

User Manual

M Series Data Radio

MR450 Remote Data Radio

Incorporating compatible

EB450 Base Station & EH450 Hot Standby Base Station



Schneider
Electric

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Part A – Preface

Safety Information

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.



The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.



This is the safety alert symbol. It is used to alert you to a potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** equipment damage.

PLEASE NOTE

Electrical equipment should be installed, operated, serviced, and maintained only by qualified personnel. No responsibility is assumed by Trio Datacom for any consequences arising out of the use of this material.

Warranty

All equipment supplied by Trio Datacom Pty Ltd (As of 1 January 2009) is covered by warranty for faulty workmanship and parts for a period of three (3) years 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

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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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Compliance Information



Warning - RF Exposure

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

To satisfy EU and FCC requirements a minimum separation distance should be maintained between the antenna of this device and persons during operation as per the table below.

Range of Antenna gains (dBd)	Minimum Separation from Antenna (Meters)
0 to 4	0.91
4 to 8	1.44
8 to 12	2.28
12 to 16	3.61

Important Notices for Class I, Division 2, Groups A, B, C & D Hazardous Locations

Applies to models MR450-xxxx-xHx (CSA Marked)

This product is available for use in Class I, Division 2, Groups A, B, C & D Hazardous Locations. Such locations are defined in Article 500 of the US National Fire Protection Association (NFPA) publication NFPA 70, otherwise known as the National Electrical Code and in Section 18 of the Canadian Standards Association C22.1 (Canadian Electrical Code).

The transceiver has been recognised for use in these hazardous locations by the Canadian Standards Association (CSA) International. CSA certification is in accordance with CSA Standard C22.2 No. 213-M1987 and UL Standard 1604 subject to the following conditions of approval:

1. The radio modem must be mounted in a suitable enclosure so that a tool is required to gain access for disconnection of antenna, power and communication cables.
2. The antenna, DC power and interface cables must be routed through conduit in accordance with the National Electrical Codes.
3. Installation, operation and maintenance of the radio modem should be in accordance with the radio modem's user manual and the National Electrical Codes.
4. Tampering or replacement with non-factory components may adversely affect the safe use of the radio modem in hazardous locations and may void the approval.
5. A power connector with screw-type retaining screws as supplied by Schneider Electric MUST be used.

**WARNING EXPLOSION HAZARD**

Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous. Substitution of components may impair suitability for Class I, Division 2. Refer to Articles 500 through 502 of the National Electrical Code (NFPA 70) and Section 18 of CSA C22.1 for further information on hazardous locations and approved Division 2 wiring methods. Low Voltage Safety (Europe)

In order to comply with the R&TTE (Radio & Telecommunications Terminal Equipment) directive 1999/5/EC Article 3 (Low Voltage Directive 73/23/EEC), all radio modem installations must include an external in-line lightning arrestor or equivalent device that complies with the following specifications:

- DC Blocking Capability - 1.5kV impulse (Rise Time 10mS, Fall Time 700mS) (Repetition 10 Times) or 1.0kV rms 50Hz sine wave for 1 minute.

The MR450 has been classified as SELV throughout. All ports shall be connected to like circuits and shall not extend beyond the building boundary of the host equipment unless connected via an isolation unit compliant with the requirements of section 7 of EN60950-1.

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 10-12 (October 2012): Updated Build matrix
Issue 02-13 (February 2013): Added specifications to rear of manual

**WEEE Notice (Europe)**

This symbol on the product or its packaging indicates that this product must not be disposed of with other waste. Instead, it is your responsibility to dispose of your waste equipment by handing it over to a designated collection point for the recycling of waste electrical and electronic equipment. The separate collection and recycling of your waste equipment at the time of disposal will help conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste equipment for recycling, please contact the dealer from whom you originally purchased the product.

Dieses Symbol auf dem Produkt oder seinem Verpacken zeigt an, daß dieses Produkt nicht mit anderer Vergeudung entledigt werden darf. Stattdessen ist es Ihre Verantwortlichkeit, sich Ihre überschüssige Ausrüstung zu entledigen, indem es rüber sie zu einem gekennzeichneten Ansammlungspunkt für die Abfallverwertung elektrische und elektronische Ausrüstung übergibt. Die unterschiedliche Ansammlung und die Wiederverwertung Ihrer überschüssigen Ausrüstung zu der Zeit der Beseitigung helfen, Naturressourcen zu konservieren und sicherzugehen, daß es in gewissem Sinne aufbereitet wird, daß menschliche Gesundheit und das Klima schützt. Zu mehr Information ungefähr, wo Sie weg von Ihrer überschüssigen Ausrüstung für die Wiederverwertung fallen können, treten Sie bitte mit dem Händler in Verbindung, von dem Sie ursprünglich das Produkt kauften.

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
 - Flash upgrade-able firmware – insurance against obsolescence.
 - Remote over-the-air configuration of any radio from any location.
 - Multistream™ simultaneous data streams allows for multiple vendor devices / protocols to be transported on the one radio network.
 - Flexible data stream routing and steering providing optimum radio channel efficiency – complex data radio systems can be implemented with fewer radio channels.
 - Multi-function radio capable of dropping off one stream to a port and forward on or repeat (store and forward) the same or other data.
 - Stand-alone internal store and forward operation – buffered store and forward operation even in the ER remote units.
 - Professional N Type antenna connector
 - High data integrity - CRC error checking
 - User configurable 300-38,400 bps asynch RS-232 port
 - Fully transparent 3 wire user interface
- 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)
 - Unique integrated C/DSMA collision avoidance technology permits simultaneous polling and spontaneous reporting operation in the same system.
 - Network wide non intrusive diagnostics which runs simultaneously with the application.
 - Network wide diagnostics interrogation which can be performed from anywhere in the system including any remote site.
 - Diagnostics will route its way to any remote or base / repeater site regardless of how many base / repeater stations are interconnected.
 - External controlled sleep mode operation for ABB Total Flow (R) type applications (optional low power sleep mode plug-in)

Build Matrix

Product Data Sheet Trio MR450 Model Code

	TBURMR450-aabbbbcde represents the part number matrix
Model	Model Type
TBURM	M-Series
Code	Select: Unit Type
R	Remote Station with full enclosure
Code	Select: Generic Frequency Band
450	380 to 520MHz
Code	Select: Frequency (400MHz bands)
M	395 to 470MHz (Tx & Rx)
H	450 to 520MHz (Tx & Rx)
Code	Select: RF Channel Data Rate & Bandwidth (Internal Modem)
001	ACMA 2400bps 12.5KHz / 4800bps 25KHz (Australia)
002	ACMA 4800bps 12.5KHz / 9600bps 25KHz (Australia)
003	FCC (IC) 9600bps 12.5KHz (North America)
004	ETSI 4800bps 12.5KHz (Europe)
Code	Select: Diagnostics
D	Diagnostics Only
L	Sleep Mode Module & Diagnostics
Code	Select: Hazardous Area Approvals
H	Hazardous Environment Class1 Div2
Code	Select: Hot Standby Configurations
O	None
<p>Example: TBURMR450-M003DH0 specifies: Trio M-Series, Remote station, Generic 450MHz band with a specific range of 400 to 470MHz, a 9600bps modem with a bandwidth of 12.5kHz, Diagnostics, Class1 Div2.</p> <p>Communications Standard: FCC- Federal Communications Commission (USA) IC- Industry Canada ETSI - European Telecommunication Standards Institute ACMA - Australian Communications and Media Authority</p>	

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.

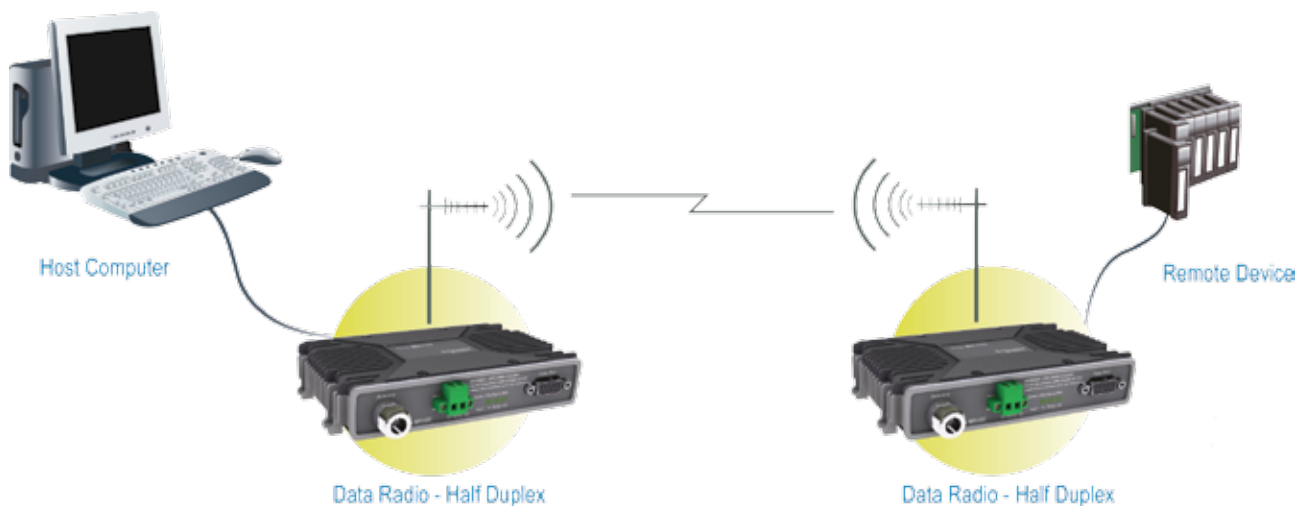
Information Systems

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.

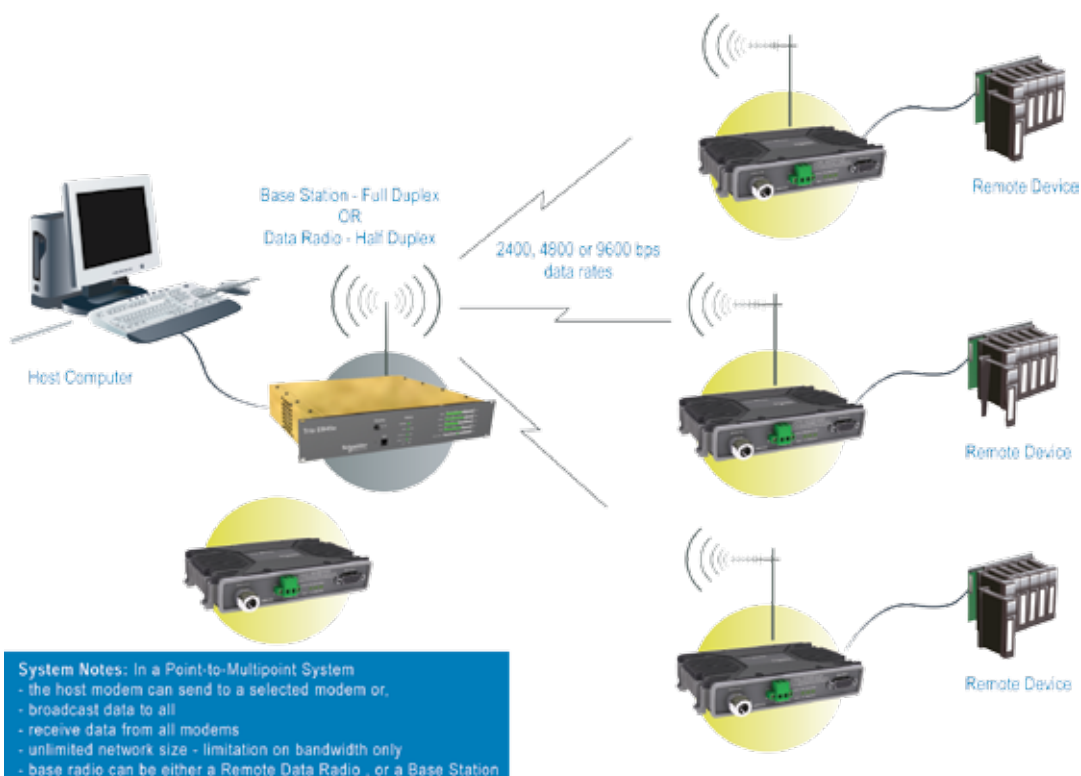


Point-to-Multipoint Systems

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.

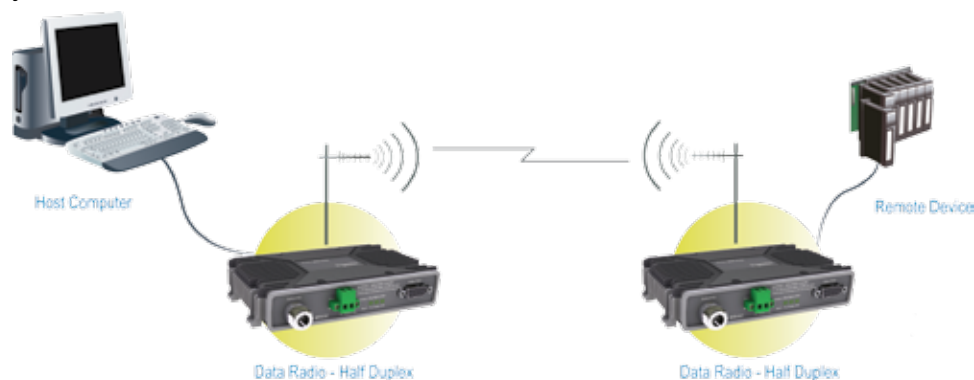
Half duplex systems often utilise a full duplex master (EB or EH), to make the system simpler and for faster operation.

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.



