Appendix J: Manual

Please refer to the following pages.

Aprisa XE

User Manual

April 2012

Version 8.6.77

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Trademarks

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Disclaimer

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RoHS and WEEE Compliance

The Aprisa XE is fully compliant with the European Commission's RoHS (Restriction of Certain Hazardous Substances in Electrical and Electronic Equipment) and WEEE (Waste Electrical and Electronic Equipment) environmental directives.

Restriction of hazardous substances (RoHS)

The RoHS Directive prohibits the sale in the European Union of electronic equipment containing these hazardous substances: lead*, cadmium, mercury, hexavalent chromium, polybrominated biphenyls (PBBs), and polybrominated diphenyl ethers (PBDEs).

4RF Limited has worked with its component suppliers to ensure compliance with the RoHS Directive which came into effect on the 1st July 2006.

*The European Commission Technical Adaptation Committee (TAC) has exempted lead in solder for high-reliability applications for which viable lead-free alternatives have not yet been identified. The exemption covers communications network infrastructure equipment, which includes 4RF Limited Aprisa XE microwave radios.

End-of-life recycling programme (WEEE)

The WEEE Directive concerns the recovery, reuse, and recycling of electronic and electrical equipment. Under the Directive, used equipment must be marked, collected separately, and disposed of properly.

4RF Limited has instigated a programme to manage the reuse, recycling, and recovery of waste in an environmentally safe manner using processes that comply with the WEEE Directive (EU Waste Electrical and Electronic Equipment 2002/96/EC).

4RF Limited invites questions from customers and partners on its environmental programmes and compliance with the European Commission's Directives (sales@4RF.com).

Compliance General

The Aprisa XE digital radio predominantly operates within frequency bands that require a site license be issued by the radio regulatory authority with jurisdiction over the territory in which the equipment is being operated.

It is the responsibility of the user, before operating the equipment, to ensure that where required the appropriate license has been granted and all conditions attendant to that license have been met.

Changes or modifications not approved by the party responsible for compliance could void the user's authority to operate the equipment.

Equipment authorizations sought by 4RF Limited are based on the Aprisa XE radio equipment being installed at a fixed location and operated in a continuous point-to-point mode within the environmental profile defined by EN 300 019, Class 3.2. Operation outside these criteria may invalidate the authorizations and / or license conditions.

The term 'Terminal' with reference to the Aprisa XE User Manual, is a generic term for one end of a fixed point-to-point Aprisa XE link and does not confer any rights to connect to any public network or to operate the equipment within any territory.

Compliance ETSI

The Aprisa XE radio terminal is designed to comply with the European Telecommunications Standards Institute (ETSI) specifications as follows:

Radio performance	EN 302 217 Parts 1, 2.1, and 2.2
EMC	EN 301 489 Parts 1 & 4
Environmental	EN 300 019, Class 3.2
Safety	EN 60950

An Aprisa XE radio terminal operating in the following frequency bands / channel sizes has been tested and is compliant to the ETSI radio specifications and suitably displays the CE logo.

Other bands are compliant to the same radio performance specifications as adapted by 4RF Limited and therefore may be used in regions where compliance requirements demand CE performance at other frequencies.

Frequency band	**Channel size**	**Power input**	**Notified body**
300 MHz 400 MHz	25 kHz, 50 kHz, 75 kHz, 125 kHz, 150 kHz, 250 kHz, 500 kHz, 1.0 MHz, 1.75 MHz, 3.50 MHz	12 VDC, 24 VDC, 48 VDC, 115/230 VAC	Notified Body 0678
600 MHz 700 MHz 800 MHz 900 MHz	500 kHz	12 VDC, 24 VDC, 48 VDC, 115/230 VAC	Notified Body 0678
1400 MHz	75 kHz, 150 kHz, 250 kHz, 500 kHz, 1.0 MHz, 1.75 MHz, 3.50 MHz, 7 MHz	12 VDC, 12 VDC LP, 24 VDC, 48 VDC, 115/230 VAC	
1800 MHz 2000 MHz 2500 MHz	250 kHz, 500 kHz, 1.0 MHz, 1.75 MHz, 3.50 MHz, 7 MHz, 14 MHz	12 VDC, 24 VDC, 48 VDC, 115/230 VAC	

Informal Declaration of Conformity

Dansk	Undertegnede 4RF Limited erklærer herved, at følgende udstyr Aprisa Radio overholder de væsentlige krav og øvrige relevante krav i direktiv 1999/5/EF.
Deutsch	Hiermit erklärt 4RF Limited, dass sich dieses Aprisa Radio in Übereinstimmung mit den grundlegenden Anforderungen und den anderen relevanten Vorschriften der Richtlinie 1999/5/EG befindet. (BMWi)
Dutch	Hierbij verklaart 4RF Limited dat het toestel Aprisa Radio in overeenstemming is met de essentiële eisen en de andere relevante bepalingen van richtlijn 1999/5/EG.
English	Hereby, 4RF Limited, declares that this Aprisa Radio equipment is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.
Español	Por medio de la presente 4RF Limited declara que el Aprisa Radio cumple con los requisitos esenciales y cualesquiera otras disposiciones aplicables o exigibles de la Directiva 1999/5/CE.
Σλληνας	ΜΕ ΤΗΝ ΠΑΡΟΥΣΑ 4RF Limited ΔΗΛΩΝΕΙ ΟΤΙ Aprisa Radio ΣΥΜΜΟΡΦΩΝΤΑΙ ΠΡΟΣ ΤΙΣ ΟΥΣΙΩΔΕΙΣ ΑΠΑΙΤΗΣΕΙΣ ΚΑΙ ΤΙΣ ΔΟΙΠΕΣ ΣΧΕΤΙΚΕΣ ΔΙΑΤΑΞΕΙΣ ΤΗΣ ΟΤΗΓΙΑΣ 1995/5/ΚΕ.
Français	Par la présente 4RF Limited déclare que l'appareil Aprisa Radio est conformé aux exigences essentielles et aux autres dispositions pertinentes de la directive 1999/5/CE.
Italiano	Con la presente 4RF Limited dichiara che questo Aprisa Radio è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti stabilite dalla direttiva 1999/5/CE.
Português	4RF Limited declara que este Aprisa Radio está conforme com os requisitos essenciais e outras provisões da Directiva 1999/5/CE.
Suomalainen	4RF Limited vakuuttaa täten että Aprisa Radio tyyppinen laite on direktiivin 1999/5/EY oleellisten vaatimusten ja sitä koskevien direktiivin muiden ehtojen mukainen.
Svensk	Härmed intygar 4RF Limited att denna Aprisa Radio står I överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 1999/5/EG.

A formal Declaration of Conformity document is shipped with each Aprisa XE terminal.

Compliance Federal Communications Commission

The Aprisa XE radio terminal is designed to comply with the Federal Communications Commission (FCC) specifications as follows:

Radio performance / EMC (dependant on variant)	47CFR part 90 Private Land Mobile Radio Services 47CFR part 101 Fixed Microwave Services 47CFR part 27 Misc Wireless Communication Services 47CFR part 15 Radio Frequency Devices
Safety	EN 60950

Frequency band limits	Channel size	Power input	Authorization	FCC ID
421 MHz to 512 MHz	25 kHz	48 VDC	Part 90 Certification	UIPN0400025A0200A
932.5 MHz to 944 MHz	100 kHz, 200 kHz	24 VDC, 48 VDC, 110 VAC	Part 101 Verification	-
2314.5 MHz to 2317.5 MHz 2346.5 MHz to 2349.5 MHz	250 kHz, 500 kHz	24 VDC, 48 VDC, 110 VAC	Part 27 Certification	UIPN2500AAAA0200A
2180 MHz to 2290 MHz	500 kHz	110 VAC	Part 101 Certification	UIPXE20001300

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

RF Exposure Warning

WARNING:

The installer and / or user of Aprisa XE radio terminals shall ensure that a separation distance as given in the following table is maintained between the main axis of the terminal's antenna and the body of the user or nearby persons.

Minimum separation distances given are based on the maximum values of the following methodologies:

1. Maximum Permissible Exposure non-occupational limit (B or general public) of 47 CFR 1.1310 and the methodology of FCC's OST/OET Bulletin number 65.
2. Reference levels as given in Annex III, European Directive on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) (1999/519/EC). These distances will ensure indirect compliance with the requirements of EN 50385:2002.

Frequency (MHz)	Maximum power (dBm)	Maximum antenna gain (dBi)	Maximum power density (mW/cm^2)	Minimum separation distance (m)
400	+ 35	15	0.20	2.0
512	+ 35	15	0.26	1.8
715	+ 34	15	0.36	1.3
806	+ 34	28	0.40	5.6
890	+ 34	28	0.45	5.3
960	+ 34	28	0.48	5.1
1550	+ 34	33	0.78	7.2
2300	+ 34	37	1.00	10.0
2700	+ 34	38	1.00	11.2

Contents

1. Getting Started

This section is an overview of the steps required to commission a link in the field.

Phase 1: Pre-installation		
1.	Confirm path planning.	Page 23
2.	Ensure that the site preparation is complete: • Power requirements • Tower requirements • Environmental considerations, for example, temperature control • Rack space	Page 26
3.	Confirm the interface card configuration.	

