User Manual
M Series Data Radio

MR450 Remote Data Radio

Incorporating compatible

EB450 Base Station & EH450 Hot Standby Base Station

TRIO DATACOM

www.trio.com.au

Issue 1: August 2004

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Part A – Preface

Warranty

All equipment supplied by Trio DataCom Pty Ltd is covered by warranty for faulty workmanship and parts for a period of twelve (12) months from the date of delivery to the customer. During the warranty period Trio DataCom Pty Ltd shall, at its option, repair or replace faulty parts or equipment provided the fault has not been caused by misuse, accident, deliberate damage, abnormal atmosphere, liquid immersion or lightning discharge; or where attempts have been made by unauthorised persons to repair or modify the equipment.

The warranty does not cover modifications to software. All equipment for repair under warranty must be returned freight paid to Trio DataCom Pty Ltd or to such other place as Trio DataCom Pty Ltd shall nominate. Following repair or replacement the equipment shall be returned to the customer freight forward. If it is not possible due to the nature of the equipment for it to be returned to Trio DataCom Pty Ltd, then such expenses as may be incurred by Trio DataCom Pty Ltd in servicing the equipment in situ shall be chargeable to the customer.

When equipment for repair does not qualify for repair or replacement under warranty, repairs shall be performed at the prevailing costs for parts and labour. Under no circumstances shall Trio DataCom Pty Ltd's liability extend beyond the above nor shall Trio DataCom Pty Ltd, its principals, servants or agents be liable for the consequential damages caused by the failure or malfunction of any equipment.

Important Notice

This manual covers the operation of the M Series of Digital Data Radios. Specifications described are typical only and are subject to normal manufacturing and service tolerances.

Trio DataCom Pty Ltd reserves the right to modify the equipment, its specification or this manual without prior notice, in the interest of improving performance, reliability or servicing. At the time of publication all data is correct for the operation of the equipment at the voltage and/or temperature referred to. Performance data indicates typical values related to the particular product.

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Warning - RF Exposure (FCC/IC)

The radio equipment described in this user manual emits low level radio frequency energy. Professional installation is required. The concentrated energy may pose a health hazard depending on the type of antenna used.

This device is intended for FIXED installation conditions. DO NOT allow people to come within 2 metres (6.6 feet) of non-directional antennas and 6 metres (20 feet) from the front of directional antennas when the transmitter is operating.

More information is available from www.fcc.gov/oet/info/documents/bulletins

Related Products

ER450 Remote Data Radio
EB450 Base/Repeater Station
EH450 Hot Standby Base Station

Other Related Documentation and Products

E Series Quick Start Guides
TVIEW+ Management Suite
Digital Orderwire Voice Module (EDOVM)
Multiplexer Stream Router (MSR)

Revision History

Issue 1	August 2004	Intitial Release

Part B – M Series Overview

Definition of M Series Data Radio

The M Series is a range of wireless modems designed for the transmission of data communications for SCADA, telemetry and any other information and control applications that utilise ASCII messaging techniques. The M Series uses advanced "digital" modulation and signal processing techniques to achieve exceptionally high data throughput efficiency using traditional licensed narrow band radio channels.

These products are available in many frequency band and regulatory formats, to suit spectrum bandplans in various continental regions. The range is designed for both fixed point to point (PTP), and multiple address (MAS) or point to multipoint (PMP) systems.

M Series Product Range

The M Series range consists of the a *half duplex* "Remote" radio modem and provision to use an E Series *Base Station*, including an optional *Hot Standby controller* to control two base station units in a redundant configuration.

Frequency band variants are indicated by the band prefix and model numbering. (See Model Number Codes)

MR450 Remote Radio

EB450 Base / Repeater Station

EH450 Hot Standby Base Station

M Series – Features and Benefits

- 395-520 MHz band operation
- 0.1 to 5 watt transmitter output power
- Software selectable Tx and Rx frequencies
- Simplex or half duplex operation with any Tx-Rx splits
- One model suitable for 12.5 and 25 kHz channel spacing
- Synthesized digital data radio design
- High frequency stability
- Professional N Type antenna connector
- Separate versions for true 9600 bps or 2400/4800 bps over-air data rates
- Fully integrated DSP based data modem
- High data integrity - CRC error checking
- User configurable 300-19,200 bps asynch RS-232 port
- Fully transparent 3 wire user interface
- Intelligent transmitter control - auto Tx on data
- Compatible with most industry standard data protocols, e.g., MODBUS, DNP-3, IEC 870-5-101 etc.
- Multi-function bi-colour Tx/Rx data LEDs showing Port activity (breakout box style), as well as LEDs indicating Tx, Rx, RF Signal, Data Synchronisation and DC Power status of the radio.
- Compatible with E-Series Base / Repeater Station (EB) and Hot Standby Base Station (EH)

Model Number Codes

D, E, S & M Series Data Radios - Part Number Matrix = Tyxxx-aabbb-cde

T y x x x - a a b b b - c d e

Options - Base Stations*

0	= No Options
1	= 450MHz Band Reject Typically Internal [DUPLX450BR]
2	= 450MHz Band Reject (<9MHz split)[DUPLX450BR/5]
3	= 450MHz Band Pass [DUPLX450BP]
4	= 900MHz Band Reject Typically Internal [DUPLX900BR]
5	= 900MHz Band Pass [DUPLX900BP]
6	= 900MHz Band Pass (76MHz split)[DUPLX852/930]

Options - Hot Standby Configurations'

		Duplexer		Antenna	
		Number	Type	Antenna Config	Antenna Type
0	= No Options				
A		-	-	-	Separate Tx & Rx
B		-	-	Dual [x4]	Separate Tx & Rx
C		Single	Internal	Single	Combined Tx/Rx
D		Dual [x2]	Internal	Dual [x2]	Combined Tx/Rx
E		Single	External	Single	Combined Tx/Rx
F		Dual [x2]	External	Dual [x2]	Combined Tx/Rx

Note: Specify Internally or Externally fitted. Externally fitted duplexes require feeder tails.

Options*

0	= No Options
D	= Diagnostics - [DIAGS/D, DIAGS/DH, DIAGS/E or DIAGS/EH, DIAGS/M] (D, E & M Series Only)
E	= Hazardous Environment Class 1, Div 2 and Diagnostics [HAZ-APROVAL/M + DIAGS/M] (M Series)
N	= Remote Fitted into NEMA Enclosure [NEMA 4/R]
F	= Full Duplex Operation [ERFD450] (ER450 only)
X	= Full Duplex Operation [ERFD450 & DIAGS/E] (ER450 only)
S	= SMA Connector (SR450 Remote Only)

RF Channel Data Rate & Bandwidth (Internal Modem

D Series		S Series		E Series		M Series	
A01	= ACA 4800bps 12.5kHz	001	= 12.5kHz (No Modem Fitted)	A01	= ACA 4800# / 9600bps 12.5Hz	001	= 2400bps 12.5KHz / 4800bps 25kHz
A02	= ACA 9600bps 25kHz	002	= 25kHz (No Modem Fitted)	A02	= ACA 9600# / 19k2bps 25kHz	002	= 4800bps 12.5KHz / 9600bps 25kHz
F01	= FCC 9600bps 12.5kHz	241	= 2400bps in 12.5kHz [24SR]*	F01	= FCC 9600# / 19K2bps 12.5kHz	003	= FCC 9600bps 12.5KHz
		242	= 2400bps in 25kHz [24SR]*	F02	= FCC 19k2bps 25kHz		
		482	= 4800bps in 25kHz [48SR]*	E01	= ETSI 9600bps 12.5kHz		
				E02	= ETSI 19k2bps 25kHz		

NOTE: *M Series Compatible EB/EH450 Base Stations are Type A01 or F01*

Frequency (200 & 400 MHz Bands)

39	= 208 to 240MHz (Tx & Rx)
46	= 370 to 388MHz (Tx & Rx)
47	= 380 to 396MHz (Tx & Rx)
48	= 395 to 406MHz (Tx & Rx)
50	= 403 to 417MHz (Tx & Rx)
58	= (Tx) 406 to 421MHz (Rx) 415 to 430MHz
59	= (Tx) 415 to 430MHz (Rx) 406 to 421MHz
56	= 418 to 435MHz (Tx & Rx)
57	= 428 to 444MHz (Tx & Rx)
55	= 436 to 450MHz (Tx & Rx)
51	= 450 to 465MHz (Tx & Rx)
52	= 465 to 480MHz (Tx & Rx)
53	= 480 to 494MHz (Tx & Rx)
60	= 490 to 500MHz (Tx & Rx)
54	= 505 to 518MHz (Tx & Rx)
27	= (Tx) 511 to 515MHz (Rx) 501 to 505MHz
M	= 395 to 465MHz (Tx & Rx) (M Series Only)
H	= 450 to 520MHz (Tx & Rx) (M Series Only)

Frequency (800 & 900 MHz Band) (D & S Series Only)

07	= (Tx) 847 to 857MHz (Rx) 923 to 933MHz (D Series only, 1W Full Duple
10	= (Tx) 848 to 858MHz (Rx) 920 to 934MHz
06	= (Tx) 923 to 933MHz (Rx) 847 to 857MHz (D Series only, 1W Full Duple
11	= (Tx) 920 to 934MHz (Rx) 848 to 858MHz
12	= 855 to 860MHz (Tx & Rx)
14	= (Tx) 925 to 943MHz (Rx) 906 to 924MHz *'
15	= (Tx) 904 to 922MHz (Rx) 925 to 943MHz *'
16	= 924 to 944MHz (Tx & Rx) **
17	= (Tx) 919 to 937MHz (Rx) 943 to 959MHz *'
18	= (Tx) 943 to 961MHz (Rx) 916 to 938MHz **

Note: Other frequency bands available upon request.

Generic Frequency Band

200	= 208 to 245MHz (D & S Series only)
450	= 370 to 518MHz (E, M & S Series only)
900	= 800 to 960MHz (D & S Series only)

Unit Type

R	= Remote Station
B	= Base / Repeater Station
S	= Standard Base / Repeater Station (D Series Only)
H	= Hot Standby Base / Repeater (D, E & M Series Only)

Model Type

D	= D Series Family
E	= E Series Family
M	= M Series Family
S	= S Series Family

NOTES:

* *Additional charges apply. Must be ordered separately. Please refer to price list.*

\# *Provides compatibility with D Series radio*

[ ] Items in [ ] parenthesis refer to actual Trio part numbers

** *Consult factory for availability.*

Standards: *ACA - Australian Communications Authority*
FCC - Federal Communications Commission
ETSI - European Telecommunication Standards Institute

Example:

E R 4 5 0 - 5 1 A 0 2 - D 0

The example shown specifies: E Series, Remote Radio, generic 450MHz band, with a specific frequency of 450MHz to 465MHz, a 96/19.2kbps modem, with a bandwidth of 25kHz, diagnostics and standard N type connector.

Version: 4/04

Standard Accessories

Part Number **Description**

Duplexers

DUPLX450BR	Duplexer BAND REJECT 400-520 MHz for use with Base / Repeater / Links. For Tx / Rx frequency splits >9MHz. (Fitted Externally for a Link, Internally or Externally for Base / Repeater)
DUPLX450BR/5	Duplexer BAND REJECT 400-520 MHz for use with Base / Repeater / Links. For Tx / Rx frequency splits <9MHz. (Fitted Externally)
DUPLX450BP	Duplexer PSEUDO BAND PASS Cavity 400-520 MHz for External use with Base / Repeater / Links.

Notes:

1. *Frequencies must be specified at time of order.*
2. *Interconnecting (Feeder Tail) cables must be ordered separately for Externally fitted Duplexers.*

Antennas

ANT450/9A	Antenna Yagi 6 Element 9dBd Aluminium 400-520 MHz c/w mtg clamps
ANT450/9S	Antenna Yagi 6 Element 9dBd S/Steel 400-520 MHz c/w mtg clamps
ANT450/13A	Antenna Yagi15 Element 13dBd Aluminium 400-520 MHz c/w mtg clamps.
ANT450/13S	Antenna Yagi 15 Element 13dBd S/Steel 400-520 MHz c/w mtg clamps.
ANTOMNI/4	Antenna Omnidirectional Unity Gain Side Mount Dipole 400-520 MHz c/w galv. clamp
ANT450/D	Antenna Omnidirectional Unity Gain Ground Independent Dipole 400-520 MHz c/w 3m cable, mounting bracket & BNC connector
ANT450/6OM	Antenna Omnidirectional 6dBd 400-520 MHz c/w mtg clamps
ANT450/9OM	Antenna Omnidirectional 9dBd 400-520 MHz c/w mtg clamps

Note:

1. *Frequencies must be specified at time of order.*

Power Supplies

PS13V82A	Power Supply 13.8V 2A 240VAC
PS13V810A	Power Supply Switch Mode 240VAC 13.8V 10A for Base Stations – Battery Charge Capability

Part Number **Description**

RF Cables and Accessories

NM/NM/TL	Feeder Tail - N Male to N Type Male 50cm fully sweep tested
NM/NM/TLL	Feeder Tail - N Male to N Type Male 1 metre fully sweep tested
RFCAB5M	5.0m RG-58 type Antenna Feeder Cable terminated with N type Male Connectors
RFCAB5M2	5.0m RG-213 type Antenna Feeder Cable terminated with N type Male Connectors
RFCAB10M	10.0m RG-213 type Antenna Feeder Cable terminated with N type Male Connectors
RFCAB20M	20.0m RG-213 type Antenna Feeder Cable terminated with N type Male Connectors
RFCAB20M4	20.0m LDF4-50 type (1/2" foam dialectric) Antenna Feeder Cable terminated with N type Male Connectors
LGHTARRST	Lightning Surge Arrestor In-line N Female to N Female

Network Management Diagnostics

DIAGS/M	Network Management and Remote Diagnostics Facilities per Radio – M Series
DIAGS/E	Network Management and Remote Diagnostics Facilities per Radio – E Series for EB450
DIAGS/EH	Network Management and Remote Diagnostics Facilities – E Series for EH450

Software

TVIEW+	Configuration, Network Management and Remote Diagnostics Software

Other

NEMA 4 /R	Stainless Steel Enclosure for Remote Site Equipment. Size 600mm (h) x 600mm (d) x 580mm (w) – Room for Third Party RTU / PLC equip. (Approx. 400 (h) x 600 (d) x 580mm (w)
EDOVM	Digital Order Wire Voice Module
ERFDTRAY	19" Rack Tray for Mounting of ER450 Full Duplex Radio and External Band Reject Duplexer
TVIEW+MSeries	M Series Programming Cable

Part C – Applications

Generic Connectivity

The M Series has been designed for SCADA and telemetry applications, and any other applications that use an ASCII communications protocol, and which connect physically using the RS232 interface standard (although converters can be used to adapt other interfaces such as RS422/485, RS530/V35, G703 etc).

Any protocol that can be displayed using a PC based terminal program operating via a serial communications port is suitable for transmission by the M Series radio modems.

An ASCII protocol is any that consists of message strings formed from ASCII characters, that being defined as a 10 or 11 bit block including start and stop bits, 7 or 8 data bits and optional parity bit(s). Port set-up dialog that includes the expressions “N,8,1”, or E,7,2” or similar indicate an ASCII protocol.

Most of the dominant telemetry industry suppliers utilise proprietary ASCII protocols, and also common 'open standard” industry protocols such as DNP3, MODBUS, TCP/IP, and PPP. These are all ASCII based protocols.

Industries and Applications

The M Series products are widely used in point-to-point and point-to-multipoint (multiple access) applications for remote interconnection of PLCs, RTUs, dataloggers, and other data monitoring and control devices - including specialist utility devices (such as powerline ACRs). In addition, other applications such as area wide security and alarm systems, public information systems (traffic flow and public signage systems) and environmental monitoring systems.

Application Detail

SCADA Systems

This is where one or more centralised control sites are used to monitor and control remote field devices over wide areas. Examples include regional utilities monitoring and controlling networks over entire shires or a greater city metropolis. Industry sectors include energy utilities (gas and electricity distribution), water and sewerage utilities, catchment and environment groups (rivers, dams and catchment management authorities).

Telemetry Systems

Dedicated telemetry control systems interconnecting sequential devices either where cabling is not practical or distances are considerable.

Examples include:

- ore conveyor or slurry pipeline systems
- simple water systems (pump and reservoir interlinking)
- broadcast industry (linking studio to transmitter) etc.