Digipeater Systems

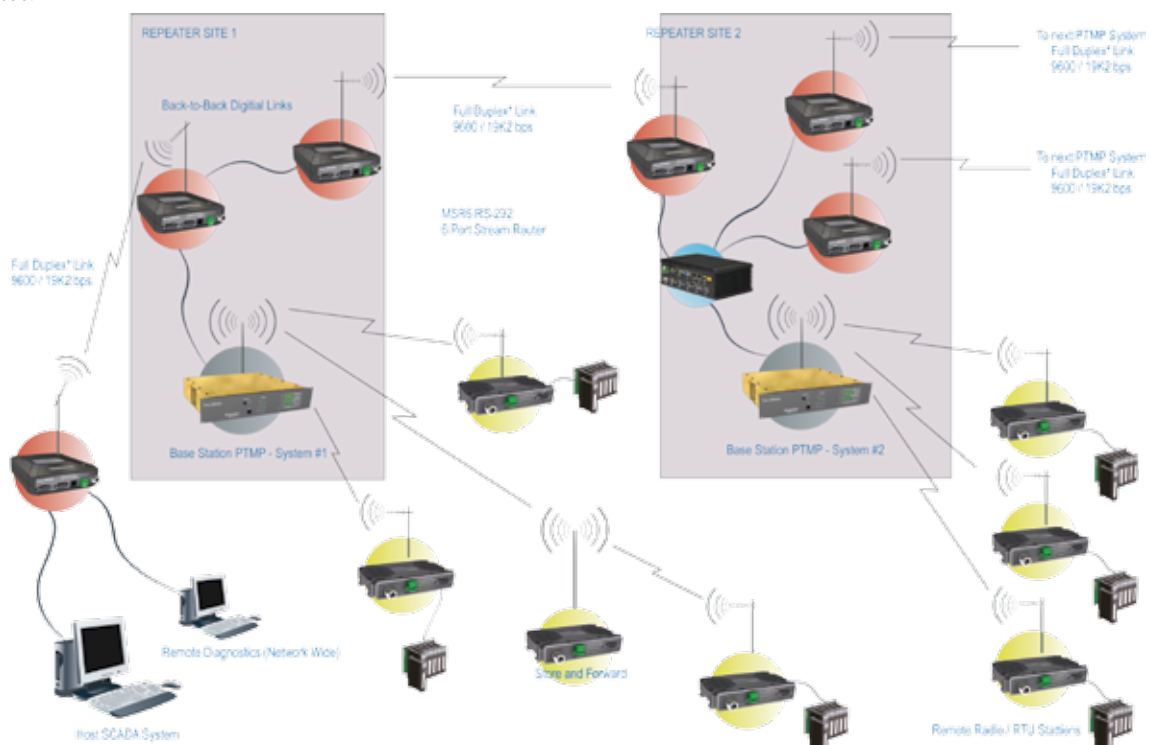
This configuration is used where all sites are required to communicate via a repeater site. A repeater site is used because it has a position and/or height advantage and thus provides superior or extended RF coverage. The radio modem at the repeater does not have to be physically connected to the application's 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

Selecting Antennas

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.

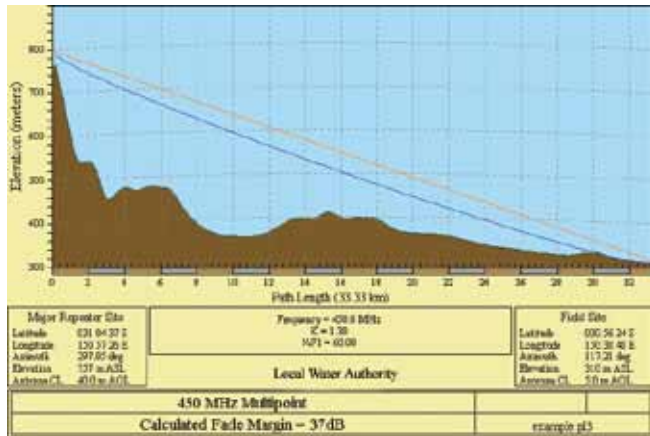
It is good design practice to consider the results of at least two of these models to design a radio path.

Examples of Predictive Path Modelling

Clear line of site

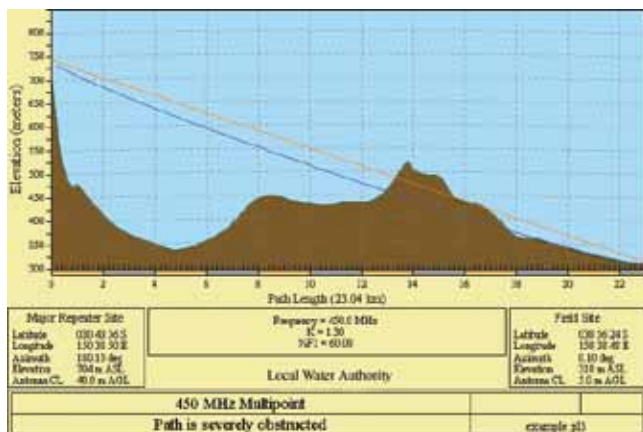
Radio path with good signal levels, attenuated only by free space loss.

Obstructed Radio Path



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	ANT450/60M	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

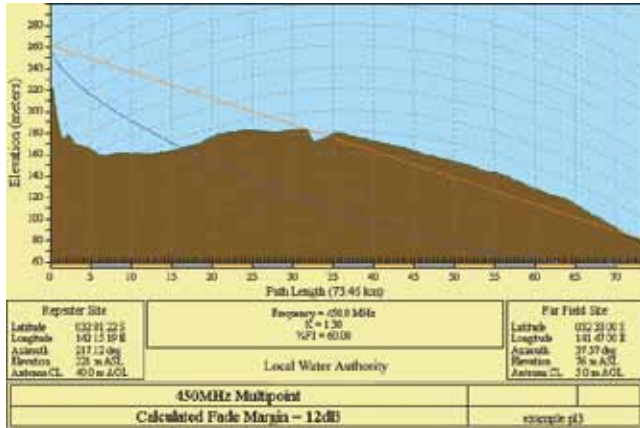
This path has an obstruction that will seriously degrade the signal arriving at the field site.



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	ANT450/60M	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).



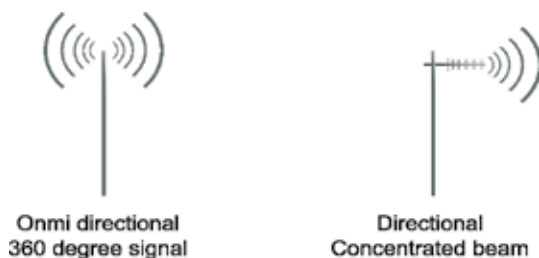
longpath.pl3	Repeater Site	Far Field Site
Elevation (m)	221.26	75.58
Latitude	032 01 21.63 S	032 33 00.00 S
Longitude	142 15 19.26 E	141 47 00.00 E
Azimuth	217.12	37.37
Antenna Type	ANT450/6OM	ANT450/9AL
Antenna Height (m)	40.00	5.00
Antenna Gain (dBi)	8.15	11.15
Antenna Gain (dBd)	6.00	9.00
TX Line 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

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.



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 stabilise 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 arrester in order to meet EN6095. See Part A - Preface for lightning arrester specifications.

Common Cable Types @ 450MHz	Loss per meter @ 450MHz	Loss per 10m
RG58C/U	0.4426dB	4.4dB
RG213/U	0.1639dB	1.6dB
FSJ1-50 (1/4" 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.

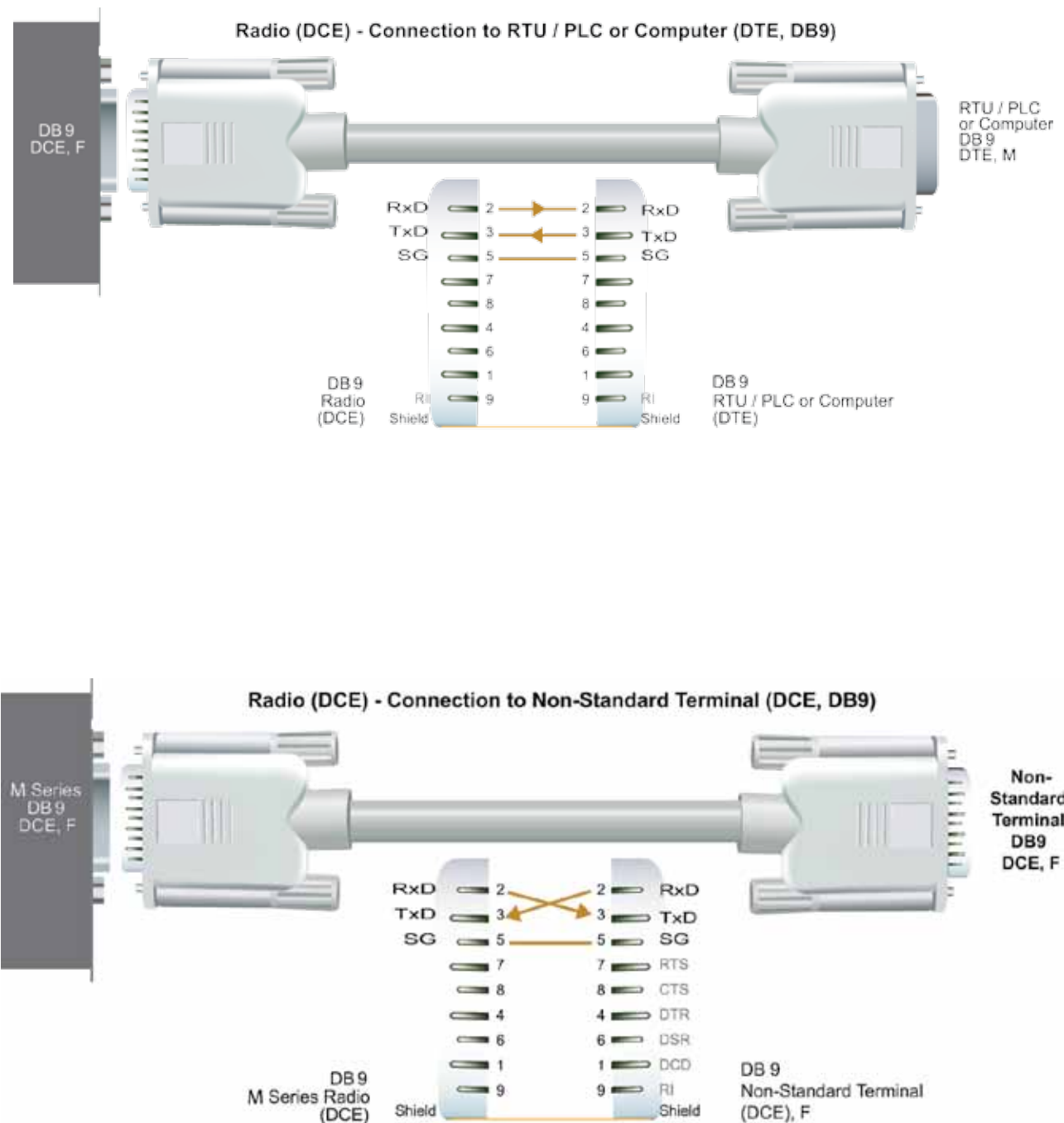
The standard interface between a DTE and DCE device (using the same connector type) is a straight through cable (i.e. each pin connects to the same numbered corresponding pin at the other end of the cable).

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.

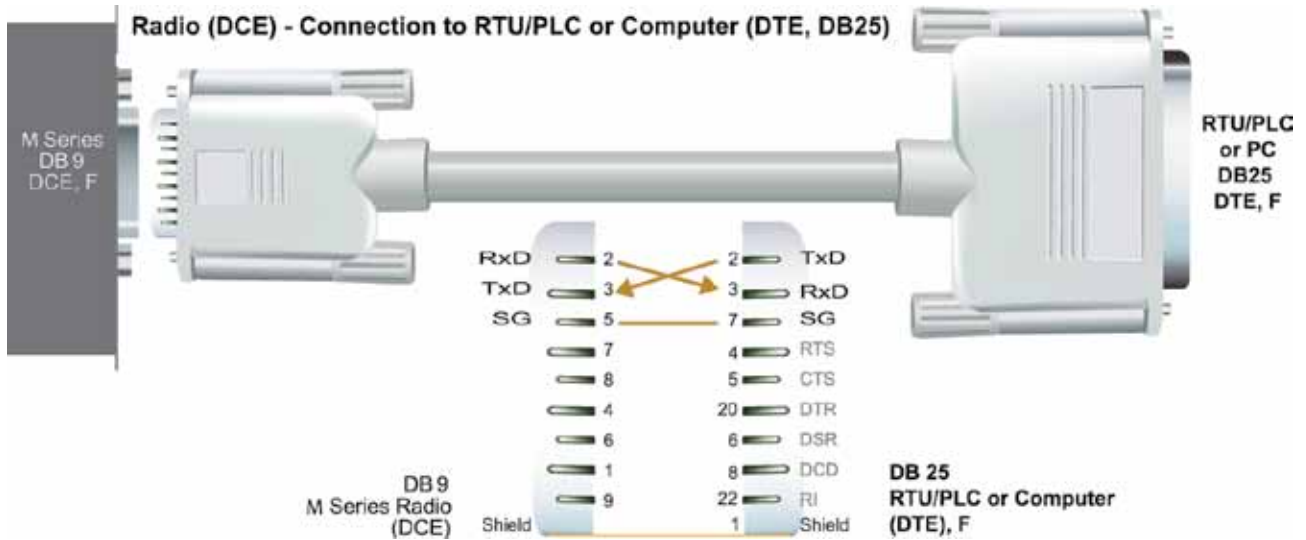
The wiring standard is “unbalanced”, and provides for three basic data transfer wires (TXD, RXD, and SG – signal ground).