Phase 2: Installing the terminals		
1.	Before installing the terminal into the rack, check that all the required interface cards are fitted.	
	Position and mount the terminal in the rack.	Page 33
2.	Connect earthing to the terminal.	Page 28
3.	Confirm that the: • Antenna is mounted and visually aligned. • Feeder cable is connected to the antenna. • Feeder connections are tightened to recommended level. • Tower earthing is complete.	
4.	Install lightning protection.	Page 28
5.	Connect the coaxial jumper cable between the lightning protection and the terminal duplexer.	
6.	Connect the power supply to the terminal and apply power.	Page 35

Phase 3: Establishing the link		
1.	If you don't know the terminal's IP address : Connect the setup cable between the terminal's Setup port and the PC using accessory kit adaptor. Use HyperTerminal to confirm the IP settings for the terminal: • Local IP address • Local subnet mask • Remote terminal IP address Reboot the terminal	Page 58
2.	Connect the Ethernet cable between the terminal's 4-port Ethernet switch and the PC.	
3.	Confirm that the PC IP settings are correct for the 4-port Ethernet switch: • IP address • subnet mask	Page 50
4.	Confirm that Java is installed on the PC.	Page 49
5.	Start the web browser, and log into the terminal.	Page 60
6.	Set or confirm the RF characteristics: • TX and RX frequencies • Modulation type • TX output power	Page 69
7.	Compare the actual RSSI to the expected RSSI value (from your path planning).	
8.	Fine-align the antennas.	Page 201
9.	Confirm that the terminal clock sources are set correctly.	Page 73
10.	Confirm that the TX and RX LEDs are green. Disregard the OK LED status for now.	

Phase 4: Configuring the traffic		
1.	Confirm that the interface hardware and software slot configurations match.	
2.	Confirm the interface card settings.	Page 92
3.	Open the Cross Connections application and configure the cross connections: • Download the configuration. • Confirm or modify the traffic cross connections. • Save the configuration to the terminal. • Activate the configuration.	Page 146
4.	Save the configuration to disk and close the Cross Connections application.	Page 155
5.	Connect the connection of interface cables.	
6.	Confirm or adjust the terminal clocking for network synchronization, if required.	
7.	Test that the traffic is passing over the link as configured.	
8.	Confirm or configure the external alarm settings in SuperVisor.	Page 81
9.	Setup an external alarm connection cable, if required.	
10.	Reset any alarms and error counters.	Page 244
11.	Perform traffic pre-commissioning tests (optional)	
12.	Complete the commissioning form (at the back of the manual) and file.	Page 327

2. Introduction

About This Manual

What It Covers

This user manual describes how to install and configure Aprisa XE fixed point-to-point digital radio links.

It specifically documents an Aprisa XE terminal running system software version 8.6.77.

It is recommended that you read the relevant sections of this manual before installing or operating the terminal.

Who Should Read It

This manual has been written for professional field technicians and engineers who have an appropriate level of education and experience.

Contact Us

If you experience any difficulty installing or using Aprisa XE after reading this manual, please contact Customer Support or your local 4RF representative.

Our area representative contact details are available from our website:

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PO Box 13-506
Wellington 6032
New Zealand

E-mail	support@4rf.com
Web site	www.4rf.com
Telephone	+64 4 499 6000
Facsimile	+64 4 473 4447
Attention	Customer Services

What's in the Box

Inside the box you will find:

- Aprisa XE terminal
- Accessory kit
- Aprisa CD
- Aprisa XE Quick Start Guide
- Commissioning Form
- Configuration sheet

Aprisa XE CD Contents

The Aprisa XE CD contains the following:

Software

- The latest version of the terminal software (see ‘Terminal Upgrades’ on page 214)
- The Cross Connections application - required if you want to use the Cross Connections application offline (see ‘Installing Cross Connections application’ on page 146).
- Java VM - Java plug-in needed to run the Supervisor software.
- Web browsers - Mozilla Firefox and Internet Explorer are included for your convenience.
- Adobe™ Acrobat® Reader® which you need to view the PDF files on the Aprisa CD.

Documentation

- User manual — an electronic (PDF) version for you to view online or print.
- Product collateral — application overviews, product description, quick start guide, case studies, software release notes and white papers.

Tools

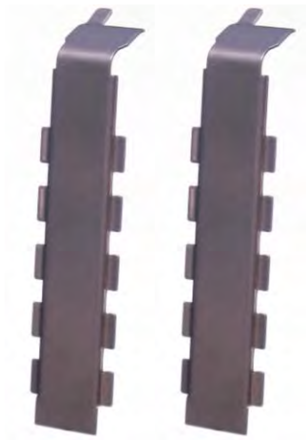
- Surveyor - a path propagation calculator developed by 4RF (see ‘Path planning’ on page 23).
- XEpower – a power consumption model program.

Accessory Kit

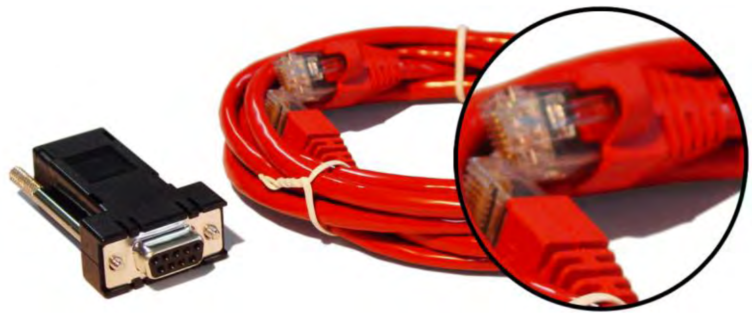
The accessory kit contains the following items:

Two mounting brackets and screws

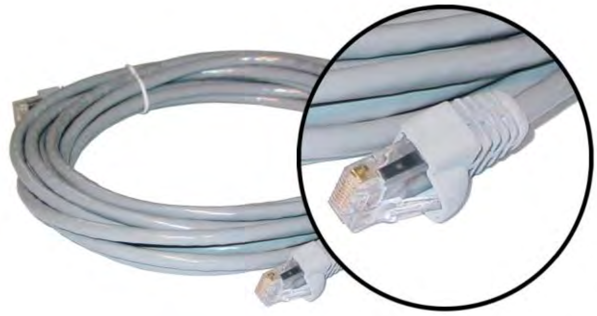
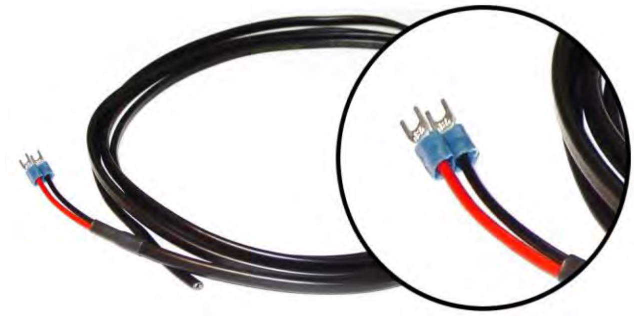
Two interface slot blanking plates



Setup cable (RJ-45 to RJ-45) 2 m
and RS-232 DB9 female adaptor



Hardware kit
(includes Allen key for fascia screws)

Alarm cable (RJ-45 to RJ-45) 5 m	
Ground cable 5 m	
DC power cable 3 m (for use with the ±48 VDC, ±24 and 12 VDC low power power supplies)	
AC power cable 2 m (for use with the 110 / 230 VAC power supply)	

3. Preparation

Path Planning

Proper path planning is essential. When considering the components of your radio system, think about:

- antenna selection and siting
- coaxial cable selection
- link budget

You can also use Surveyor to help you with path feasibility planning.

Surveyor is a path propagation calculator developed by 4RF to assist path planners quickly and efficiently verify the viability of point-to-point transmission links deploying the Aprisa microwave radio systems.

The software program calculates the anticipated link performance for the transmission system elements you have selected. However, it is not a substitute for in-depth path planning.

You will find Surveyor a valuable addition to your planning toolbox.

A copy of Surveyor is provided on the Aprisa CD supplied with this manual. You can download updates from www.4rf.com.

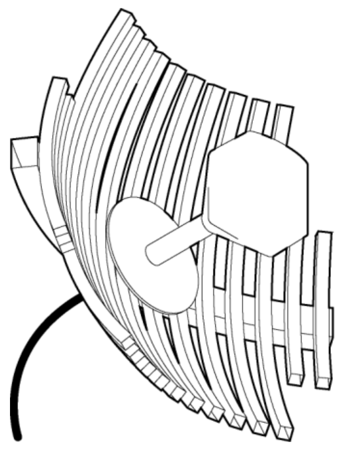
Antenna Selection and Siting

Selecting and siting antennas are important considerations in your system design.

There are three main types of directional antenna that are commonly used with the radios parabolic grid, Yagi and corner reflector antennas.

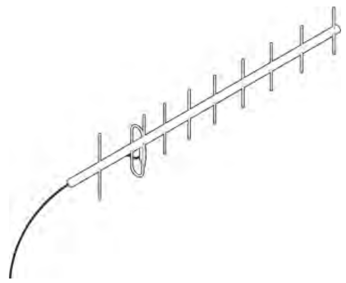
The antenna that should be used for a particular situation is determined primarily by the frequency of operation and the gain required to establish a reliable link.