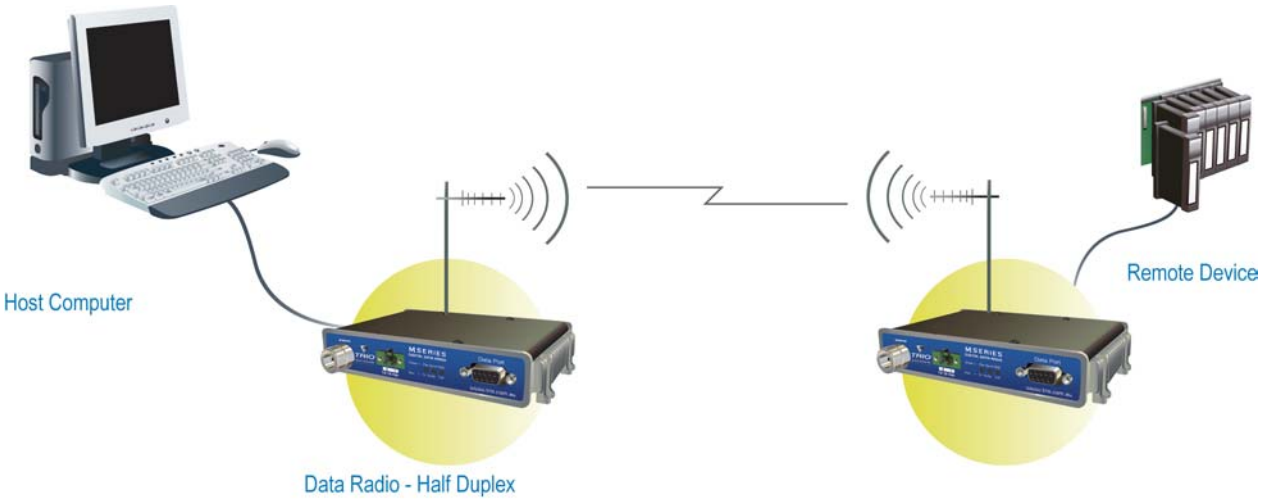
Information Systems

Public Information systems such as freeway vehicle flow, travel time monitoring, feedback signage, parking signage systems and meteorological stations etc.

Systems Architecture

Point-to-Point

This simple system architecture provides a virtual connection between the two points, similar to a cable. Operation is half-duplex.

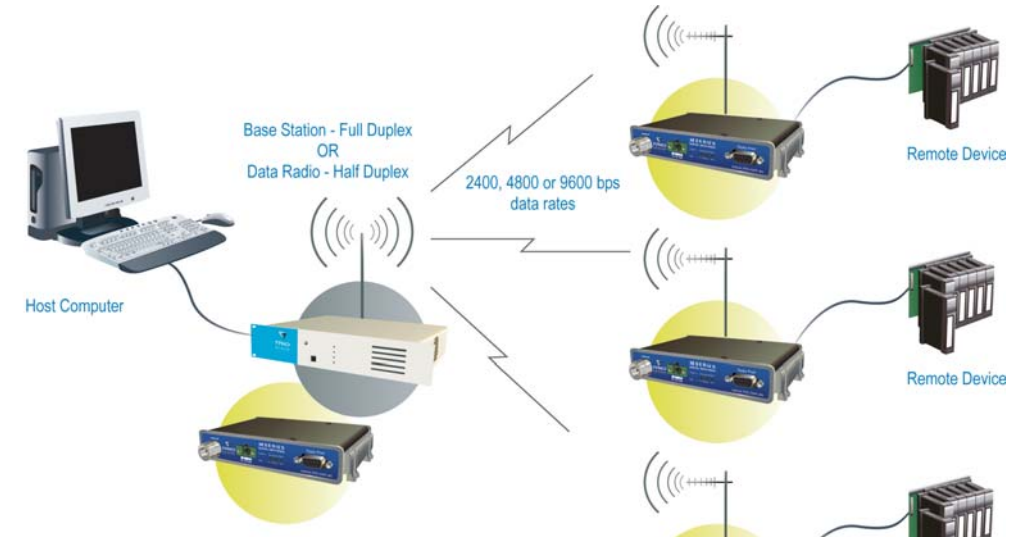


Point-to-Multipoint Systems

In a multiple access radio system, messages can be broadcast from one (master) site to all others, either using a half duplex radio system or from any site to all others, using a simplex radio channel.

Half duplex systems often utilise a full duplex master (EB or EH), to make the system simpler and for faster operation.

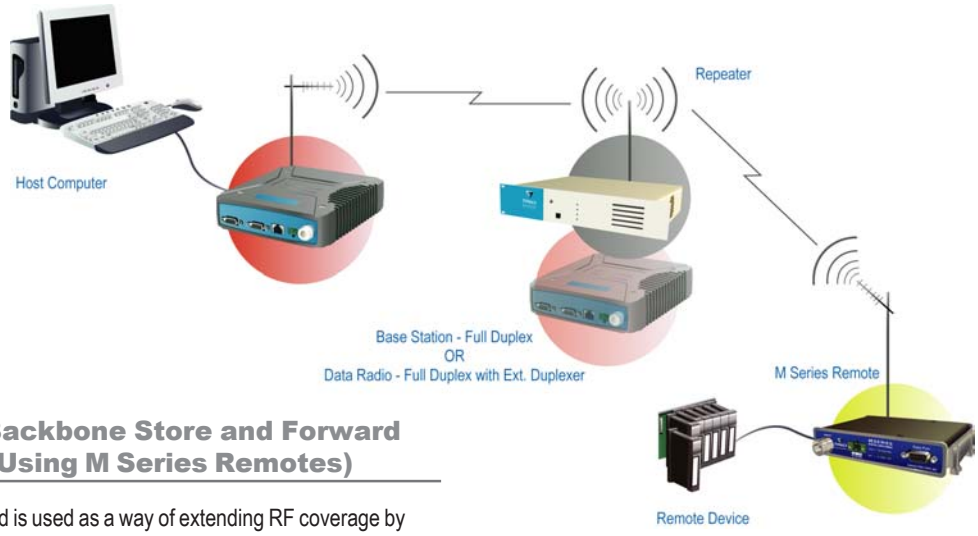
In either case, it will be necessary for the application to support an addressing system, since the master needs to be able to select which remote device it wishes to communicate with. The radio system operates “transparently”, allowing the application’s protocol to provide the addressing, and thus control the traffic.



System Notes: In a Point-to-Multipoint System
- the host modem can send to a selected modem or,
- broadcast data to all
- receive data from all modems
- unlimited network size - limitation on bandwidth only
- base radio can be either a Remote Data Radio , or a Base Station

Digipeater Systems

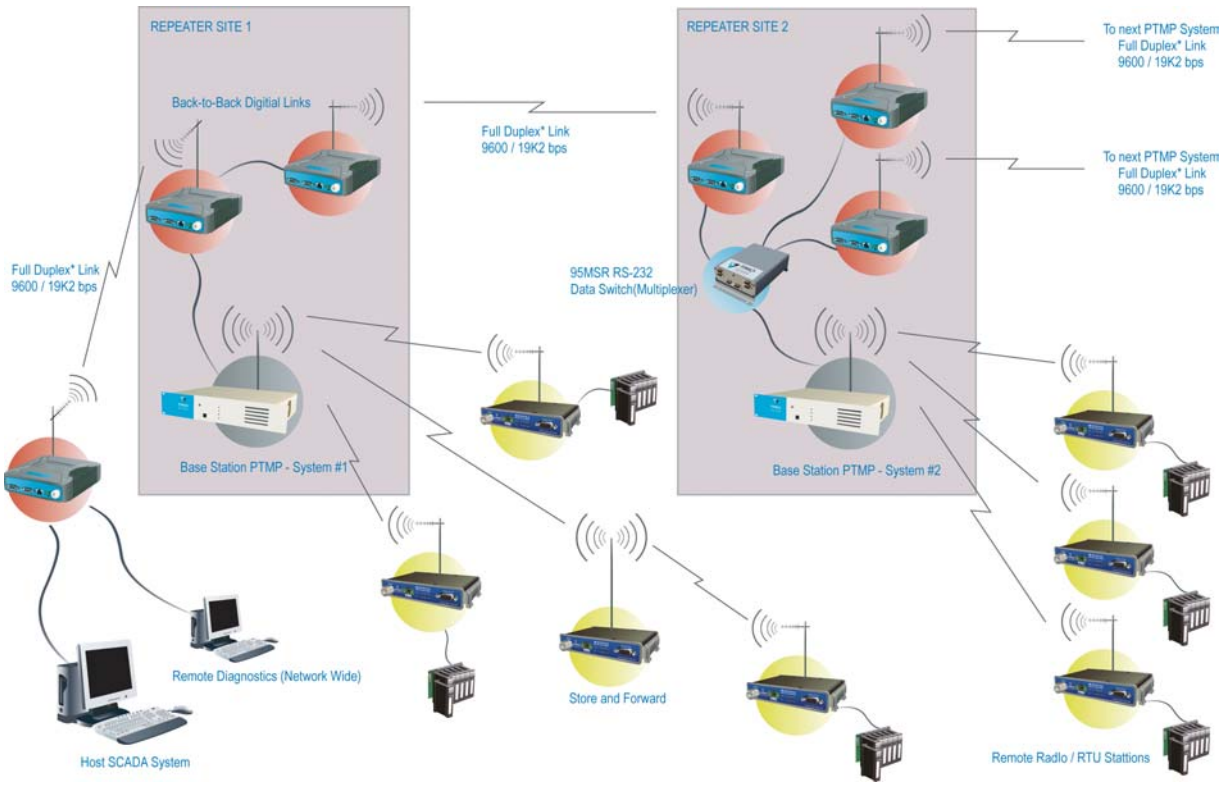
This configuration is used where all sites are required to communicate via a repeater site. A repeater site is used because it has a position and/or height advantage and thus provides superior or extended RF coverage. The radio modem at the repeater does not have to be physically connected to the application's master site. Information from the application's master is transmitted to the repeater via radio, and the repeater then relays this information to the other field sites. In this scenario, the repeater is the master from an RF point of view, and the application master is effectively a "remote" from an RF point of view, even though it is controlling the data transfer on the system.



E Series Backbone Store and Forward Systems (Using M Series Remotes)

Store and forward is used as a way of extending RF coverage by repeating data messages from one site to another.

Example shows E Series Backbone with E or M Series remotes.



Part D – System Planning and Design

Understanding RF Path Requirements

A radio modem needs a minimum amount of received RF signal to operate reliably and provide adequate data throughput.

In most cases, spectrum regulatory authorities will also define or limit the amount of signal that can be transmitted, and the transmitted power will decay with distance and other factors, as it moves away from the transmitting antenna.

It follows, therefore, that for a given transmission level, there will be a finite distance at which a receiver can operate reliably with respect to the transmitter.

Apart from signal loss due to distance, other factors that will decay a signal include obstructions (hills, buildings, foliage), horizon (effectively the bulge between two points on the earth), and (to a minimal extent at UHF frequencies) factors such as fog, heavy rain-bursts, dust storms, etc.

In order to ascertain the available RF coverage from a transmitting station, it will be necessary to consider these factors. This can be done in a number of ways, including

(a) using basic formulas to calculate the theoretically available signal - allowing only for free space loss due to distance,

(b) using sophisticated software to build earth terrain models and apply other correction factors such as earth curvature and the effects of obstructions, and

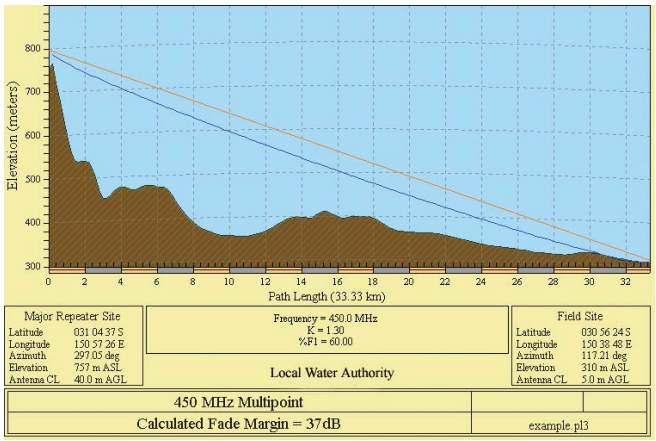
(c) by actual field strength testing.

It is good design practice to consider the results of at least two of these models to design a radio path.

Examples of Predictive Path Modelling

Clear line of site

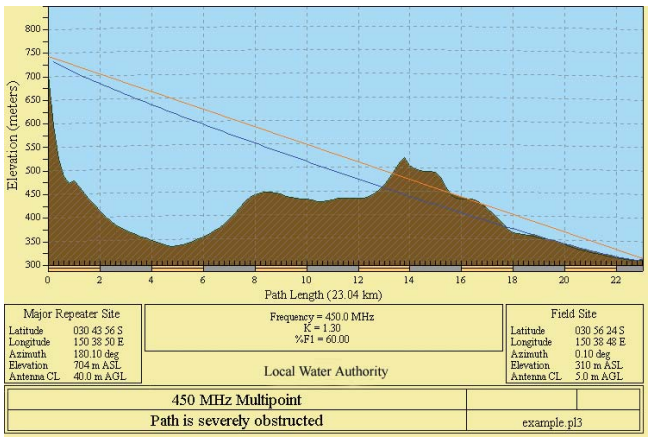
Radio path with good signal levels, attenuated only by free space loss.



goodpath.pl3	Major Repeater Site	Field Site
Elevation (m)	756.69	309.67
Latitude	031 04 37.49 S	030 56 24.00 S
Longitude	150 57 26.34 E	150 38 48.00 E
Azimuth	297.05	117.21
Antenna Type	ANT450/6OM	ANT450/9AL
Antenna Height (m)	40.00	5.00
Antenna Gain (dBi)	8.15	11.15
Antenna Gain (dBd)	6.00	9.00
TX Line Type	LDF4-50	LDF4-50
TX Line Length (m)	40.00	5.00
TX Line Unit Loss (dB/100 m)	6.79	6.79
TX Line Loss (dB)	2.72	0.34
Connector Loss (dB)	2.00	2.00
Frequency (MHz)	450.00	
Path Length (km)	33.33	
Free Space Loss (dB)	115.99	
Diffraction Loss (dB)	0.00	
Net Path Loss (dB)	103.75	103.75
Radio Type Model	EB450	ER450
TX Power (watts)	5.00	1.00
TX Power (dBW)	6.99	0.00
Effective Radiated Power (watts)	6.71	4.63
Effective Radiated Power (dBW)	8.27	6.66
RX Sensitivity Level (uv)	0.71	1.26
RX Sensitivity Level (dBW)	-140.00	-135.00
RX Signal (uv)	45.93	102.70
RX Signal (dBW)	-103.75	-96.76
RX Field Strength (uv/m)	453.14	545.42
Fade Margin (dB)	36.25	38.24
Raleigh Service Probability (%)	99.976	99.985

Obstructed Radio Path

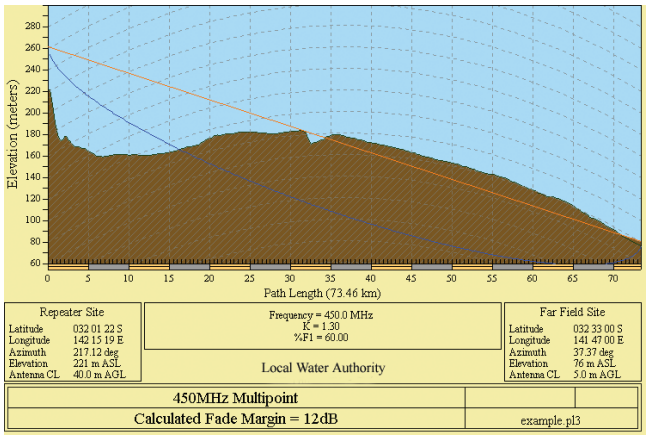
This path has an obstruction that will seriously degrade the signal arriving at the field site.



