disables the DCD output on the port. This selection is not permissible if hardware based flow control has been selected.

RF Carrier Detect

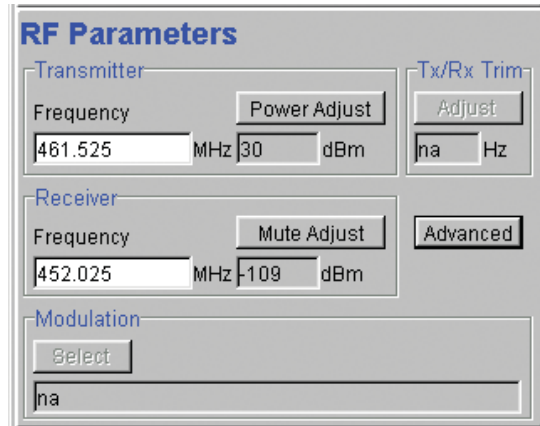
This selection causes DCD to be asserted at the onset of a received RF signal being detected. This will generally occur several milliseconds before data is transmitted from the port.

Data Detect (RS485 Flow Control)

This selection causes DCD to be asserted when data is about to be transmitted from the port. This option is not available if handshaking is set to "None" or "Xon/Xoff".

RF Parameters

This section of the main window permits adjustment of transmitter and receiver, radio channel modulation scheme, frequency trim and advanced features.



Transmitter

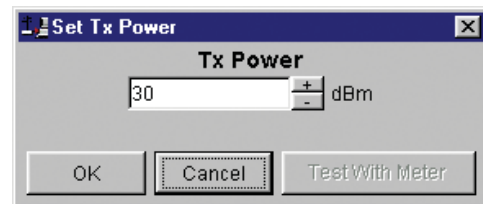
The transmitter can be configured for transmit frequency and power level.

Frequency

The required transmit frequency in MHz can be entered in the display field. The programmer checks that the selected frequency is in the range for the particular model of radio and provides warnings if not.

Power Adjust

The currently selected transmit power is displayed below the button in dBm. The power level can be adjusted by selecting this button which displays a dialogue box. The up/down keys, or a typed in value, can be used to select the required power level in dBm steps. There are two methods for setting the power.



- Using Factory Calibration

To use the factory calibration of the radio the desired power is set immediately using the OK button in the dialogue box. This method permits the transmit power to be set without energising the transmitter. Note that although the transmit power has been adjusted it must be written to NVRAM using the modem "Write" function to ensure it is retained after a power on reset.

- Using a Power Meter

To overcome manufacturing variations in the power setting a more accurate setting of power can be achieved by the selecting the "Test With Meter" button in the dialogue box. This displays another dialogue box warning the user that the transmitter is about to be energised and that the power meter used should be able to handle at least 10 Watts from the modem.

Selecting OK in this warning dialogue box will energise the transmitter which will also be indicated by the red transmit LED on the unit. The power is adjusted using the up/down keys until the required power level is obtained. Selecting OK will retain the power setting and turn the transmitter off. Note that although the transmit power has been adjusted it must be written to NVRAM using the modem "Write" function to ensure it is retained after the modem is rebooted.

Selecting "stop test" will stop and leave you in power adjust box. "Cancel" will stop test and take you back to the main window.

Receiver

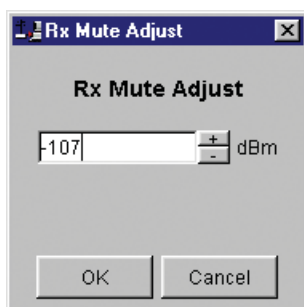
The receiver can be configured for receive frequency and mute level.

Frequency

The required receive frequency in MHz can be entered in the display field. The programmer checks that the selected frequency is in the range for the particular model of radio and provides warnings if not.

Mute Adjust

The currently selected mute level is displayed in the main window below the button in dBm. The mute level can be adjusted by selecting this button which displays a dialogue box. The up/down keys, or a typed in value, can be used to select the required mute level in dBm steps. Whilst a session is in progress with a unit the mute level adjustment is live. Selecting OK will retain the mute level setting. Note that although the mute level has been adjusted it must be written to NVRAM using the modem "Write" function to ensure it is retained after the modem is rebooted.



Whilst the modem is capable of receiving extremely weak radio signals, and successfully extracting the data content from the waveforms the mute level should be set to assist the modem in filtering out unwanted signals. Unwanted signals can be the result of background noise or interference. The mute level should be set at a level above these unwanted signals and at a level low enough to detect the wanted signal. Detection of a received signal above the mute level is indicated by the "RxSig" LED on the unit.

Setting of a correct mute level at a base station is critical if collision avoidance is operational in a point to multipoint system. In this situation detection of "noise" instead of a valid transmission from the remote modems will effectively "lock out" all of the remote units from accessing and using the channel.

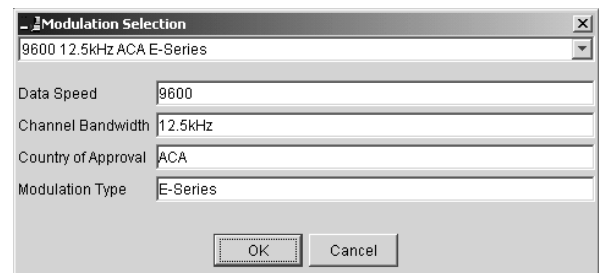
Due to normal manufacturing variations the actual mute level may vary by several dBm to that selected. If a more accurate adjustment is required an unmodulated signal of the correct frequency and desired threshold level can be applied to the radio modem's antenna connector.

Modulation

The radio modem utilises a DSP to control the modulation of transmit signals and de-modulation of received signals. This provides greater flexibility in the ability of the radio modem to support new modulation schemes whilst maintaining compatibility with existing modulation schemes.

The currently selected modulation scheme is displayed in the main window below the select button. The modulation scheme can be adjusted by selecting this button which displays a dialogue box. The desired modulation scheme can then be selected from the pull-down menu in the dialogue box and retained using the OK button.

In the case of 12.5kHz channel radio modems the presently supported



modulation schemes include:

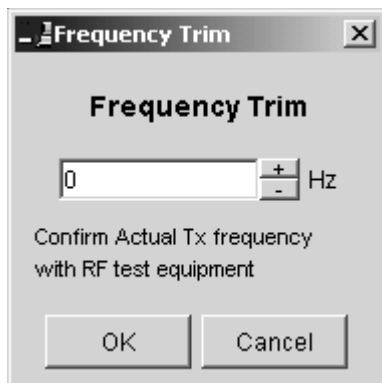
- 9600 12.5kHz ACA E Series. This is a new 9600bps modulation scheme available in E Series products which supports a significantly reduced delay between detection of a valid RF carrier signal and demodulation of user data.
- 4800 12.5kHz ACA D Series. This is a current 4800bps modulation scheme used in the D Series products to provide backward compatibility.

In the case of 25kHz channel radio modems the presently supported modulation schemes include:

- 19200 25kHz ACA E Series. This is a new 19200bps modulation scheme available in E-Series products which supports a significantly reduced delay between detection of a valid RF carrier signal and demodulation of user data.
- 9600 25kHz ACA D Series. This is a current 9600bps modulation scheme used in the D Series products to provide backward compatibility.

Tx/Rx (Frequency) Trim

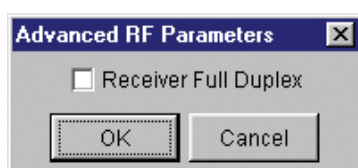
The currently selected frequency trim, which is common to both transmitter and receiver, is displayed in the main window below the button in Hz. The frequency trim can be adjusted live by selecting this button which displays a dialogue box. The up/down keys can be used to select the required frequency offset in steps pre-determined by the radio modem. Selecting OK will retain the frequency trim setting. Note that although the frequency trim has been adjusted it must be written to NVRAM using the modem "Write" function to ensure it is retained after the modem is rebooted.



This facility permits correction for drifts in the frequency reference caused by component ageing. For example, a standard crystal may vary in fundamental frequency operation over 1 year by one part per million. An adjustment range of ± 10 ppm, displayed in Hz, has been allowed for and if this is insufficient the unit should be returned to the dealer/factory for re-calibration.

Advanced

This button permits setting of advanced features. When selected a dialogue box appears which permits configuration of the type of received data clock alignment method.



In the case of full duplex units the receiver is always active and is not interrupted by transmissions from the unit as would be the case for half duplex units. In this situation it is not necessary, or desirable in the case of a base station, for the recovered data clock alignment to be remembered between bursts of received signals. In this situation the "Receiver Full Duplex" check box to the left should be selected.

NOTE: For half duplex units the "Receiver Full Duplex" check box should not be set.

System Parameters

This section of the main window configures the PTT control, collision avoidance, stream setup for routing of data, advanced features and provides unit information.

PTT (Press To Talk) Control

RF transmission can be configured to occur permanently, automatically on data received at Port A or Port B, or RTS being asserted on Port A or Port B. A PTT timeout facility can be configured to limit the period for which the transmitter is enabled. Each option is selected by setting the control to the left of the description on the main window. When PTT is active the "Tx" LED on the unit is illuminated and RF power is being fed to the antenna.

Permanent Tx

This will cause the transmitter to be permanently enabled (keyed) and displays another dialogue box warning the user that the transmitter will be energised immediately after the configuration is written to the unit. Selecting OK confirms this setting. The other PTT selections are disabled when this option is selected.

NOTE: This option is only available for half duplex units when being programmed locally.

Auto On Data

This will cause the transmitter to be enabled (keyed) automatically on data received at Port A or Port B and included in a complete frame for transmission over the radio channel. The maximum period for which the transmitter will be enabled is limited by the PTT timeout setting.

From Port A RTS

This will cause the transmitter to be enabled (keyed) on Port A RTS being asserted. The maximum period for which the transmitter will be enabled is limited by the PTT timeout setting. Applications which rely on establishing a link ahead of data being transferred require this method of activation.

From Port B RTS

This will cause the transmitter to be enabled (keyed) on Port B RTS being asserted. The maximum period for which the transmitter will be enabled is limited by the PTT timeout setting. Applications which rely on establishing a link ahead of data being transferred require this method of activation.

PTT Timeout

The PTT timeout facility is used to disable the transmitter if it exceeds the designated time. The timeout value can range from 1 to 255 seconds and the facility is disabled by setting a zero value.

The timeout value chosen for this should be set according to system requirements which may include:

- Prevention of a remote unit remaining keyed up and locking out all other remote units in a point to multipoint system.
- Limiting the period a remote unit remains keyed up to prevent battery drain in a low power application.

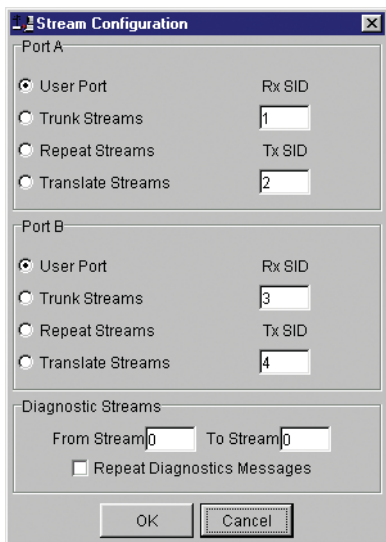
NOTE: If a PTT timeout occurs before completion of a data transmission data will be lost.

Stream Setup

This button brings up a dialogue box to permit editing of Stream Identifier (SID) codes which are used by the modem as the addressing mechanism for data stream routing. A SID code can be placed at the start of each data frame as it is sent over the radio channel. The receiving modems use this code to determine how to route the data message. The modem supports simultaneous operation of both Port "A" and Port "B" over the one radio link, along with the inclusion of a diagnostics data stream.