Parabolic Grid Antennas



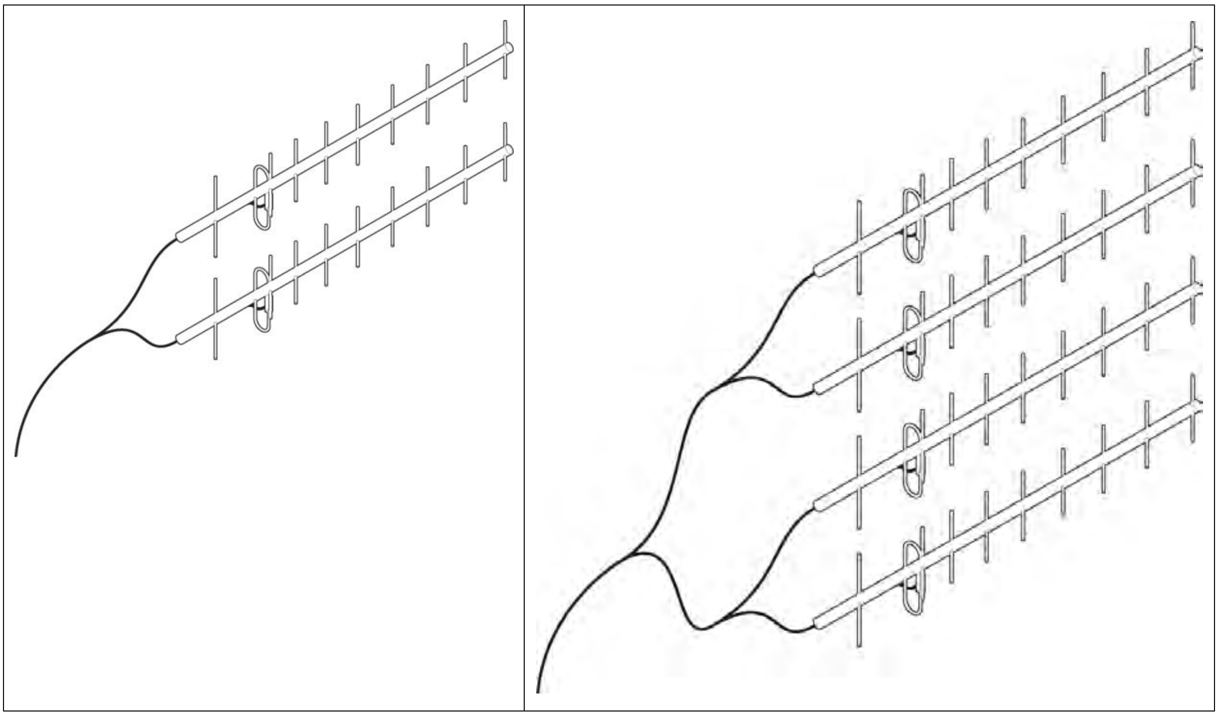
Factor	Explanation
Frequency	Often used in 1350-2700 MHz bands
Gain	Varies with size (17 dBi to 30 dBi typical)
Wind loading	Can be significant
Tower aperture required	Can be significant
Size	Range from 0.6 m to 3 m diameter
Front to back ratio	Good
Cost	High

Yagi Antennas



Factor	Explanation
Frequency	Often used in 330-960 MHz bands
Gain	Varies with size (typically 11 dBi to 16 dBi)
Stackable gain increase	2 Yagi antennas (+ 2.8 dB) 4 Yagi antennas (+ 5.6 dB)
Wind loading	Less than a parabolic grid antenna
Tower aperture required	Unstacked: Less than a parabolic grid antenna Stacked: about the same as a parabolic grid antenna
Size	Range from 0.6 m to 3 m in length
Front to back ratio	Low
Cost	Low

It is possible to increase the gain of a Yagi antenna installation by placing two or more of them in a stack. The relative position of the antennas is critical.



Example of stacked antennas

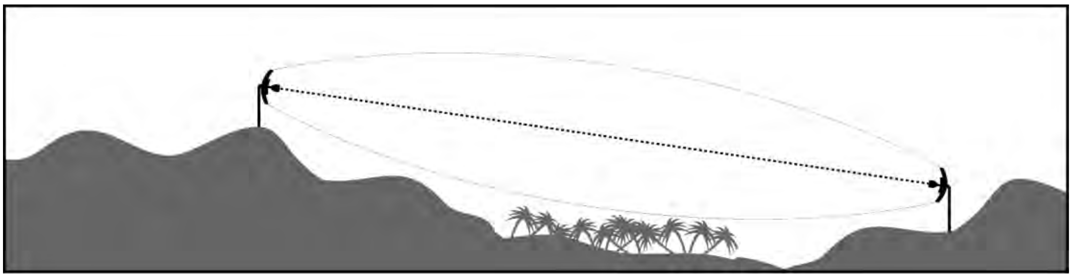
Corner Reflector Antennas

Factor	Explanation
Frequency	Often used in 330-960 MHz bands
Gain	Typically 10 dBd
Wind loading	Less than a parabolic grid antenna
Tower aperture required	About the same as a parabolic grid antenna
Size	Range from 0.36 m to 0.75 m in length
Front to back ratio	High (typically 30 dB)
Beamwidth	Broad (up to 60°)
Cost	Medium

Antenna Siting

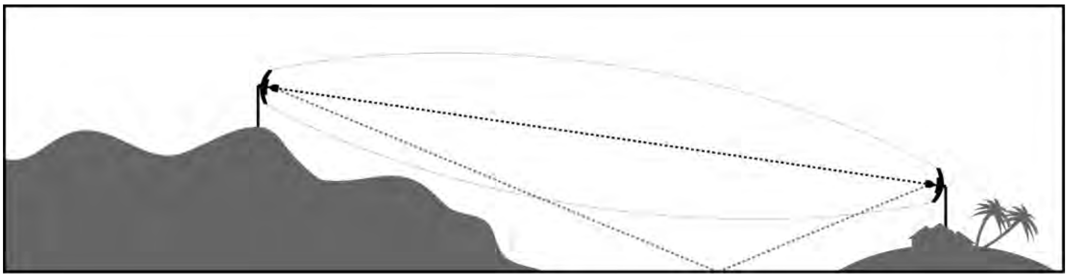
When siting antennas, consider the following points:

- A site with a clear line of sight to the remote terminal is needed. Pay particular attention to trees, buildings, and other obstructions close to the antenna site.



Example of a clear line-of-sight path

- Any large flat areas that reflect RF energy along the link path, for instance, water, could cause multipath fading. If the link path crosses a feature that is likely to cause RF reflections, shield the antenna from the reflected signals by positioning it on the far side of the roof of the equipment shelter or other structure.



Example of a mid-path reflection path

- The antenna site should be as far as possible from other potential sources of RF interference such as electrical equipment, power lines and roads.
- The antenna site should be as close as possible to the equipment shelter.

Note: Wide angle and zoom photographs taken at the proposed antenna location (looking down the proposed path), can be useful when considering the best mounting positions.

Coaxial Feeder Cables

To ensure maximum performance, it is recommended that you use good quality low-loss coaxial cable for all feeder runs. For installations requiring long antenna cable runs, use Andrew Heliax™ or equivalent.

When using large diameter feeders, use a short flexible jumper cable between the feeder and the terminal to reduce stress on the antenna port connector.

All coaxial cable has loss, that is, the RF energy traveling through it is attenuated. Generally speaking, the larger the diameter of the cable, the less the loss. When selecting a coaxial cable consider the following:

Factor	Effect
Attenuation	Short cables and larger diameter cables have less attenuation
Cost	Smaller diameter cables are cheaper
Ease of installation	Easier with smaller diameter cables or short cables

When running cables:

- Run coaxial cable from the installation to the antenna, ensuring you leave enough extra cable at each end to allow drip loops to be formed.
- For 19-inch rack mount installations, cables may be run from the front of the rack directly onto the antenna port. They may also be run through the back of the rack to the front.
- Terminate and earth or ground the cables in accordance with the manufacturers' instructions. Bond the outer conductor of the coaxial feeder cables to the base of the tower mast.

Link Budget

All of the above factors (and many others not mentioned) combine in any proposed installation to create a link budget. The link budget predicts how well the radio link will perform after it is installed.

Use the outputs of the link budget during commissioning testing to confirm the link has been installed correctly, and that it will provide reliable service.

Site Requirements

Power Supply

Ensure that the correct power supply is available for powering the terminal.

The nominal input voltage for a terminal is 12, 24 or 48 volts DC or 115 / 230 volts AC rms.

The DC supply voltage is factory preset at time of order and cannot be adjusted in the field.

The terminal voltage is indicated on the chassis label by the DC input connector and on the specification label fitted to the terminal.

WARNING:

Before connecting power, ground the chassis using the safety earth terminal on the front panel.

Equipment Cooling

Mount the terminal so that air can flow through it. Do not obstruct the free flow of air around the terminal. The two internal, speed-controlled fans fitted into the chassis provide sufficient cooling.

The operation of the fans is monitored and an alarm is raised under failure conditions.