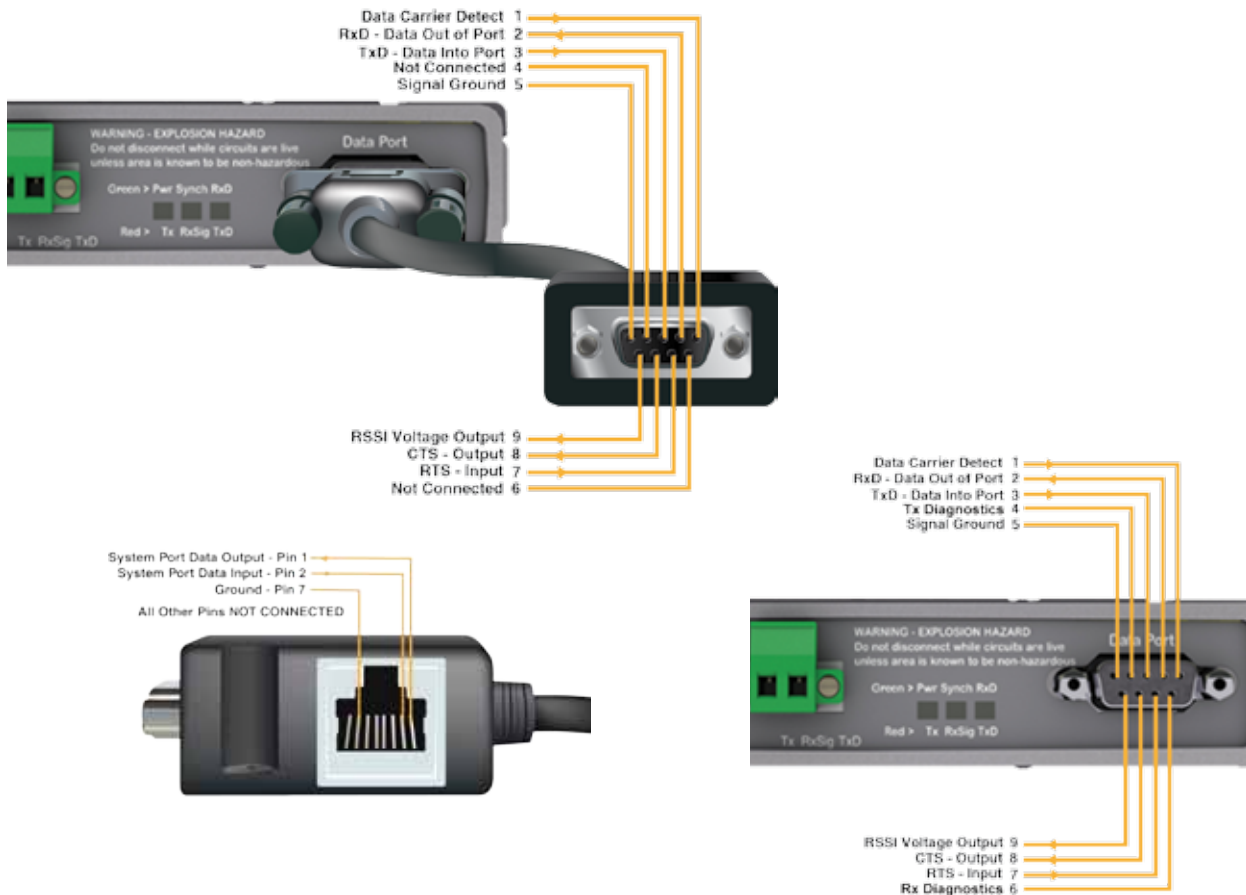
Cable Wiring Diagrams



Cable Wiring Diagrams



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



Power Supply and Environmental Considerations

General

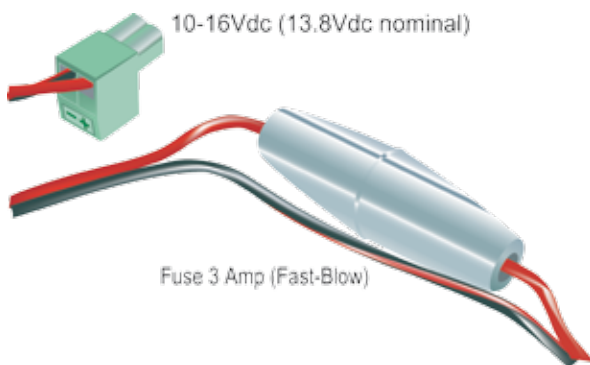
When mounting the equipment, consideration should be given to the environmental aspects of the site. The cabinet should be positioned so that it is shaded from hot afternoon sun, or icy cold wind. Whilst the radios are designed for harsh temperature extremes, they will give a longer service life if operated 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 the M-Series data sheet for power supply specifications.



CAUTION

Caution: The M-Series is fitted with an internal, soldered SMT fuse. To avoid blowing the internal fuse, ensure an external fuse is fitted.

The internal SMD fuse can be replaced with the following types:

Farnel Part No : 1123259

Digi-Key Part No : 283-2546-1-ND

As the SMT solder in fuse is not easily field servicable, it is strongly recommended to field an external field servicable fuse as shown above.

Solar Applications

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.

Sleep Mode

In some applications low power consumption is required. To achieve this, the system designer can enable an externally controlled Sleep Mode in the M Series.

When enabled, the Sleep Mode control input is activated on Pin 8. When this pin is pulled to ground, the radio enters sleep mode. When using sleep mode, the user must ensure that the Sleep Mode plugin option is installed in the radio. This is specified in the M Series Model Number:

MR450x-xxx-Lxx - L denotes the sleep mode option is fitted.

When in sleep mode, the radio (with RS-232 User Port connected) will nominally draw 13mA at 13.8volts. Start up time to normal operation is 75mS.

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



The M Series is supplied with 6 mounting screws for fixing the radio to a plate. If you wish to use other mounting screws, please ensure:

- (a) the screw head O.D. maximum dimension is 7mm
- (b) the screw thread O.D. maximum dimension is 3.7mm



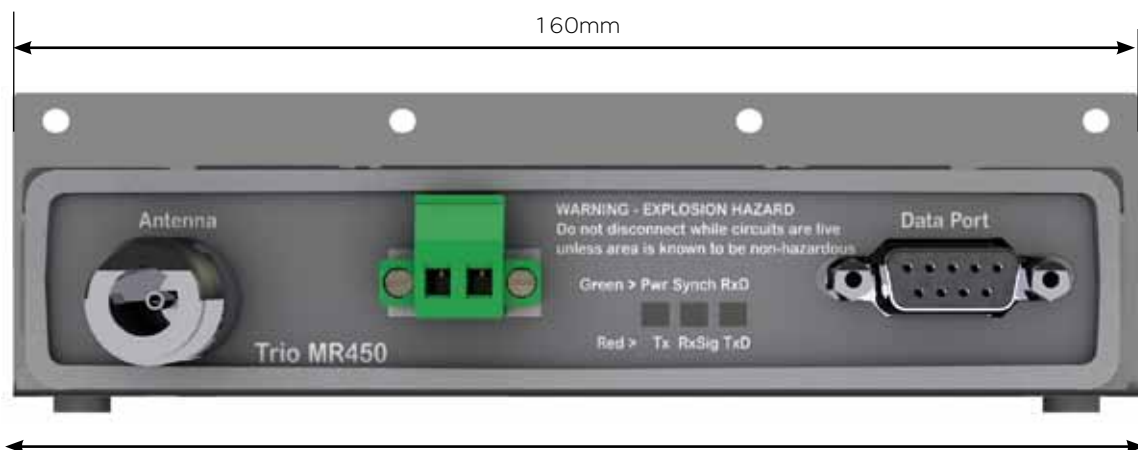
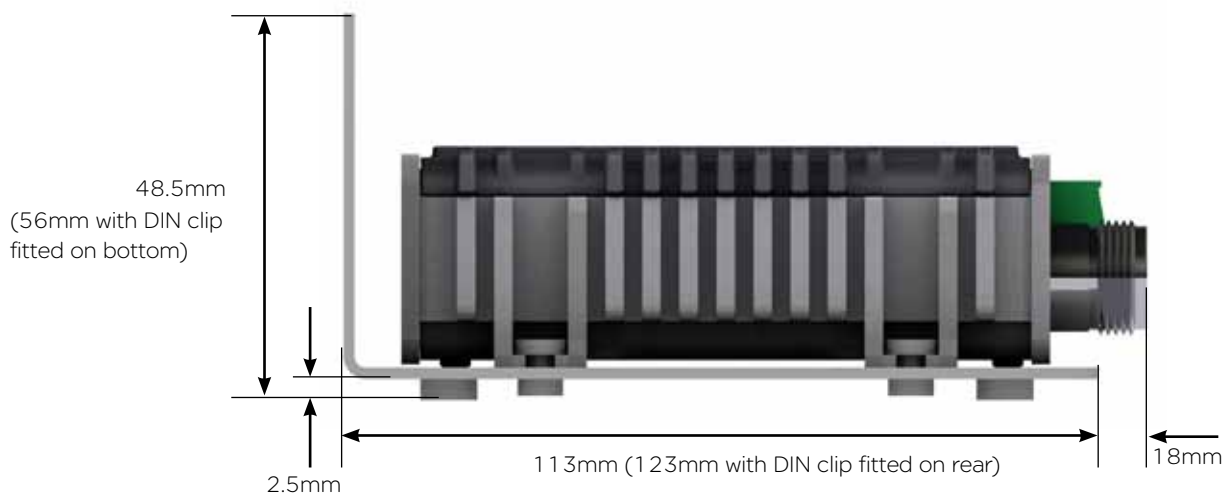
DIN mounting kit

An optional DIN mounting kit is available for the M-Series. The Mount is screwed onto the bottom of M-Series giving the unit the ability to be simply 'clipped' and Locked onto 3.5mm Din Rail.

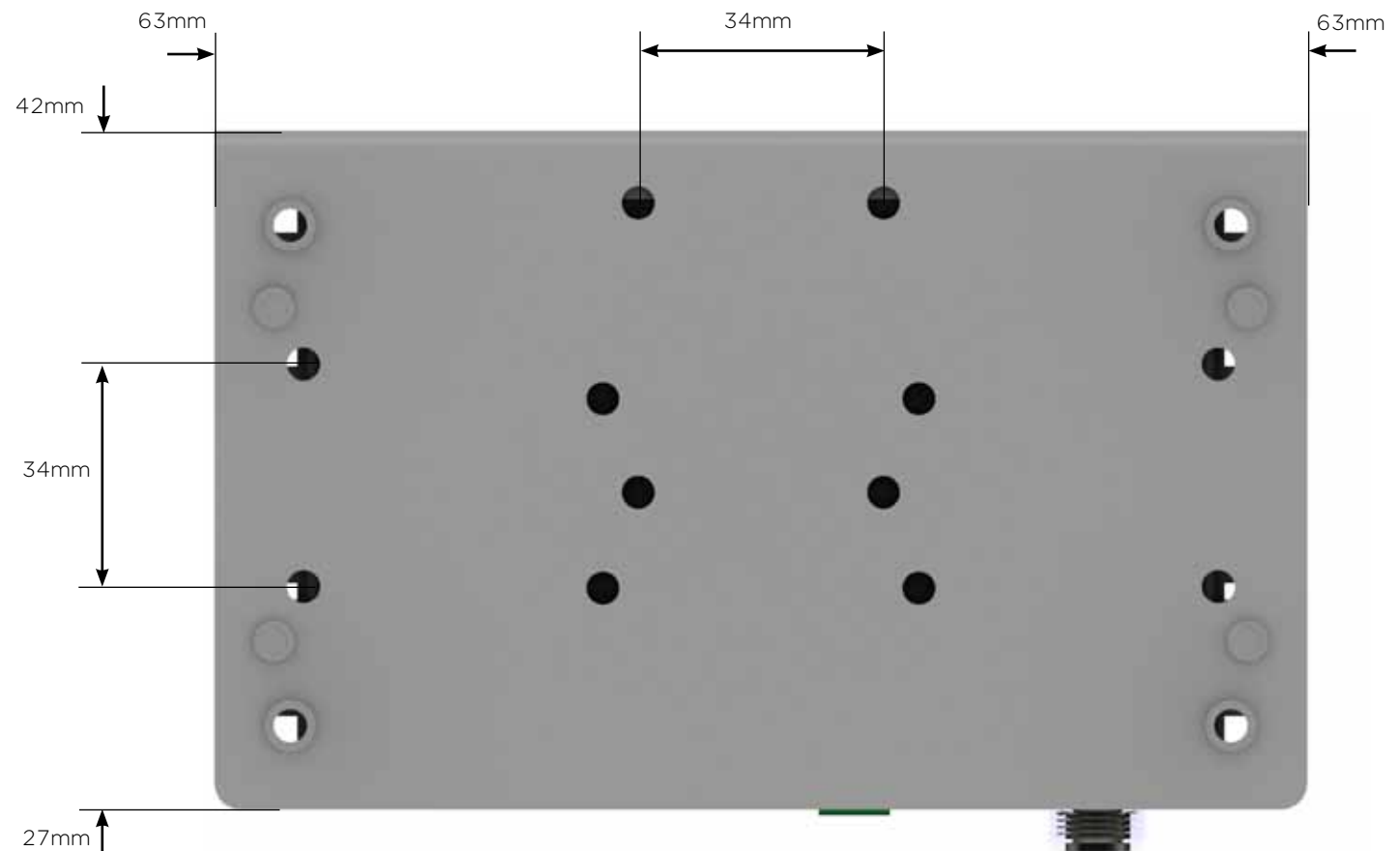
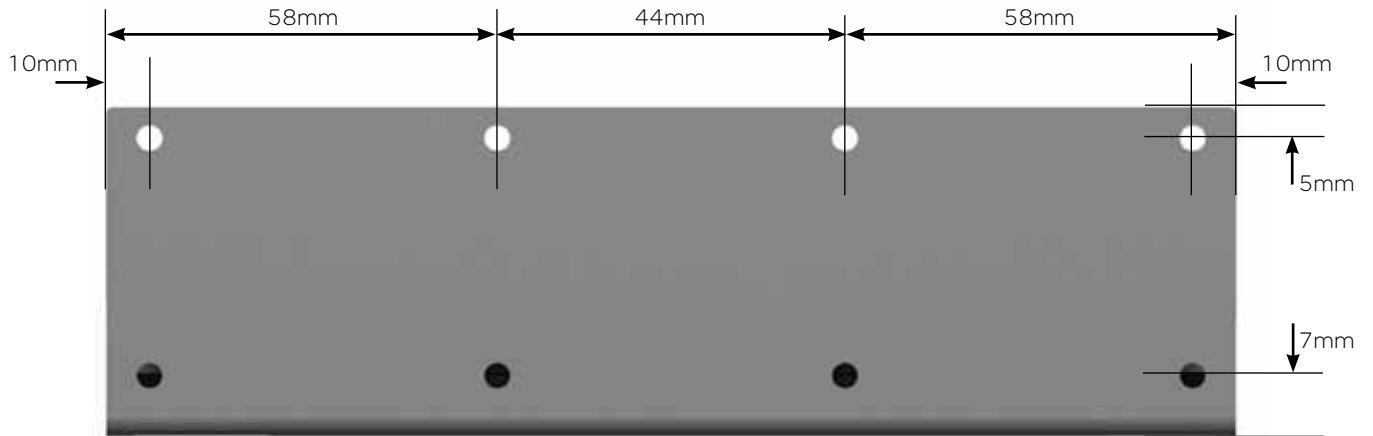
Each Din kit supplies:

- A DIN rail mounting bracket
- A Phoenix DIN rail clip
- x4 Countersunk M4X8 screws (to mount DIN rail clip to bracket)
- x4 M4 nuts (to mount DIN rail clip to bracket)
- x4 Pan head M3X6 screws (to mount Spread spectrum radio to bracket)
- x4 Pan head M4X2.5 screws (to mount M-Series to bracket)

DIN rail mounting bracket



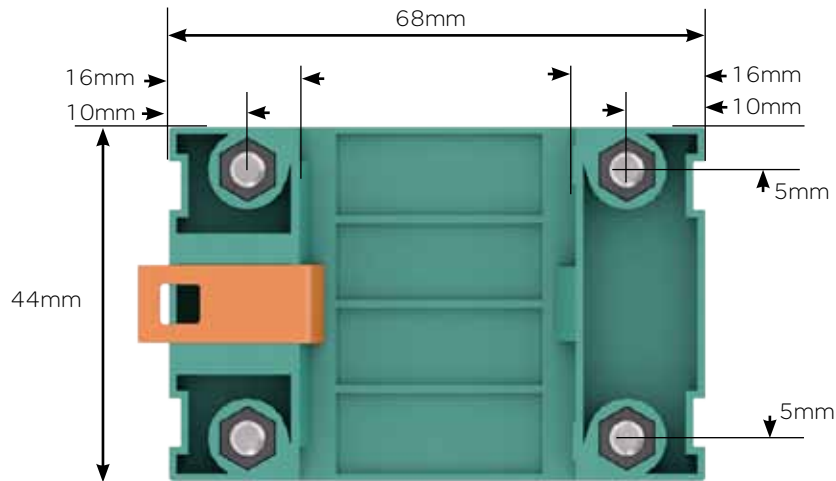
Note : Drawings not to scale.