Each port is independent and fully supports one of four options which can be chosen as described below. Note that the port B parameters are greyed out when port B is not enabled.

The following diagram illustrates the structure of the stream routing function for each data port.



User Port

This option is selected by clicking on the User Port button and filling in the RXSID and TXSID fields to the right.

In the User Port mode (Referred to in the previous programmer as MUX/DEMUX mode) all SID code operations are performed transparently to the user. Data placed into a user port which has been assigned a specified SID code, will only be received by a modem at the other end of the radio link that has a user port assigned with the same SID code.

In this way, Port "A" and Port "B" can be assigned different SID codes, thereby separating the data streams.

Two SID codes values are available for each user port RXSID and TXSID. The RXSID codes apply to the data being received by the modem, and the TXSID codes apply to the data being transmitted by the modem. This allows for different transmit and receive codes if required, but generally they would be both the same.

A situation where Tx and Rx SID codes may be different is in a repeater configuration. In this type of application all data messages sent to the repeater will be "repeated". Thus by having different Tx and Rx codes a control unit will not "hear" its own transmission and remotes will not hear the reply from any other remote.

If the diagnostics facility is installed in the modem, then it too has a pair SID codes. The diagnostics data simply uses a different data stream or streams to the user data, but is processed internally by the modem. If access to the diagnostics facility is required, similar to when the diagnostics utility is used with the modem, then the data port concerned and the diagnostics stream, must have the same SID codes assigned to them. Alternatively the System port can be used, which is 19.2K, Slip.

(Previously TXSID was referred to as SIDA2 or SIDB2 and RXSID was referred to as SIDA1 or SIDB1 for ports A and B respectively).

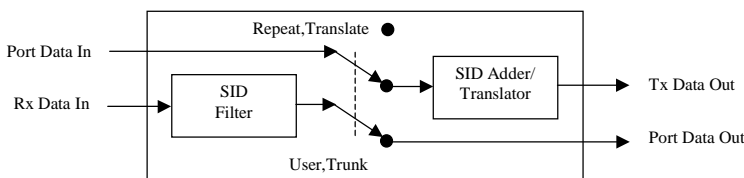
Trunk Streams

In the Trunk Streams mode, data that is inputted into the modem for transmission must have a SID code appended to the start of the data packet by the user. The modem does not do it as in the User Port mode of operation. When a data packet is received by the modem, it is passed through a SID code filter which is bounded by a lower and upper limit of SID codes. The SID code is *not stripped off* from the user data.

For instance the lower bound is 03 and the upper bound is 07. If a message is received with a SID code of 02 appended it would not be passed to the user. If a message is received with a SID code of 04 then it is passed to the user, with 04 at the start of the frame.

The SID codes can range from 0 to 255, and physically consist of the byte value of the code i.e. a code of 156 is equivalent to "10011100" binary.

Stream Router



To select the Trunk Streams option click on the Trunk Streams button of the port to be used and fill in the fields to the right. The “From” field is for the lower SID code limit and the “To” field for the upper SID code limit.

NOTE: When using Trunk Streams an unambiguous packet delineation scheme (eg. SLIP) should be used so that the SID code in the user data can be decoded correctly.

Repeat Streams

The modem is capable of operating in a repeater mode. Each user port can be configured as a separate repeater. The associated user ports are effectively disconnected from the “outside world” when in repeater mode. Data received from the radio channel is passed directly to the transmitter, and placed back onto the radio channel.

The repeater must receive a complete frame of data before it is retransmitted. In some systems this store and forward delay may be significant, and careful selection of maximum frame sizes configured at the source unit must be considered to minimise the delay.

To enable the mode for the port click the Repeat Streams button and select the range of SID codes on frames to be repeated.

Translate Streams

This is essentially a hybrid of the User Port and Repeat Streams functions available on a port. Whereas the latter repeats a range of streams, this function instead translates one stream to another, by demultiplexing one stream (defined by Rx SID), and re-transmitting it with a new stream address (defined by Tx SID).

NOTE: Data is not presented to the user ports.

Diagnostics Processor

The Diagnostics Processor uses several streams defined by the range of SID codes. The diagnostics commands received on each stream are sent back over the same stream. The Diagnostics Processor is an option which must be enabled before this section of the menu will become active.

Diagnostics Repeat

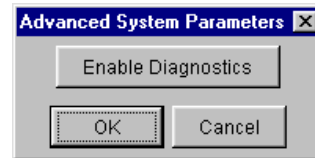
This option can be toggled on and off simply by clicking the button.

Some applications will require that the master unit in a point to multipoint system to repeat diagnostics frames only (i.e. the master modem is *not* set up as a repeater).

This will be the case when the system diagnostics controller is connected to a remote unit in the system, and it polls the system population from this point. The master unit must retransmit any diagnostic frames that are not addressed to itself onto the remainder of the population.

Advanced

This button permits setting of advanced system parameter features. This presently includes enabling the diagnostics facility within the unit. Once enabled the diagnostics utility can be used to monitor the performance of the unit.



The Enable Diagnostics button should be selected and the 8 character diagnostics key code entered prior to selecting OK. If the key code is accepted or has been previously entered the Enable Diagnostics button will be greyed out. Contact your supplier for Key Code purchase.

Collision Avoidance

In a point to multipoint system the master unit (usually a base station) can transmit at any time and the remotes will all receive the broadcast signal. However, if more than one remote unit transmits at a time, then a collision will occur during the multiple transmissions, resulting in a loss of data from one or more units.

Two collision avoidance mechanisms have been included in the modem. The standard (Digital) method utilises a signalling channel which is embedded in overhead data transmitted over the radio channel. The second method utilises detection of a carrier signal to postpone transmission of data. Both methods require configuration of several options for successful operation.

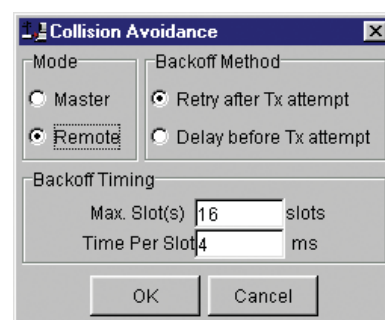
The desired option for collision avoidance is selected by checking the control button to the left of the description on the main window.

None

When selected this turns off all collision avoidance mechanisms. This should only be used in point to point applications.

Digital

This is the standard method of collision avoidance and utilises a channel busy indication bit in the signalling channel transmitted to all remotes for control. When selected a dialogue box appears and several options must be configured:

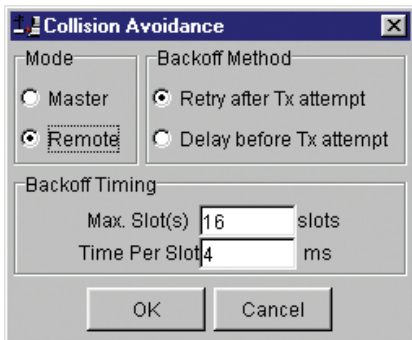


- Mode – “Master” or “Remote”. When the master unit receives a valid transmission from a remote unit it sets the channel busy indication bit. This busy bit is interpreted by the other remotes to not transmit. Once the transmission from the first remote ends the master unit resets the busy bit to indicate the channel is now clear to transmit on. The master unit, which is normally a base station, takes about 5ms to detect a transmission from a remote unit and set the channel busy indication bit on the radio channel. During this period collision of remote transmissions can still occur and is unavoidable. NOTE: The master can only be a full duplex unit.
- Backoff Method – “Retry after Tx Attempt” or “Delay before Tx Attempt”. The method chosen is system dependent and can only be configured if the mode is “remote”. The former is best used when data responses from remotes are largely asynchronous. The latter is best used when this is not the case.
- Backoff Timing – “Maximum Slots”, “Time per Slot”. This can only be configured if the mode is “remote”. When a remote is ready to transmit data but it finds the busy bit from the master set it holds back its transmission for a random “backoff” time after which it tries to transmit data again. This ensures that modems waiting to be allowed to transmit do not re-attempt to do so at the same time. The “Maximum Slots” (1 to 16) and the “Time per Slot” (1 to 255ms) are used to calculate the backoff time by multiplying the slot time by a random number between 1 and the maximum slot number. For example if the time per slot is 30ms and the maximum slots is 4, the random backoff times can be 30, 60, 90 or 120ms.

As the channel busy indication bit is critical for reliable operation default interpretation of this bit is defined in the remote units. If the master modem stops transmission (or has not yet started) the remote will interpret that the channel is busy and will not transmit until the master comes on line.

Carrier Detect

This method of collision avoidance utilises a carrier transmitted to all remotes to indicate that the radio channel is busy. When selected a dialogue box appears and several options must be configured:

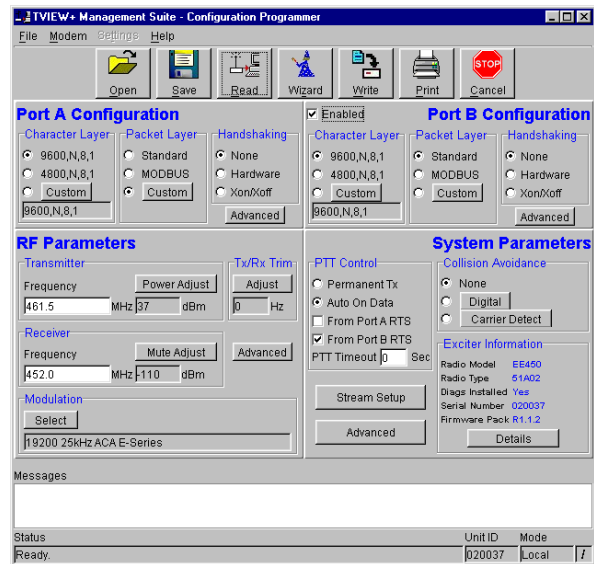


- Mode – “Master” or “Remote”. When the master unit receives a valid transmission from a remote unit it transmits a carrier signal to indicate busy. Of course the master will also initiate a transmission if it has data to send. The transmitted carrier is interpreted by the other remotes to not transmit. Once the transmission from the first remote ends the master unit stops transmission to indicate the channel is now clear to transmit on. The master unit, which is normally a base station, takes about 5ms to detect a transmission from a remote unit and transmit a carrier signal. During this period collision of remote transmissions can still occur and is unavoidable.

NOTE: The master can only be a full duplex unit and cannot be permanently transmitting. For half duplex and simplex systems all units should be set as “Remote” (no Master).

- Backoff Timing – “Maximum Slots”, “Time per Slot”. This can only be configured if the mode is “remote”. When a remote is ready to transmit data but it detects a carrier signal from the master set it holds back its transmission for a random “backoff” time after which it tries to transmit data again. This ensures that modems waiting to be allowed to transmit do not re-attempt to do so at the same time. The “Maximum Slots” (1 to 16) and the “Time per Slot” (1 to 255ms) are used to calculate the backoff time by multiplying the slot time by a random number between 1 and the maximum slot number. For example if the time per slot is 30ms and the maximum slots is 4, the random backoff times can be 30, 60, 90 or 120ms.

Unit Information



The information displayed is intended to assist the user to identify the radio modem as well as support should their services be needed.

Radio Model refers to the type of unit. The ER450 is a remote unit and the EE450 is an exciter inside a base station unit.

Radio Type refers to the frequency band supported by the radio as well as the channel bandwidth. For example 51A02 is a type 51 band with a 25kHz channel.

Diags Installed is set to yes or no depending on whether the diagnostics key has been set in the unit.

Serial Number is unique to each unit and is set within the unit at time of production as well as included on the label fixed to the unit.