The environmental operating conditions are as follows:

Operating temperature	-10°C to +50°C
Storage temperature	-20°C to +70°C
Humidity	Maximum 95% non-condensing

Earthing and Lightning Protection

WARNING:

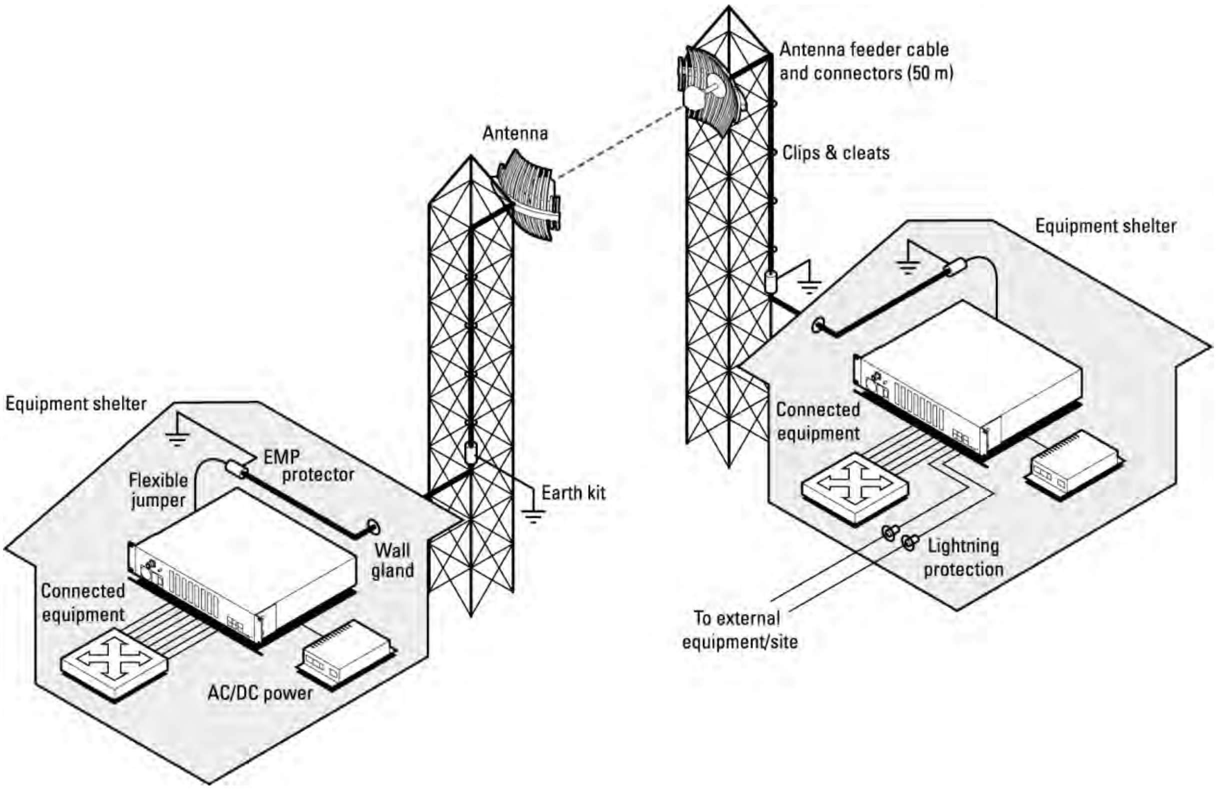
Lightning can easily damage electronic equipment.

To avoid this risk, install primary lightning protection devices on any interfaces that are reticulated in the local cable network.

You should also install a coaxial surge suppressor on the antenna port of the duplexer.

Earth the antenna tower, feeders and lightning protection devices in accordance with the appropriate local and national standards. The diagram below shows the minimum requirements.

Use grounding kits as specified or supplied by the coaxial cable manufacturer to properly ground or bond the cable outer.



4. About the Terminal

Introduction

The terminals operate in a number of frequency bands from 300 MHz up to 2.7 GHz carrying ethernet, voice and data traffic over distances up to 100 kilometres.

They are designed to meet the demands of a wide range of low to medium capacity access and backhaul applications.

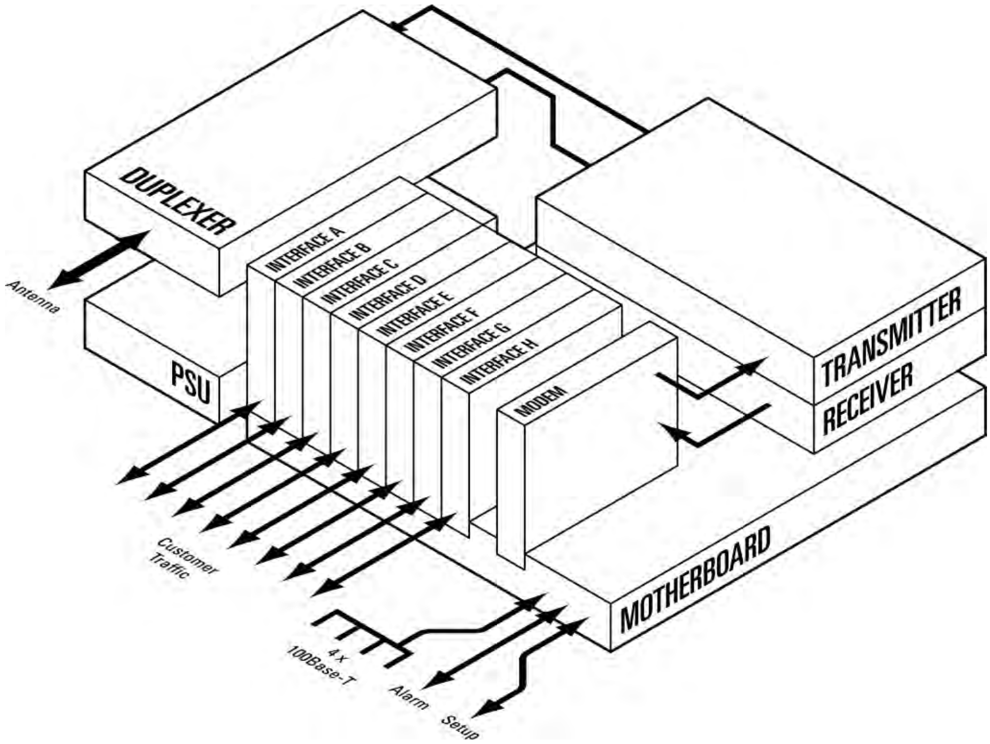
The digital access terminal is a compact, powerful point-to-point linking solution with up to 64 Mbit/s of radio link capacity, and customer-configurable interface options integrated within the radio platform.

Modules

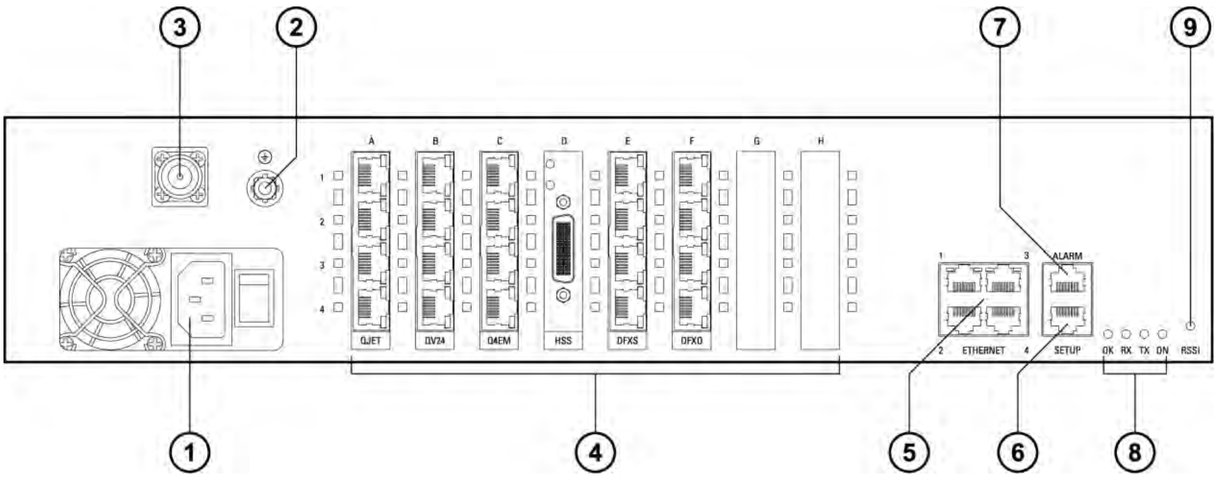
The terminal is modular in design, which helps reduce mean time to repair (MTTR). It is designed for 19-inch rack mounting and is only 2U high for standard configurations.

The five main modules housed inside the chassis are the transceiver, modem, motherboard, power supply, and duplexer. Interface cards are fitted into the eight interface slots on the motherboard. Modules are interconnected via several buses on the motherboard. A duplexer can be mounted inside or outside the chassis.

The interrelationships between the components are shown below:



Front Panel Connections and Indicators



All connections to the terminal are made on the front panel of the terminal.

No.	Label	Description
1	AC or DC power input	DC and AC power supplies are available (AC is shown)
2	Safety earth stud	An M5 stud for connection to an external protection ground for protection against electric shock in case of a fault.
3	Antenna connector	N-type 50Ω female connector for connection of antenna feeder cable.
4	Interface slots A to H	Eight interface slots on the motherboard to fit interface cards.
5	ETHERNET	Integrated four-port layer 2 switch.
6	SETUP	RJ-45 serial connection to PC for initial configuration.
7	ALARM	RJ-45 connector for two external alarm input and four external alarm output connections.
8	LED indicators	
	OK	Indicates normal operation and minor and major alarm conditions.
	RX	Indicates status of receive path including normal operation and alarms such as BER, RSSI and loss of synchronization.
	TX	Indicates status of transmit path including normal operation and alarms such as forward / reverse power and temperature.
	ON	Blue LED indicates that there is power to the terminal.
9	RSSI	RSSI test point suitable for 2 mm diameter multimeter test lead pin.

Interface Card Types

Each terminal has eight interface slots labeled A to H. Each slot can be fitted with any interface card type. Typically, the terminal is delivered pre-configured with the requested interface cards.

The following interface card types are currently available:

Name	Interface card type	Function
QJET	Quad E1/T1 interface card	Four E1 / T1 interfaces (Framed or Unframed).
Q4EM	Quad 4 wire E&M interface card	Four 4 wire E&M voice channels
DFXS	Dual 2 wire FXS interface card	Two 2 wire loop signalling foreign exchange subscriber (POTS) channels
DFXO	Dual 2 wire FXO interface card	Two 2 wire loop signalling foreign exchange office channels
HSS	High-Speed Synchronous interface card	A single high speed serial data channel configured as synchronous V.24, V.35, X.21, V.36 / RS-449, or RS-530.
QV24	Quad V.24 serial interface card	Four V.24 / RS-232 serial data channels Synchronous and asynchronous

5. Mounting and Installing the Terminal

This section covers installing the hardware associated with the terminal. Before you begin a terminal installation, read this section thoroughly.