obstpath.pl3	Major Repeater Site	Field Site
Elevation (m)	703.83	309.67
Latitude	030 43 55.92 S	030 56 24.00 S
Longitude	150 38 49.51 E	150 38 48.00 E
Azimuth	180.10	0.10
Antenna Type	ANT450/6OM	ANT450/9AL
Antenna Height (m)	40.00	5.00
Antenna Gain (dBi)	8.15	11.15
Antenna Gain (dBd)	6.00	9.00
TX Line Type	LDF4-50	LDF4-50
TX Line Length (m)	40.00	5.00
TX Line Unit Loss (dB/100 m)	6.79	6.79
TX Line Loss (dB)	2.72	0.34
Connector Loss (dB)	2.00	2.00
Frequency (MHz)	450.00	
Path Length (km)	23.04	
Free Space Loss (dB)	112.78	
Diffraction Loss (dB)	16.71	
Net Path Loss (dB)	117.25	117.25
Radio Type Model	EB450	ER450
TX Power (watts)	5.00	1.00
TX Power (dBW)	6.99	0.00
Effective Radiated Power (watts)	6.71	4.63
Effective Radiated Power (dBW)	8.27	6.66
RX Sensitivity Level (uv)	0.71	1.26
RX Sensitivity Level (dBW)	-140.00	-135.00
RX Signal (uv)	9.70	21.70
RX Signal (dBW)	-117.25	-110.26
RX Field Strength (uv/m)	95.74	115.23
Fade Margin (dB)	22.75	24.74
Raleigh Service Probability (%)	99.470	99.665

Effect of Earth Curvature on Long Paths

This path requires greater mast height to offset the earth curvature experienced at such a distance (73km).



longpath.pl3	Repeater Site	Far Field Site
Elevation (m)	221.26	75.58
Latitude	032 01 21.63 S	032 33 00.00 S
Longitude	142 15 19.26 E	141 47 00.00 E
Azimuth	217.12	37.37
Antenna Type	ANT450/6OM	ANT450/9AL
Antenna Height (m)	40.00	5.00
Antenna Gain (dBi)	8.15	11.15
Antenna Gain (dBd)	6.00	9.00
TX Line Type	LDF4-50	LDF4-50
TX Line Length (m)	40.00	5.00
	6.79	6.79
TX Line Loss (dB)	2.72	0.34
Connector Loss (dB)	2.00	2.00
Frequency (MHz)	450.00	
Path Length (km)	73.46	
Free Space Loss (dB)	122.85	
Diffraction Loss (dB)	22.94	
Net Path Loss (dB)	133.55	133.55
Radio Type Model	EB450	ER450
TX Power (watts)	5.00	1.00
TX Power (dBW)	6.99	0.00
Effective Radiated Power (watts)	6.72	4.64
Effective Radiated Power (dBW)	8.27	6.66
RX Sensitivity Level (uv)	0.71	1.26
RX Sensitivity Level (dBW)	-140.00	-135.00
RX Signal (uv)	1.49	3.32
RX Signal (dBW)	-133.55	-126.56
RX Field Strength (uv/m)	14.65	17.64
Fade Margin (dB)	6.45	8.44
Raleigh Service Probability (%)	79.735	86.656

Selecting Antennas

There are basically two types of antennas – omni-directional and directional.

Omnidirectional antennas are designed to radiate signal in a 360 degrees segment around the antenna. Basic short range antennas such as folded dipoles and ground independent whips are used to radiate the signal in a "ball" shaped pattern. High gain omni antennas such as the "co-linear" compress the sphere of energy into the horizontal plane, providing a relatively flat "disc" shaped pattern which goes further because all of the energy is radiated in the horizontal plane.

Directional antennas are designed to concentrate the signal into a "beam" of energy for transmission in a single direction (i.e. for point-to-point or remote to base applications).

Beamwidths vary according to the antenna type, and so can be selected to suit design requirements. The most common UHF directional antenna is the yagi, which offers useable beam widths of 30-50 degrees. Even higher "gain" is available using parabolic "dish" type antennas such as gridpacks.

Onmi directional
360 degree signal

Directional
Concentrated beam

Antenna Gain

By compressing the transmission energy into a disc or beam, the antenna provides more energy (a stronger signal) in that direction, and thus is said to have a performance "gain" over a basic omni antenna. Gain is usually expressed in dBd, which is referenced to a standard folded dipole. Gain can also be expressed in dBi, which is referenced to a theoretical "isotropic" radiator. Either way, if you intend to send and receive signals from a single direction, there is advantage in using a directional antenna - both due to the increased signal in the wanted direction, and the relatively decreased signal in the unwanted direction (i.e. "interference rejection" properties).

Tuning the Antenna

Many antennas are manufactured for use over a wide frequency range. Typical fixed use antennas such as folded dipoles and yagis are generally supplied with the quoted gain available over the entire specified band range, and do not require tuning. Co-linear antennas are normally built to a specific frequency specified when ordering.

With mobile "whip" type antennas, it is sometimes necessary to "tune" the antenna for the best performance on the required frequency. This is usually done by trimming an antenna element whilst measuring VSWR, or simply trimming to a manufacturer supplied chart showing length vs frequency. These antennas would normally be supplied with the tuning information provided.

Antenna Placement

When mounting the antenna, it is necessary to consider the following criteria:

The mounting structure will need to be solid enough to withstand additional loading on the antenna mount due to extreme wind, ice or snow (and in some cases, large birds).

For omni directional antennas, it is necessary to consider the effect of the mounting structure (tower mast or building) on the radiation pattern. Close in structures, particularly steel structures, can alter the radiation pattern of the antenna. Where possible, omni antennas should always be mounted on the top of the mast or pole to minimise this effect. If this is not possible, mount the antenna on a horizontal outrigger to get it at least 1-2m away from the structure. When mounting on buildings, a small mast or pole (2-4m) can significantly improve the radiation pattern by providing clearance from the building structure.

For directional antennas, it is generally only necessary to consider the structure in relation to the forward radiation pattern of the antenna, unless the structure is metallic, and of a solid nature. In this case it is also prudent to position the antenna as far away from the structure as is practical. With directional antennas, it is also necessary to ensure that the antenna cannot move in such a way that the directional beamwidth will be affected. For long yagi antennas, it is often necessary to install a fibreglass strut to stablilise the antenna under windy conditions.

Alignment of Directional Antennas

This is generally performed by altering the alignment of the antenna whilst measuring the received signal strength. If the signal is weak, it may be necessary to pre-align the antenna using a compass, GPS, visual or map guidance in order to "find" the wanted signal. Yagi antennas have a number of lower gain "lobes" centred around the primary lobe. When aligning for best signal strength, it is important to scan the antenna through at least 90 degrees, to ensure that the centre (strongest) lobe is identified.

When aligning a directional antenna, avoid placing your hands or body in the vicinity of the radiating element or the forward beam pattern, as this will affect the performance of the antenna.

RF Feeders and Protection

The antenna is connected to the radio modem by way of an RF feeder. In choosing the feeder type, one must compromise between the loss caused by the feeder, and the cost, flexibility, and bulk of lower loss feeders. To do this, it is often prudent to perform path analysis first, in order to determine how much "spare" signal can be allowed to be lost in the feeder. The feeder is also a critical part of the lightning protection system.

All elevated antennas may be exposed to induced or direct lightning strikes, and correct grounding of the feeder and mast are an essential part of this process. Gas discharge lightning arresters should also be fitted to all sites.

Note: All ETSI installations require the use of a lightning surge arrestor in order to meet EN6095. See Part A - Preface for lightning arrestor specifications.

Common Cable Types	Loss per meter @ 450MHz	Loss per 10m @ 450MHz
RG58C/U	0.4426dB	4.4dB
RG213/U	0.1639dB	1.6dB
FSJ1-50 (¼" superflex)	0.1475dB	1.5dB
LDF4-50 (1/2" heliax)	0.0525dB	0.52dB
LDF5-50 (7/8" heliax)	0.0262dB	0.3dB

Data Connectivity

The V24 Standard

The M Series radio modems provide an asynchronous V24 compliant RS232 port for connection to a serial data device.

There are two types of RS232 interfaces – DTE and DCE.

DTE stands for *data terminal equipment* and is generally applied to any intelligent device that has a need to communicate to another device via RS232. For example: P.C. Comm ports are always DTE, as are most PLC and RTU serial ports.

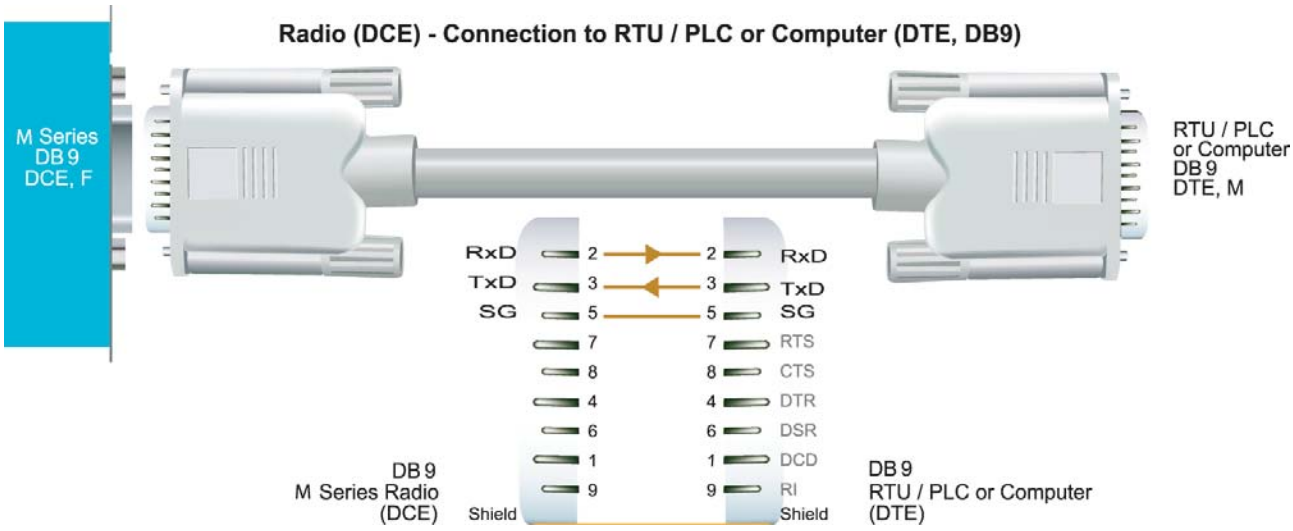
DCE stands for *data communication equipment* and is generally applied to a device used for sending data over some medium (wires, radio, fibre etc), i.e. any MODEM.

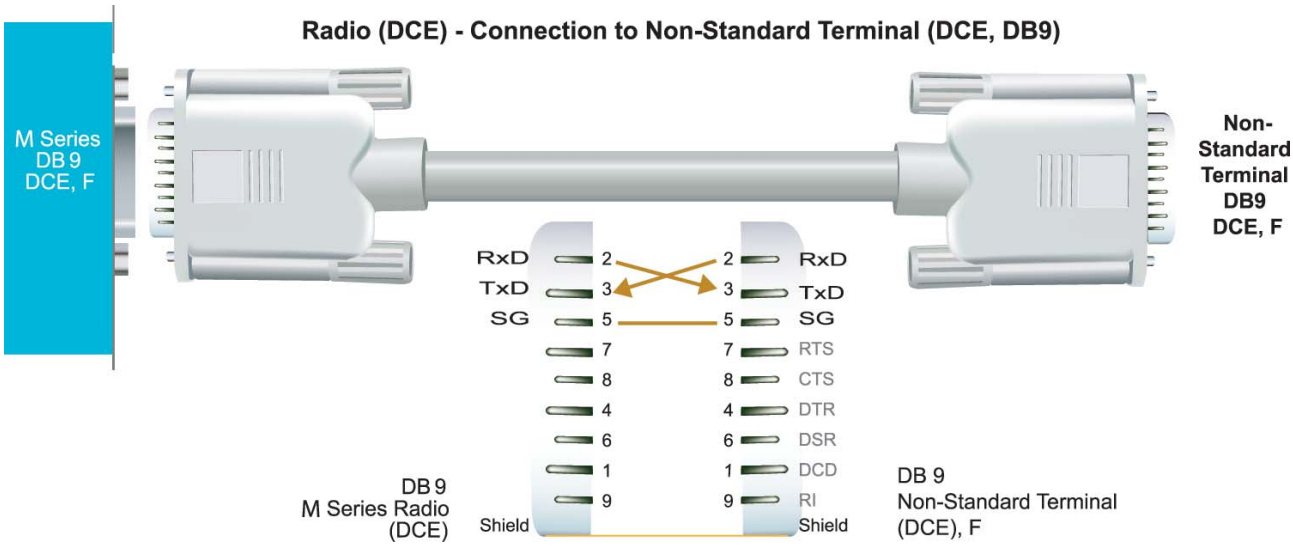
The standard interface between a DTE and DCE device (using the same connector type) is a straight through cable (i.e. each pin connects to the same numbered corresponding pin at the other end of the cable).

The "V24" definition originally specified the DB25 connector standard, but this has been complicated by the emergence of the DB9 (pseudo) standard for asynch devices, and this connector standard has different pin assignments.

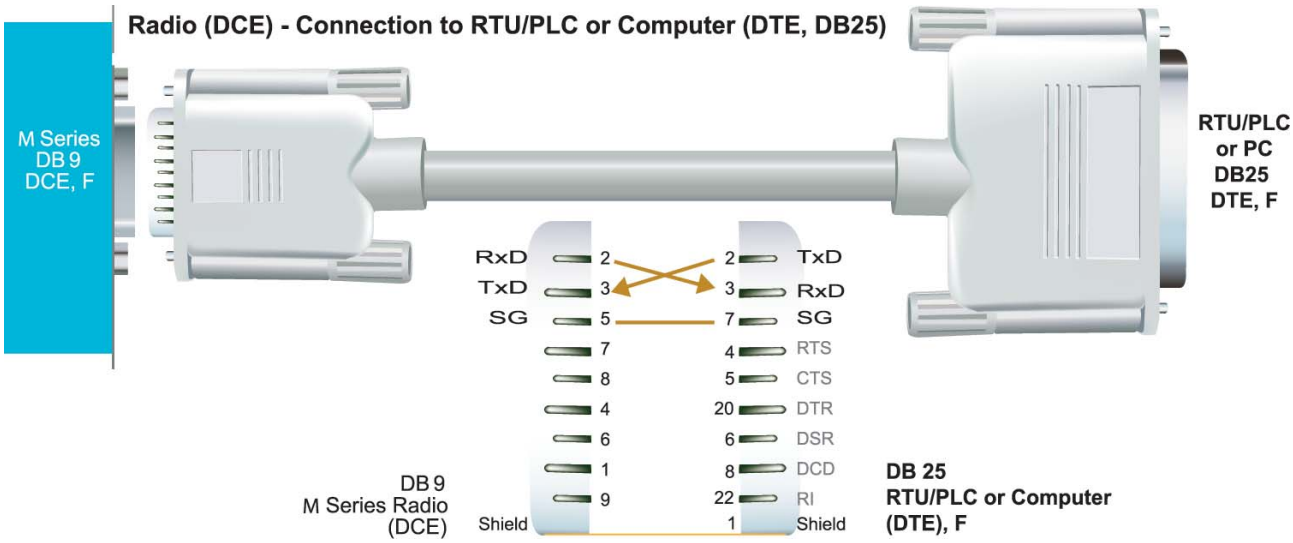
The wiring standard is "unbalanced", and provides for three basic data transfer wires (TXD, RXD, and SG – signal ground).

Cable Wiring Diagrams

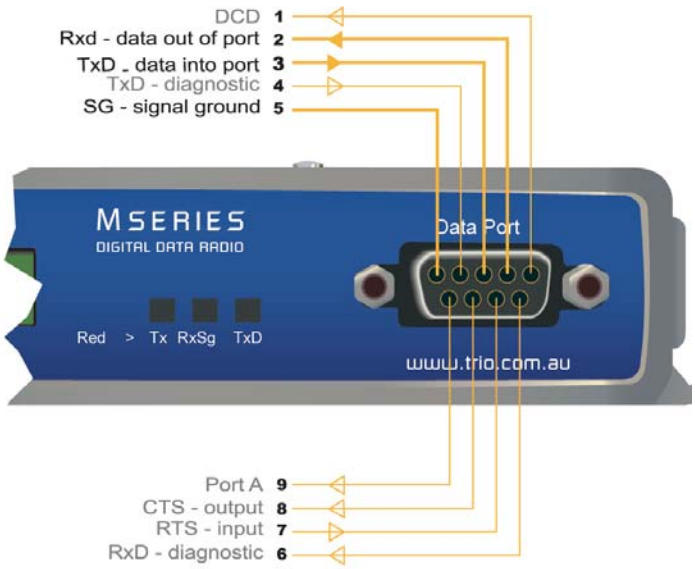




Cable Wiring Diagrams



RS232 Connector Pin outs (DCE)
Port A, Female DB9



Power Supply and Environmental Considerations

General

When mounting the equipment, consideration should be given to the environmental aspects of the site. The cabinet should be positioned so that it is shaded from hot afternoon sun, or icy cold wind. Whilst the radios are designed for harsh temperature extremes, they will give a longer service life if operated in a more stable temperature environment. In an industrial environment, the radio modems should be isolated from excessive vibration, which can cause data errors and destroy electronic components, solder joints, and crystals.