Firmware Pack refers to the firmware package version installed in the radio. There are several components associated with microcontroller and DSP firmware installed and a single version number is used to identify them.



Unit Information - Details

More detailed information is also available to assist in identifying components installed in the unit (remote, base station or hot standby).

The additional information provided is:

- Controller Rev refers to the microcontroller firmware component version for the radio.
- DSP Code Rev refers to the DSP firmware component version for the radio.
- Processor Board ID refers to the processor board identification number and hardware revision information for the radio.
- RF Deck ID refers to the RF deck board identification number and hardware revision information inside the radio.
- Production Build Code refers to the automated production test and calibration sequence used during manufacture of the radio.
- Hardware indicates whether the radio is half or full duplex.
- Unit Type indicates whether the unit is recognised as a remote or base station.

In the case of a base station unit the following additional information is provided:

- Base Firmware Pack refers to the firmware package version installed in the base station (front panel) controller which is separate to the radio installed. There are several components associated with this firmware package and a single version number is used to identify them.
- Base Controller Rev refers to the microcontroller firmware component version for the base station.

Messages

The message window provides a log of error messages occurring during use of the programmer utility. Several error messages may occur as a result of a selection.

Status Bar

The status bar is located at the bottom of the main window and provides information regarding communication actions occurring with the radio data modem.

Additional fields located on the status bar include:

- Unit ID refers to the identification label used by the diagnostics utility. This is currently the same as the unit's serial number.
- Mode refers to the type of session established. It can be a File, Local indicating a local port connection to the unit or Remote indicating communications is via a radio channel.
- Rotating bar progress indicator showing data is being transferred to or received from a unit.

Part J – TVIEW+ Management Suite - Remote Diagnostics & Network Controller

Introduction

This section covers the operation of the *Remote Diagnostic and Network Management Controller* Software Version 3.7.X or greater.

Overview

The Diagnostic Controller is a Windows® based program, that can be run on a standard desktop or laptop PC.

The software runs in the 32 bit Windows environment and offers many options and configurations which are easily accessible via pop-up windows. These include group or timed polling, remote switching of duplicated base stations, viewing of databases, logging and trending of real time parameters, etc.

The Diagnostic Controller can be installed to run as a stand-alone package, or as part of the TView+ Management Suite.

It is for use in conjunction with the D & E Series of data radio modems and can be used for simple point-to-point links, or for more complex point-to-multipoint and multilayer link systems.

The diagnostic facilities allow retrieval of packet statistics from each radio modem. These statistics are used to calculate Packet and Bit Error Rates, a units' condition/health, network efficiency and bandwidth utilisation.

The use of the diagnostics facilities provided by the controller gives the radio modem system designer and operator a powerful tool for both the maintenance and continuing reliability of their system.

The general operating parameters that can be obtained from remote modem units are:-

- Last RSSI level.
- Last transmitted power level.
- Receive frequency offset.
- Power supply voltage level.
- Current internal temperature.

These are displayed on the controllers screen in a "quick read" format of bar graphs, as well as detailed response listings.

For the E Series radio modems to operate with the diagnostic controller, they must be factory preset to include the diagnostics response facilities or installed at a later stage (in the field) via the programmer. Contact your supply for details.

The diagnostics data stream operates "alongside" the main user data stream. No interference between the two streams occurs, so as far as the primary user of the data system is concerned, the diagnostics data does not exist.

Features

- 32 Bit Windows Based User Software.
- Full graphical presentation.
- Full SCADA style features such as database, trending, networking, etc.
- Able to interrogate and display important operating parameters of each radio modem.
- Provides performance data of any unit - good frames received, bad frames received, packet error rate, transmitted packet sizes, channel usage, etc.
- Provides statistical Packet Error Rate (PER) performance calculations for any unit.
- Provides powerful network tools such as channel occupancy statistics, average received transmission duration, etc.
- Can be set to background poll radio system for continuous system monitoring and logging.
- Provides full time/date stamped Status and Alarm logging/reporting. A relational database is created and managed using Microsoft Jet database engine Ver3.5. The database file, which is an ".mdb" file, can be accessed with external programs such as Microsoft Access.

System Description

General

The diagnostics process is based on a series of polls being transmitted to the remote modem units with each modem having its own unique assigned address which is factory preset.

When a diagnostic poll is received by a modem it checks to see if it is addressed to itself, and if so, it responds with its diagnostic data back to the controller. If it is not addressed to the modem, the modem simply "passes the message on", and does not respond to the controller.

In a multilayer system, several "pass on's" may occur before the destination modem is reached.

The modem's diagnostic response message is addressed to the controller, and as each modem in the "chain" decodes this message it will "pass it back", eventually the message reaches the controller for processing.

The controller software provides a database to hold the modem units associated data (i.e. Serial number, assigned name, location, alarm limits, SID code address, base station pairing information, status poll response data, alarms, etc).

The units' address is the serial number of the unit which is factory preset. The name is any mnemonic that the user wishes to attach to the modem. This name is then used to address the unit for access to diagnostic facilities.

The responses from the modem have boundary limits placed on them. If a response is outside these limits then an alarm is raised. For instance, the DC supply volts can have a lower limit of 12V, and an upper limit of 16V. Should a response to a poll received show that the DC volts is at 11V, then an alarm is reported.

A unit can be excluded from a poll sequence by removing it from the poll group.

Intensive polling of a single unit is possible using the Individual polling facility.

A poll "run" can be set up. A time can be designated for the controller to poll each of the modems in the system. This may be useful for systems that have a low traffic period where diagnostics can be "slotted in", thereby spreading the data throughput of the system more efficiently.

The screen is divided into three main scrolling sections - Status Polls, Alarms and Base Station Activities. The status poll section displays current poll activity while the alarm section displays any polls alarms which have been reported. The Base Station activity section displays any changeovers that have occurred to Hot Standby Base Units - if no Hot Standby Base Stations are employed within the system, this section will remain blank.

If base stations are employed in the system, then the two exciter units contained in one base unit can be paired together. The exciters operate in a mutually exclusive environment i.e. only one is active at a time. When the exciters are to be polled, only the active one will be sent a poll.

The base exciters can be toggled, so as the other exciter unit in the base can be polled if required.

A relational database is created and managed using Microsoft Jet database engine Ver3.5. The database file, which is an ".mdb" file, can be accessed with external programs such as Microsoft Access. All polls and alarms are time and date stamped and saved to the database. All database entries can be sorted and printed.

For some multilayer systems, Stream Identifier (SID) Codes may have to be added to the diagnostic data packets. Each modem can be assigned a SID address (the default is 00) and the SID code feature enabled.

Refer to Appendix A "Technical Notes" for further details of SID code addressing.

The diagnostic core of each radio (Firmware Version 2.4.0 and above) stores packet statistics for later retrieval. The Diagnostic controller software uses these statistics to calculate packet and bit error rates, network efficiency, bandwidth utilisation, and radio link integrity. These network analysis features are an invaluable tool for larger networks.

In the transmit direction, each radio modem can report the number of:-

- data bytes transmitted (TxByteCnt).
- frames transmitted (TxFrameCnt).

With these counters one can then calculate average frame size, average frame rate and channel utilisation.

In the receive direction, each radio modem can report the:-

- Data bytes received (GoodByteCnt).
- Good frames received (GoodFrameCnt).
- Bad frames received (BadFramCnt).
- Total time the radio has received signal (RSSIgoodTicker).
- Lost synchronization count (LostSynchCnt).
- Lost RSSI count (LostRSSICnt).

These counters can be used to calculate average frame size, average frame rate, channel occupancy, channel utilisation and link integrity.

Radio modems with Firmware Revisions 2.4.x and above have the advanced statistical counters as noted above. Firmware revisions below this (i.e. 2.3.x) only have Good Frame count, Bad Frame count, Lost RSSI count and Lost Synch Count available. The diagnostic controller will detect which firmware the radio has, and only report the available counters.

All these features combine to provide a powerful tool for the system operator.

Modem Connection

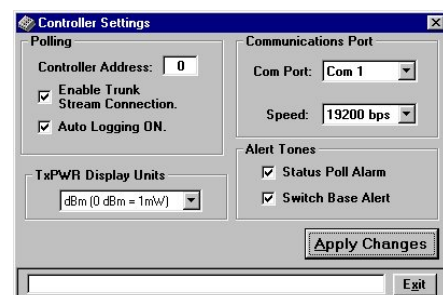
The diagnostics controller normally connects via a COM port on the controller PC and the "System Port" on the radio modem (Port "A & B" can be used if required).

NOTE: The controller can connect to any port of any data radio modem within the system as long as the data radio port is configured accordingly. When "Settings" is selected, the controller will interrogate the computers coms ports and display the available ports. Possible valid com ports are 1-16 or "None". Choose the desired port. None allows you to free the com port for use with other programs without exiting the diagnostic.

The modem port must have its SID codes enabled, and have the SID code set to the system diags SID (normally this is set to "00").

The data format used is the SLIP protocol, running at 9600 baud, No parity, 8 data bits and 1 stop bit. Appendix B "SLIP Protocol" contains a detailed definition of the SLIP Protocol.

COM1 of the controller PC is to be directly connected to the 9 way D-Min of the modem using a 3 wire interface (see drawing below). Should the PC have a 25 way connector, then the standard RS232, 25 way to 9 way conversion should be used.



Operating Instructions

General

When the Diagnostic controller starts, a presentation screen is displayed which will then lead you into the main diagnostics screen. This is where all the major functions of the controller are accessed.

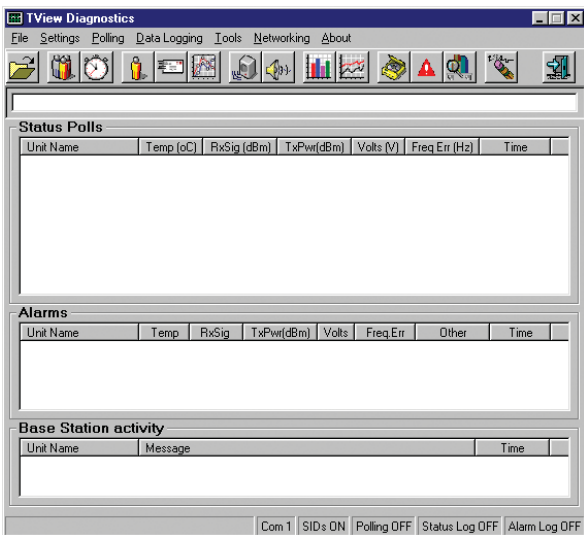
The main screen presents the operator with the typical Windows pull down type menu bars - "File", "Settings", etc. Icons of the most commonly used selections are also provided across the top of the screen.

This screen is divided into 3 main sections:-

1. **Status Polls** screen which displays all poll results obtained.
2. **Alarms** screen which displays any alarms that occur.
3. **Base Station Activity** screen which displays any changeovers that occur with Hot Standby Base Stations within the system.

The line above Status Polls is a "Processing Status Bar". It will display messages about errors, warnings and poll processing.

The bottom row of the screen also displays a summary of the configured parameters such as which com port is being used, whether SID codes are on or off, whether polling is enabled or disabled, current database path and file name, etc.