CAUTION:

You must comply with the safety precautions in this manual or on the product itself.

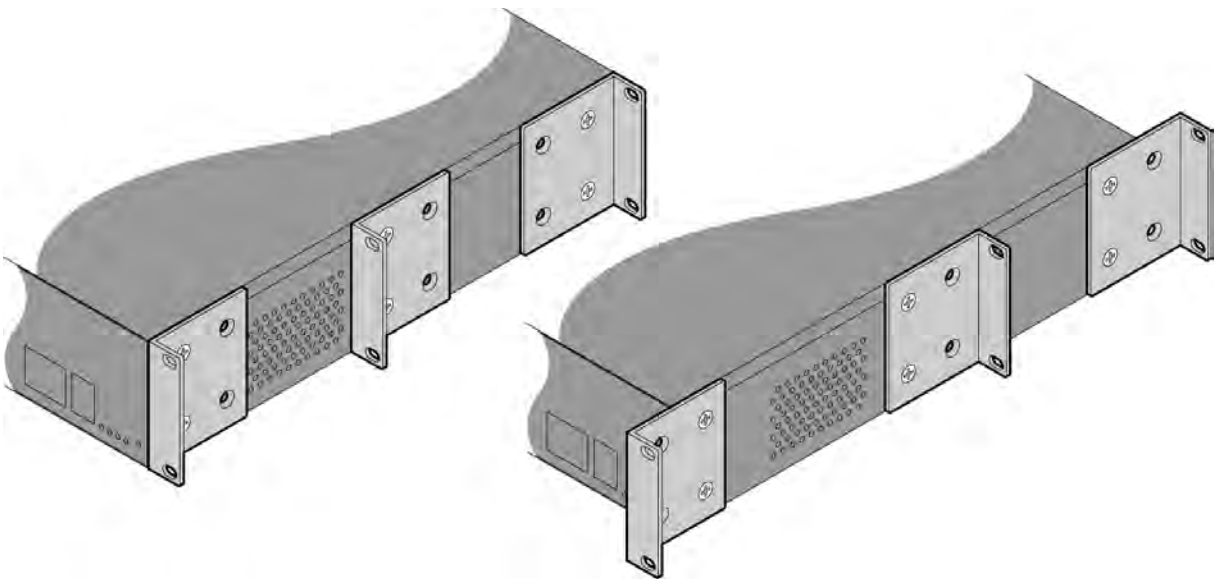
4RF Limited does not assume any liability for failure to comply with these precautions.

Required Tools

No special tools are needed to install the terminal other than those required to physically mount the terminal into the rack.

Installing the Terminal

The terminal is designed for 19-inch rack mounting and is supplied with rack mounting brackets. The rack brackets can be front, mid, or rear mounted (as shown below) to suit individual installation requirements. Once the rack brackets are attached, carefully lift the terminal into position in the rack, and fasten with screws and washers.



Installing the Antenna and Feeder Cable

Carefully mount the antenna following the antenna manufacturers' instructions. Run feeder cable from the antenna to the terminal mounting location.

Lightning protection must be incorporated into the antenna system. For more information, please contact Customer Support.

WARNING:

When the link is operating, there is RF energy radiated from the antenna. Do not stand in front of or touch the antenna while the terminal is operating.

1. Fit the appropriate male or female N-type connector to the antenna feeder at the antenna end. Carefully follow the connector manufacturers' instructions.
2. Securely attach the feeder cable to the mast and cable trays using cable ties or cable hangers. Follow the cable manufacturer's recommendations about the use of feeder clips, and their recommended spacing.
3. Connect the antenna and feeder cable. Ensure the N-type connector is tight. Weatherproof the connection with a boot, tape, or other approved method.
4. Fit the appropriate N-type male connector to the antenna feeder at the terminal end (the terminal is N-type female). Carefully follow the connector manufacturer's instructions.
5. Connect the feeder cable to the antenna port on the terminal. Use a jumper cable, if needed. Ensure the N-type connector is tight.
6. Connect a coaxial surge suppressor or similar lightning protector between the feeder and jumper cables (or at the point where the cable enters the equipment shelter).

   Earth the case of the lightning protector to the site Lightning Protection Earth. Also earth the terminal M5 earth stud to a protection earth.

External Alarms

Two external alarm inputs and four external alarm outputs are provided on the RJ-45 ALARM connector on the front panel. These enable an internal alarm to provide an external alarm to the network operator's existing network management system via contact closure or opening, or for an external alarm to be transported via the radio link.

The latency for an alarm presented on an external alarm input to the alarm being output on an external alarm output is < 2 seconds.

Alarm outputs are isolated semiconductor relay type contacts rated 0 to 60 VDC or AC rms with a maximum current of 100 mA.

Alarm inputs are isolated current detectors with an operating voltage range of 9 to 60 VDC or AC rms (effective current threshold of 5.0 to 6.5 mA constant current).

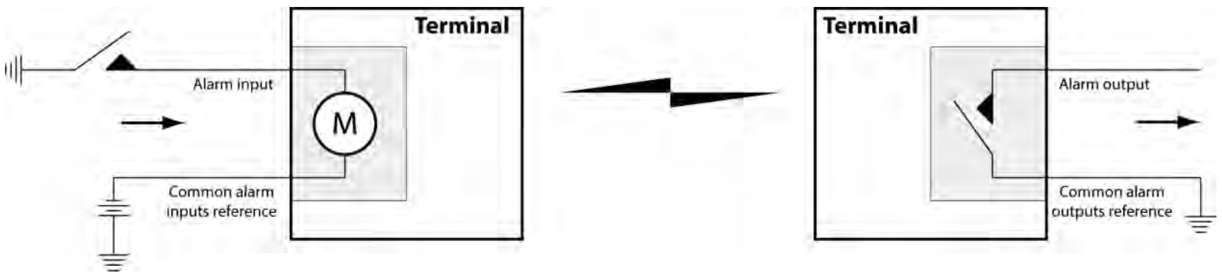
The common reference potential for the two external alarm inputs must be applied to pin 3 and the common reference potential for the four external alarm outputs must be applied to pin 4.

Alarm Circuit Setup

A typical alarm circuit setup is:

- An external battery applied to the 'common alarm inputs reference' and a normally open relay contact connected to the alarm input. Closing the contact applies the source to the alarm input detector which turns the alarm on (setup for 'alarm on when source on'). See 'Configuring the External Alarm Inputs' on page 81 for the setup options.

- An external earth applied to the 'common alarm outputs reference' and a ground contact detector connected to the alarm output. When the alarm is on (active), the external alarm output relay contact closes (setup for 'relay closed when alarm on'). See 'Configuring the External Alarm Outputs' on page 83 for the setup options.



The terminal front panel RJ-45 ALARM connections are:

RJ-45 pin	Connection description	TIA-568A wire colour
1	External alarm input 1	green / white
2	External alarm input 2	green
3	Common reference for alarm inputs 1 to 2	orange / white
4	Common reference for alarm outputs 1 to 4	blue
5	External alarm output 1	blue / white
6	External alarm output 2	orange
7	External alarm output 3	brown / white
8	External alarm output 4	brown

Interface Cabling

All interface cabling connections are made with RJ-45 male connectors which plug into the front of the interface cards (see ‘Interface Connections’ on page 257).

QJET Q4EM DFXO and DFXS

The cabling to the QJET, Q4EM, DFXO and DFXS interface cards must have a minimum conductor size of 0.4 mm^2 (26 AWG).

Ethernet

Standard Ethernet network cables are used for all Ethernet port cabling.

Power Supplies

US and Canada: Installations should be in accordance with US National Electrical Code ANSI / NFPA 70, and Canadian Electrical Code, Part 1 C22.1.

WARNING:

Do not apply power to the terminal until you have completed installing the interface cards and connecting the antenna.

Before disconnecting the safety earth during maintenance, remove AC or DC power supply connections, antenna cable and all interface cables from the terminal.

DC Power Supply

There are four DC power supply options for the terminal; 12 VDC, 12 VDC Low Power, 24 VDC and 48 VDC.

The DC inputs are polarity critical so the DC voltage must be applied with the correct polarity.

Nominal voltage	Input voltage range	Maximum Power input	Maximum input current	Recommended DC breaker rating
+12 VDC LP	10.5 to 18 VDC	53 W	5 A	8 A
±12 VDC	10.5 to 18 VDC	180 W	18 A	25 A
±24 VDC	20.5 to 30 VDC	180 W	8 A	10 A
±48 VDC	40 to 60 VDC	180 W	4 A	5 A

CAUTION: An all-pole switch or DC circuit breaker of the rating shown in the table above must be fitted between the terminal DC input and the DC power source.

Each terminal or MHSB terminal should have its own separate fuse or DC circuit breaker.

12 VDC / 24 VDC / 48 VDC Power Supply

The power supply DC input is isolated from ground, so the DC power input can be either positive grounded or negative grounded. The positive or negative terminal should be connected to ground.

12 VDC LP Power Supply

The 12 VDC Low Power is a high efficiency power supply for low power consumption applications up to a maximum of 53 watts input power (see ‘Power Consumption’ on page 312).

The DC input on this power supply is not isolated from ground as the negative input is internally connected to ground via the Aprisa XE chassis. The DC power input for this power supply must be a positive 12 V supply with the negative grounded.