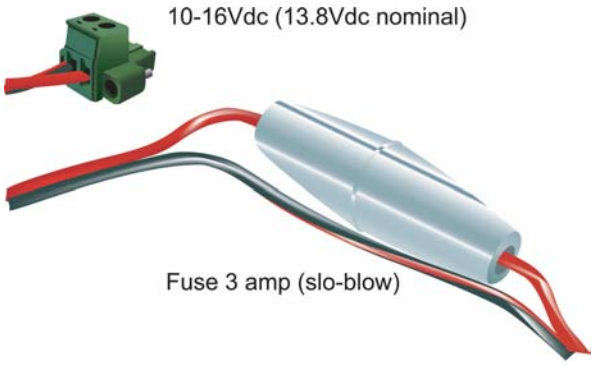
The cabinet should provide full protection from moisture, dust, corrosive atmospheres, and residues from ants and small vermin (which can be corrosive or conductive). The radio modem will radiate heat from the in-built heatsink, and the higher the transmitter duty cycle, the more heat will be radiated from the heatsink. Ensure there is sufficient ventilation in the form of passive or forced air circulation to ensure that the radio is able to maintain quoted temperature limits.

Power Supply

The power supply should provide a clean, filtered DC source. The radio modem is designed and calibrated to operate from a 13.8VDC regulated supply, but will operate from 10-16 volts (filtered) DC.

The power supply must be able to supply sufficient current to provide clean filtered DC under the full current conditions of the radio modem (i.e. when transmitting full RF power). See Part I - Specifications for more details of the power supply requirements.

Solar Applications



⚠ **Caution**: There is **NO** internal replaceable fuse, and therefore the radio modem power supply **MUST** be externally fused. (MR450: 3 amp slo-blow fuse, EB450: 5 amp fast-blow fuse, EH450 Controller: 1 amp fast-blow fuse).

In solar or battery-backed installations, a battery management unit should be fitted to cut off power to the radio when battery levels fall below the minimum voltage specification of the radio. In solar applications, a solar regulation unit MUST ALSO be fitted to ensure that the radio (and battery) is protected from excessive voltage under full sun conditions.

When calculating solar and battery capacity requirements, the constant current consumption will be approximately equal to the transmit current multiplied by the duty cycle of the transmitter, plus the receive current multiplied by the (remaining) duty cycle of the receiver.

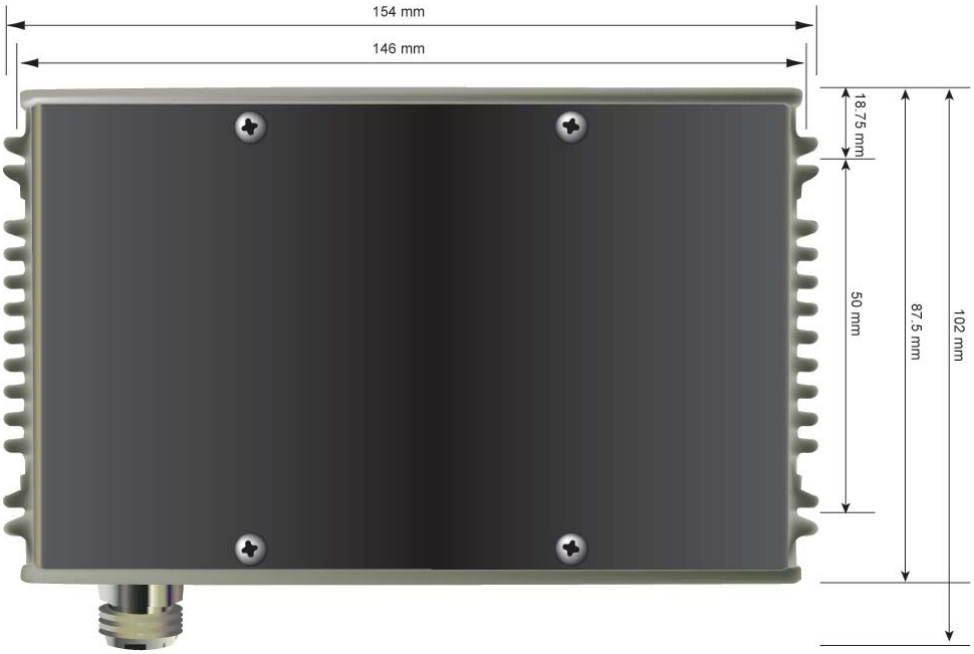
The Tx/Rx duty cycle will be entirely dependent on the amount of data being transmitted by the radio modem, unless the device has been configured for continuous transmit, in which case the constant current consumption will be equal to the transmit current only (at 100% duty cycle).

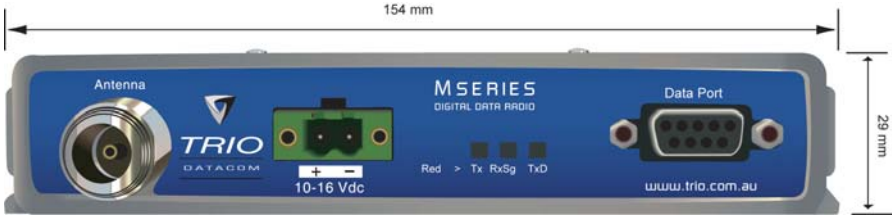
Note: Operation below the minimum specified supply voltages could result in poor radio performance. If the supply voltage falls below 7.2Vdc the radio will shut down. Normal radio startup will not occur until 10Vdc is supplied.

Site Earthing

The radio must not be allowed to provide a ground path from chassis to (DB9) signal ground or (-) battery ground. Ensure that the chassis mounting plate, power supply (-) earth, RTU terminal device, and lightning arrester, are all securely earthed to a common ground point to which an earth stake is attached. Please pay particular attention to 24Vdc PLC systems using DC-DC converters to supply 13.8Vdc.

Physical Dimensions - Remote Data Radio - MR450





Physical Dimensions - Base Station - EB450

Physical Dimensions - Hot Standby Base Station - EH450

Part E – Getting Started

MR450 Quick Start Guide

Introduction

Welcome to the *MR450 Quick Start Guide*. This guide provides step-by-step instructions, with simple explanations to get you up and running.

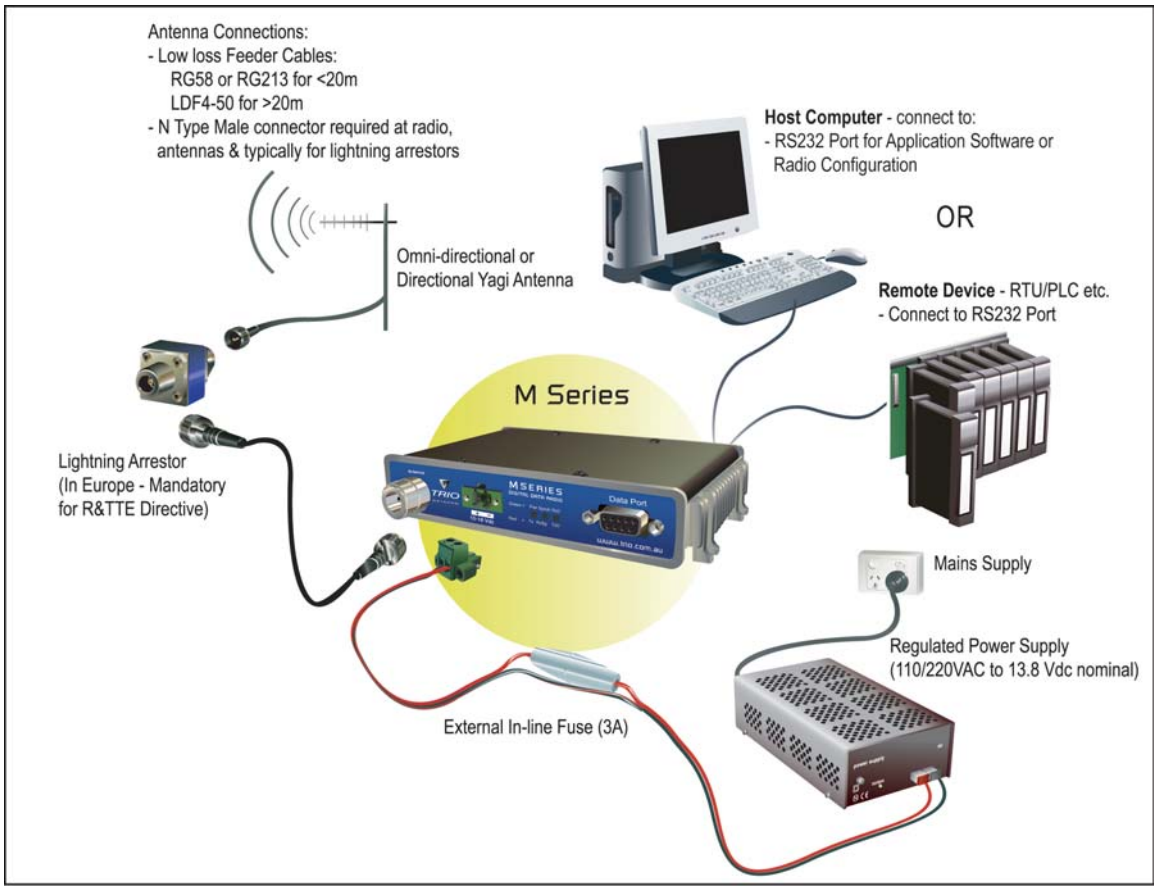
Mounting and Environmental Considerations

The MR450 radio comes complete with integrated mounting feet and is attached to a panel or tray by means of screws or bolts, using the hole slots provided.

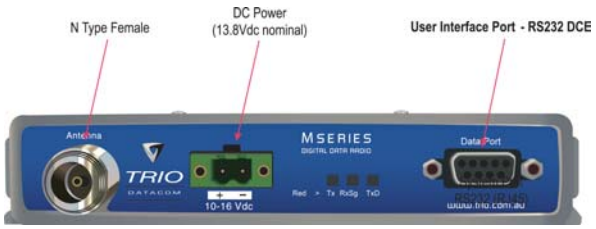
Note: In high power or high temperature applications, it is desirable to mount the radio with maximum ventilation for the heat sink.

The radio should be mounted in a clean and dry location, protected from water, excessive dust, corrosive fumes, extremes of temperature and direct sunlight. Please allow sufficient passive or active ventilation to ensure the radio modem's heat sink to operate efficiently.

Typical Radio Setup



MR450 Connections Layout



Connecting Antennas and RF Feeders

The RF antenna system should be installed in accordance with the manufacturers notes.

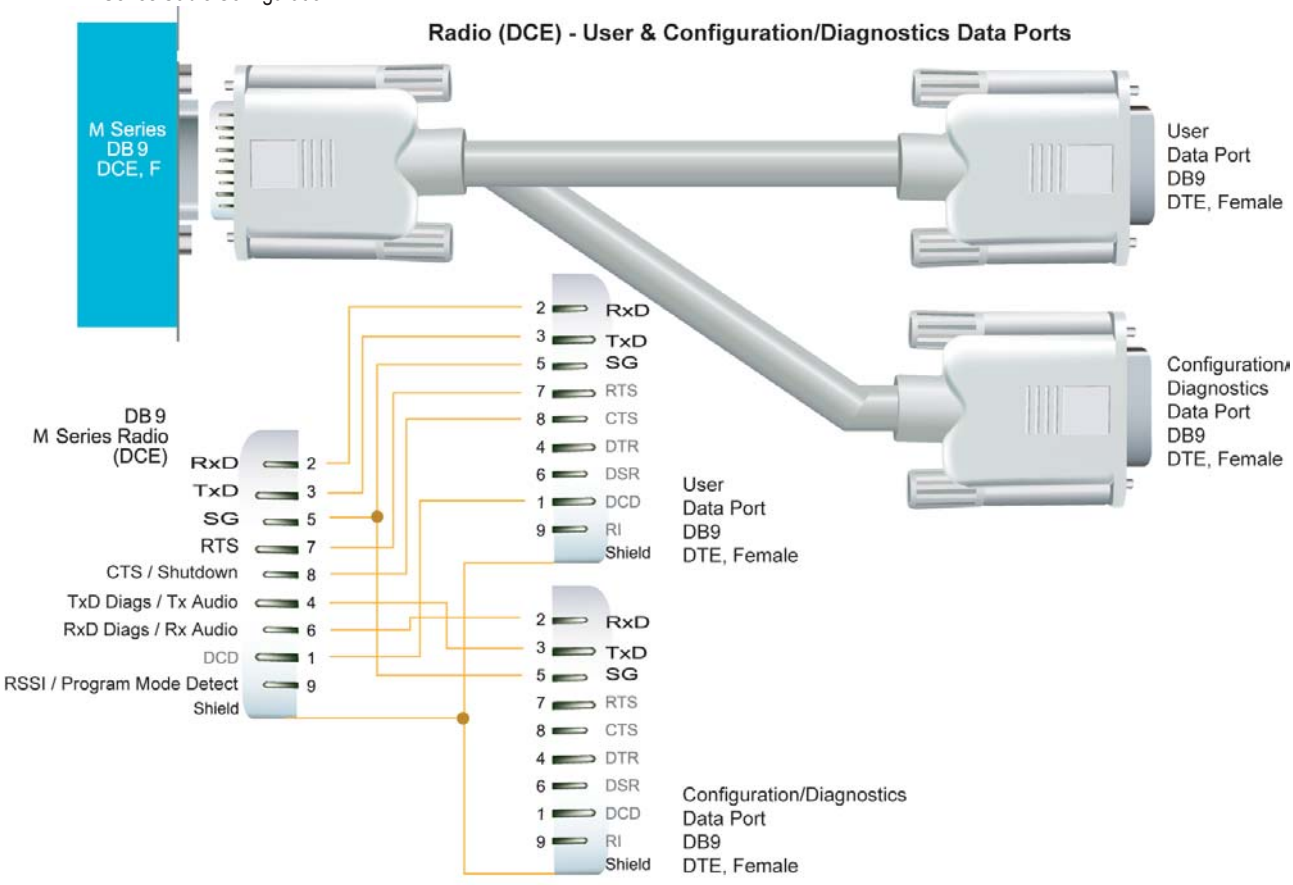
The RF connector used on the M Series radios are N Type female connectors. Always use good quality low loss feeder cable, selected according to the length of the cable run. Ensure all external connections are waterproofed using amalgamating tape.

Preset directional antennas in the required direction using a compass, GPS, or visual alignment and ensure correct polarisation (vertical or horizontal).

Communications Ports

The TVIEW+ M Series User & Configuration / Diagnostics Cable is a DB9 (Male) to two DB9 (Females) patch cable. It provides a connection for user data and configuration / diagnostics. It is intended for RS232 serial communications.

TVIEW+ M Series Cable Configuration:



User Interface

The user port is wired as a RS232 DCE, configured for no handshaking (3-wire) interface.

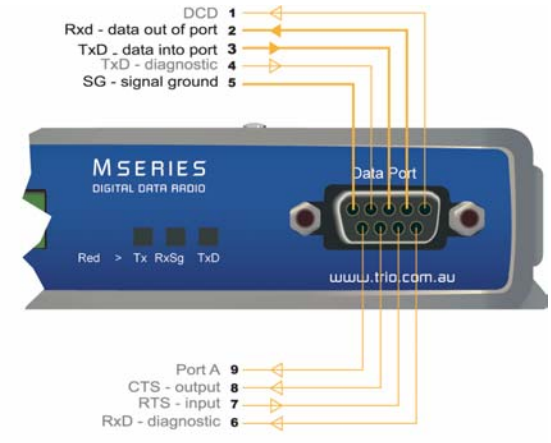
Only 3 wires need to be connected between the radio and the application device.