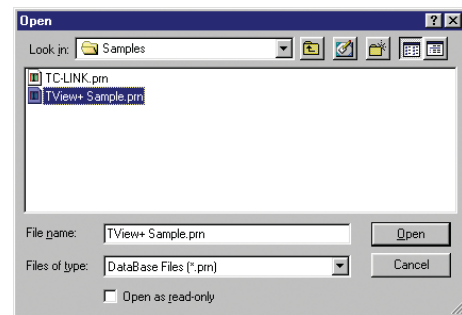


Menu Selection

File Menu

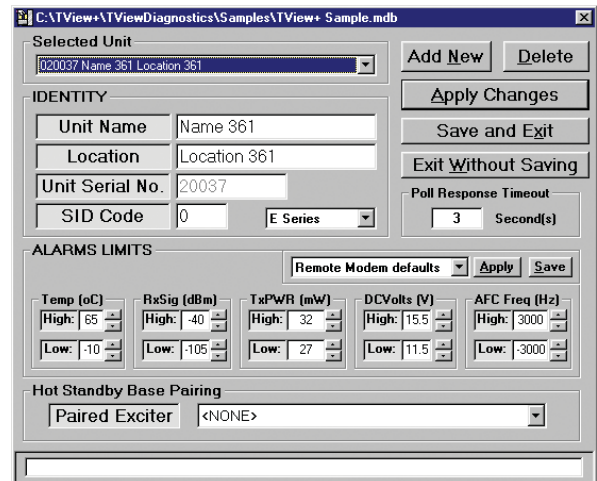
To utilise the Remote Diagnostics facilities, a database must be created which includes the individual serial numbers, alarm parameters and various other parameters of each unit.

The file menu allows the operator to create a **New** database, **Open** an existing database, **Add/Edit/Delete** a database or **View** an existing database. All such database tools utilise standard Windows type formats for file selections as shown.



File - Add/Edit/Delete

After creating a New database or Opening an existing database, the Add/Edit/Delete menu can be accessed.



Selected Unit

Selected unit is a pull down selection box, for selecting a unit to view or edit.

The bottom line is a "Processing Status Bar". It will display messages about errors, warnings and poll processing.

Unit Name and Location

Unit name is required and must be unique(max. 20 character).

Location allows the user to enter descriptions of sites and their locations (optional, (max. 20 character).

Unit Serial Number

Is the factory preset unique serial number of the unit. This is obtained from the label located on the unit or read from the unit using the Programmer. On base stations the exciter serial numbers must be read from the lid label or electronically with the programmer.

SID Code (Diagnostic Stream Identifier)

Is the SID code address number being used by the unit for the diagnostics stream. This is normally set to 0. Check the radio units programmed configuration for confirmation and or system configuration.

Unit Series

Default to "E Series", option on pull down box to select "D Series"

Poll Response Timeout

Is the time in seconds the Diagnostic controller will wait for a response from the remote unit. When a time out occurs, the controller will retry. If three poll attempts fail then the poll request is terminated, and a No Acknowledge (No Ack) message will appear in the alarms window. One second is usually more than enough "wait" time. In a multilayer system, longer response times may be necessary.

Alarm Limits

Allows the user to set thresholds for each unit which, when exceeded, will report an alarm. Default settings are provided for remote devices and base stations. These are selected by clicking on the appropriate buttons presented.

If the controller receives a status poll parameter result which is outside any of the threshold settings, it will immediately retry, in case it was an erroneous measurement. If the next received poll result is still outside the threshold, the retries will continue until it has received a status poll within the threshold settings, or three status polls. If three polls outside the required threshold are received, the average of these polls is displayed in the status poll window and the offending parameter(s) appear as alarms in the Alarms window.

Defaults drop down box

Choose either "Remote Modem Defaults" or "Base Modem Defaults" from the drop down list. Click "Apply" to set the alarm limits to the selected defaults. Click "Save" to save custom default values.

Hot Standby Base Pairing

Is used when a Hot Standby Base is employed within the system. The two exciters contained in each base unit need to be "paired" together. Since only one of the exciter-modems can be active (on-line) at any time, only one can answer a poll. Thus the two should be paired together so they are treated as mutually exclusive.

This selection allows the user to pair the two radio modems, by selecting the other exciter with which the currently selected exciter is to be paired with. The two units must of course exist in the database as independent serial numbers before they can be paired.

Add New Button

Click this button to add a new radio modem to the database. The Selected Unit, Name, Location, Unit Serial numbers and Hot Standby Base Pairing fields will be cleared, ready for the entry of a new unit. After filling in the details click the "Apply" button to complete entry.

Apply Button

Applies changes to selected units or complete the "add new" radios to the data base. Additions and changes made on the screen do not result in changes to the database unless this button is activated. This must be done before selecting a new serial number/unit. Note that the newly changed database will not be saved to disk until the Save and Exit button is activated.

Delete Button

Allows deletion of units from the database. NOTE: Deleting a unit from the database will delete all it's associated status poll and alarm history.

Click and a selection list of serial numbers will appear. Select one at a time and then press the "Delete" button on the selection box.

Save and Exit Button

Press this button to save the newly changed database and then exit. Additions and changes to the database will be saved to disk as long as the "Apply" button was pushed.

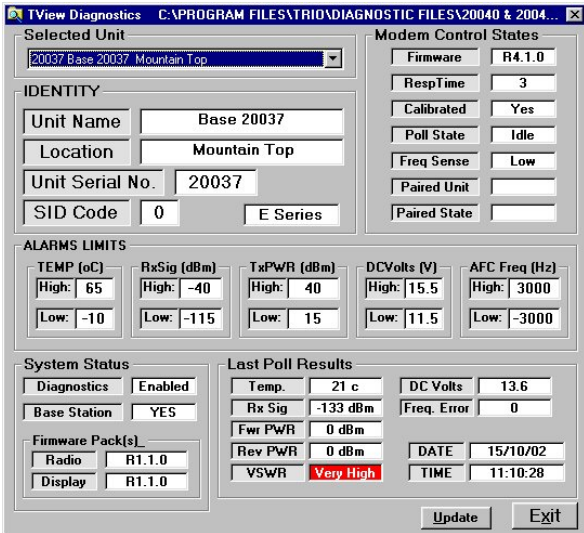
Exit without Saving Button

Press this button to exit without saving the newly changed database.

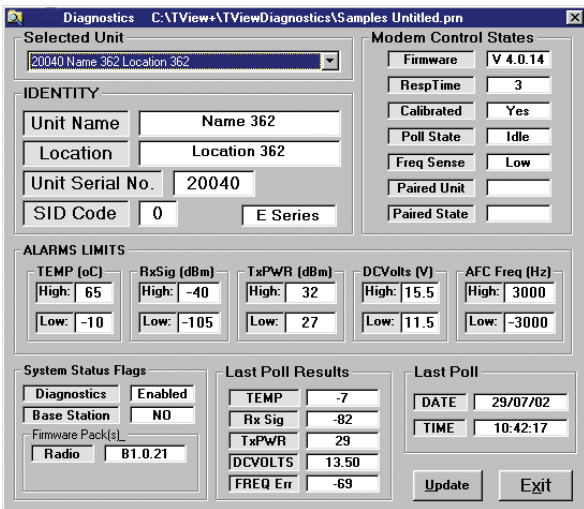
File - View (view only)

The View Screen shows the unit alarm limits, current control states, calibration constants, last poll results for firmware and system information.

Note: The View window is different for Remote radios and Base Stations as well as for D Series.



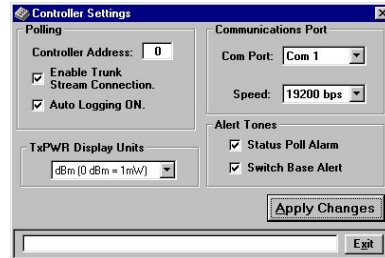
Base Station - E Series



Remote Radio - E Series

Settings

The settings menu allows the user to configure various setup parameters. These include:-



Communications Port

With the pull down box, select the required communications port. Com 1 to Com 16. Select the required com port speed (9k6 or 19k2bps). Default is 19k2bps.

Controller Address

Normally set to 0. Networks which have multiple controllers active, should use different controller addresses, so responses from remotes are ignored if the poll was not sent by that controller.

Enable SID Codes

Enabled or disabled (Default enabled). In some systems, external application of SID codes is used as a method of giving the modems in the system specific data addresses. The modems are placed into the "stream routing" mode, and the user (e.g. Diagnostic controller) supplies the SID code at the start of each data packet to be transmitted. In this way the user can "steer" the data flow through the given network path.

Should the diagnostics controller be used in such a network then it too needs to append the data addresses or SID codes to the beginning of all data messages sent.

In the controllers database record for each modem, a field is supplied where the user can select the SID code for that particular modem. By selecting the Diagnostic SID code that suits the system topology, the diagnostics data messages can be routed successfully to the correct destination.

Auto Logging ON

When enabled all logging functions will be activated when polling is turned on.

Alert Tones

When enabled will emit a tone from the PC speaker or sound card when Status poll alarms occur and/or Base Station change overs occur.

Tx Power Display Units

Select either "dBm" or "milli Watts" as the display units. Power will be displayed throughout the system in the selected power measurement unit.

Note: Power will always be stored in the database file as milli-watts

Polling

In order to obtain diagnostics information, the diagnostics controller provides a number of automatic polling facilities, which include: Group polling, Timed polling and Individual polling. The Group and Timed poll facilities will automatically cycle through a selected group of units at a predetermined interval (in seconds). The Individual poll facility permits intensive polling of a single unit at a selectable rate, independent of any Group polling that may be active at the time.

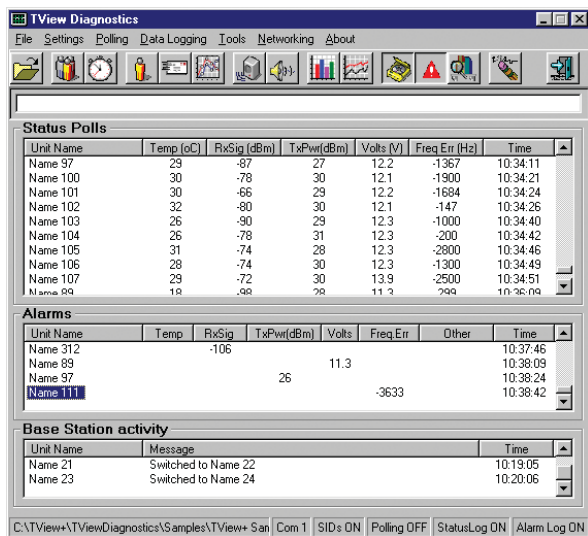
When the modem is polled for the first time, the controller will poll (ask) the radio for its calibration constants and firmware revision (these can be viewed in the “View” window under the File menu). When this initialisation procedure is complete, status polling can commence. If the radio were to perform a “cold boot” for what ever reason (eg loss of power, cold boot command received, etc), the controller will detect this and initiate the above initialisation procedure again and display “cold boot” alarm in “other”.

If Hot-Standby base stations are employed in the system, then only the “on-line” unit will be polled. If a hot standby changeover occurs at the base, then the new “on-line” modem will be polled and the off-line unit removed from the poll sequence. A “Changeover” alarm will be displayed in the Base Station Activity screen.

The status poll requests that are reported and displayed on the main screen are;

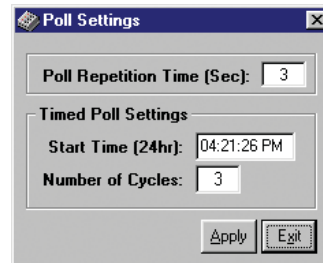
- Temperature
- Received Signal Strength
- Transmitter Power
- DC Supply Volts
- Received Frequency Error
- Time and dat stamped

The line above Status Polls is a “Processing Status Bar”. It will display messages about errors, warnings and poll processing.



Poll Setup (Settings)

Under the Polling menu option, choose “Setup...” The Poll Settings dialog box will appear. Here you can set :



Poll Repetition Time

Is the time in seconds (2 to 3600 secs) between each status poll of the group poll cycle. Each unit in the poll group will be polled in turn, at this time interval.