DC Power Input Cabling

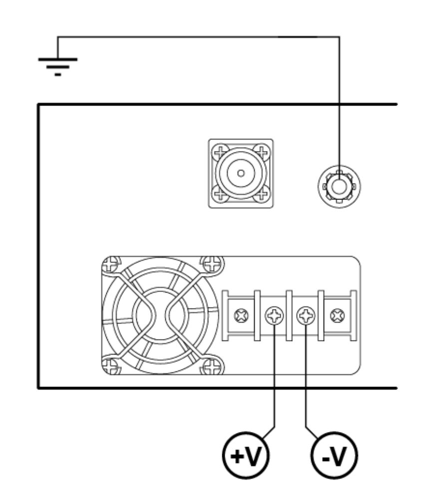
The DC power input is terminated on the front panel of the terminal with two high-current M3 screw clamps for the positive and negative DC input and a M5 stud for the earth connection.

The DC power cables have pre-terminated lugs to fit into the power input M3 screw clamps on one end and bare wire at the other end.

The appropriate power cable for the power supply ordered is included in the accessory kit.

12 VDC LP / 24 VDC / 48 VDC Cable

The 12 VDC LP, 24 VDC and 48 VDC power supplies are supplied with a 3 metre red / black cable of 2.0 mm^2 (23 strands of 0.32 mm^2).



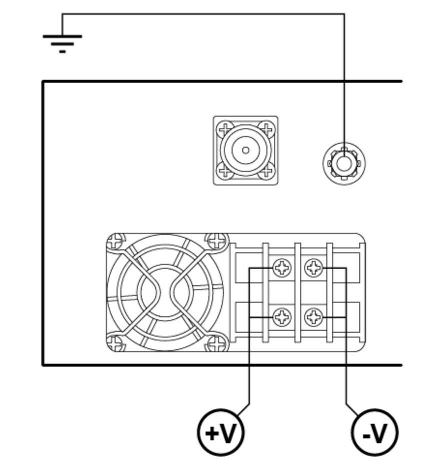
Terminal	Power input	Cable colour
+V	Positive DC input	Red
-V	Negative DC input	Black

12 VDC Cable

The 12 VDC power supply is supplied with a 3 metre red/black cable of two pairs of 2.3 mm^2 (72 strands of 0.2 mm^2) making a total of 4.6 mm^2 per connection. This increase in wire size is to carry the increased current consumption of the 12 VDC supply (max 18 Amps per terminal).

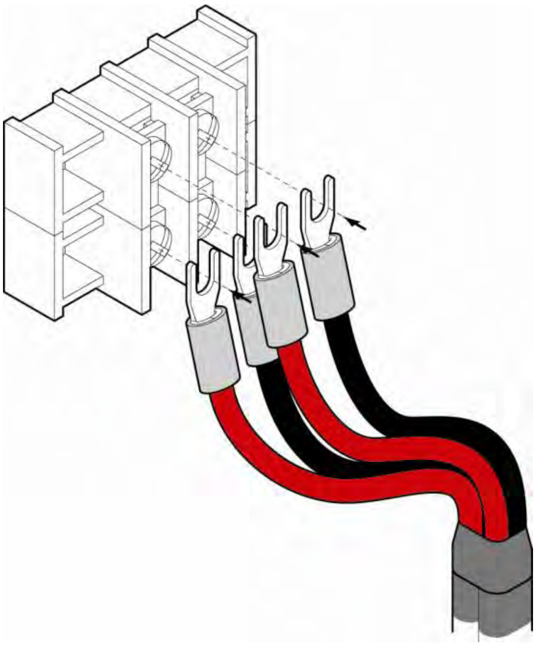
This 3 metre cable is engineered to power a fully loaded terminal from a 12 VDC supply. A longer cable should not be used as the additional voltage drop could cause the power supply to fail.

If longer cable runs are required between the 12 VDC power supply and the terminal, it is suggested that high current distribution bus bars are used to feed the rack and the supplied power cable used between the bus bars and the terminals.

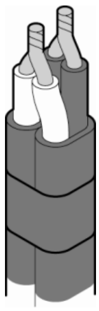


Terminal	Power input	Cable colour
+V	Positive DC input	Red
-V	Negative DC input	Black

1. Fit both pairs of lugs into the terminal screw clamps.



2. Twist the other ends together when fitting to the source.



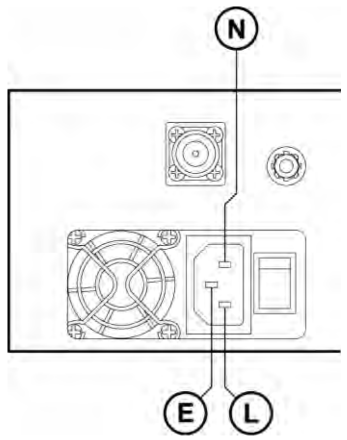
AC Power Supply

There is one AC power supply for the terminal. This AC power supply is auto-sensing to operate with a nominal input voltage of 115 Vrms or 230 Vrms.

The power input is terminated on the front panel of the terminal using a standard IEC plug. This power supply has a power on/off switch.

A power cable is included in the accessory kit and is pre-fitted with an IEC socket connector and the country-specific plug that was specified when the order was placed.

Nominal voltage	Input voltage range	Maximum Power input	Max VA	Frequency
115 VAC	103 - 127 Vrms	180 W	400 VA	47 - 63 Hz
230 VAC	207 - 254 Vrms	180 W	400 VA	47 - 63 Hz



Terminal	Power input	Cable colour
E	Earth	Green/yellow
N	Neutral	Blue
L	Line / Phase	Brown

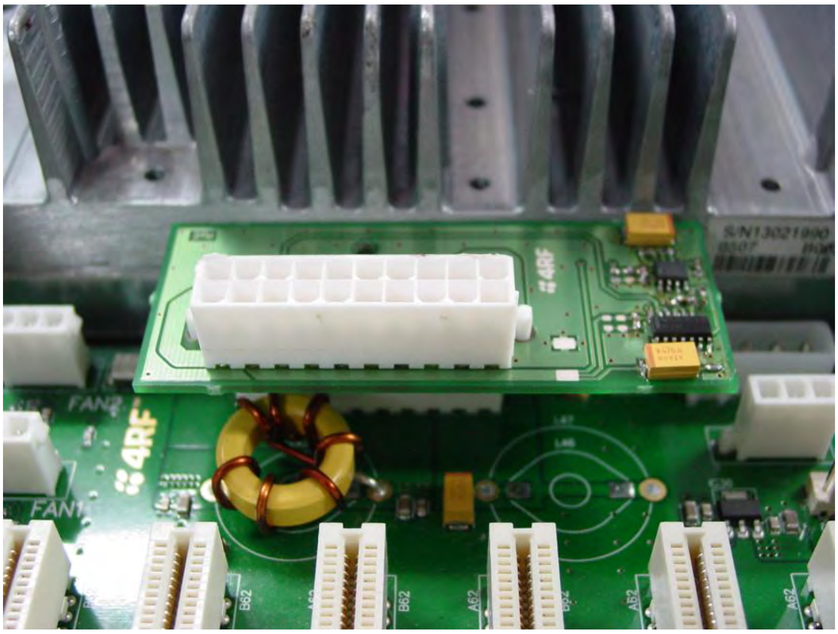
Important: Please check with your local power authority about correct colour usage and pinouts. AC power cords used must be in accordance with national requirements.

Norway and Sweden: PLUGGABLE CLASS I EQUIPMENT intended for connection to a telephone network or similar communications system requires a label stating that the equipment must be connected to an earthed mains socket outlet.

Brownout Recovery Module

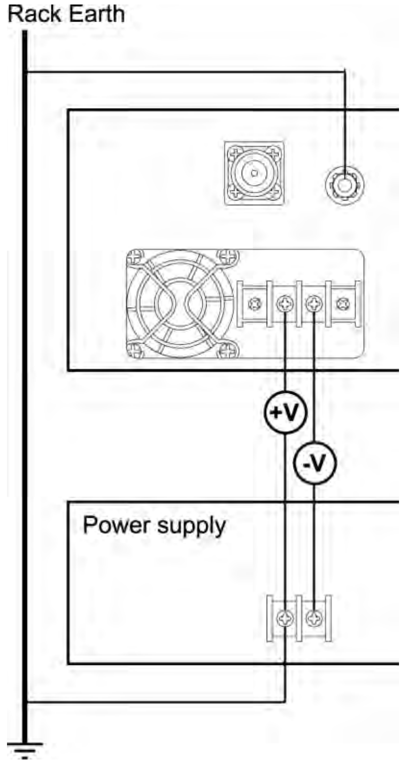
A Brownout Recovery Module (BRM) is factory fitted to the Aprisa XE motherboard power connector when the radio is fitted with an AC power supply.

The AC power supply has a safety mechanism that trips the power if it detects a power input brownout. The BRM restarts the power supply after 3 seconds.

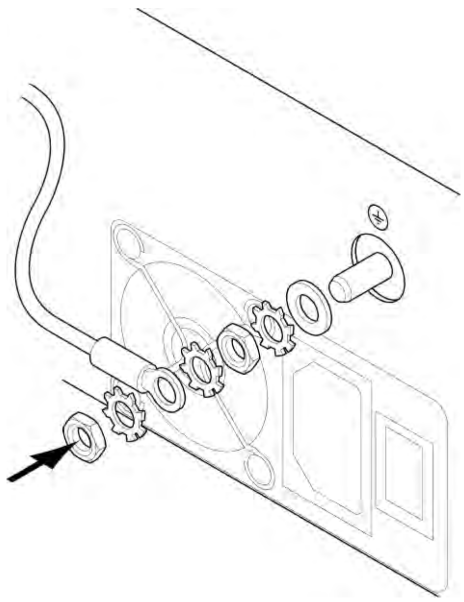


Safety Earth

The terminal chassis must have a protection / safety earth connected between the terminal earth stud and a common protection earth in the rack. The DC power input can be either positive grounded or negative grounded depending on the power supply system available.