DIN rail clip

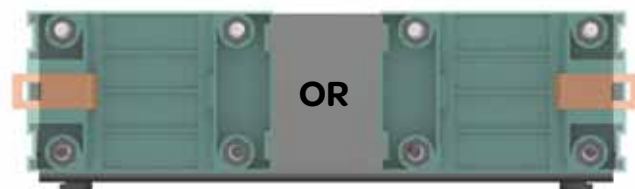
The DIN rail clip has a spring loaded latch to allow easy installation/removal of the radio device being installed.

The DIN rail clip can be fitted to the DIN rail mounting bracket x5 different ways to allow as much installation flexibility as possible.



Rear mount DIN rail clip

The DIN rail clip can be fitted on the rear of the DIN rail mounting bracket two ways shown below.

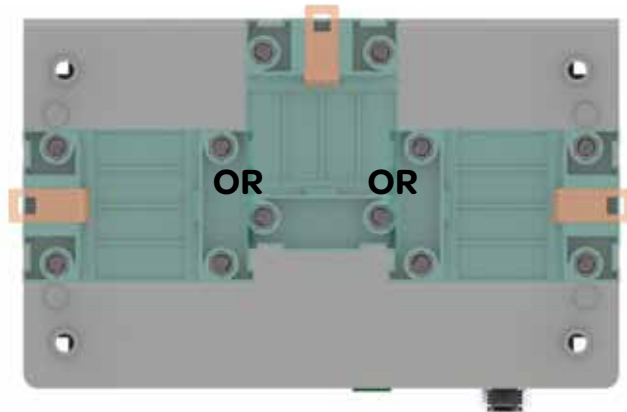


Examples of rear fitted DIN clips:

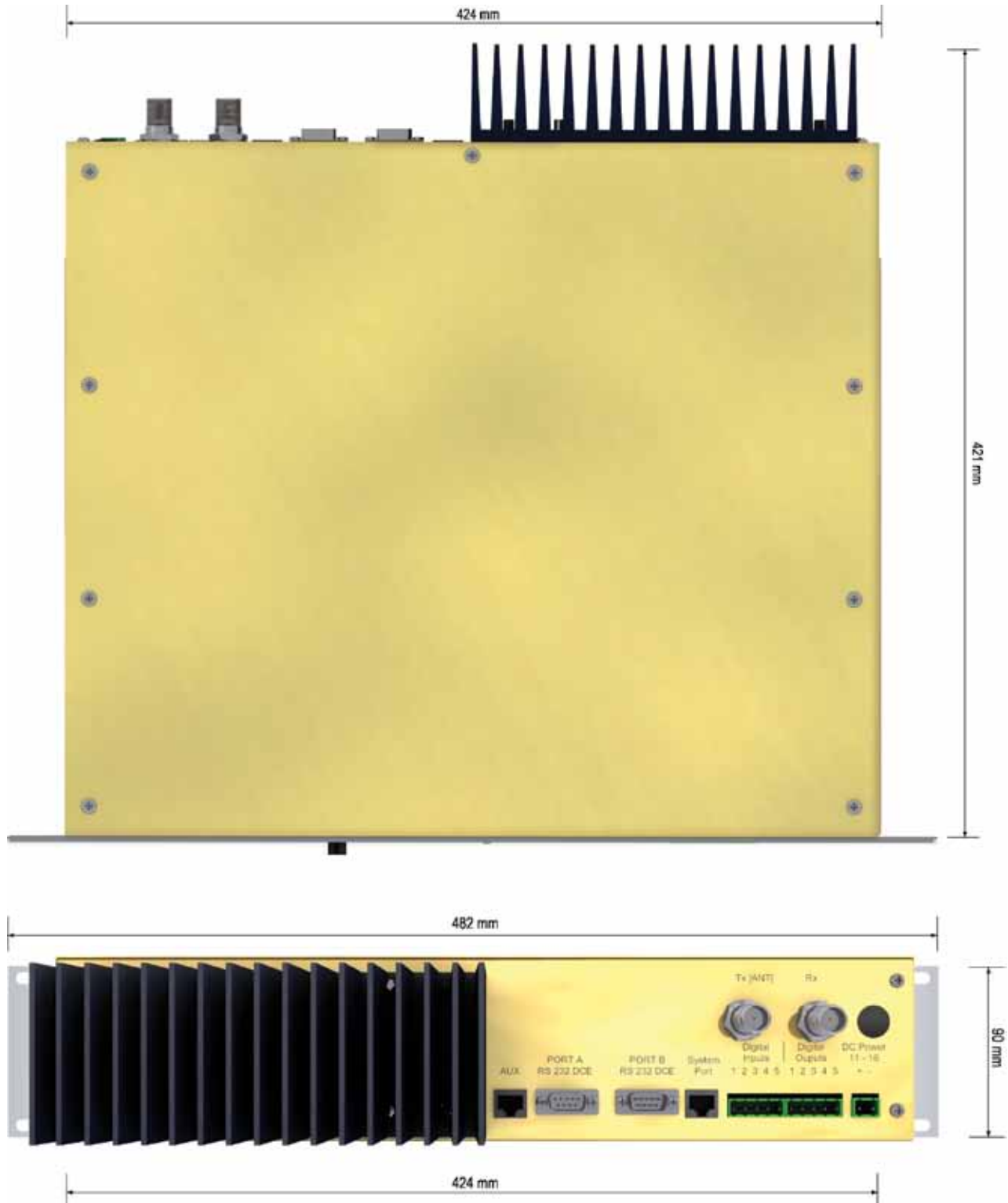


Bottom mount DIN rail clip

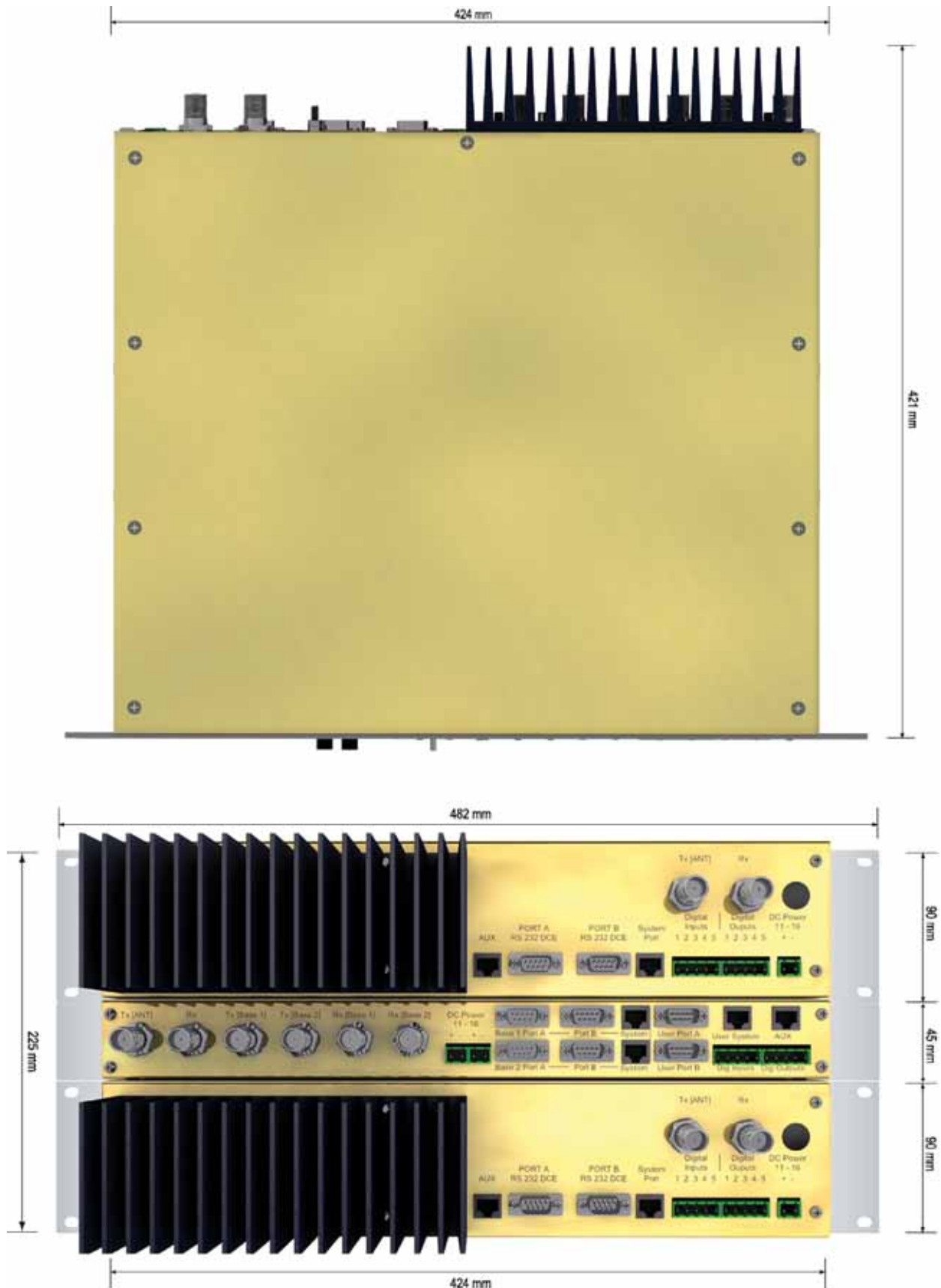
The DIN rail clip can be fitted on the bottom of the DIN rail mounting bracket three different ways shown below.

**Examples of bottom fitted DIN clips:**

Physical Dimensions - Base Station - EB450



Physical Dimensions - Hot Standby Base - 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.



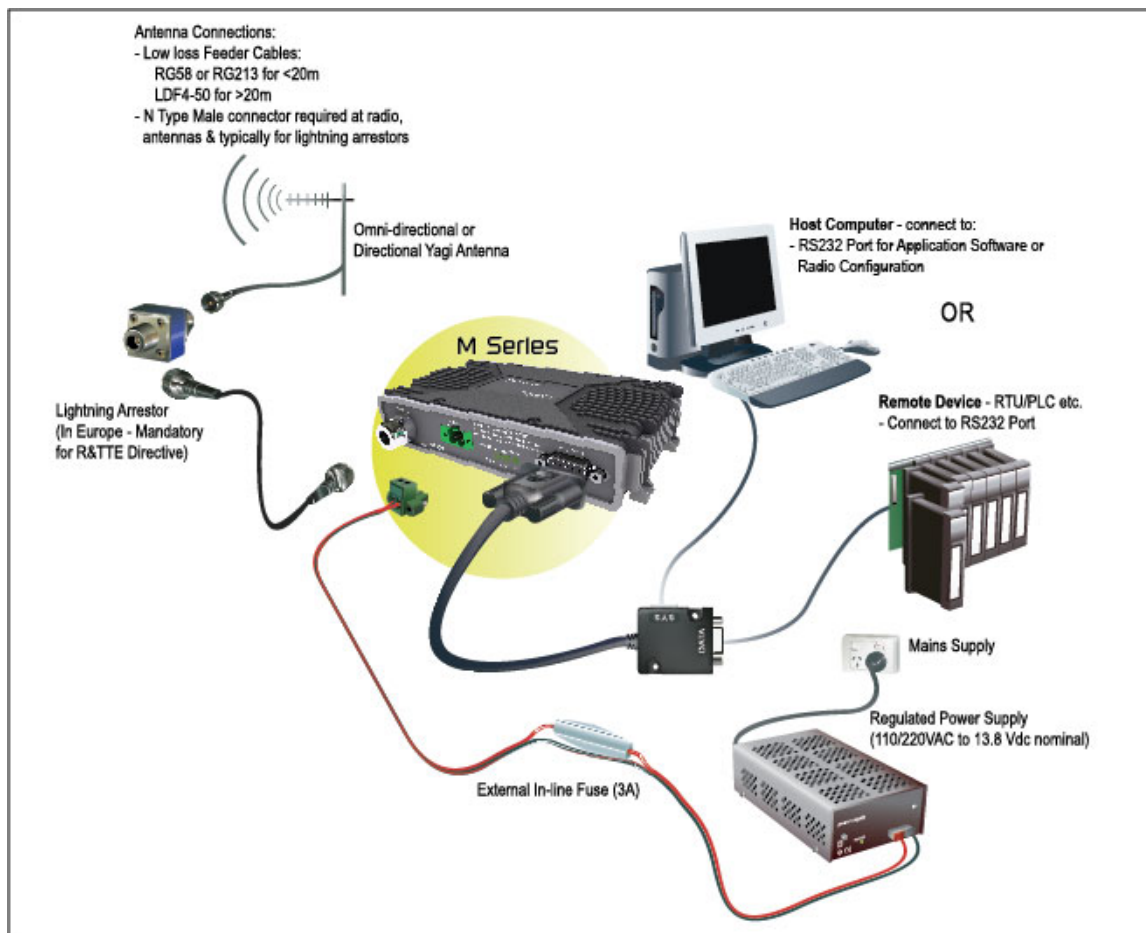
Mounting and Environmental Considerations

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.