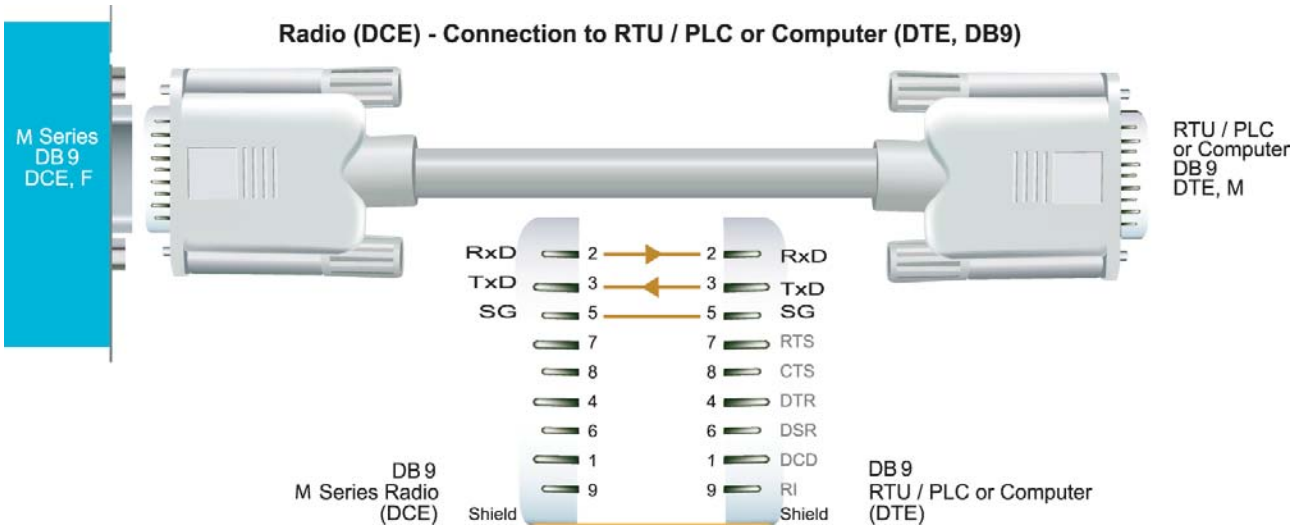
Typical pins used:

- Pin 2 (RxD) - Data Output from Modem.
- Pin 3 (TxD) - Data Input To Modem .
- Pin 5 (SG) - signal ground.

See Part D – System Planning and Design - Data Connectivity, for further details of other cable configurations.

RS232 Connector Pin outs (DCE)
Port A, Female DB9





Activating the Transmitter

In most systems, the transmitter by default is controlled automatically by the radio when it has data to transmit.

To manually activate the radio transmitter, connect (ie: link) the RTS signal (Pin 7) to Aux (Pin 8).

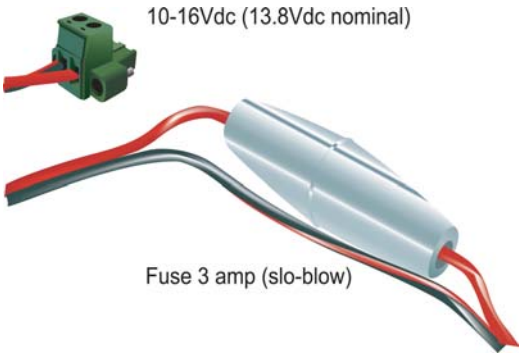
To operate in this mode, the radio must be configured via the programming software for PTT from RTS.

⚠ **Caution**: Ensure a RF load is present BEFORE transmitting.

Power Supply Requirements

The M Series radio modem is designed and calibrated to operate from a filtered 13.8Vdc regulated supply, but will operate from a 10-16Vdc range. See the User Manual for more details on power supply requirements.

⚠ **Caution**: There is **NO** internal replaceable fuse and therefore an external fuse **MUST** be fitted as shown in diagram below (MR450: 3 amp slo-blow fuse, EB450: 5 amp fast-blow fuse, EH450 Controller 1 amp slo-blow fuse).



The radio is designed to self protect, and will blow the external fuse if the voltage exceeds 16Vdc, or if reverse polarity is applied.

The radio modem can also be damaged if there is any potential difference between the chassis-ground, RS232 signal ground, power (-) input, or antenna coaxial shield. Before connecting any wiring, ensure all components are earthed to a common ground point (please pay particular attention to 24V PLC power systems where converters are used).

Connect the antenna and RS 232 plugs BEFORE applying power to the unit.

Lastly, before inserting the power plug, please **re-check that the polarity and voltage on the power plug is correct using a multimeter.** Failure to use an external fuse will result in damage to the radio which will void the warranty.

TVIEW+ Management Suite - Radio Configuration

This TVIEW+ Management Suite provides a facility for local radio configuration and diagnostics.

Example: Configuration session –

1 Attach the TVIEW+MSeries cable between the radio Data Port A and the PC serial port. Ensure the Configuration/Diagnostics plug is connected to the PC serial port and NOT the User Data plug.

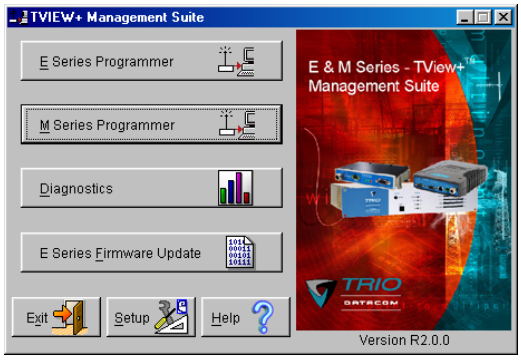
2 Launch TVIEW+ & Select "Programmer"

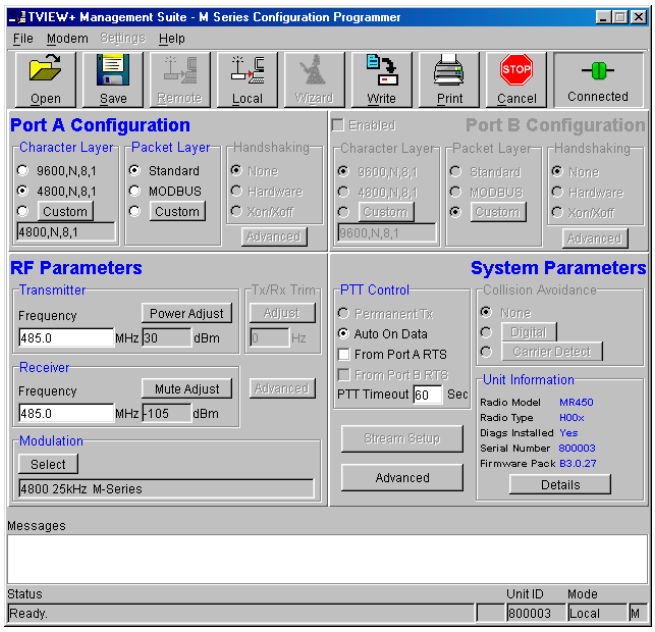
3 Select **"Read"** the radio

4 Change the configuration as required

5 Select "Write" the parameters back to the radio

Refer to to the User Manual for detailed operation of advanced features.



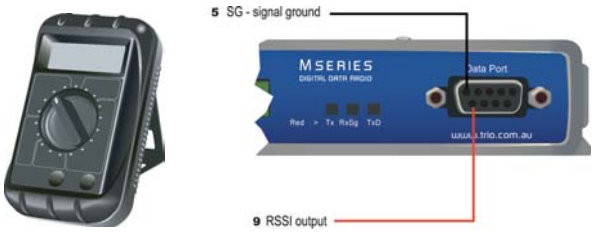


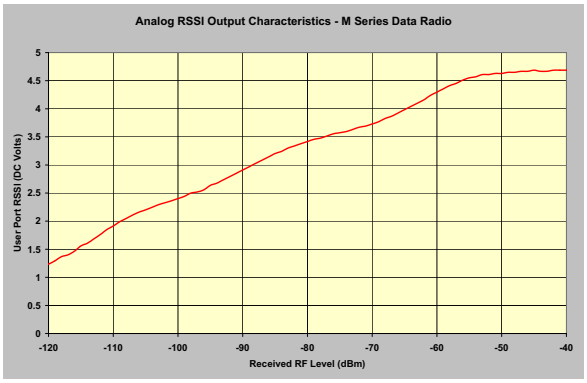
Optimising the Antenna for best RX signal

Once the unit is operational, it is important to optimise the antenna tuning.

In the case of a directional antenna, it will be necessary to align the antenna for the best received signal.

This can be done by using the (0-5Vdc) output on Pin 9 of the Port to indicate signal strength (RSSI). This voltage can be converted to dBm using the chart below.



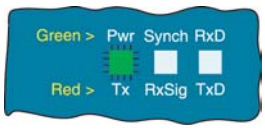


LED Indicators & Test Outputs

LED Legend

Radio is Powered

If all the LEDs are off, check if power is reaching the radio modem. Successful power-up is indicated by the **"PWR"** LED indicating a continuous (healthy) GREEN state.



Note that this LED turns RED when the transmitter is active.

Radio Errors

Internal radio management software monitors many aspects of the radio hardware. Under certain circumstances radio faults may prevent normal operation. In the event that these fault conditions occur, the radio will enter an ERROR state and this will be indicated by flashing ALL LEDs RED, then flashing a pattern of GREEN LEDs. The pattern of all GREEN LEDs represents the specific type of error that has occurred. See Table below.

User Port	Synch/ RxSig	Pwr/Tx	Error Diagnosis
OFF	OFF	ON	External Supply Voltage out of spec. (1)
ON	ON	OFF	VCO Out of Lock. (2)

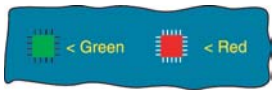
All other patterns indicate serious hardware errors that can only be fixed by an authorised service center. Please record this pattern and return the result with the service return information.

Note (1): If external voltage is too high (>16Vdc) radio damage may occur. If the external voltage is too low (<10Vdc) the radio may not operate within specifications.

Note (2) : If this error occurs the radio will need to be returned for service.

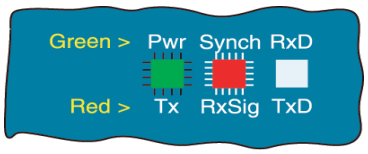
Received Signal Indicator

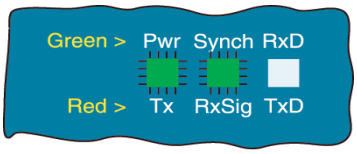
LED Legend



The **"Rx/Synch"** LED is used to indicate the state of the receiver. If the LED is off, no signal is being received. A RED indication shows that an RF carrier is being received, but no data stream can be decoded. This may indicate the presence of interference or another user on the channel.

A continuous GREEN indication shows that the modem is locked and synchronised to the incoming signal, and has good Bit Error Rate (BER).





Data Flow "breakout" LEDs

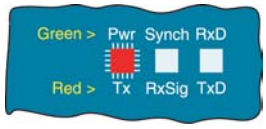
There is also a LED to indicate data flow into and out of the user port. Data into the radio modem is shown as a RED flash, and received data out of the modem is shown as a GREEN flash.

If data is alternately flowing in and out quickly, then the indicator appears orange.

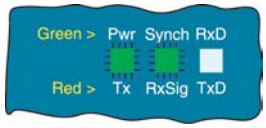
Verifying Operational Health

It is possible to verify the operation of the radio modem using the indicators provided by the unit. The state of the transmitter and receiver, and data flow can be interpreted by the indicator LEDs (see below).

Half Duplex – Master or Slave (Tx)



Half Duplex – Master or Slave (Rx)



EB450 Quick Start Guide

Introduction

Welcome to the *Quick Start Guide for the EB450 Base / Repeater Data Radio*. This guide provides step-by-step instructions, with simple explanations to get you up-and-running.

Mounting and Environmental Considerations

The EB450 Base Station is housed in a 2RU 19" rack enclosure. The 4 mounting holes on the front panel should be used to secure the unit to the rack.

The radio should be mounted in a clean and dry location, protected from water, excessive dust, corrosive fumes, extremes of temperature and direct sunlight. Please allow sufficient passive or active ventilation to allow the radio modem's heatsink to operate efficiently.

All permanent connections are made at the rear of the unit. This includes: Power, Antenna, Communications Ports, Digital I/O and System Port. The front panel has an additional System Port connection point for easy access.

Full Duplex Considerations

The EB450 is designed for continuous full duplex transmission. An automatic thermostatically controlled fan will operate whenever the internal temperature exceeds 50 degrees Celsius.

External Duplexer Considerations

The EB450 is normally supplied with separate Tx and Rx ports for connection to an external duplexing system.

Depending on the frequency band of operation and the Tx/Rx frequency split, internal band reject duplexers are available.

Connecting Antennas and RF Feeders

See MR450 Quick Start Guide

Communications Ports

See MR450 Quick Start Guide

Power Supply and Protection

See MR450 Quick Start Guide

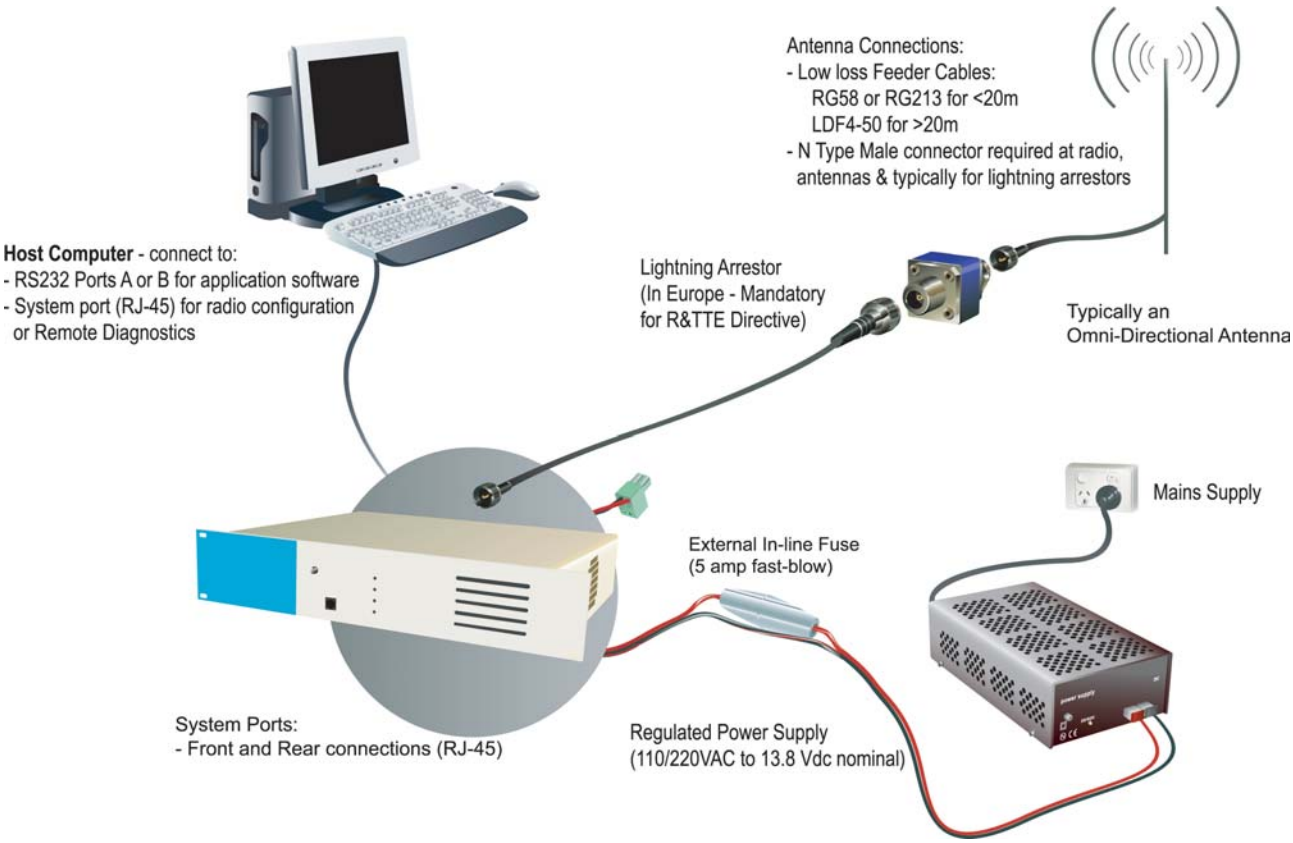
TVIEW+ Management Suite - Radio Configuration

See MR450 Quick Start Guide

Optimising the Antenna for VSWR and best RX signal

See MR450 Quick Start Guide

Typical Radio Setup



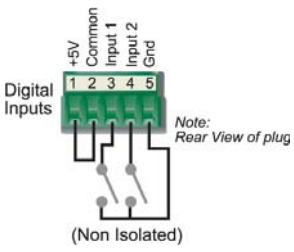
Digital Inputs and Outputs

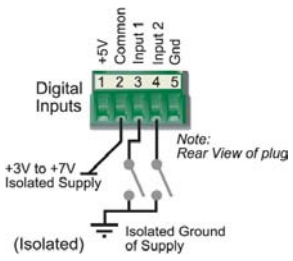
The EB450 provides a facility for two channels of digital user inputs and outputs (Digital User I/O). Information on how to control and monitor this I/O using TVIEW+ Diagnostics can be found in the E Series User Manual - Part J - TVIEW+ Management Suite - Remote Diagnostics & Network Controller.