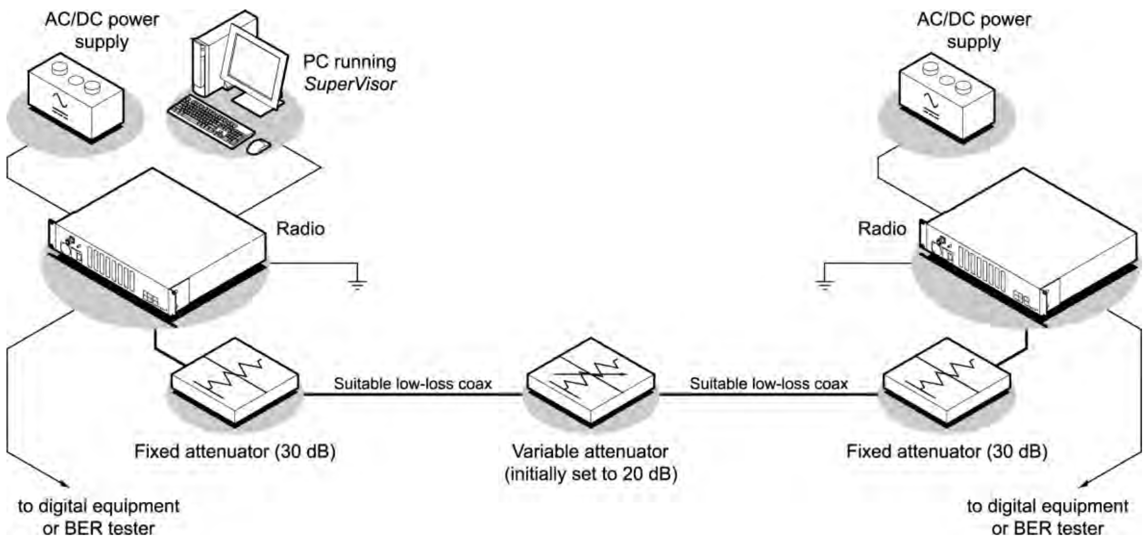


Ground the terminal chassis using the terminal earth stud on the front panel as shown:



Bench Setup

Before installing the link in the field, it is recommended that you bench-test the link. A suggested setup for basic bench testing is shown below:



When setting up the equipment for bench testing, note the following:

- Earthing—the terminal should be earthed at all times. The terminal earth stud must be connected to a protection earth.

- Attenuators— In a bench setup, there must be 60 - 80 dB at up to 3 GHz of 50 ohm coaxial attenuation (capable of handling the transmit power of +35dBm) between the terminals' N type antenna connectors.

  This can be achieved with two fixed attenuators fitted to the antennas 'N' connectors and a variable attenuator with a ≥ 60 dB range. You can use other attenuator values as long as you consider the transmit power output level (max +33 dBm) and the receiver signal input (max -20 dBm).

- Cables—use double-screened coaxial cable that is suitable for use up to 3 GHz at ≈ 1 metre.

CAUTION: Do not apply signals greater than -20 dBm to the antenna connection as they can damage the receiver.

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6. Connecting to the Terminal

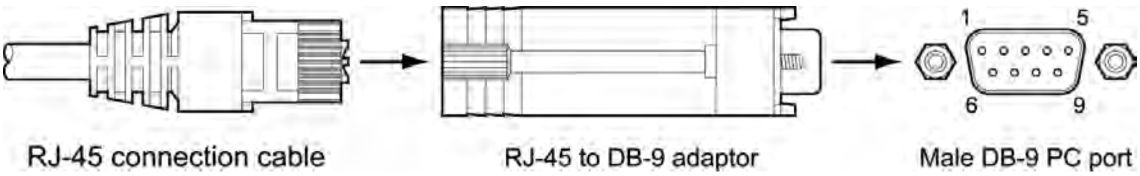
Connecting to the Terminal's Setup Port

You can configure basic terminal settings by connecting to the terminal using the Setup cable. This can be useful if you need to confirm the terminal's IP address, for example.

You can password-protect the setup menu to prevent unauthorized users from modifying terminal settings.

A straight RJ-45 connection cable and a RJ-45 to DB-9 adapter is provided with each terminal.

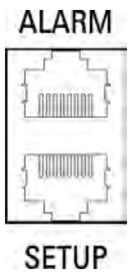
1. Plug the DB-9 into serial port of the PC.
2. Plug the RJ-45 connection cable into the adaptor as shown below:



3. Plug the other end of the RJ-45 connection cable into the SETUP port of the terminal.

Note: Connecting the PC serial port to the Interface Cards or ALARM connectors may result in damage to the PC or terminal.

Ensure that the RJ-45 connection cable is connected to the RJ-45 connector marked 'SETUP'.



Cable pinouts (RJ-45 to DB-9)

If you need a conversion connector or cable, refer to the following table:

Console port (DCE, RJ-45)	RJ-45 to RJ-45 cable		RJ-45 to DB-9 adaptor		PC port (DTE, DB-9)
Signal	RJ-45 pin	RJ-45 pin	RJ-45 pin	DB-9 pin	Signal
RTS	1	1	1	7	RTS
DTR	2	2	2	4	DTR
TXD	3	3	3	3	TXD
GND	4	4	4	5	GND
GND	5	5	5	NC	NC
RXD	6	6	6	2	RXD
DSR	7	7	7	6	DSR
CTS	8	8	8	8	CTS

Configure the PC COM Port Settings

Terminal emulation software e.g. HyperTerminal is used to setup the basic configuration of a terminal.

The PC's COM port settings must be setup as follows:

Bits per second	115200
Data bits	8
Parity	None
Stop bits	1
Flow Control	None

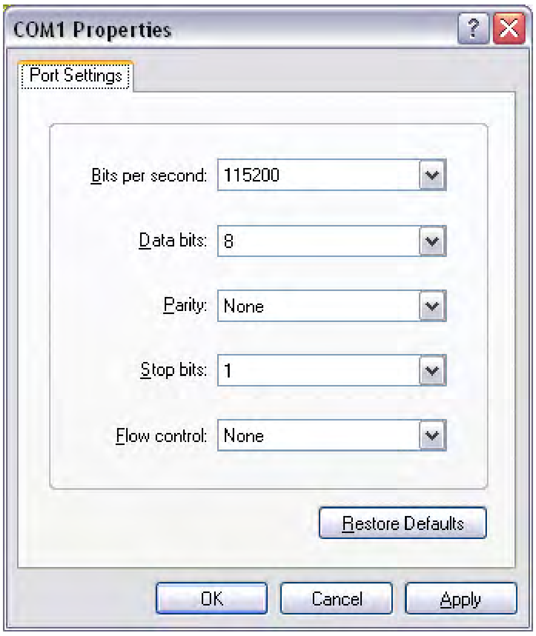
Start a HyperTerminal Session

1. On the PC, select Start > Programs > Accessories > Communications > HyperTerminal.
2. Enter a name for the connection and click OK.

3. Select the designated COM Port from the Connect Using drop-down box. Ensure it is the same COM port that you configured earlier on your PC. Click OK.

Note: The Country/region, Area code, and Phone number information will appear automatically.

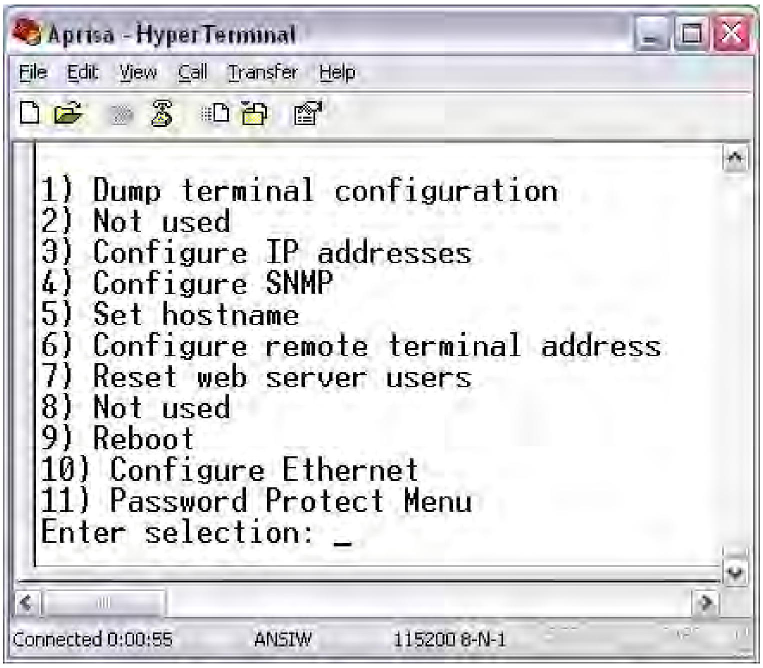
4. Set the COM Port settings as follows:



5. When you have completed the settings, click OK, which will open the HyperTerminal window.
6. Apply power to the terminal.

Note: If power was applied to the terminal before launching HyperTerminal, hit the Enter key to initiate the link.