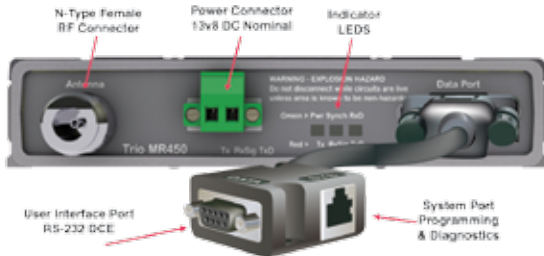
Note: In high power or high temperature applications, it is desirable to mount the radio with maximum ventilation for the heat sink.

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



Communications Ports

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 (Rx/D) - Data Output from Modem.
- Pin 3 (Tx/D) - 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.

Connecting Antennas and RF Feeders

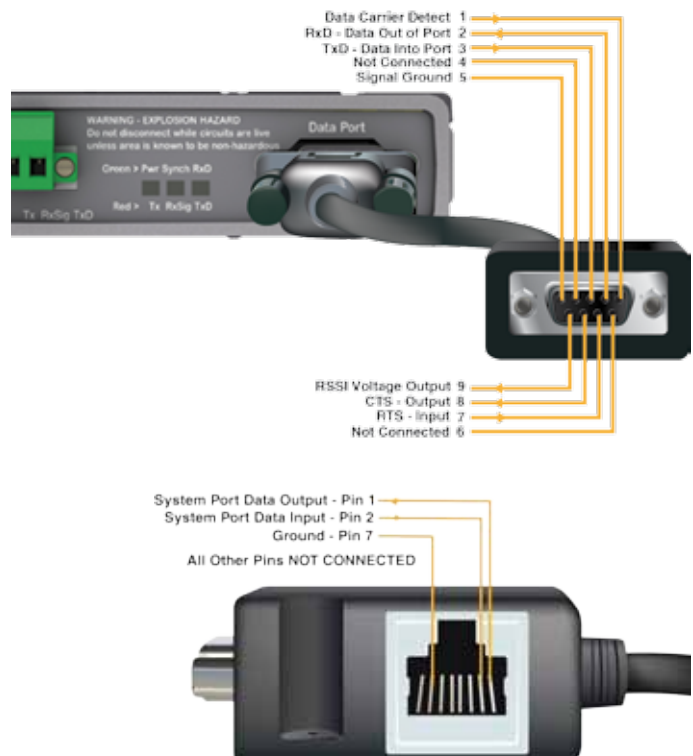
The RF antenna system should be installed in accordance with the manufacturers notes.

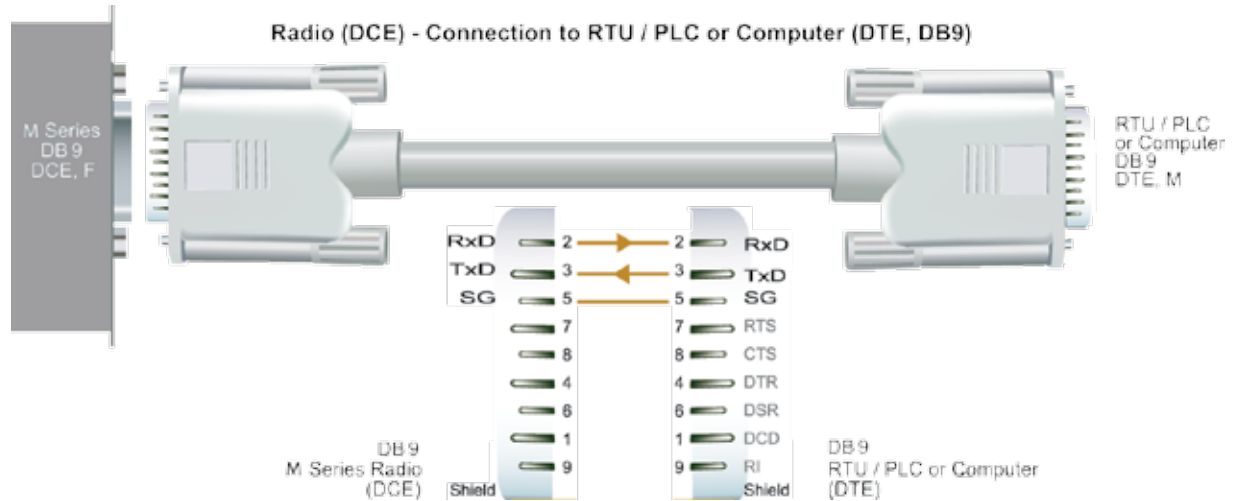
The RF connector used on the M Series radios are N Type female connectors. Always use good quality low loss feeder cable, selected according to the length of the cable run. Ensure all external connections are waterproofed using amalgamating tape.

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



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

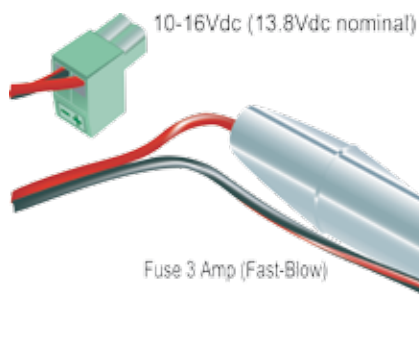
Caution: Ensure a RF load is present BEFORE transmitting.

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

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 from permanent damage if the voltage exceeds 16Vdc or if reverse polarity is applied. The radio may need to be returned for service if this occurs.

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.

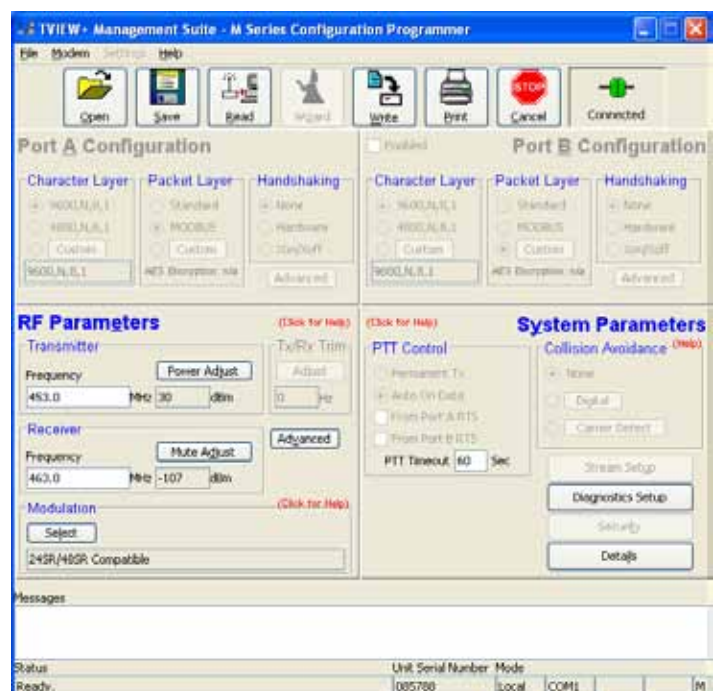
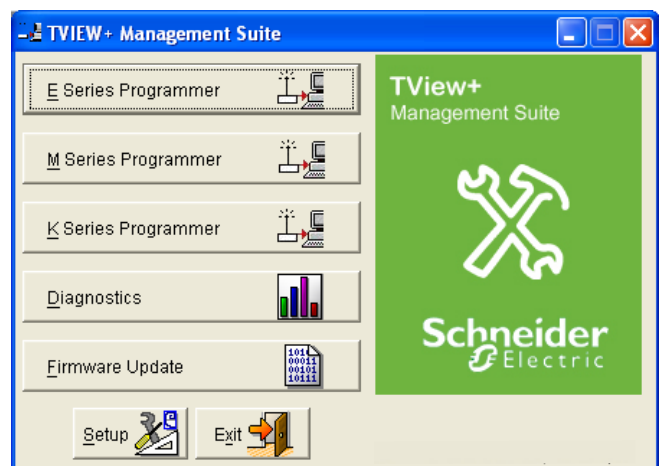
TVIEW+ Management Suite - Radio Configuration

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

Example: Configuration session –

- 1 Attach the TVIEW+M Series 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 the User Manual for detailed operation of advanced features.

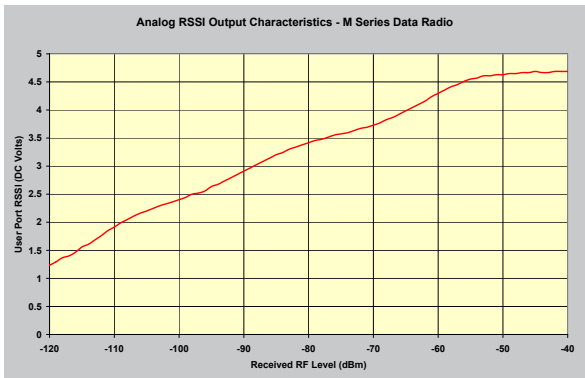


Optimising the Antenna for best RX signal

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



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.

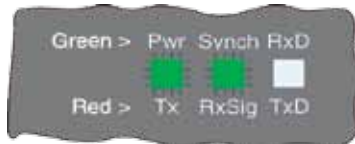
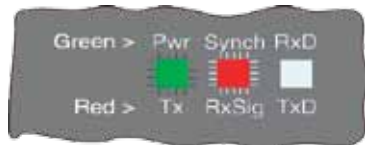
Received Signal Indicator

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

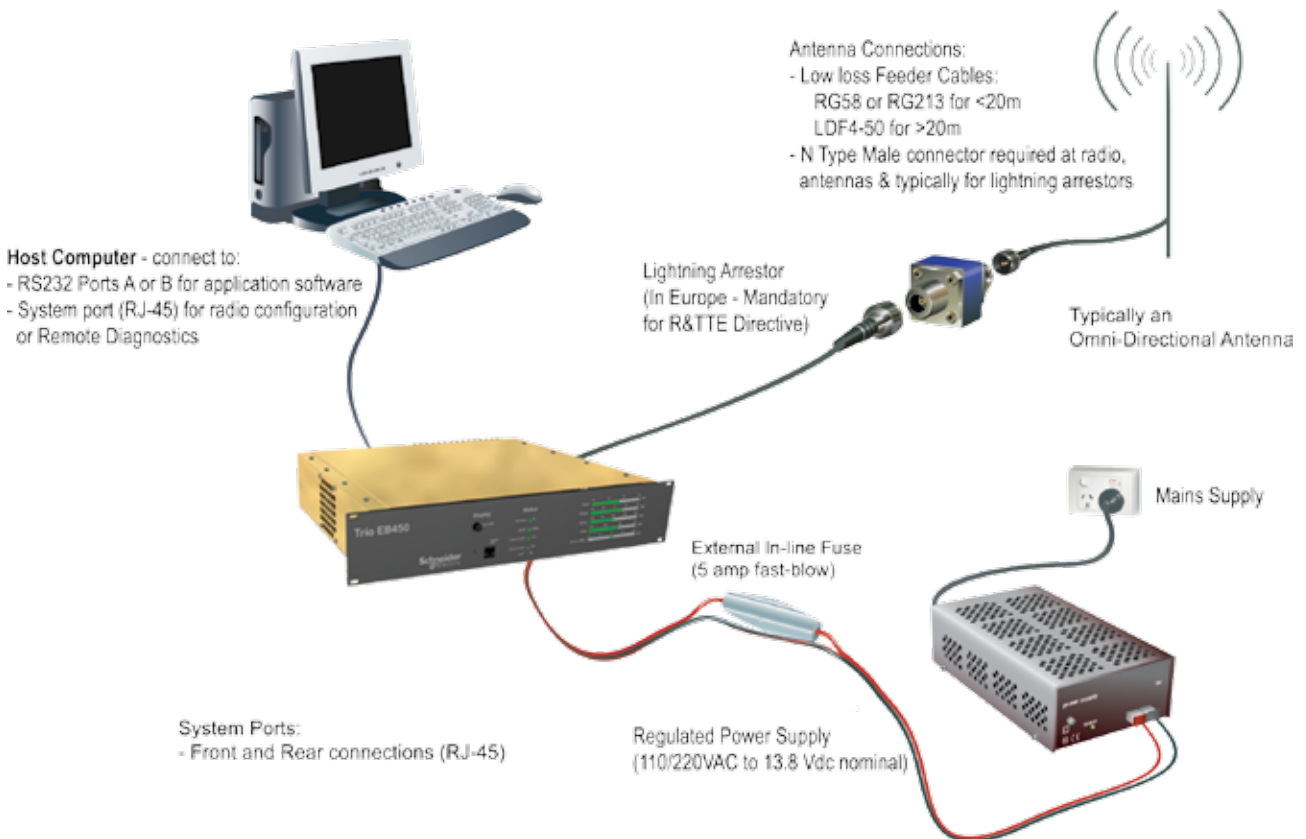
TVIEW+ Management Suite - Radio Configuration

See MR450 Quick Start Guide

Optimising the Antenna for VSWR and best RX signal

See MR450 Quick Start Guide

Typical Radio Setup



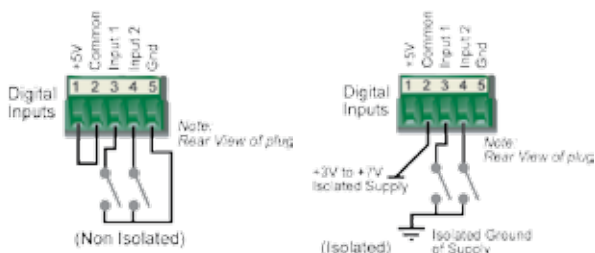
Digital Inputs and Outputs

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.

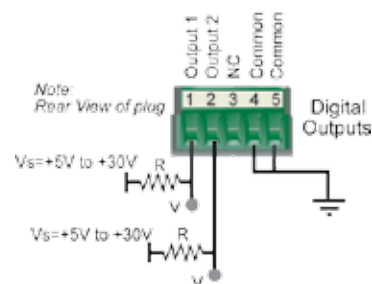
Outputs

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 +1.3v8 supply and 330 Ohms for a +5v supply.

When the OUTPUT is OFF, $V = V_s$. 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.



Hardware Error

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

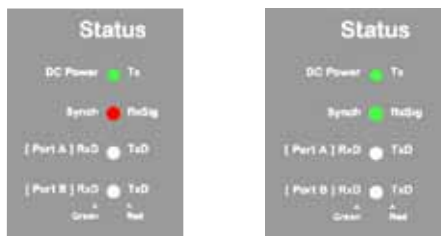
Received Signal Indicator

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 (1 1.5W) 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 swappable 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



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.