All user I/O is optocoupled for isolation between the EB450 and uses equipment. When using the I/O facility the I/O electrical characteristics and ratings must be observed. Failure to observe these ratings may result in equipment damage.

Inputs

Two User Inputs are available. They have identical interface characteristics. Each input has an internal resistance of 470 Ohms. Some form of switching contact (ie: switch, relay) is normally used to change the state of the input. Both an isolated and non-isolated input configuration is possible.





TVIEW+ Diagnostics will recognise an input as being ON when the switch is closed. If the switch is open (or not connected) TVIEW+ diagnostics will recognise the inputs as being OFF.

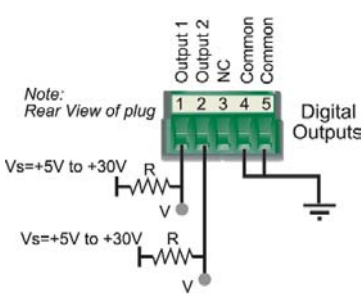
Outputs

Two User Outputs (Open Collector) are available. They have identical interface characteristics. The maximum current allowed through each output is 20ma. External resistors must be used keep the current below this value.

Each output has an internal resistance of 100 Ohms.Ohms law can be used to calculate the resistance required for a specific voltage (keeping the current below 20mA). Nominally 1k Ohm is used for a +13v8 supply and 330 Ohms for a +5v supply.

When the OUTPUT is OFF, V = Vs. No current will flow when output is off.

When the OUTPUT is ON, V = nominally 2.3 volts . Current is set by resistor.

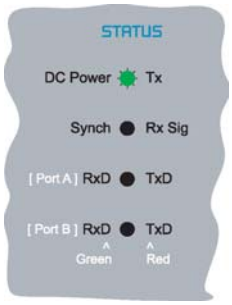


LED Indicators & Test outputs

Radio is Powered

If all the LEDs are off, no power is reaching the radio modem.

Successful power-up is indicated by the **"PWR"** LED indicating a continuous (healthy) GREEN state. Note that this LED is turned RED when the transmitter is active.



LED Legend

Hardware Error

A hardware error is indicated on the status LEDs by all LEDs flashing RED at a rate of 1Hz. This indicates internal communications to the exciter inside the basestation has been lost and the base station needs to be returned to repair.

Received Signal Indicator

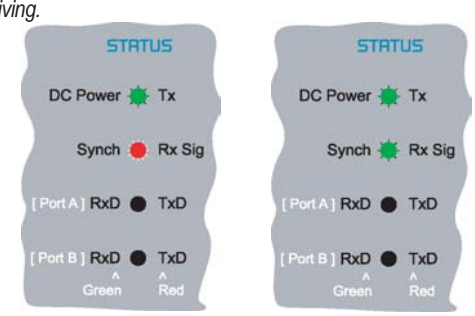
The **"RX/SYNC"** LED indicates the state of the receiver.

If the LED is off, no signal is being received.

A RED indication shows that an RF carrier is being received, but no data stream can be decoded. This will briefly happen at the very start of every valid received transmission or may indicate the presence of interference, or another user on the channel.

A continuous GREEN indication shows that the modem is locked and synchronised to the incoming signal, and has excellent Bit Error Rate (BER). Any losses of synchronisation (BER errors) are shown as a visible RED flicker of the LED.

Note: This might only be apparent on a PTMP slave when only receiving.



Data Flow "breakout" LEDs

There are also two LEDs to indicate data flow into and out of the two user ports.

Input data to be transmitted is shown as a RED flash, and received data to be output to the port is shown as a GREEN flash.

If data is alternately flowing in and out quickly, then the indicator appears Orange.

Bar Graph Indicators

The bar graph indicators on the front panel provide variable information regarding the performance of the Base Station. To enable / disable the bar graph display depress the Display ON / OFF button. The display will turn off automatically after 5 minutes.

DC Supply:

Indicates the supply input voltage at the exciter module. Typically 13.8Vdc.

Indication: <10Vdc no LED's on, 10-10.9Vdc LED's RED, 11-15.6Vdc All LED's GREEN, >=15.7Vdc last LED RED.

Tx Power:

Indicates forward RF power output as measured at the TX antenna port. Typically +37dBm.

Indication: <20dBm no LED's on, 20-40.6dBm (11.5W) LED's GREEN, >=40.7dBm last LED RED.

Tx Drive:

Indicates exciter drive level. Typically +20dBm.

Indication: <10dBm no LED's on, 10.0-25.9dBm LED's GREEN, >=26.0dBm last LED RED.

Rx Sig:

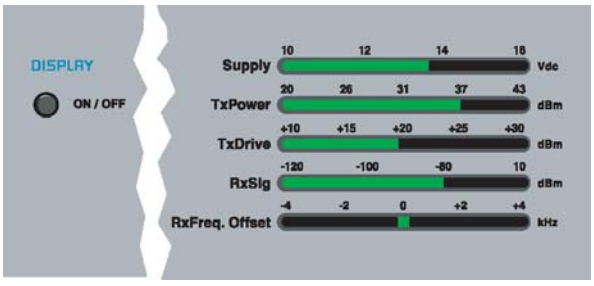
Indicates receive signal strength. Typically -85 to -65dBm.

Indication: <-120dBm no LED's on, -120 to -110.1dBm LED's RED, >=-110dBm LED's GREEN.

RxFreq. Offset:

Indicates offset of receiver AFC - useful in determining frequency drift. Typically 0kHz.

Indication: Single GREEN LED to indicate current value, <-3.6kHz or >+3.6kHz LED is RED. No signal, all LED's OFF.
Note: 5 second peak hold circuitry.



Test Mode

The Bar Graph indicators have a Test Mode, which cycles all LED's for correct operation (before returning to their normal operation). To activate this mode, simply depress the ON / OFF button while applying power to the unit.

EH450 Quick Start Guide

Introduction

Welcome to the *Quick Start Guide for the EH450 Hot Standby Base / Repeater Station*. This section provides additional step-by-step instructions to install, commission and operate the EH450 Hot Standby Base Station. This document should be read in conjunction with the EB450 Base Station Quick Start Guide.

The EH450 is a fully redundant, hot standby digital data radio base / repeater station providing automatic changeover facilities.

The EH450 is designed as a modular solution, comprising 2 identical EB450 base station units (standard) linked to a central, fail-safe monitoring and changeover controller (Hot Standby Controller). Either base station may be taken out for maintenance without the need for any system down time. The automatic changeover is triggered by out of tolerance (alarm) conditions based on either RF and/or user data throughput parameters.

Features and Benefits

- Individual and identical base stations with separate control logic changeover panel
- Modules are hot swapable without user downtime
- Flexible antenna options – single, separate Tx & Rx, two Tx and two Rx
- Both on-line and off-line units monitored regardless of active status
- Also refer to the common Features and Benefits list of the E Series Data Radio in the E Series User Manual

Base / Repeater Unit

Base / Repeater Unit

Hot Standby Controller Unit

Rear View

Note: RF connectors not used on ETSI version

Operational Description

The Hot Standby Controller (HSC) unit is a 1RU rack mounted module that interfaces to two physically separate base stations (each 2RU rack mounted modules) via a number of RF and data cables.

Both base stations are operating simultaneously and both units are constantly receiving signals, however only data from one base station, the "online" base station is directed to the user equipment. The online base station is the only base station transmitting at any time. The Hot Standby Controller has the following functions:

- Diplex the transmit and receive paths (Assuming internal duplexer fitted), TX Only.
- Amplify and split the incoming signal two ways so both base stations receive at once.
- Monitor status reports from both base stations to identify faults and swap over the online base station if required.
- Switch the antenna via internal coaxial relay duplexer to the online base station transmitter and inhibit the offline base station from transmitting.
- Switch the User A and B data ports through to the online base station.

An optocoupler based switch in the base station controller directs data to and from ports A and B on the rear panel directly to ports A and B on the on-line base station without any involvement from the Hot Standby controller microcontrollers (apart from selecting the on-line base). This provides protection of the system from failure of the microcontroller.

As well as ports A and B, each base has a system port. The system port of each base station is interfaced to the microcontroller on the Hot Standby controller. This allows the microcontroller in charge of selecting the base station to receive diagnostic messages from each base station to decide their health.

The base station has it's own system port on the rear panel and this is interfaced to the Hot Standby Controller Module. The HSC will route diagnostics at the rear panel system port to and from the system ports of the base stations.

Warning

The base station front panel system port has priority over the rear panel port, which is used for communication between the base station and the Hot Standby Controller. This is to permit service personnel to reconfigure the base station module without disconnection from the Hot Standby Controller. It should be noted however, that when the front panel port is accessed, a changeover event will occur due to lost communications with the Hot Standby Controller.

Mounting and Environmental Considerations

The EH450 Hot Standby Base Station is housed as a 5RU 19" rack mounted set, encompassing 2 x 2RU Base Station units and 1 x 1RU Hot Standby Controller unit. The mounting holes on the front panels should be used to secure the units to the rack.

The unit should be mounted in a clean and dry location, protected from water, excessive dust, corrosive fumes, extremes of temperature and direct sunlight. Please allow sufficient passive or active ventilation to allow the radio modem's heatsink to operate efficiently.

All permanent connections are made at the rear of the unit. This includes: Power, Antenna, Communications Ports, Digital I/O and System Port. The front panel has an additional System Port connection point for easy access.

The Base Station front panel system ports must not be used while in this configuration.

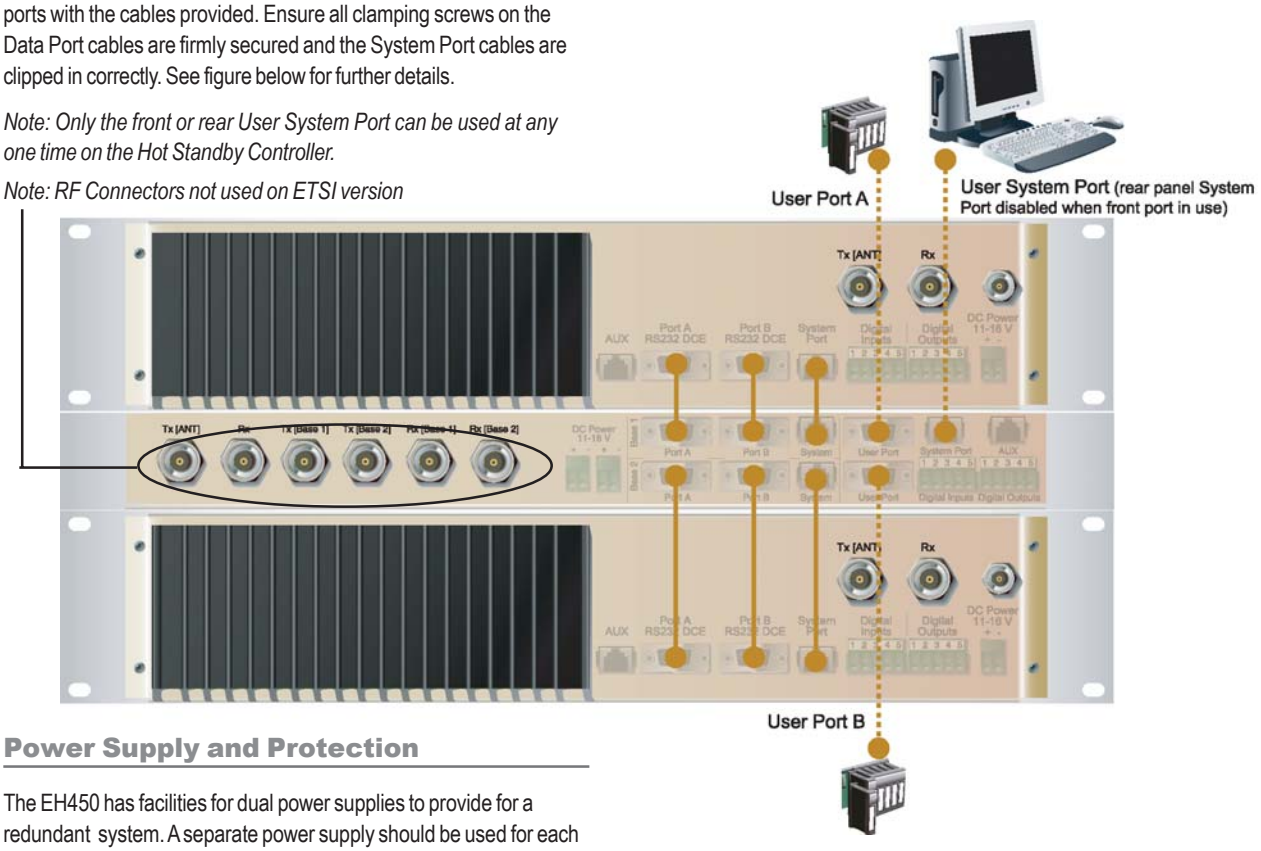
Communications Ports

The A & B Data Ports and System Ports of each Base Station connect directly to the Hot Standby Controller units corresponding ports with the cables provided. Ensure all clamping screws on the Data Port cables are firmly secured and the System Port cables are clipped in correctly. See figure below for further details.

Note: Only the front or rear User System Port can be used at any one time on the Hot Standby Controller.

Note: RF Connectors not used on ETSI version

The Hot Standby Controller units A & B Data Ports connect directly to you application device and the System Port connects directly to your local PC. See ER450 Quick Start Guide Section for further details.

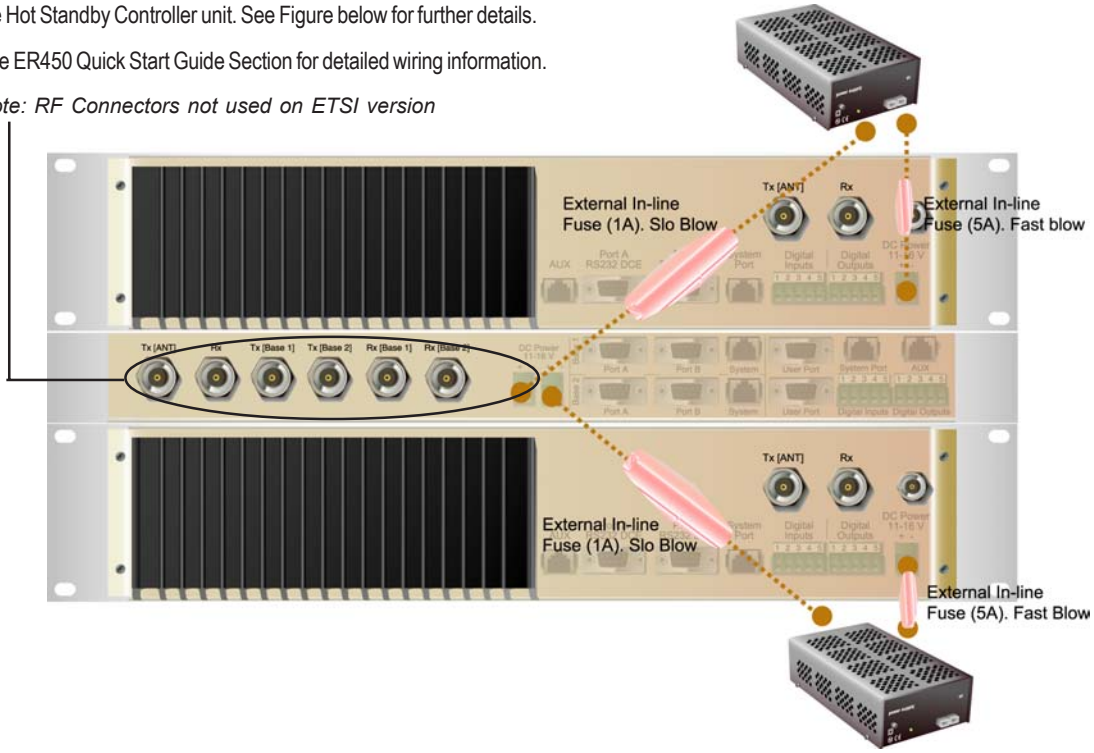


Power Supply and Protection

The EH450 has facilities for dual power supplies to provide for a redundant system. A separate power supply should be used for each of the Base Station units. The Hot Standby Controller unit has connections for dual power supplies and it is recommended that the power supplies from each of the Base Stations also be used to power the Hot Standby Controller unit. See Figure below for further details.