Timed Polling

Allows the user to schedule a period when the group poll will commence. This is a useful feature for systems that have times of little traffic loading such as the early hours of the morning.

Start Time

Time at which the Timed poll cycle will commence. The time format will be as per the regional settings.

Number of Cycles

This is the number of times the controller will cycle through the poll group when the Timed Group poll commences. Each unit in the poll group will be polled this number of times.

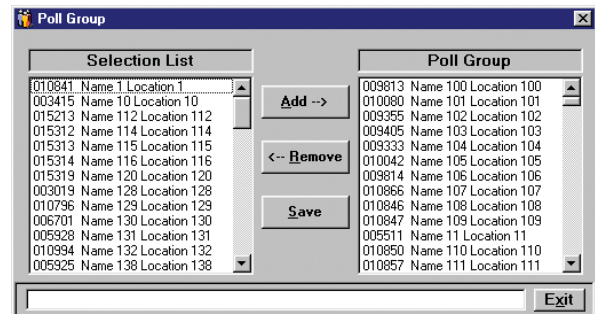
Apply Button

Click “Apply” to initiate any changes made in this dialog box.

Poll Group Select

Under the Polling menu, select “Poll Group Select...”

This dialog box enables Adding/Removing of radios to/from the automatic poll group. Units in the Selection list box are available for adding to the poll group. These units will not be polled during a group poll cycle.



Units in the Poll Group list box will be polled during a group poll cycle.

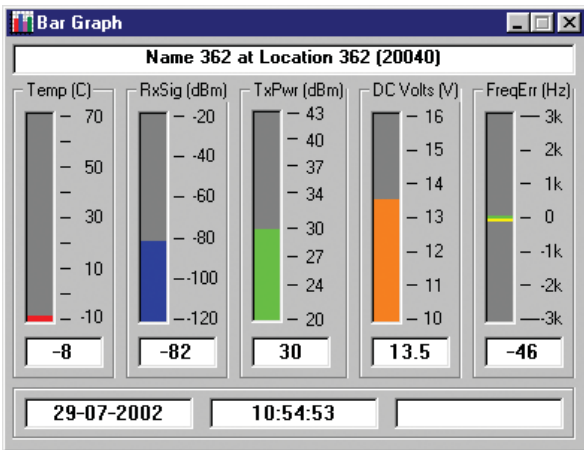
Clicking the Save button will save any changes in the poll group to the database.

Group Polling

This is the standard mode of operation. The diagnostic controller will continuously cycle through the poll group, unit by unit at the poll repetition time (2 to 3600 secs).

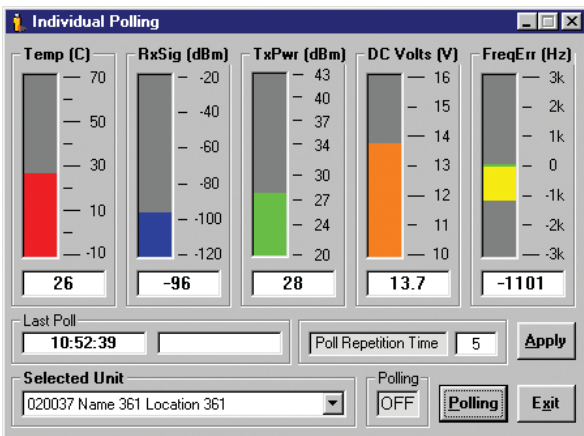
Bar Graph

Display Bar Graph can be selected which displays all polls on the “Bar Graph”. If a unit alarms, the measurement in question will have a red background in the Text box.



Individual Poll

Allows intensive polling of a single unit, independently of any group polling that may be active. The individual poll window provides a bar graph display for rapid visual recognition of the radio modems parameter levels.



The line above Status Polls is a “Processing Status Bar”. It will display messages about errors, warnings and poll processing.

Polling Button

The selected unit will be removed from the poll group, then polled at the selectable rate (Poll Repetition time) by clicking the Polling button.

Poll Repetition Time (2 to 3600 Sec)

Is the rate at which individual status polling will occur. Click on the “Apply” button to apply any change made to the poll repetition time.

Switch Exciter

Only visible if the selected unit is a “Hot Standby Base station” then a switch base facility is provided for remote switching of the exciter units. With polling on, click on the “Switch Exciter” button. The changeover may take a number of seconds. The active unit will be displayed in the “Active unit” field.

NOTE: The hot standby base station has a minimum “toggle” time of 1 minute. This is to avoid rapid switching between exciter units, should a fault be detected in both modems.

Data Logging

Status poll and Alarm data can be logged to a database file for viewing at a later date. A relational database is created and managed using Microsoft Jet database engine Ver3.5. The database file, which is an “.mdb” file, can be accessed with external programs such as Microsoft Access. You have the option of enabling logging of Status polls only, Alarms only or both.

Log Status Polls

To log Status polls either select “Log Status polls” under the Data Logging menu item or click the corresponding toolbar button.

Log Alarms

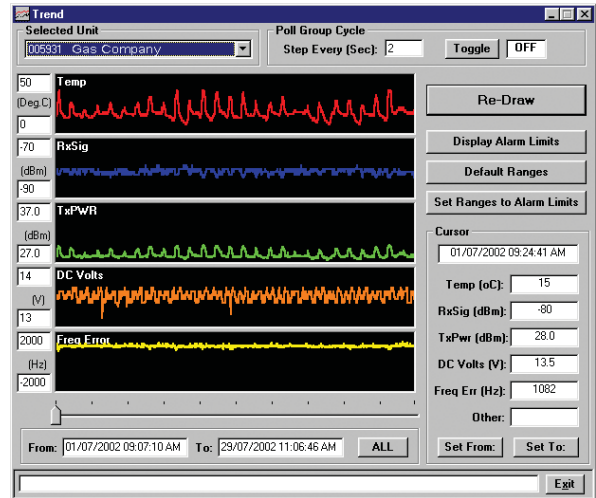
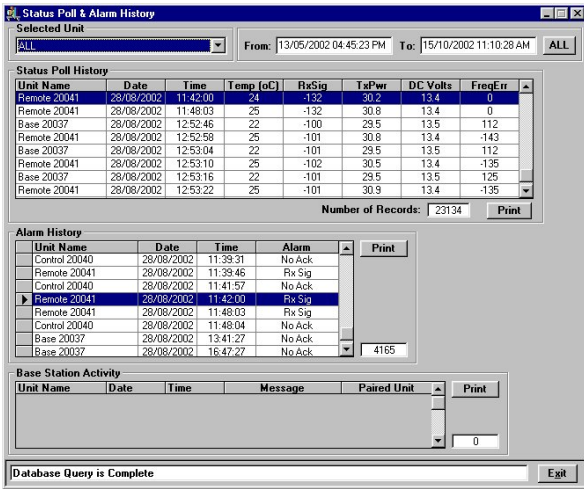
To log Alarms either select “Log Alarms” under the Data Logging menu item or click the corresponding toolbar button.

NOTE: If “Auto Logging ON” is enabled in the settings dialog box, then Status Poll logging and Alarm logging will automatically be turned on when Group or Individual polling is turned on.

View History

Status poll history may be viewed using the Status Poll & Alarm History window. This window has three tables: Status Poll History, Alarm History and Base Station Activity. Each table has a “Number of Records” box to indicate how big the selection is.

You may select “ALL” to see every units poll results, or view an individual units poll results.



The line above Status Polls is a "Processing Status Bar". It will display messages about errors, warnings and poll processing.

From To or ALL Fields

These fields determine the time span you wish to view. For example, if you have collected several months of data, and only wish to view a 24 hour period, then adjust the From: and To: fields accordingly and select the unit.

When the History window first appears, the From: and To: fields will contain the last 24 hours of data.

If "ALL" is selected it will display the start and end dates of the database.

The Date/Time format will be as per the regional settings short date format.

NOTE: The smaller the time span you select, the faster the database search will be. This will also depend on the poll rate that was used during that time span.

Sorting

Each of these tables can be sorted in ascending order by: unit, date or poll parameter. To sort, just click on the required column header.

To show the full status of a single report in the "Alarm History" click on the box at the left by the unit name. Note this only works on valid poll results not "NoAck".

Printing

A printout of each table is possible by clicking on the associated Print button. The table data will be sent to the default printer and formatted as per your default printer configuration set up.

View Trend

The logged status poll data can be viewed in graph format, which allows viewing of status trends over selectable time spans. This provides a very effective and fast method of analysing a units' operating parameters over time.

Select "View Trend" under the Data Logging menu item or click the associated toolbar button.

Features available include:

- Scaling of graph(s).
- View individual poll results using the cursor.
- Automatically scroll through the group poll database, unit by unit at a selectable time interval.
- No Acknowledge messages are displayed by a gap in the graphed data and a "NoAck" in other on the Time Line.

The line above Status Polls is a "Processing Status Bar". It will display messages about errors, warnings and poll processing.

Vertical Scale Setting

- Manually set the vertical scales by simple typing in the new level(s), then either press "Enter" or click on the "Re Draw" button, or select a new unit.
- Click the "Default Ranges" button to set all the vertical scales back to the default levels.
- Click the "Set Ranges to Alarm Limits" button to set the vertical scale limits to the selected unit alarm limits.

From: & To: Fields

These fields determine the time span you wish to view. For example, if you have collected several months of data, and only wish to view a 24 hour period, then adjust the From: and To: fields accordingly.

When the Trending window first appears, the From: and To: fields will contain the last 24 hours of data.

If "ALL" is selected it will display the start and end dates of the database.

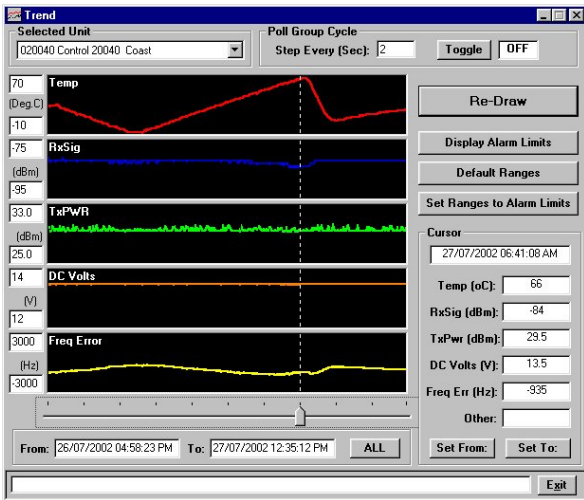
NOTE: The smaller the time span you select, the faster the database search and draw. This will also depend on the poll rate that was used during that time span.

Use the ALL button to set the From: and To: fields to the maximum and minimum dates found in the data in the database.

Poll Group Cycle

When toggled ON, this will step through each radio in the poll group and display the trend graph. Set the step interval in the "Step Every (Sec)" field. Default = 2 seconds

Cursor: Use the slider control, found at the bottom of the display to move the cursor. The cursor box displays the parameter data of the status poll at the current cursor position.



Use the "Set From" button to set the From: field to the current cursor position.

Use the "Set To" button to set the To: field to the current cursor position.

Tools - Statistical Performance

The diagnostic core of radios with Firmware V2.4.X and above have 6 counters which store packet statistics for later retrieval. They are:-

- Lost Synch.
- Lost RxSig.
- Good Frames.
- Bad Frames.
- Time Ticker.
- RSSI Ticker.

The Diagnostic controller software uses these statistics to calculate packet and bit error rates, network efficiency, bandwidth utilisation and radio link integrity. These network analysis features are an invaluable tool for larger networks.