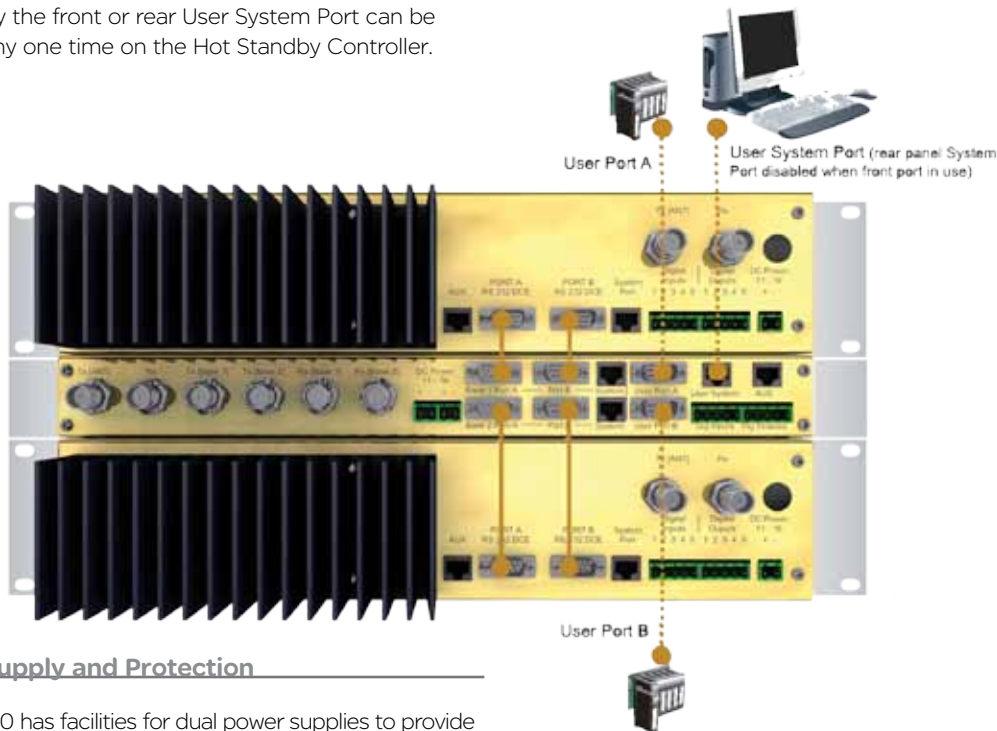
The Base Station front panel system ports must not be used while in this configuration.

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.

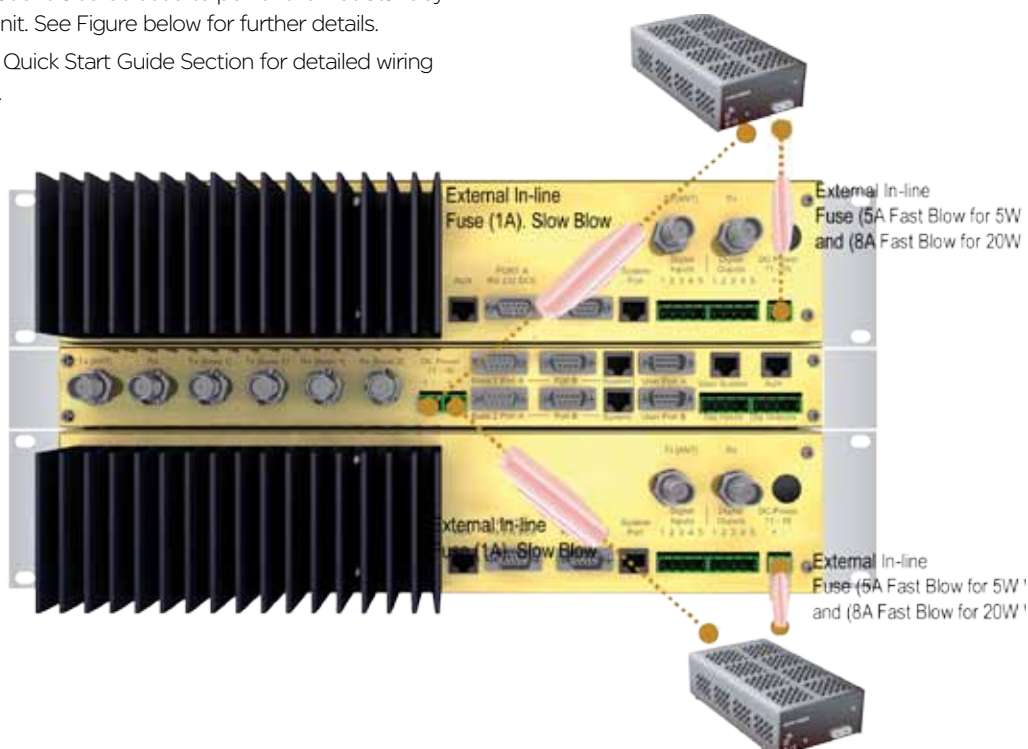
The Hot Standby Controller units A & B Data Ports connect directly to your application device and the System Port connects directly to your local PC. See ER450 Quick Start Guide Section for further details.



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.

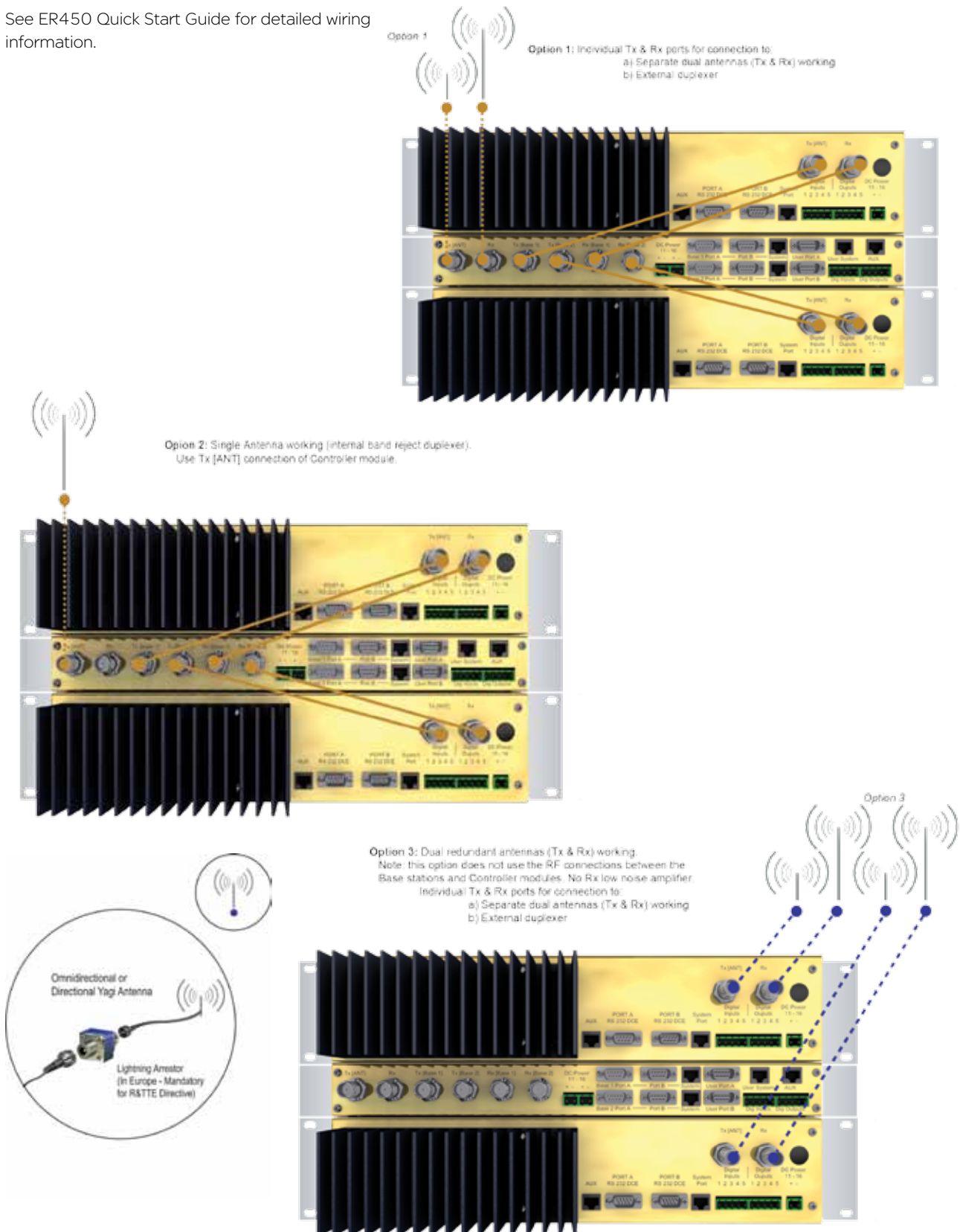
See ER450 Quick Start Guide Section for detailed wiring information.



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

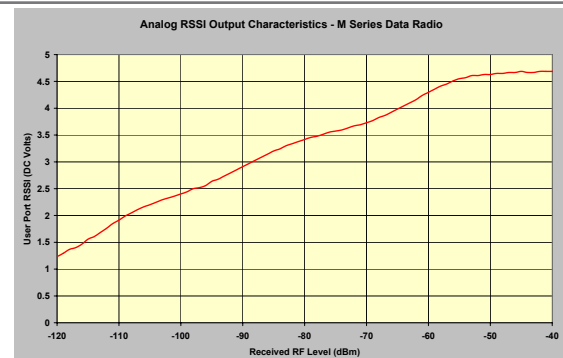
Bi-colour LEDs are provided to indicate RS232 data being transmitted and received on Port A. A RED flash indicates a byte (or bytes) of incoming data from the serial line which will be transmitted to air, and a green flash indicates a byte of data received “off air” being released onto the serial line.

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 shows Pin 9 voltage as it relates to signal strength.



M-Series Error LED indications

Error indications will be indicated by illuminating all the red LEDs followed by an error specific sequence of green LEDs as shown in the tables below.

Serious Error LED indications:

Serious errors are those that may be able to be recovered by following the appropriate corrective action.

Port A	Rx/Sync	Tx/Pwr	Error type	Corrective Action
			Supply voltage error	Check supply voltage is +10 to +16 VDC
			*Modulation error	*Check modulation scheme is available for model type

* There are also Fatal errors that use this indication so the unit will need to be sent back to factory for service if the corrective action does not work.

Fatal Error LED indications:

Fatal errors are those that can only be recovered by returning the unit back to the factory.

Port A	Rx/Sync	Tx/Pwr	Corrective Action
			The Corrective action for all fatal errors are to send the unit back to the factory for service.

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 5–7 years or more. 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.

VSWR should be inspected at regular intervals to ensure the state of the antenna and co-axial cable is in good working order. Generally, a rise in VSWR is an indication of a problem.

VSWR should always be < 2:1 during normal operation.

Part H – Tview+ 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.

Note: Some firmware features described in this section of the User Manual are only available on M Series Gen II radios (running firmware R3.9.x or later).

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.

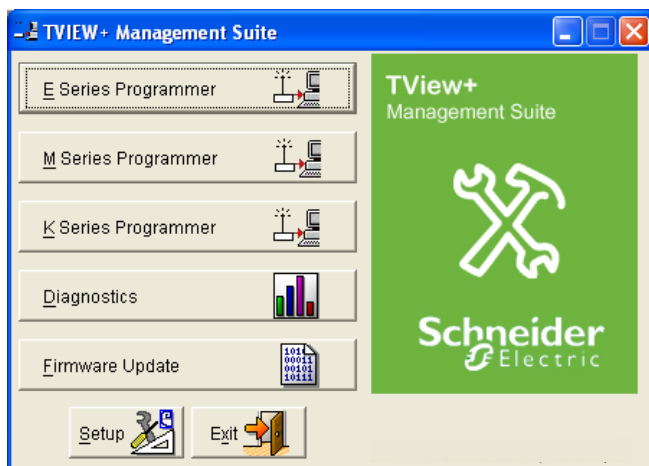
Other:

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:

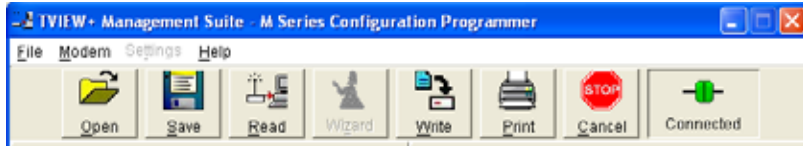
- Read unit
- Configure parameters (or Open a previously saved configuration file)
- Write unit

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.

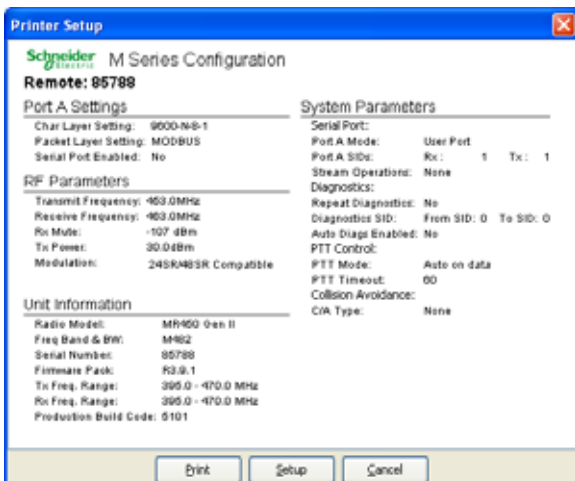
Save (also available on the toolbar)

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

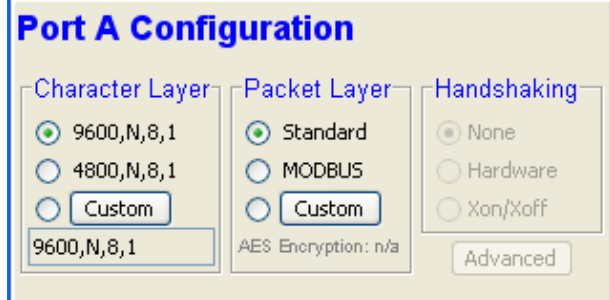
This menu launches the loading of the M-Series user manual.

Port A Configuration

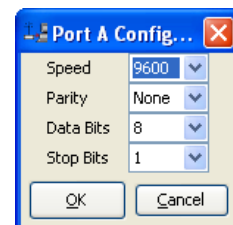
Character Layer

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.