See ER450 Quick Start Guide Section for detailed wiring information.

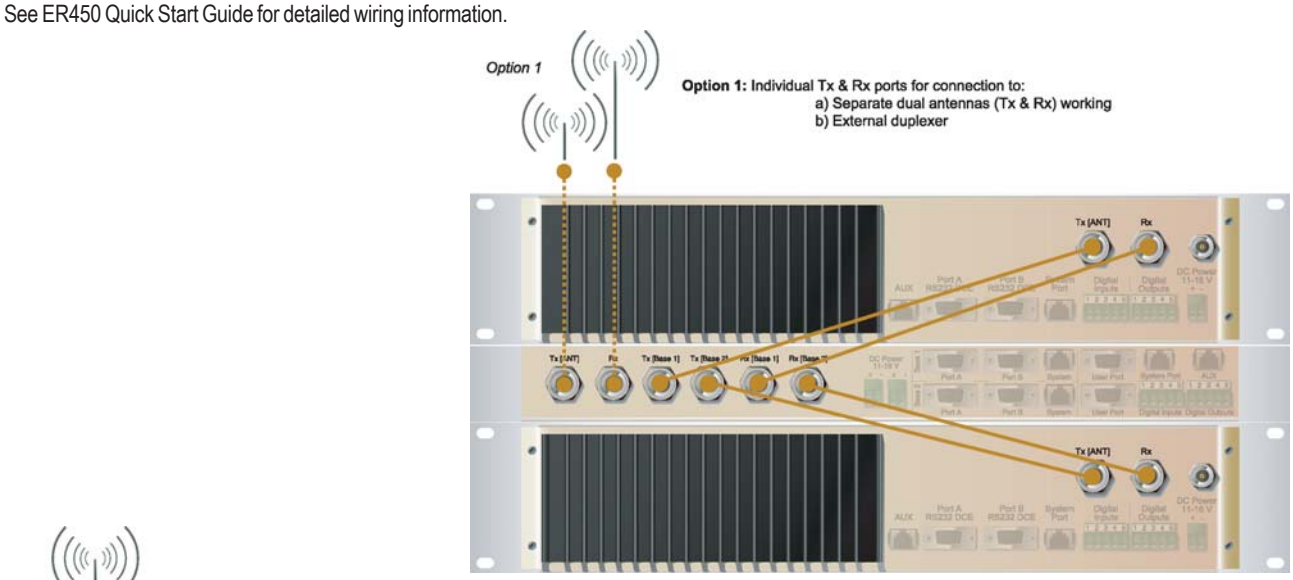
Note: RF Connectors not used on ETSI version

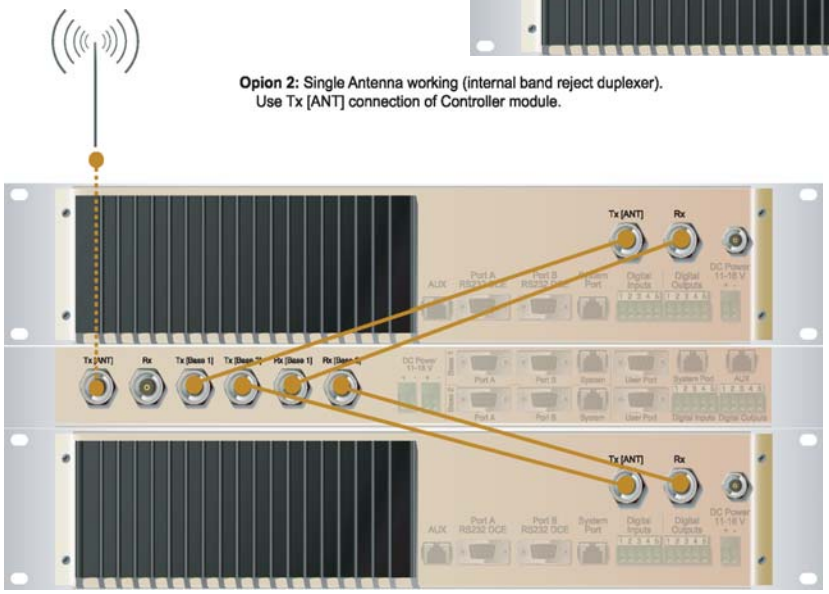


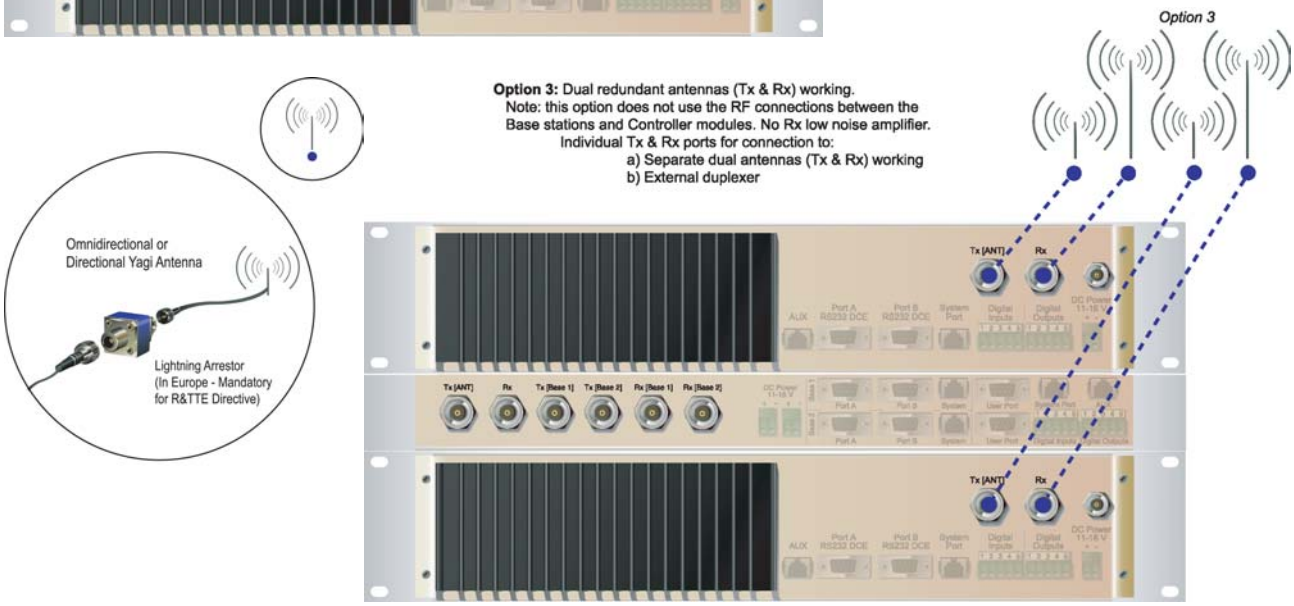
Connecting Antennas and RF Feeders

There are 3 primary antenna connection options. All connectors used are standard N Type sockets. See figures below for further details.

See ER450 Quick Start Guide for detailed wiring information.







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 LEDs

- 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:

OFF	=>	Unknown
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 – 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 as detailed in 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.

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 Port A is indicated by the TXD/RXD LED.

(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 Port A. 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.

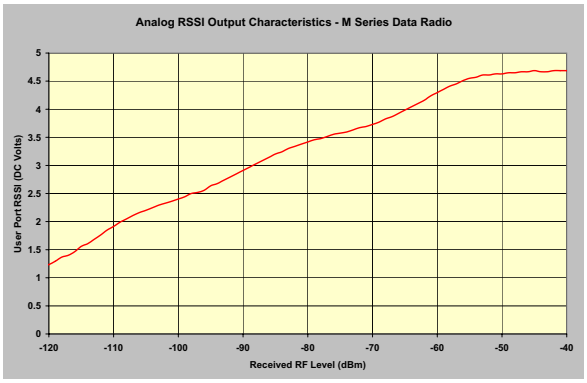
Antenna Alignment and RSSI Testing

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 A.

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

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 performance of the radio path using TVIEW+ Diagnostics and an E-Series Radio.

Part G – Maintenance

Routine Maintenance Considerations

The M Series hardware itself does not require routine maintenance. However all radio products contain crystal frequency references, and the stability of these crystals change with time. The effect of this is that the product will slowly drift off frequency, and eventually it will require re-calibration. M 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.

Re-calibration 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 H – TVIEW+ Management Suite - Programmer

Part I – Specifications

Part J - Support Options

Part H – TVIEW+ Management Suite - Programmer

Introduction

This manual covers the installation and operation of the M 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

All utilities can be run on any IBM compatible computer running Windows 95® and above. This section describes use of the programmer in detail. Users should refer to the E-Series User Manual for information on the diagnostics utility.

The programmer is used to set configuration parameters within the MR450 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 (EB and EH Only). 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* and M Series* data radio modems and E Series* base stations. It supports homogeneous systems of radios as well as mixed systems of both E and M series radios.

* Requires the optional DIAGS Network Management and Remote Diagnostic Facility to be installed - per radio. Local (unit) diagnostics only when connected to M Series radio.

Installation

Unit Connection

Programmer

The unit is connected to the PC using the supplied DB9 Male - DB9 Female cable (part no. TVIEW+MSERIES) for local configuration changes. The cable should be connected to the user port of the radio and a valid PC serial port (e.g. COM 1) DB9 connector.

(See Part E - Getting Started: MR450 Communications Ports)

Diagnostics Utilities

The unit is connected to the PC using a specific M-Series TVIEW+ Diagnostics cable. Details for making this cable can be found in Part E - Getting Started: MR450 Communications Ports.

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 and M 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.

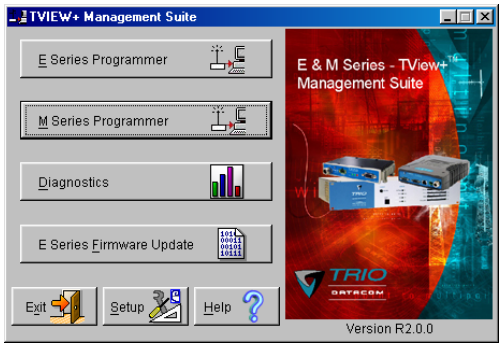
Other:

The current E Series and M 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.

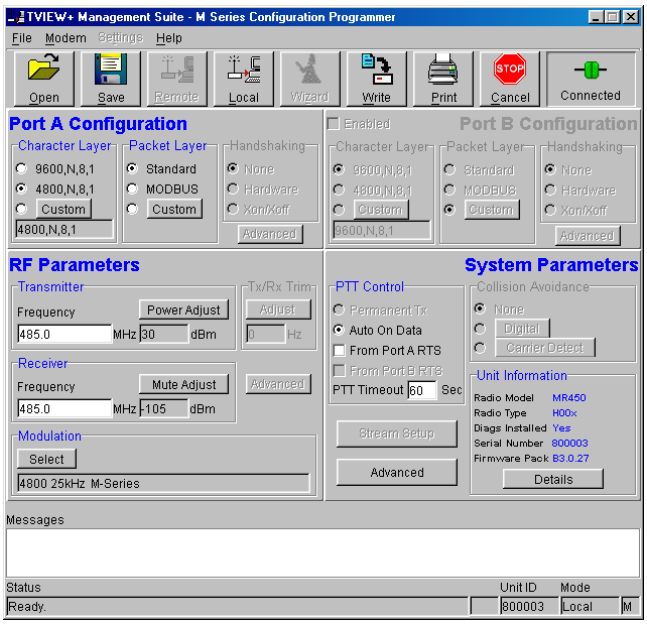
To commence programming a unit (radio remote or base station) a session must first be established by using the "READ" function. This function reads the current configuration from the unit and displays it in the main window. Several options in the main window may be blanked out until a session has been 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:

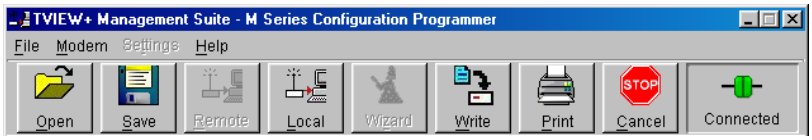
- Read unit
- Configure parameters (or Open a previously saved configuration file)
- Write unit

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 (e.g. 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 unit's 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 programming session with the unit, reads configuration data from the unit and displays it in the programmer main window. After configuration data is read from the unit it is available for editing and writing back to the unit or saving to a file. You can monitor the status of your programming connection using the "Connection Plug" icon in the top right hand corner of the programmer.

If the icon is RED and NOT CONNECTED, then a programming session has NOT been started.

If the icon is RED and CONNECTED, then a programming session has been started but the radio has not completed the programming session initialisation.

If the icon is GREEN and CONNECTED, then a programming session has been successfully started.

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.

Note: In general, any change made on the programmer screen must be written to the unit (using the write function) to become permanently stored. However, changes to Power adjust and Mute adjust take immediate effect to allow test and adjustment prior to permanent storage via the write function.

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 and Mute Adjust.

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 unit is re-powered.
- Connect the next unit.
- Write the next unit which establishes a session and recognises the unit serial number and type, which then configures the unit
- Re-power 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

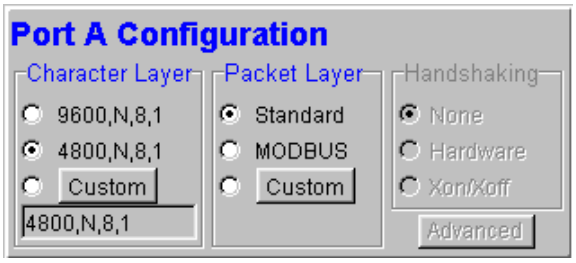
This menu launches the loading of the M-Series user manual.

Port A Configuration

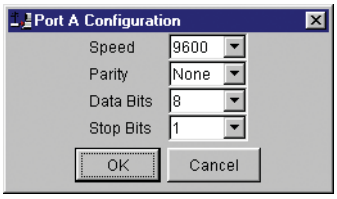
Character Layer

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 packetised and sent by itself regardless of all the above variables.

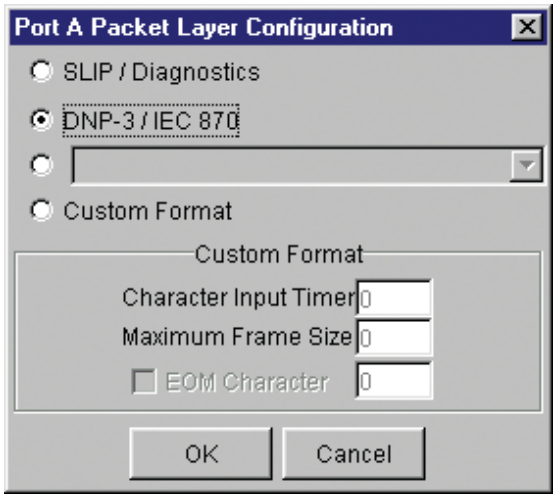
Modbus

This selection configures the PAD driver with options automatically set to implement the MODBUS protocol, e.g. 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™ 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 pre-defined 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.

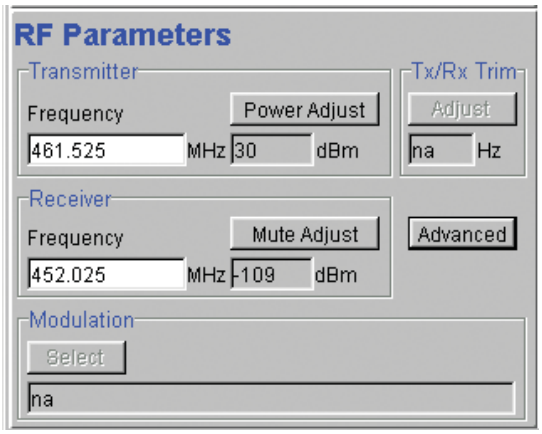
Port Hardware

The modem acts as Data Communications Equipment (DCE) and has the following interface signals:

Data Carrier Detect (DCD) - Active when RF carrier is present.
Request To Send (RTS) - TX PTT when RTS active
Receive Data Output (RXD) - Received Data
Transmit Data Input (TXD) - Transmit Data

RF Parameters

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



Transmitter

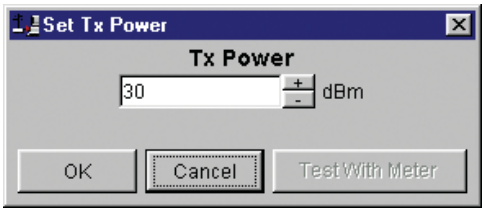
The transmitter can be configured for transmit frequency and power level.