Statistical Performance Formulae

Timers:

Time Ticker (10mS): (RRT) = timer that increments by one every 10mSec

Elapsed Time: = Total elapsed time in hh:mm:ss from reset calculated from RRT

RSSI Ticker (10mS): = timer that increments by one every 10mSec when RxSig present. (Virtual connection to RxSig LED)

Transmit Channel:

Tx Frames: = Number of Tx HDLC frames.

Tx Byte: = Number of Tx Bytes

Average Frame Size: = TxByteCnt / TxFrameCnt

Average Frame Rate (mSec): = TxFrameCnt / RTT * 0.01

Channel Utilisation (%): = (TxByteCnt * 8) / (RTT * RFChannelBitRate) where RFChannelBitRate is 9600 or 4800 Bits per sec.

Receive Channel:

Good Frames: = Good Frames Rx'd

Bad Frames: = Bad Frames Rx'd. Rx HDLC frame error.

Good Bytes: = Good Bytes Rx'd

Average Frame Size: = GoodByteCnt / GoodFrameCnt

Average Frame Rate (mSec): = (GoodFrameCnt + BadFrameCnt) / RTT * 0.01

Channel Occupancy (%): = RSSIgoodTicker / RTT * 100 (Average from reset)

Channel Occ Sliding: = $\text{RSSI}_{\text{good}} / \text{RTT} * 100$
(Average from last update)

Channel Utilisation (%): = $(\text{GoodByteCnt} * 8) / (\text{RTT} * \text{RFChannelBitRate})$

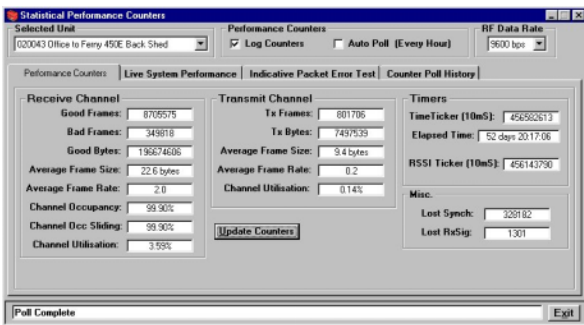
Miscellaneous:

Lost Synch: = Increments on lost synch, must be validated with RxSig. (Virtual connection to Synch LED)

Lost RSSI: = Increments on lost RxSig (Virtual connection to RxSig LED)

Radio modems with Firmware Revisions 2.4.x and above have the advanced statistical counters as noted above. Firmware revisions below this (i.e. 2.3.x) only have Good Frame count, Bad Frame count, Lost RSSI count and Lost Synch Count available. The diagnostic controller will detect which firmware the radio has, and only report the available counters.

Statistical Performance Counters Window



Selected Unit

When a unit is selected, the controller will confirm that the firmware revision has been received. If not, it will attempt to poll the radio automatically to retrieve the revision number.

RF Data Rate

Select from the pull down menu 4800, 9600 or 19200 bps, depending on your system settings

Status Bar

Reports any poll processing in progress or errors that may have occurred.

Performance Counters Tab

This is the main statistical performance tool used for assessing network performance.

- Make sure "log counters" is checked on
- Click the **Update Counters** button to retrieve the current statistical performance results.
- Click the **Auto Poll OFF/ON** button to automatically update the counters every hour for selected unit.

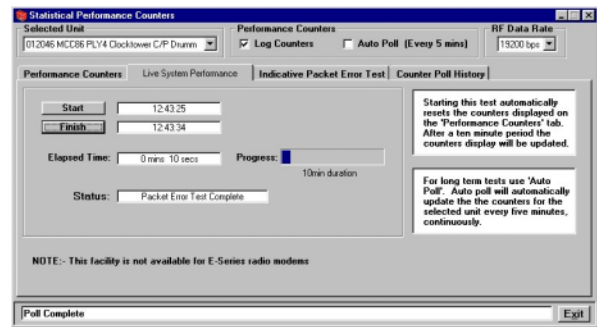
Click the **Log Counters OFF/ON** button to log the counters every time they are updated. These can be viewed on the "Counter Poll History" Tab.

Notes:

- The controller will attempt a series of polls when either resetting or retrieving the counters. You should monitor the status window to ensure that the poll process completes. If errors occur, they may be due to conditions like packet collisions on a busy network, diagnostic controller trying to perform too many poll functions (i.e. group polling, individual polling), etc.
- E Series data radios have 32 bit counters and will count for 1 year, 4 months & 10 days if not reset occurs.

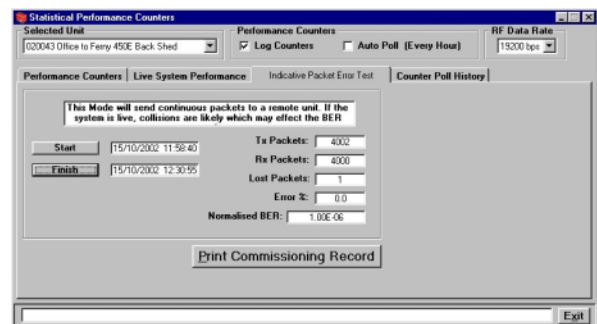
Live System Performance Tab

This provides an automatic test facility which will automatically reset all the radio modems counters, and then after a 10 minute period retrieve the new counter values. View the Performance counters tab to see the result.



Indicative Packet Error Test Tab with Commissioning Record

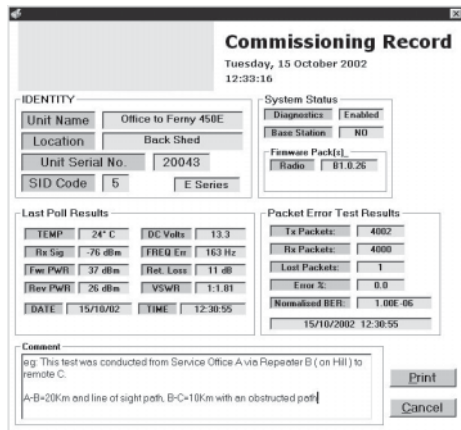
This Tab provides a simple link test facility. When this is running, continuous Poll/Response diagnostic messages will be transmitted to and from the unit and Packet Error Rate results recorded. If a response is not received within the Poll Response Timeout period, then an error (last Packet) is recorded. If the system is live, collisions are likely and may affect Error results.



Print Commissioning Record

From the “Indicative Packet Error test” a commissioning sheet can be printed to file (eg: using Adobe PDF write or similar), or printed directly.

After running the test for the desired time (best results with no user data), the test can be stopped with the “Finish” button. Select “Print Commissioning Record” button and a page appears with the results and also the unit identity, last poll results, system status and date/time stamp for each record.

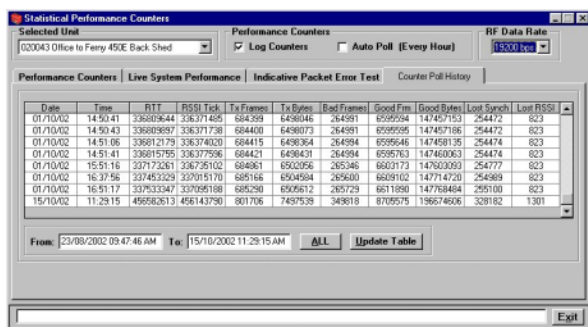


On this page there is also a facility to type in a “Comment” field. This is useful for recording information such as where the test was conducted and through what part of the system the test was conducted. eg: via a repeater.

Press “Print” button when ready to send to the default printer.

Counter Poll History Tab

This is a database viewing facility. When logging is enabled “Log Counters”, each time the counters are retrieved they will be written to the database. Adjust the **From:** & **To:** fields to view a specified time span or press ALL to obtain complete database period.



Networking

Monitoring the radio network from other workstations on a LAN network is made easy with the networking facilities provided by the Diagnostics Controller. The radio network controller can be configured as either a Server or Client. The Server will send poll information to each attached client, depending on their access rights.

Client groups can be set up. Each Client can be assigned to one client group. Each radio modem can be assigned to one or more Client groups.

A default Client group called "ALL" is automatically set up containing all radio units in the database.

Client Groups Example:

All	Pumps	Test
Test Unit 1	Pump 1	Test Unit 1
Test Unit 2	Pump 2	Test Unit 2
Test Unit 3	Pump 3	Test Unit 3
Pump 1		
Pump 2		
Pump 3		

In the above example, there are three client groups, ALL (the default), Pumps, and Test. A Radio modem can be a member of more than one group.

Client Examples:

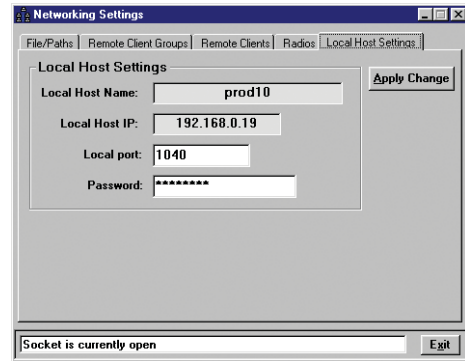
- Central - This is the Diagnostic Server which is attached to the radio network.
- Test Client - This is a Diags controller in client mode.
- Pump Monitor - This is a Diags controller in client mode.

In the above example, the Central workstation, running Diagnostics in Server mode, is polling all the radios in the network and distributing the received messages to the attached clients.

The Test Client and Pump Monitor are receiving Status poll and alarm information from the Central server. The Test Client will only receive poll information for radios found in the "Test Client Group" i.e. Test Units 1, 2 and 3. The Pump Monitor will only receive poll information for radios found in the "Pumps Client Group" i.e. Pumps 1, 2 and 3.

Networking - Setting

The Server should be configured properly first before any connection attempts are made by clients. It will always be safer to stop any polling that may be in progress when making changes to the Server client set up.



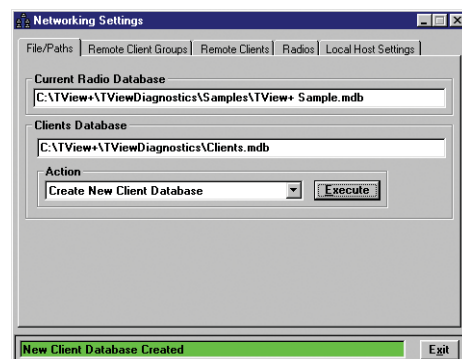
Local Host Settings Tab

It is assumed that the workstation is running Windows, and has been configured with the TCP/IP network protocol.

- Open or create a radio database.
- Under the Networking menu bar select "Settings" from the menu bar.
- In the Networking window click the "Local Host Settings" button.
- The Local Host settings will appear, which contains the Server Host Name, IP address, Local Port and Password.
- The Local Port is the socket number. Select an unused socket number. Usually a number between 1000 and 2000 would be safe.
- Enter a password. This is required when in client mode, to access incoming data from the server.
- Apply Change.

Creating Client Database- File/Paths Tab

When in Server mode the Diagnostic controller uses an additional database file (.mdb) to store Client information. This file is linked to the main radio Database file. The link is managed by the Microsoft Jet database engine. This separate linked file configuration permits archiving of the main radio database (.mdb) without losing client configuration data.



- In the Networking window click the "File/Paths" button.
- The "Current Radio Database" is displayed if open.
- Select "Create New Client Database" from the Action drop down list.
- Click "Execute" to create and link the client database.

Adding Client Group(s)

- Click the Remote Client Groups tab.
- Enter the group name in the field provided.
- Click on the Add button to add the group name to the database.

Deleting a Client Group

- Click on the "Remote Client Groups" tab.
- Select the group you wish to delete.
- Click on the "Delete" button to delete the group name from the database.