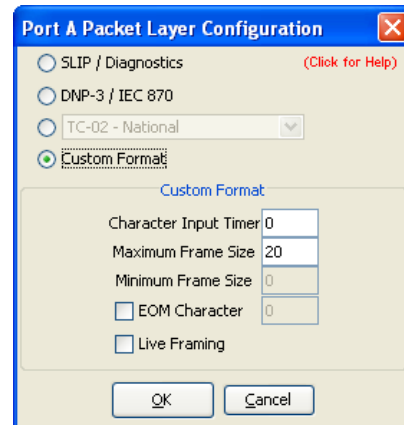
Note: The first character is always packetised and sent by itself regardless of all the above variables.

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.

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 1.0 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

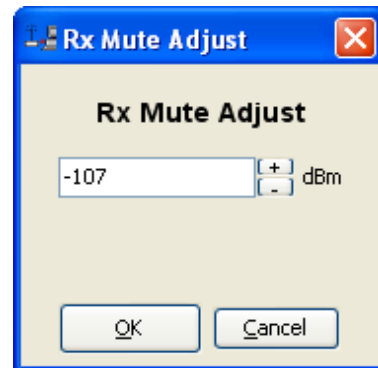
The receiver can be configured for receive frequency and mute level.

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



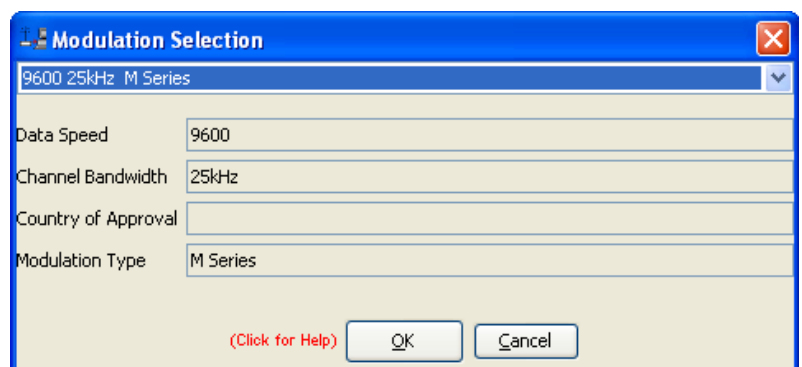
can be adjusted by selecting this button which displays a dialogue box. The up/down keys, or a typed in value, can be used to select the required mute level in dBm steps. Whilst a session is in progress with a unit the mute level adjustment is live. Selecting OK will retain the mute level setting. Note 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.

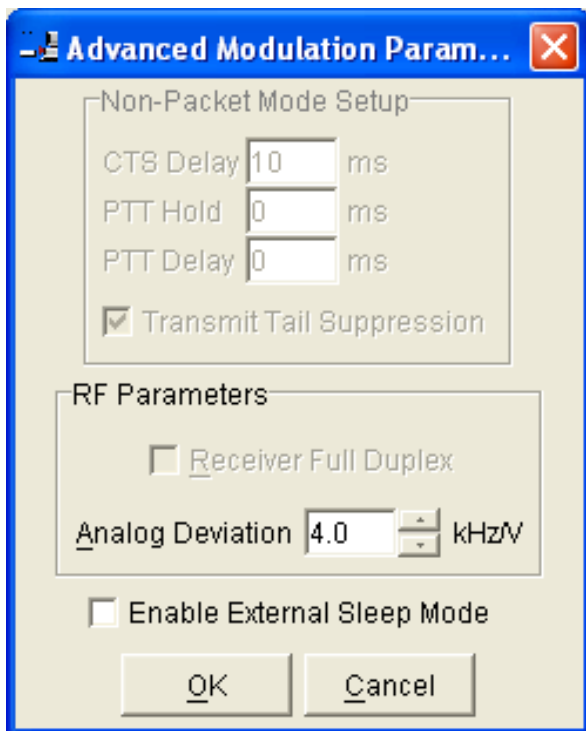
Modulation

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.



Advanced Parameters Window

This configuration window allows the user to control two advanced unit features.



Analog Deviation: This configuration parameter allows the user to raise or lower the Analog Deviation when the radio is operating in Analog Mode. The deviation default is 4.0kHz/Volt.

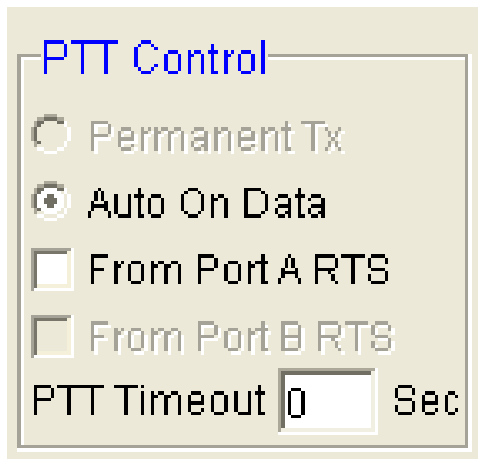
This can be raised to 4.8kHz/V or lowered to 3.2kHz/V.

Enable External Sleep Mode: This configuration parameter allows the user to enable external sleep mode control via Pin 8 (CTS). Normally configured as an output, by enabling this option Pin 8 (CTS) becomes an input. When pulled to ground (0v) the radio will enter sleep mode.

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 Transmit) 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.

Stream Setup (M Gen II only - requires FW Pack R3.9.x or later)

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

User Port

This option is selected by clicking on the User Port button and filling in the RXSID and TXSID fields to the right. The radio comes preconfigured with default values.

In User Port mode all SID code operations are performed transparently to the user data. Data placed into a user port which has been assigned a specified SID code, will only be received by a modem at the other end of the radio link that has a user port assigned with the same SID code. The SID code is added by the radio modem to the user data stream and removed by the radio modem when user data is outputted to a data port.

In this way, any Data Port in a System can be assigned different SID codes, thereby separating the data streams.

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

A situation where Tx and Rx SID codes may be different is in a repeater configuration. In this type of application all data messages sent to the repeater will be "repeated". Thus by having different Tx and Rx codes, a control unit will not "hear" its own transmission, and remotes will not hear the reply from any other remote. For more information please consult the Schneider Electric Trio E Series training material available as a power point slide from our website at www.triodatacom.com

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

User Port with SmartStream™ ID

This option is similar to User Port mode, except that the port can be configured to decode a range of Streams. For instance, if a user wanted to monitor traffic on several streams then this feature could be enabled to do this.

The option is selected by clicking on the User Port with SmartStream™ button and configuring the RXSID From and To parameters as well as the TXSID fields to the right.

SmartStream™ and user derived TxSID

This option is available when SmartStream™ is enabled. It allows the Tx SID value to be derived from the user data message. For instance, if the protocol was MODBUS then the system designer can select to derive the Tx SID from the MODBUS remote address and then steer the message across the radio network using specific rules. This can be useful in simplex systems where the system designer may need to prevent two or more repeaters from keying at the same time.

Trunk Streams

In the Trunk Streams mode, data that is inputted into the modem for transmission must have a SID code appended to the start of the data packet. This mode requires the use of a "SLIP" interface as configured using the packet layer.

Trunk Stream mode is normally used in conjunction with TView+ Diagnostics software, when connection to a MSR Stream Router or when connecting radios together such as a back-to-back connections as used in multiple point to point links.

The image shows a 'Stream Configuration' dialog box with a blue title bar and a close button (X) in the top right corner. The dialog is divided into two main sections: 'Data Port' and 'Port B'.

Data Port Section:

- Four radio buttons are listed: 'User Port', 'User Port with Smart Stream ID' (which is selected), 'Enable User Derived TxSID' (with an unchecked checkbox), 'Trunk Streams', and 'Disabled (allow Repeat/Translate)'.
- To the right of these buttons are four input fields: 'Rx SID From' (containing '1'), 'Rx SID To' (containing '2'), 'Tx SID' (containing '1'), and an empty field.

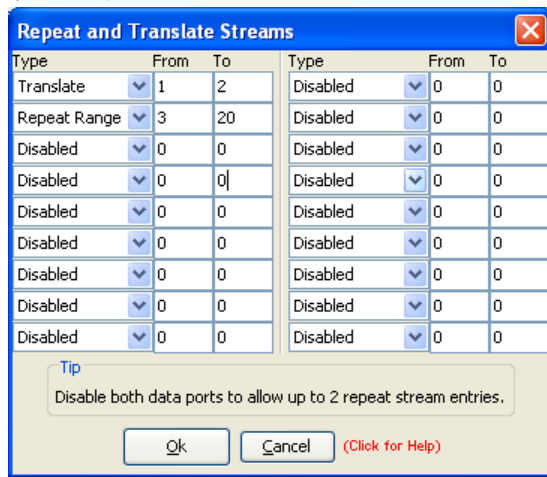
Port B Section:

- Three radio buttons are listed: 'User Port', 'Trunk Streams', and 'Disabled (allow Repeat/Translate)' (which is selected).
- To the right of these buttons are three input fields: 'From' (containing '3'), 'To' (containing '4'), and an empty field.

At the bottom of the dialog, there are three buttons: 'Repeat / Translate Configuration', 'OK', and 'Cancel'.

In Trunk Stream mode a range of SID codes can be transmitted and received via a data port. This range is specified when this mode is selected. In a typical application, such as a back to back connection as used in a multiple point to point links, where all data (including diagnostics) from one radio needs to be “trunked” through to the other radio, the range used is 0 to 255. Trunked mode allows a configurable selection of data streams to be “trunked” to other equipment yet the data remains separated as the SID codes are appended to each packet of data outputted.

Repeat Range



The dialog box titled "Repeat and Translate Streams" contains two columns of settings. The left column has a "Type" dropdown with options: Translate, Repeat Range, Disabled, Disabled, Disabled, Disabled, Disabled, Disabled, Disabled, and Disabled. The right column has a "Type" dropdown with options: Disabled, Disabled, Disabled, Disabled, Disabled, Disabled, Disabled, Disabled, Disabled, and Disabled. Each dropdown is followed by "From" and "To" input fields. A tip box at the bottom states: "Disable both data ports to allow up to 2 repeat stream entries." Buttons for "Ok", "Cancel", and "(Click for Help)" are at the bottom right.

Type	From	To	Type	From	To
Translate	1	2	Disabled	0	0
Repeat Range	3	20	Disabled	0	0
Disabled	0	0	Disabled	0	0
Disabled	0	0	Disabled	0	0
Disabled	0	0	Disabled	0	0
Disabled	0	0	Disabled	0	0
Disabled	0	0	Disabled	0	0
Disabled	0	0	Disabled	0	0
Disabled	0	0	Disabled	0	0
Disabled	0	0	Disabled	0	0

Tip
Disable both data ports to allow up to 2 repeat stream entries.

Ok Cancel (Click for Help)

The modem is capable of operating in a repeater mode. To configure the modem as a repeater, a phantom or virtual port is configured as an internal digital loopback plug. The data streams which are repeated can be configured as the entire SID range or a subset of ranges.

Data received from the radio channel is passed directly to the transmitter, and placed back onto the radio channel. This feature requires a firmware revision of R3.9.x or later.

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

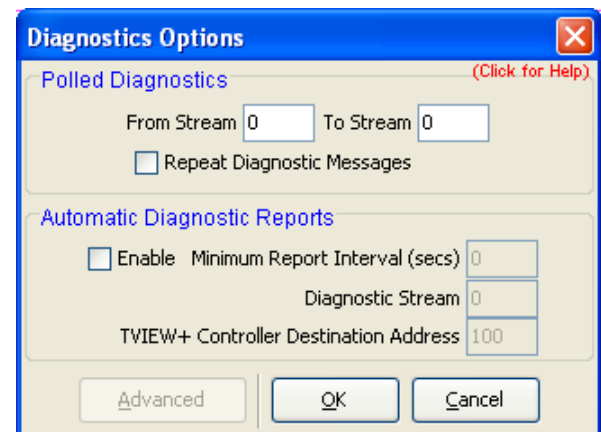
To enable the mode select “Repeat Range” in the Type field and specify the range of SID codes for which will be repeated.

Translate

This function is similar to repeat streams however it also translates the SID code from one value to another as the repeating function occurs.

This mode can be used to uncontrolled data repeating in system where more than one repeater is required, such as store and forward systems or pipe-lines.

Diagnostics Setup (Packet Modes Only)



The dialog box titled "Diagnostics Options" has a "(Click for Help)" link. It contains two sections: "Polled Diagnostics" and "Automatic Diagnostic Reports".

Polled Diagnostics

From Stream 0 To Stream 0

☐ Repeat Diagnostic Messages

Automatic Diagnostic Reports

☐ Enable Minimum Report Interval (secs) 0

Diagnostic Stream 0

TVIEW+ Controller Destination Address 100

Advanced OK Cancel

Polled Diagnostics

The Diagnostics Processor can be configured to listen for diagnostics on a range of SID codes. The factory default is SID code 0 (From Stream 0 To Stream 0). The diagnostics responses are sent back over the same stream as the questions.

Diagnostics Repeat

This option can be toggled on and off by clicking the button. Some applications will require that a repeater unit in a point to multipoint system repeats diagnostics frames only.

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

Automatic Diagnostic Reports

This option allows the configuration of automatic diagnostics. This option automatically appends diagnostics messages when user data is transmitted. This option can be toggled on and off by clicking the “Enable” button.

Minimum Report Interval : Specifies the amount of time before a diagnostics message is appended to the next user data message.

Diagnostic Stream: Specifies the SID code used for the automatic diagnostics message.

Controller Destination Address: Specifies the address of the Diagnostics Controller Software that is receiving the automatic messages and displaying them. This value must match that specified in the TVIEW diagnostics software configuration.

Advanced

The Advanced button can be used to install diagnostics into the M Series radio if it was not purchased with the original order. Enter the 8 digit key-code supplied by Trio to enable diagnostics. If diagnostics is already installed this option will be “greyed out”.

Collision Avoidance

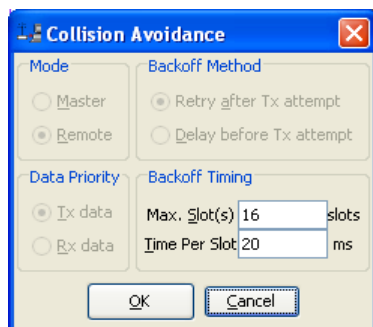
In a point to multipoint system the master unit (usually a base station) can transmit at any time and the remotes will all receive the broadcast signal. However, if more than one remote unit transmits at a time, then a collision will occur during the multiple transmissions, resulting in a loss of data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

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

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

None

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



Digital

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

Mode – “Master” or “Remote”. When the master unit receives a valid transmission from a remote unit it sets the channel busy indication bit. This busy bit is interpreted by the other remotes to not transmit. Once the transmission from the first remote ends the master unit resets the busy bit to indicate the channel is now clear to transmit on. The master unit, which is normally a base station, takes about 5ms to detect a transmission from a remote unit and set the channel busy indication bit on the radio channel. During this period collision of remote transmissions can still occur and is unavoidable. Note: The master must be permanently keyed..