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 unit and provides warnings if outside an acceptable range.

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 the unit using the "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: Although the transmit power has been adjusted it must be written to the unit using the modem "Write" function to ensure it is retained after the unit 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

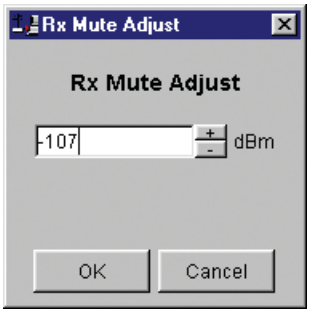
The receiver can be configured for receive frequency and mute level.

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 the unit using the "Write" function to ensure it is retained after the unit is rebooted.

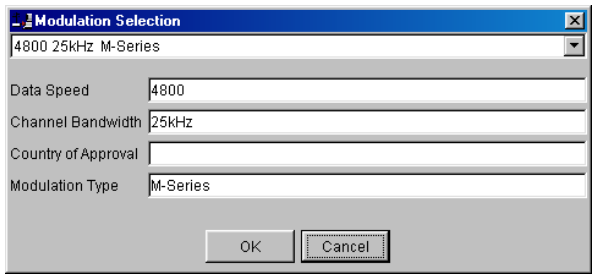


The mute level should be set to assist the unit in filtering out unwanted signals. Unwanted signals can be the result of background noise or interference. The mute level should be set at a level above these unwanted signals and at a level low enough to detect the wanted signal. Detection of a received signal above the mute level is indicated by the "RxSig" LED on the unit.

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 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. Please select the modulation scheme as directed by your license conditions or suggested by your local regulatory authority.



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 (E Series only), or RTS being asserted on Port A or Port B (E Series only). 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.

Auto On Data

This will cause the transmitter to be enabled (keyed) automatically on data received at Port A or Port B (E Series only) 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.

PTT Timeout

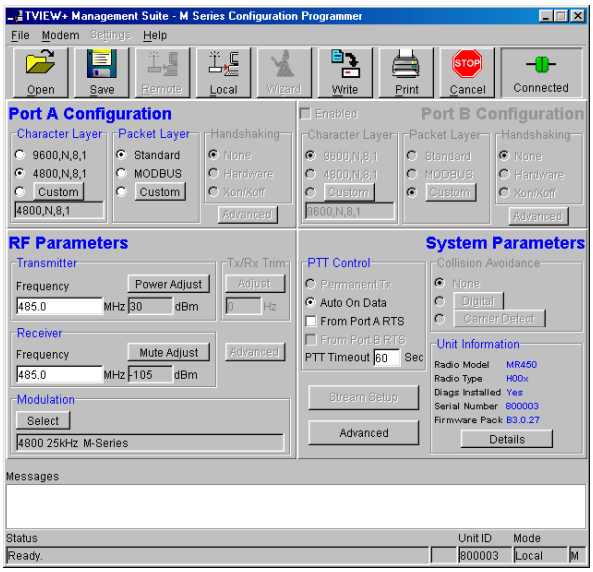
The PTT timeout facility is used to disable the transmitter if it exceeds the designated time. The timeout value can range from 1 to 255 seconds and the facility is disabled by setting a zero value.

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.

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 MR450 is a remote unit and the EE450 is a exciter inside a base station unit.

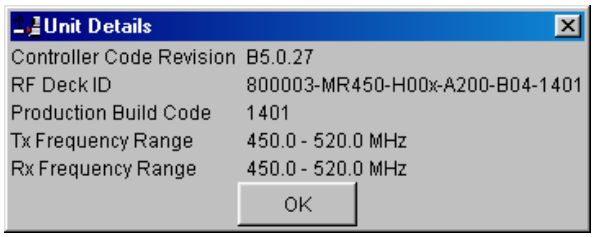
Radio Type refers to the frequency band supported by the radio as well as the channel bandwidth. For example 51A02 is a type 51 band with a 25kHz channel.

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.
- Tx and RX Frequency Range indicates the frequency range for which the radio is capable of being operated in.

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 I – Specifications

Remote Data Radio - MR450

M Series

Radio

Frequency Range: 330-520 MHz (various sub-frequency bands available)

Frequency Splits: Various Tx/Rx frequency splits - programmable

Channel Selection: 6.25 kHz channel step

Channel Spacing: One model suitable for 12.5 and 25 kHz

Frequency Accuracy: ±1.5ppm (-30 to 60°C) (-22 to 140°F) ambient

Aging: <= 1ppm/annum

Operational Modes: Simplex and Half duplex

Configuration: All configuration via Windows based software

Compliances:

FCC	PART 15, PART 90
IC	RS119, ICES-001
ACA	AS4295-1995

Transmitter

Tx Power: 0.1 to 5W (+20 to +37 dBm) ±1 dB software adjustable

Modulation: Narrow band GMSK

Timeout Timer: Programmable 0-255 seconds

Tx Spurious: <= -30 dBm

PTT Control: Auto (Data) / RTS line

Receiver

Sensitivity: -116 dBm for 12 dB SINAD

Intermodulation: Better than 65 dB

Spurious Response: Better than 70 dB

AFC Tracking: Digital receiver frequency tracking

Mute: Programmable digital mute

Diagnostics (Optional)

Non intrusive local diagnostics - runs simultaneously with the modem.

Local and remote measurement of Tx Power, Rx Signal Strength, DC Volts and Internal Temperature.

Connections

User Data Ports: DB9 female port wired as DCE (modem).
(Separate connections on DB9 for simultaneous User and Diags Data)

Antenna: N female bulkhead

Power: 2 pin screw locking (mating connector supplied)

LED Display: Multimode LED Indicators for Pwr, Tx, Rx, Sync, Data Port TxD and RxD data

Modem

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

Diagnostics Connection: RS232, 19,200 bps asynchronous

Flow Control: Selectable hardware / software / 3 wire interface. (Tx, Rx & Gnd) RF carrier driven CTS output for collision management

RF Channel Data Rate:
Three models:-
2400/4800 bps (MR450-x001-xx) or
4800/9600 bps (MR450-x002-xx) or
9600 bps (MR450-x003-xx) FCC

Data Buffer: 8 kbyte of on-board RAM

Bit Error Rate:
< $1x10^{-6}$ @ -115 dBm (2400 bps)
< $1x10^{-6}$ @ -114 dBm (4800 bps)
< $1x10^{-6}$ @ -106 dBm (9600 bps)

General

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

Transmit Current: 600 mA nom. @ 1 W
1500 mA nom. @ 5 W

Receive Current: <170 mA nominal

Dimensions: Solid Diecast Alloy Housing
154 x 102 x 29 mm
(6.1 x 4.1 x 1.2 inches)

Mounting: Integral Solid Diecast feet

Weight: 0.32 kg (0.71 lbs)

Options

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

TVIEW+™ Configuration, Network Management and Diagnostic Windows GUI Software

DIAGS/M Remote Diagnostics Facilities per Radio Modem

Related Products

EB450 Base Station*

EH450 Hot Standby Base Station*

*** Configured for M Series compatibility**

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.

TRIO DATACOM

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Victoria, Australia 3201
Phone +613 9775 0505 Fax +613 9775 0606
sales@trio.com.au www.trio.com.au

Digital Data Base Station - EB450

E Series

Radio

Frequency Range: 330-520 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 Accuracy: ±1ppm (-30 to 60°C) (-22 to 140°F) ambient

Aging: <= 1ppm/annum

Operational Modes: Simplex, Full duplex, heading (Optional Internal or external duplexer available for single antenna operation)

Configuration: All configuration via Windows based software

Compliances:

ESTI	EN300 113, EN301 489, EN60950
FCC	PART 15, PART 90
IC	RS119, ICES-001
ACA	AS4295-1995

Transmitter

Tx Power: 5W (+37 dBm) ±1 dB
User configurable with over-temperature and reverse power protection

Modulation: User configrable narrow band digitally filtered GMSK or 4 Level FSK

Tx Keyup Time: < 2 mS

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 60 dB

Intermodulation: Better than 70 dB

Spurious Response: Better than 70 dB

AFC Tracking: Digital receiver frequency tracking

Mute: Programmable digital mute

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.

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 diagnostics, configuration and programming

Antenna:
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 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 A: RS232, DCE, 600-76,800 bps asynchronous

Data Serial Port B: 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 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)

Collision Avoidance: Trio DataCom's unique supervisory channel C/DSMA collision avoidance system

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

Data Turnaround Time: <10mS

Firmware: Field upgradeable Flash memory

General

Power Supply: 13.8 Vdc nominal (11-16 Vdc)

Transmit Current:
1.3 A nominal @ 1 W
2.5 A nominal @ 5 W

Receive Current: < 350 mA

Dimensions: 19" 2 RU rack mount
485 x 90 x 420 mm (Including heatsink)
19 x 3.5 x 16.5 inches

Weight: 5kg (11 lbs)
(excluding optional duplexer)

Digital I/O:
2 Inputs monitered by TVIEW+ Diagnostics Software
2 Outputs user configurable by TVIEW+ Diagnostics Software

Options

DUPLX450Bx Internal / External Duplexers, Band Reject and Band Pass

EDOVM Digital Order Wire Voice Module

TVIEW+™ Configuration, Network Management and Diagnostic Windows GUI Software

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

Related Products

EH450 Hot Standby Base Station

ER450 Remote Data Radio

95MSR 6 and 9 Port Stream Router Multiplexer

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sales@trio.com.au www.trio.com.au

Digital Hot Standby Base - EH450

E Series

Radio

Frequency Range: 330-520 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 Accuracy: ±1ppm (-30 to 60°C) (-22 to 140°F) ambient

Aging: <= 1ppm/annum

Operational Modes: Simplex, Full duplex (optional internal or external duplexer available for single antenna operation)

Configuration: All configuration via Windows based software

Compliances:

ETSI	EN300 113, EN301 489, EN60950
FCC	PART 15, PART 90
IC	RS119, ICES-001
ACA	AS4295-1995

Transmitter

Tx Power: 5W (+37 dBm) ±1 dB
User configurable with over-temperature and reverse power protection

Modulation: User configurable narrow band digitally filtered GMSK or
4 Level FSK

Tx Keyup Time: < 2 mS

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 60 dB

Intermodulation: Better than 70 dB

Spurious Response: Better than 70 dB

AFC Tracking: Digital receiver frequency tracking

Mute: Programmable digital mute

Diagnostics (Optional)

Network wide operation from any remote terminal.

Non intrusive protocol - runs simultaneously with the application.

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

Storage of data error and channel occupancy statistics.

In-built Error Rate testing capabilities.

Connections

NOTE: Various duplicated configurations available.

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

System Port: RJ45 (front and rear) for diagnostics, configuration and programming

Antenna:
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 A: RS232, DCE, 600-76,800 bps asynchronous

Data Serial Port B: 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 Full duplex

Data Buffer: 16 kbyte of on-board RAM

Bit Error Rate:
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< $1x10^{-6}$ @ -106 dBm (19,200 bps)

Collision Avoidance: Trio DataCom's unique supervisory channel C/DSMA collision avoidance system

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

Data turnaround: <10mS

Firmware: Field upgradeable Flash memory

Hot Standby Controller (HSC)
Features: Alarm indications, manual / auto changover control, continuous monitoring of Tx power, RSSI, frequency offset, recovered data, power supply, and diagnostic commands from each base.

General

Power Supply: 13.8 Vdc nominal (11-16 Vdc)

Transmit Current:
2.0 A nominal @ 1 W
3.2 A nominal @ 5 W

Receive Current: < 1000 mA

Dimensions: 19" 5 RU rack mount
485 x 225 x 420 mm (Including heatsink)
19 x 8.9 x 16.5 inches

Weight: 12.7 kg (28lbs) (excluding optional duplexer)

Digital I/O (HSC):
TVIEW+ Diagnostics Software to;
- Monitor 2 inputs
- Set 2 outputs

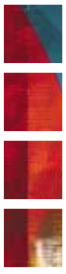
Options

DUPLX450Bx Internal / External Duplexers, Band Reject and Band Pass

EDOVM Digital Order Wire Voice Module

TVIEW+™ Configuration, Network Management and Diagnostic Software

DIAGS/EH Network Management and Remote Diagnostics Facilities



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Part J – Support Options

Website Information

The Trio DataCom website support contains links to e-mail and telephone support, technical 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**.

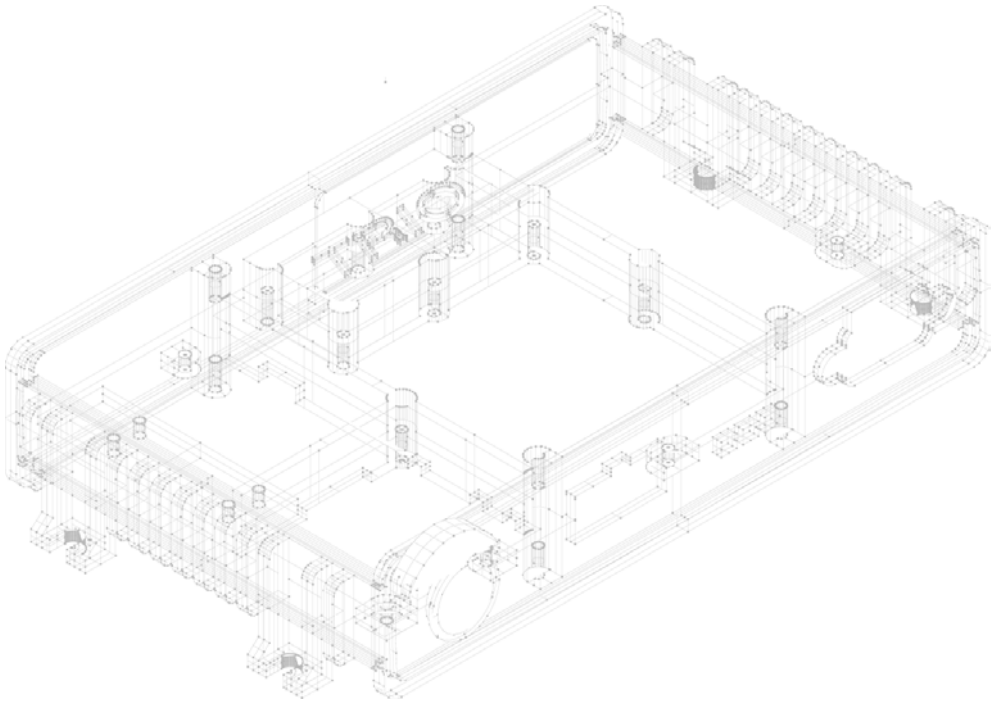
When e-mailing questions to our support staff, make sure you tell us the exact model number (and serial number if possible) of the Trio equipment you are working with. Include as much detail as possible about the situation, and any tests that you have done which may help us to better understand the issue.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

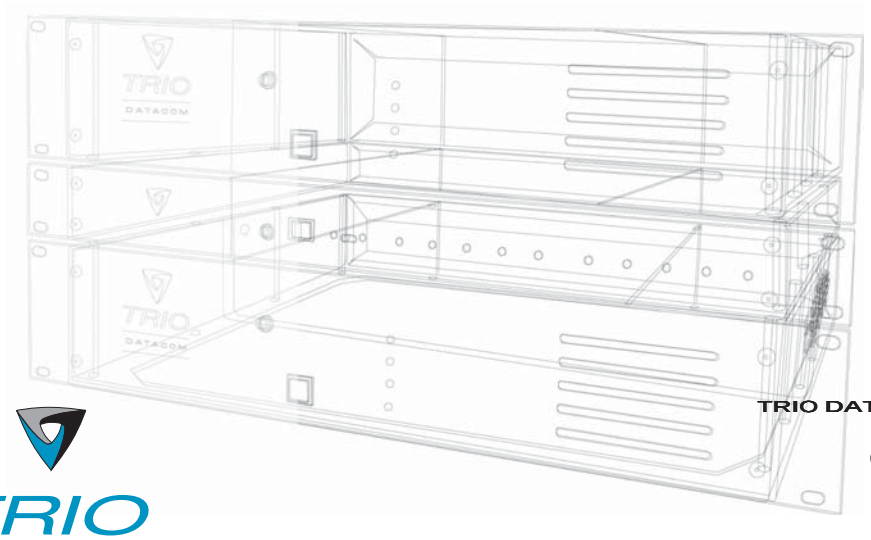
Telephone Technical Support

Telephone support is available at our head office telephone number Australia: (+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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Innovative and sophisticated
digital communications
designs products and solutions