Adding a Client

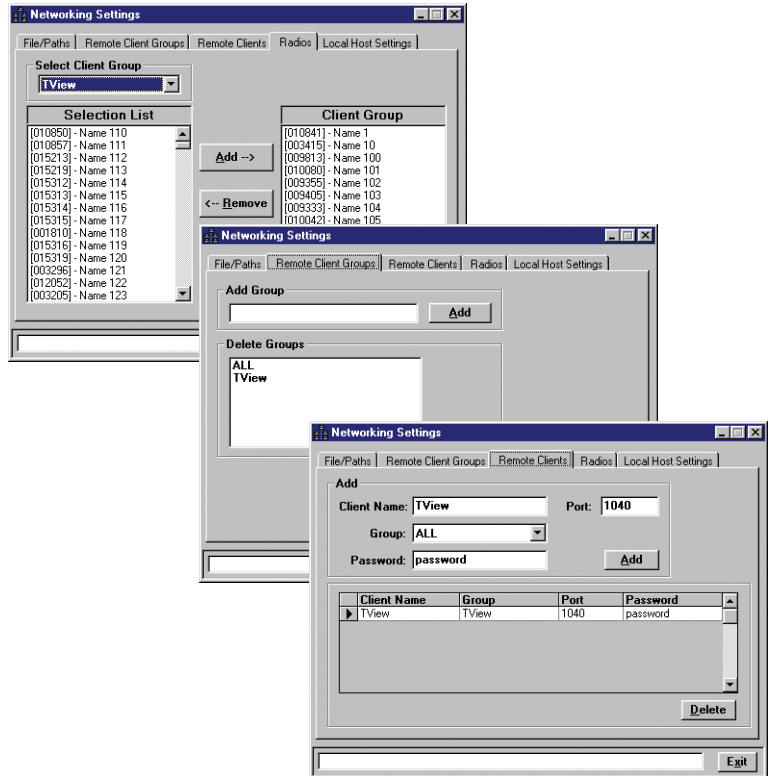
- Click on the Remote Clients tab.
- Enter Client Name. This can be either the remote clients Host name or IP address. Entering the client Host name requires extra processing to resolve the name into an IP address. Entering the IP address directly in the Client name field is more efficient, although more cryptic.
- Select a client group.
- Enter the clients password.
- Enter the client Port. This is the socket number used at the remote client.
- Click the Add button to add the client to the database.

Deleting a Client

- On the Remote Client Tab, select a client to delete by clicking on the record selector (left most column).
- Click the delete button to delete the client from the database.

Adding Radio(s) to a Client group

- On the Radios tab select a Client Group.
- Using the "Add and/or Remove" buttons to add or remove radios from the Client Group.
- Under Networking on the menu bar, Select the "Server Mode" button. This will place the diagnostic controller into Server mode.
- The Diagnostic Controller Server is now ready distribute messages to client workstations.



Setting Up a Client

In Client mode, the diagnostics controller basically just mirrors the display of the server. Poll information can not be stored locally, polling functions are not available via the remote server, and most of the tools normally provided are disabled.

It is assumed that the workstation is running Win95/98/NT, has been configured with the TCP/IP network protocol and has been added to the Diagnostic Server's Client Groups.

- Under Networking on the menu bar, select "Settings".
- The Network settings window will appear, which contains the Client Host Name and IP address, which are view only.
- Enter the **Client password** as stored at the Diagnostic Controller Server.
- Enter the **Local Port Address** (socket number) as stored in the Diagnostic Controller Server database.
- Click the "Apply Change" button.
- Under Networking on the menu bar, Select the "Client Mode" button. This will place the diagnostic controller into client mode.

A local Diagnostic session can be operated while in client mode, both status messages will appear on screen.

Diags Client

A Client only version of this software is also available. This must be used in conjunction with standard software running in "Server Mode". Local Com ports are disabled permanently in this version.

Interpreting Poll Results

General

The results returned by the poll requests give an indication of system performance. When a new modem is added to the database, default values are assigned for the limits of the returned results. The user can assign different values to these limits as required, which is determined by the fault tolerance level of their systems.

RSSI

The default RSSI limits are set at -30 to -105 dBm(-110 dBm for Base/ Repeater Station). Above -30 dBm the front end of the receiver will saturate and it is unlikely that signal levels much higher than this will ever be reported. Below -105/-110 dBm the error rate may become too high for some applications. In the modem the RSSI measurement is made periodically each 100mS, while R F carrier is being detected.

Transmitter power

The transmitter power limits are set at between 0mW and 20,000mW. The modems will normally be operating at a power level of 1 watt. The above limits are set to ± 3 dB of the nominal (3dB represents a factor of 2 for power measurements).

The effect of a change in transmittal power can be transposed to the receiver BER curves (3dB down at the transmitter is 3dB down at the receiver). The amount of variation tolerated will be determined by the RF path loss of the data link being used.

If the modem is set to low power, then the transmittal power will be nominally 200mW. Suggested limits for this would be 100mW and 400mW (± 3 dB).

For base station units or remote units set to high power, the nominal transmitter power is 5 watts. Suggested limits on these would be 2.5 watts to 10 watts (± 3 dB).

In the modem the reported transmit power measurement is given from a measurement made of the last transmission made by the modems. When the PTT is ON a periodic measurement is made of the transmit power. The modem stores this away and reports it when requested.

Parameter	Resolution	Absolute accuracy @ RT	Drift over Temp. range	Notes
Temperature	0.1 degC	+/- 4 degC	+/- 1 degC	
Supply Voltage	0.1 volts	+/- 0.5V	+/- 0.08V	+/- 0.45%
Rx Signal Strength	0.1 dBm	+/- 3 dB	+/- 2 dB	
Frequency Error	1Hz	+/- 200Hz	+/- 2500Hz	
Tx Power (Remote)	0.1 dBm	+/- 1.5 dB	+/- 0.3 dB	Note 1
Tx Reverse Power(Remote)	0.1 dBm	+/- 3 dB	+/- 1 dB	
Tx Power (Base)	0.1 dBm	+/- 0.8 dB	+/- 1 dB	Note 2
Tx Reverse Power (Base)	0.1 dBm			

Notes:

1. Remote Tx power measurements will vary due to power setting variation which can have an initial error of +/- 0.5 dB and final error of +/- 0.2 dB
2. Base Tx power measurements will vary due to power setting variation by the exciter which can have an initial/final error of +/- 0.2 dB and overshoot by the PA <1 dB.

Temperature

The modem is specified to operate within the temperature range of -30°C to 65°C. The defaults limits are set to -30°C and 60°C. At 65°C the modem goes into a high temperature foldback mode, when the power is reduced to the low power mode. This is to reduce the risk of damage to the final stage of the transmitter at excessive temperatures.

The modem will operate outside this temperature range but it is not recommended.

Supply Voltage

The modem is specified to operate over a DC supply range of 11V to 16V. The default levels are set to 11.5V to 15.5V. The modem will not operate correctly outside these bounds and damage may occur with high voltage levels being applied.

Frequency

The frequency limits are set to ± 3000 Hz. This is basically the difference between the different ends of a data link. If the difference gets much greater than this, data errors may occur (the modem will have a degree of long term frequency drift of 1ppm / annum due to the physical properties of internal components).

Part K – Appendices

Appendix A - Application and Technical Notes

TN-4	Remote Diagnostics
AN-D3	SID Code Addressing Scheme for Small to Medium Sized Data Radio Systems
AN-D4	Trunked Multi-Stream Applications of the D Series Product Range

Appendix B - Slip Protocol

The SLIP protocol, is a data transport protocol, originated and used extensively in UNIX(tm) based systems, and thus also closely associated with TCP/IP networked systems. Although not truly a "standard" it is so widely used that it has become the defacto standard for serial interface in UNIX and many other networked systems. SLIP is a method of framing messages containing binary data, on asynchronous channels. The asynchronous serial channel is configured for eight bit character size, no parity, and one stop.

A specific binary code called FEND (Frame End, hexadecimal value=C0) is reserved to define a frame boundary. Should this same code occur in the data message to be transferred across the channel controlled under SLIP, then an escape sequence is used so that the message byte will not be confused for a FEND. This escape sequence, involves replacing the message hexadecimal C0 code with a two byte sequence FESC, TFEND. FESC (Frame Escape) is the binary code hexadecimal DB, and TFEND (Transposed FEND) is binary code hexadecimal DC. Likewise, if the FESC character ever appears in the user data, it is replaced with the two character sequence FESC, TFESC (Transposed FESC). The TFESC is the binary code hexadecimal DD. The following table clarifies this.

Abbreviation	Description	Hex.Value
FEND	Frame end	C0
FESC	Frame escape	DB
TFEND	Transposed frame end	DC
TFESC	Transposed frame escape	DD

As characters arrive at the SLIP receiver, they are appended to a buffer containing the current frame. Receiving a FEND marks the end of the frame, and consequently, succeeding bytes are considered part of the next frame.

Receipt of a FESC code puts the SLIP receiver into "escaped mode", causing it to translate a following TFESC or TFEND back to a FESC or FEND code, appending it to the buffer, and resuming it's normal state. Receipt of any byte other than TFESC or TFEND while in escaped mode, is an error. No translation occurs, and the SLIP receiver leaves escaped mode. A TFESC or TFEND received while not in escaped mode is treated as an ordinary character and stored accordingly. Reception of consecutive FEND characters, causes no action to be taken (i.e. is not interpreted as zero length frames).

An example of a typical SLIP frame is shown below. The message consists of the string DA,C4,C0,C5,DB,20,BD,DC,DD. The SLIP frame will be:-

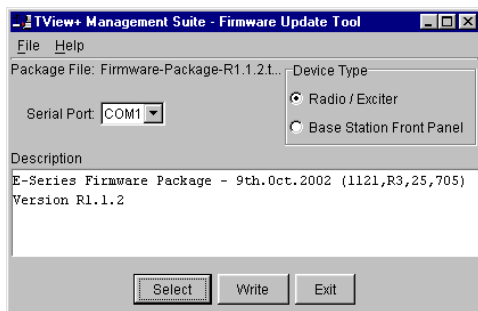
```
DA,C4,<FESC>,<TFEND>,C5,<FESC>,<TFESC>,20,BD,DC,DD,<FEND>
==> DA,C4,DB,DC,C5,DB,DD,20,BD,DC,DD,C0
```

Appendix C - Firmware Updates

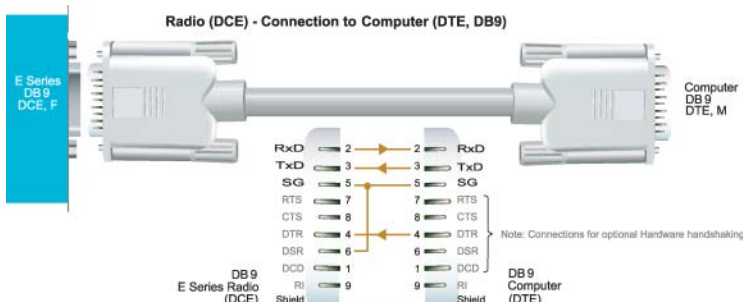
Radio/Base Firmware Update

Firmware update is performed on a unit connected locally to the PC. It is recommended that all cabling to the unit be disconnected prior to commencing firmware update to minimise any interruption to the process or disturbances of signals on cables still connected. All other TVIEW+ Management Suite utilities should also be exited during the firmware update process. The steps to update the firmware as follows:

1. Start the firmware update utility from the TView+ front panel.
2. Disconnect power from the unit by turning off the power supply or removing the power connector to the unit.
3. Connect the serial cable from the PC to Port B on the unit
4. Select the unit type from the options on the top right of the firmware update main window. Please note that "Exciter" refers to the radio contained inside the base station.
5. Select the file containing the firmware update package using the "Select" button at the bottom of the main window. After opening the file the browse window will close and a description of the firmware package will appear in the main window.