Backoff Method – “Retry after Tx Attempt” or “Delay before Tx Attempt”. The method chosen is system dependent and can only be configured if the mode is “remote”. The former is best used when data responses from remotes are largely asynchronous. The latter is best used when this is not the case.

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

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

Carrier Detect

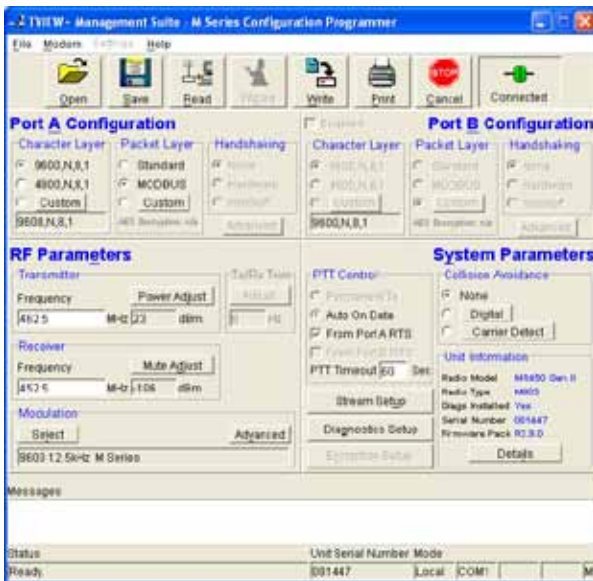
This method of collision avoidance utilises a carrier transmitted to all remotes to indicate that the radio channel is busy. When selected a dialogue box appears and several options must be configured:

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

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

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

Unit Information



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

Radio Model refers to the type of unit. The MR450 is a remote unit and the EE450 is a exciter inside a base station unit.

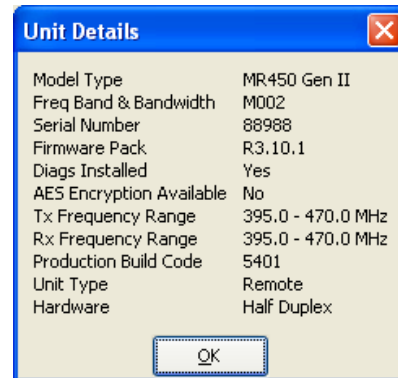
Radio Type refers to the frequency band supported by the radio. For example 51H002 is a type 51 band radio.

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

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 – Support Options

E-mail Technical Support

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.

Technical Support: Europe, Africa, Middle East

Available: Monday to Friday 8:30am - 5:30pm
Central Europe Standard Time

Direct Worldwide: +31 (71) 579 1650
Email: euro-support@controlmicrosystems.com

Technical Support: The Americas

Available: Monday to Friday 8:00am - 6:30pm
Eastern Standard Time

Toll free within North America: 1-888-226-6876
Direct Worldwide: +1 (613) 591-1943
Email: technicalsupport@controlmicrosystems.com

Technical Support: Asia Pacific

Schneider electric Australia - Customer care

Available: Monday to Friday 8:30am - 5:00pm
Australian Eastern Standard Time

Direct Worldwide: +1 300 369 233
Email: technicalsupport@au.schneider-electric.com



Part J – Specifications

	> Trio MR450
Radio	
Frequency Range	395-470MHz (M-Band) or 450-520MHz (H-Band)
Frequency Splits	Various Tx/Rx frequency splits - configurable
Channel Selection	6.25kHz channel step
Channel Spacing	12.5 and 25kHz
Frequency Accuracy	11 ppm, -30 to +60°C (-22 to 140°F) ambient
Aging	<=1 ppm/annum
Radio Modes	Simplex and Half duplex
Configuration	All configuration via Windows based software
Transmitter	
Tx Power	0.1 to 5W (+20 to +37dBm) +/- 1 dB configurable with over-temperature protection
Modulation	Configurable narrow band digitally filtered binary GMSK
Timeout Timer	Configurable 0 to 255 seconds
Tx Spurious	<= -37dBm
PTT Control	Auto (Data) / RTS line
Receiver	
Sensitivity	-116dBm for 12dB SINAD
Selectivity	Better than 60dB
Intermodulation	Better than 65dB
Spurious Response	Better than 70dB
Mute	Configurable digital mute
Connections	
Serial Data Port	RS232 DB9 female DCE. 300-38,400bps asynchronous
Serial Data Interface	3-wire data interface (TxD, RxD & GND)
Serial Data Port DCD Control	Configurable DCD operation : activated on RF carrier or from user data output
System Port	RS232 19,200bps (Shared on Data Port), for configuration and diagnostics. Y-Cable supplied for separating Serial Data Port & Systems Port
Antenna	1 x N female bulkhead
Power	2-pin locking, mating connector supplied
LED Display	Multimode Indicators for Pwr, Tx, Rx, Sync, TxD and RxD data LEDs
Modem	
RF Channel Data Rate [#]	<ul style="list-style-type: none"> • Radio Model 003 : FCC (IC) 9600bps (12.5kHz) North America • Radio Model 004 : ETSI 4800bps (12.5kHz) Europe • Radio Model 001 : ACMA 2400bps (12.5kHz) / 4800bps (25kHz) Australia • Radio Model 002 : ACMA 4800bps (12.5kHz) / 9600bps (25kHz) Australia
Typical Bit Error Rate [#]	< 1x10 ⁻⁶ @ -117dBm (2400bps), < 1x10 ⁻⁶ @ -116dBm (4800bps), < 1x10 ⁻⁶ @ -107dBm (9600bps)
Operating Modes	Base, remote, repeater or store n' forward
Data Buffer	8kbyte of on-board RAM
Channelshare™	Trio's unique supervisory collision avoidance system
Multistream™	Simultaneous data stream delivery allows for multiple vendor devices/protocols to be transported on the one radio network
Firmware	Local flash-based firmware updates
Diagnostics	
Diagnostics Overview	<ul style="list-style-type: none"> • TView+ configuration, network management and diagnostic Windows GUI software • 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 • Diagnostics parameters available <ul style="list-style-type: none"> • Transmitter Power • Received Signal Strength • DC Supply Voltage • Radio Temperature
Specifications continue on the next page	

>	Trio MR450
General	
Operating Temperature Range	-30°C to +60°C (-22°F to +140°F)
Power Supply	13.8Vdc nominal (10-16Vdc)
Transmit Current	600mA nominal @ 1W, 1500mA nominal @ 5W
Receive Current	<170mA nominal @ 13.8Vdc
Sleep Mode	Externally controlled sleep mode (13mA @ 13.8Vdc) with 75mS start up time (available only when sleep mode option board is fitted)
Housing & Dimensions	Rugged die-cast, 154 x 102 x 29mm (6.1 x 4.1 x 1.2in.)
Mounting	Integral mounting feet (standard) or DIN Rail mounting (optional)
Weight	0.32kg (0.71lbs)
Warranty	3 years on parts and labor
Approvals and Certifications	
Europe (ETSI)	ETSI EN300113, EN301489, EN60950
FCC	FCC PART 15, PART 90
Industry Canada	IC RS119, ICES-001
Australia	ACMA AS4295-1995 (Data)
Hazardous Locations	CSA Class I, Division II, Groups (A,B,C,D) for Hazardous Locations ANSI/UL equivalent)
<p>* Export restrictions may apply. Contact your local representative for more details.</p> <p># Local radio regulatory requirements may dictate the actual RF channel data rate and Bit Error Rates available. Contact your local representative for more details</p> <p>Note: Not all product features are available in every mode of operation.</p> <p>Disclaimer: Schneider Electric reserves the right to change product specifications. For more information visit www.schneider-electric.com.</p>	

Appendix A – Firmware Updates

Firmware Update Overview

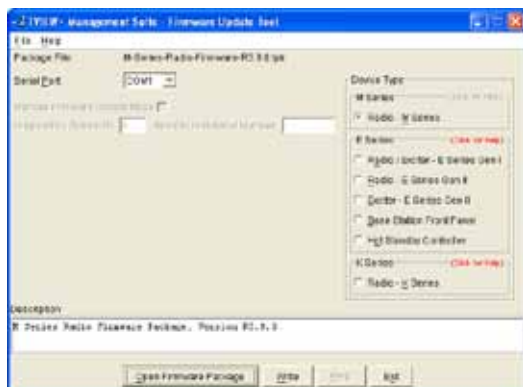
Firmware updates are performed on a unit connected locally to the PC. It is recommended that all cabling to the unit be disconnected prior to commencing firmware update to minimise any interruption to the process or disturbances of signals on cables still connected. All other TView+ Management Suite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

Please ensure you have the latest release of the TView+ Management Suite before you attempt a firmware upgrade. This can be obtained from the Trio website at http://www.triodatacom.com/scada_supp.php

Firmware Update for M Series Remote Radios (Serial No 81200 or FW R3.x.x and above)

1. Connect the TVIEW+ M Series diagnostics/programming cable from the PC Serial (COM) port to the data port on the radio. Select the appropriate COM Port if required.

Note: Details on the TVIEW+ M Series diagnostics/programming cable can be found on Page 24 of this user manual.
2. Click on the “Firmware Update” button to start the firmware update utility from the TVIEW+ front panel.
3. Select the “Device Type” as “Radio - M Series” from the options on the top right of the firmware update main window as shown below.
4. Select the file containing the firmware update package using the “Open Firmware Package” button at the bottom of the main window. After opening the file, the browse window will close and a description of the firmware package will appear in the main window as shown below.



5. Initiate the firmware updating process using the “Write” button at the bottom of the main window. The following window will appear. Click on OK to proceed.

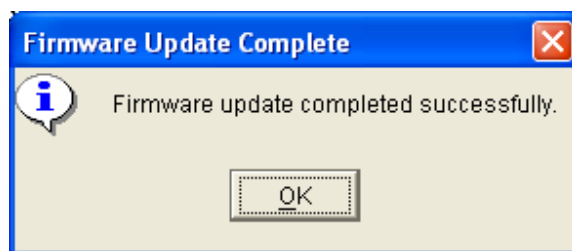


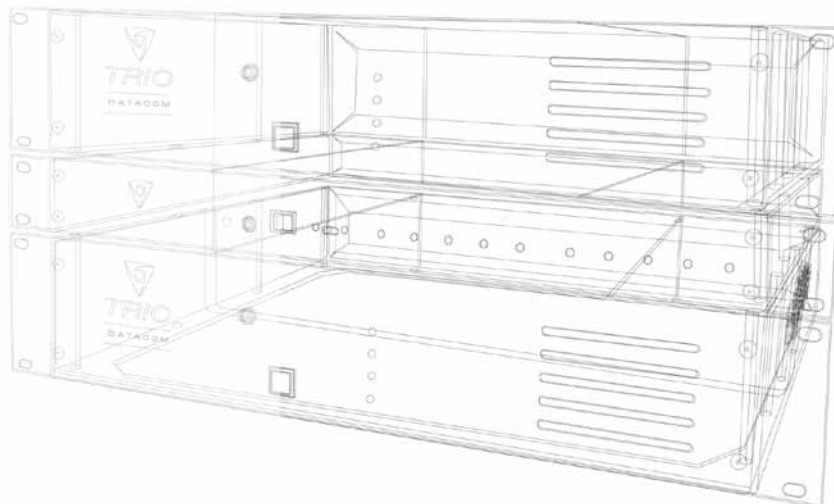
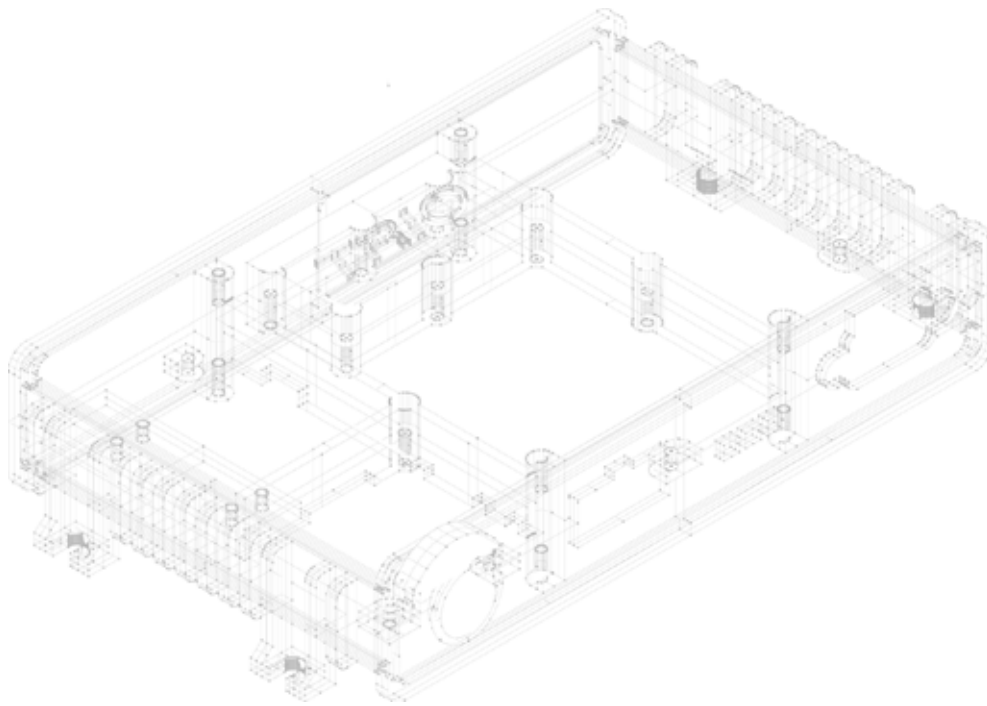
6. The following window will appear. On units with firmware pack revision R3.8.x or earlier all the LEDs will be in an OFF state while the firmware upgrade process takes place. On units with firmware pack revision R3.9.x or later, all the LEDs will be in an ORANGE state while the firmware upgrade process takes place.

Wait for the progress bar to reach 100% complete which will take between 3 to 5 minutes.



7. When the firmware update procedure has been completed, the following window will appear. The radio will automatically re-boot running the new firmware version. This completes the firmware upgrade process.





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