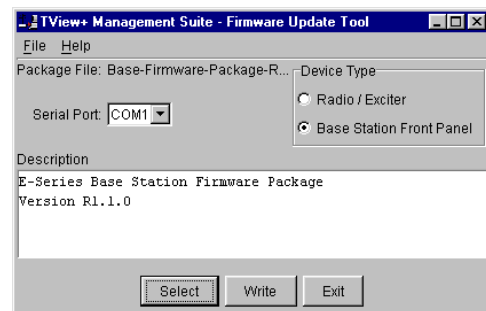
6. Initiate the firmware updating process using the "Write" button at the bottom of the main window. Another logging window will appear.
7. Reconnect power to the unit when prompted in the logging window. The status LEDs on the unit including power should all be extinguished and the transfer of firmware should commence. If this does not occur steps 6 & 7 should be repeated.
8. The logging window will display the progress of each firmware block transferred and when complete a success dialogue box appears. Type OK to close this dialogue box and type "Exit" in the main window to exit the firmware update utility.
9. Disconnect the cable from Port B and re power the unit to enable the new firmware.



Base Station Display Firmware Update

Installation Instructions:

1. Update of the front panel firmware uses the firmware update utility supplied with the TVIEW+ Management Suite.
2. Start the firmware update utility from the TVIEW+ front panel.
3. In the firmware update utility select device type as "Base Station Front Panel"
4. Select the file containing the firmware update package using the "select" button at the bottom of the main window. After opening the file the browse window will close and a description of the firmware package will appear in the main window.



5. Ensure that the base station is powered.
6. Connect the "TVIEW+ cable" to the front or rear system port of the base station.
7. On the base station front panel depress and hold the "Display On/Off" button, then momentarily depress the firmware update switch using a suitable probe before releasing the "Display On/Off" button. The firmware update switch is located behind the small hole (not labelled) in the front panel below the "Display On/Off" button.
8. Initiate the firmware update process using the "Write" button at the bottom of the main window. Another logging window will appear.
9. The logging window will display the progress of each firmware block transferred and when complete a success dialogue box appears. Click OK to close this dialogue box and click "Exit" in the main window to exit the firmware update utility.
10. Repower the base station to enable the new firmware.

Part L – Specifications

Specifications: E Series Digital Data Radio

Radio

Frequency Range: 380-520 MHz (various sub-frequency bands available)

Frequency Splits: Various Tx/Rx frequency splits - programmable

Channel Selection: Dual synthesizer, 6.25 kHz channel step

Channel Spacing: 12.5 or 25 kHz

Frequency Stability: ±1ppm (-30 to 60 C ambient, opt. -30 to 70 C) Higher frequency stability options are available (with external GPS reference)

Aging: ≤ 1ppm/annum

Half / Full Duplex:

ER450: Half duplex or Full duplex (with external duplexer and ERFD450 option)
EB/EH450: Full duplex (optional internal or external duplexer available for single antenna operation)

Configuration: All configuration via Windows based software

Transmitter

Tx Power: 0.1 - 5W (+37 dBm) ±1 dB software adjustable with over-temperature protection. EB/EH450: 100% Duty Cycle.

Modulation: Narrow band digital filtered binary GMSK

Occupied Bandwidth: Designed to FCC, ETSI, ACA requirements

Tx Keyup Time: < 1 mSecond

Timeout Timer: Programmable 0-255 seconds

Tx Spurious: ≤ -37 dBm

PTT Control: Auto (on Data) / RTS line (Port A or B) / System Port (Override)

Receiver

Sensitivity: -118 dBm for 12 dB SINAD

Selectivity: Better than 80 dB

Intermodulation: Better than 75 dB

Spurious Response: Better than 80 dB

AFC Tracking: Digital receiver frequency tracking

Mute: Programmable digital mute

Local regulatory conditions may determine the performance and suitability of individual versions in different countries. It is the responsibility of the buyer to confirm these regulatory conditions. Performance data indicates typical values related to the described unit.

Information subject to change without notice.
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Diagnostics (Optional)

Network wide operation from any remote terminal.

Non intrusive protocol - runs simultaneously with the application.

Over-the-air re-configuration of user parameters.

Programmable exception reporting of alarms.

Storage of data error and channel occupancy statistics.

In-built Error Rate testing capabilities.

Connections

User Data Ports: 2 x DB9 female ports wired as DCE (modem)

System Port: RJ45 (front and rear for EB/EH450) for diagnostic, configuration and re-programming

Antenna:

ER450: N female bulkhead. Separate N (Tx) and SMA (Rx) connectors for full duplex.*

EB/EH450: 2 x N female bulkhead (separate Tx and Rx ports).
1 x N female bulkhead (with optional internal duplexer)

Power: 2 pin locking, mating connector(s) supplied

LED Display: Multimode Indicators for Pwr, Tx, Rx, Sync, TxD and RxD data LEDs (for both port A and B)

Modem

Data Serial Port #1: RS232, DCE, 600-76,800 bps asynchronous

Data Serial Port #2: RS232, DCE, 300-38,400 bps asynchronous

System Port: RS232, 19,200 bps asynchronous

Flow Control: Selectable hardware/software/3 wire interface

RF Channel Data Rate: 4800/9600/19,200 bps Half / Full duplex*

Data Buffer: 16 kbyte of on-board RAM

Bit Error Rate:

< 1x10⁻⁶ @ -110 dBm (4800 bps)
< 1x10⁻⁶ @ -108 dBm (9600 bps)
< 1x10⁻⁶ @ -106 dBm (19,200 bps)

* With ERFD450 full duplex option plus external duplexer for single antenna operation

Collision Avoidance: Unique supervisory channel C/DSMA collision avoidance system

Multistream™: Trio DataCom unique simultaneous delivery of multiple data streams (protocols)

Data Turnaround Time: <10mS

Firmware: Field upgradeable Flash memory

General

Power Supply: 13.8 Vdc nominal (10-16 Vdc)

Transmit Current:

ER450: 750 mA nominal @ 1 W
1500 mA nominal @ 5 W
EB450: 1.3 A nominal @ 1 W
2.5 A nominal @ 5 W
EH450: 2.0 A nominal @ 1 W
3.2 A nominal @ 5 W

Receive Current:

ER450: <120 mA
EB450: <230 mA
EH450: <350 mA

Sleep Mode (ER450 only):

Hardware: External control, < 1 mA
Software: User configurable modes

Dimensions:

ER450: 170 mm x 150 mm x 49 mm (55 mm with cradle). Diecast enclosure
EB450: 19" 2 RU rack mount
485 x 90 x 420 mm
EH450: 19" 5 RU rack mount
485 x 225 x 420 mm

Mounting (ER450 only): Snap lock mounting (cradle supplied)

Weight:

ER450: 1 kg
EB450: 5 kg (excluding opt. duplexer)
EH450: 13 kg (excluding opt. duplexer)

Options

ERFD450 Full Duplex Operation (ER450) with separate N (Tx) and SMA (Rx) connectors

DUPLX450BR External Duplexer, Band Reject (for single antenna operation)

EDOVM Digital Order Wire Voice Module

NEMA 4/R Stainless Steel Enclosure (ER450), IP65, NEMA 4 rated

DIAGS/E Network Management and Remote Diagnostics Facilities per Radio Modem (E Series)

Part M – Support Options

Website Information

The Trio DataCom website support contains links to e-mail and telephone support, tech notes, manuals, software updates.

Please go to www.trio.com.au/support.htm.

E-mail Technical Support

E-mail your questions to support@trio.com.au.

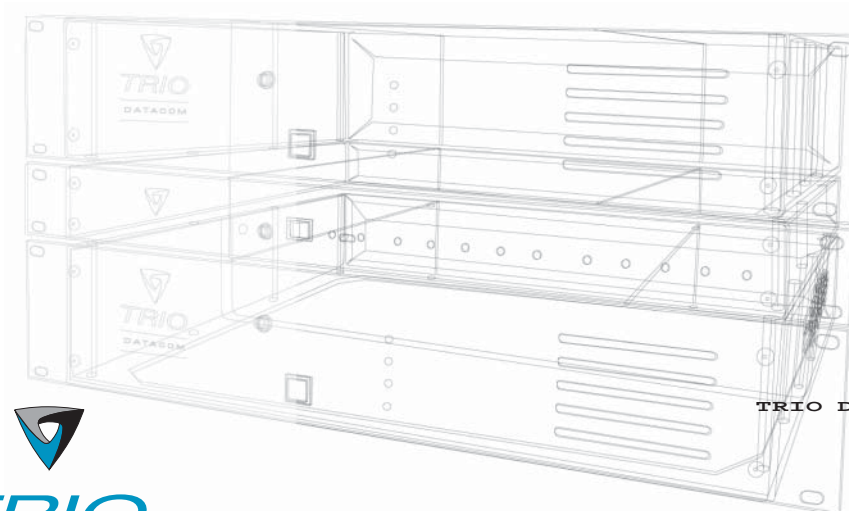
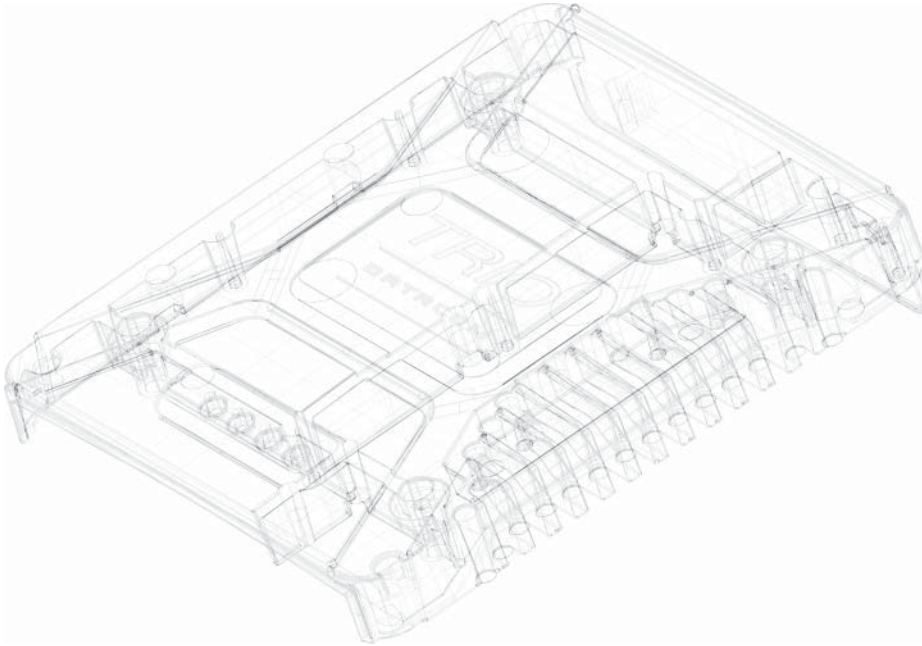
When e-mailing questions to our support staff, make sure you tell us the exact model number (and serial number if possible) of the Trio equipment you are working with. Include as much detail as possible about the situation, and any tests that you have done which may help us to better understand the issue. If possible, please include your telephone contact information should we wish to further clarify any issues.

Telephone Technical Support

Telephone support is available at our head office telephone number Aus: (+61) 3 9775 0505 during Eastern Australian business hours (9am-5pm).

Contacting the Service Department

The Service department may be contacted by e-mail to service@trio.com.au, or by telephone during Eastern Australian business hours.



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