When the terminal has completed startup, you will be presented with the Setup menu:



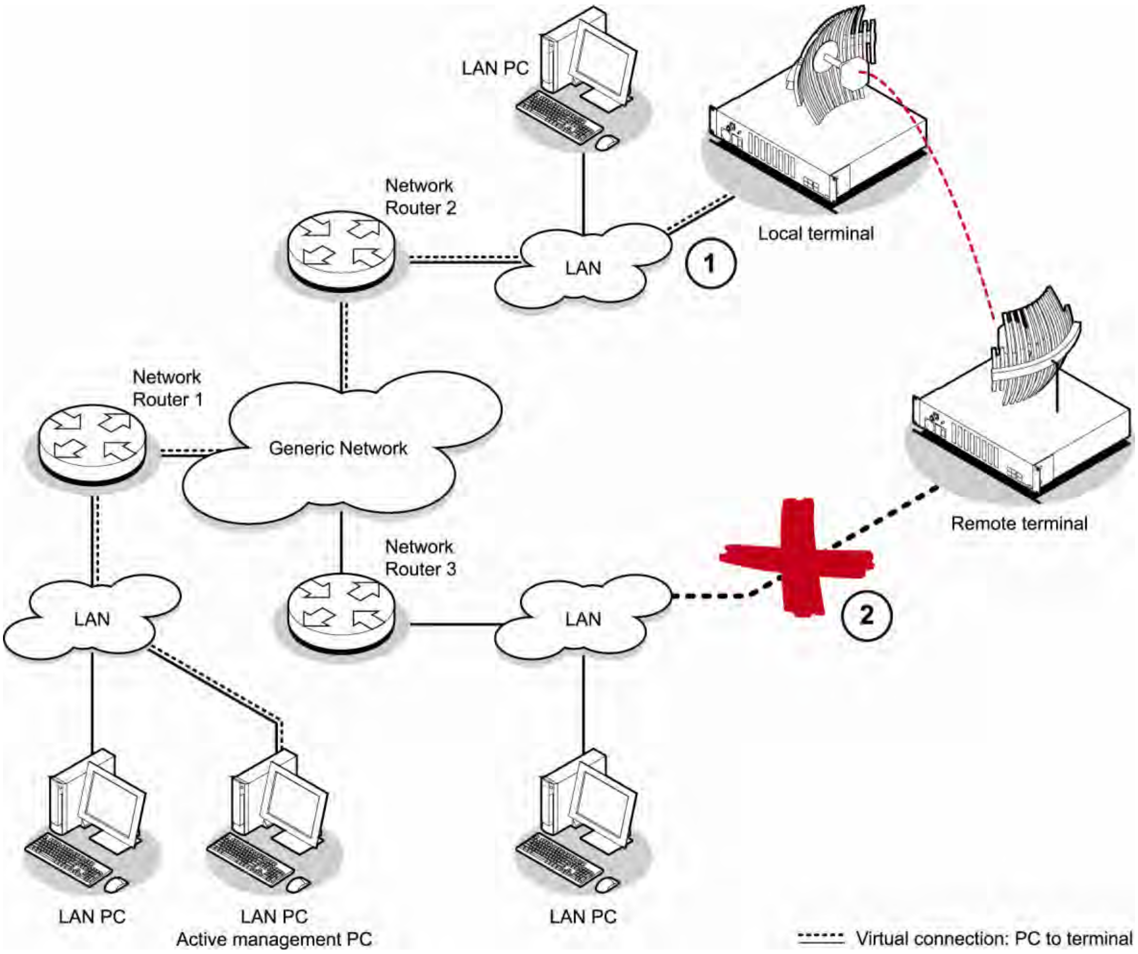
Connecting to the Terminal's Ethernet Interface

The main access to a terminal for management is with the ethernet interface using standard IP networking. There should be only one ethernet connection from the terminal to the management network.

The terminals are pre-configured to use IP addressing in one of the common 'non-routable' IP address ranges. This means the terminals are usually recognized by your operating system without any reconfiguration.

However, you should change these default addresses (see 'Changing the Terminal's IP Address' on page 64) to comply with your IP addressing scheme.

In the example below, the active management PC must only have one connection to the link as shown by path ①. There should not be any alternate path that the active management PC can use via an alternate router or alternate LAN that would allow the management traffic to be looped as shown by path ②.



PC Requirements for SuperVisor

SuperVisor requires the following minimum PC requirements:

- Microsoft Windows 2000, NT, XP, Vista or Windows 7
- Personal computer with 1.6 GHz Pentium IV
- 512 MB of RAM
- 200 MB of free hard disk space
- Ethernet interface (Local Area Network)
- COM port
- Web browser with a Java plug-in such as Mozilla FireFox (recommended), Microsoft Internet Explorer 5.0, or Netscape Navigator 6.0, but SuperVisor also supports other major web browsers.
- Java JRE 1.6.

Note: Mozilla Firefox, Internet Explorer and the Java JRE are provided on the Aprisa CD (see 'Aprisa XE CD Contents' on page 20).

PC Settings for SuperVisor

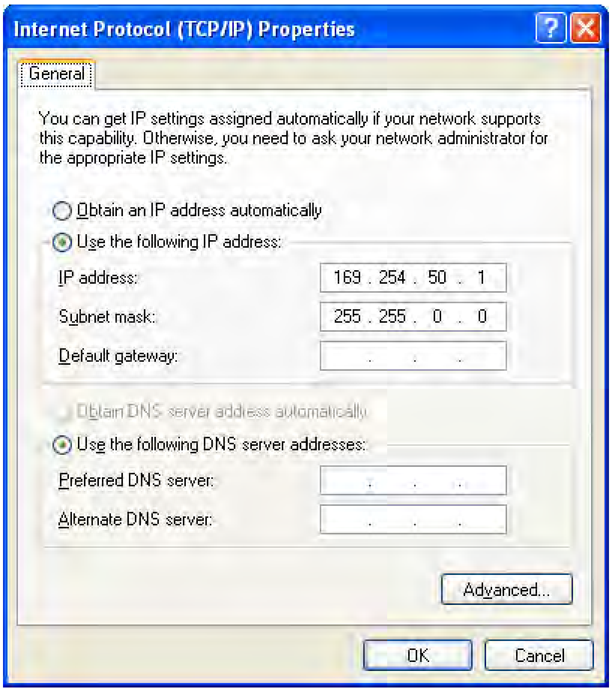
To change the PC IP address:

If your PC has previously been used for other applications, you may need to change the IP address and the subnet mask settings. You will require Administrator rights on your PC to change these.

Windows XP example: Configure IP settings

1. Open the 'Control Panel'.
2. Open 'Network Connections' and right click on the 'Local Area Connection' and select 'Properties'.
3. Click on the 'General' tab.
4. Click on 'Internet Protocol (TCP/IP)' and click on properties.
5. Enter the IP address and the subnet mask (example as shown).
6. Click 'OK' then close the Control Panel.

If the terminal is on a different subnet from the network the PC is on, set the PC default gateway address to the network gateway address which is the address of the router used to connect the subnets (for details, consult your network administrator).



To change the PC connection type:

If your PC has previously been used with Dial-up connections, you may need to change your PC Internet Connection setting to 'Never dial a connection'.

Windows XP example: Configure Windows to Never Dial a Connection

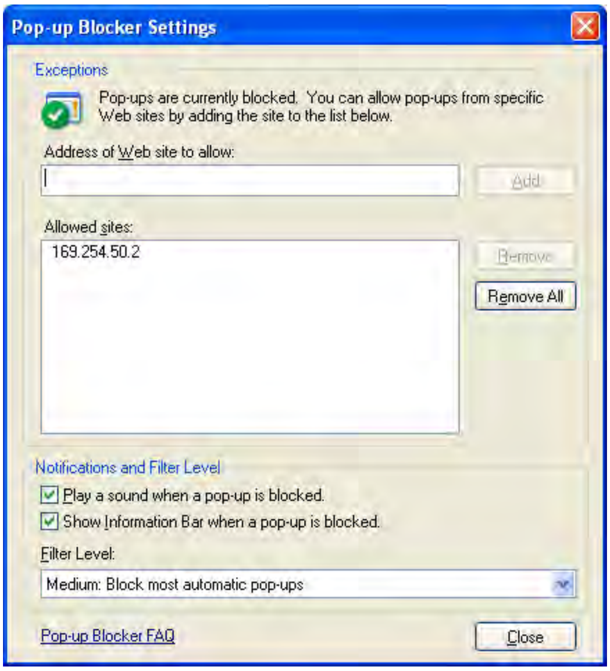
1. Open the 'Control Panel'.
2. Open 'Internet Options' and click on the 'Connections' tab.
3. Click the 'Never dial a connection' option.
4. Click 'OK' then close the Control Panel.

To change the PC pop-up status:

Some functions within SuperVisor require Pop-ups enabled e.g. saving a MIB

Windows XP example: Configure explorer to enable Pop-ups

1. Open the 'Control Panel'.
2. Open 'Internet Options' and click on the 'Privacy' tab.
3. Click on 'Settings'.
4. Set the 'Address of Web site to allow' to the terminal address or set the 'Filter Level' to 'Low: Allow Pop-ups from secure sites' and close the window.
5. Click 'OK' then close the Control Panel.



IP Addressing of Terminals

When logging into a link, it is important to understand the relationship between the Local / Remote and the Near end / Far end terminals.

The **Near** end terminal is the terminal that has its ethernet port physically connected to your IP network.

The **Far** end terminal is the terminal that is at the other end of the link from the Near end terminal and communicates through the management connection over the radio link to the Near end terminal.

The **Local** terminal is the terminal that SuperVisor is logged into and is displayed on the left hand side of the SuperVisor screen. The Local terminal can be the Near end or Far end terminal.

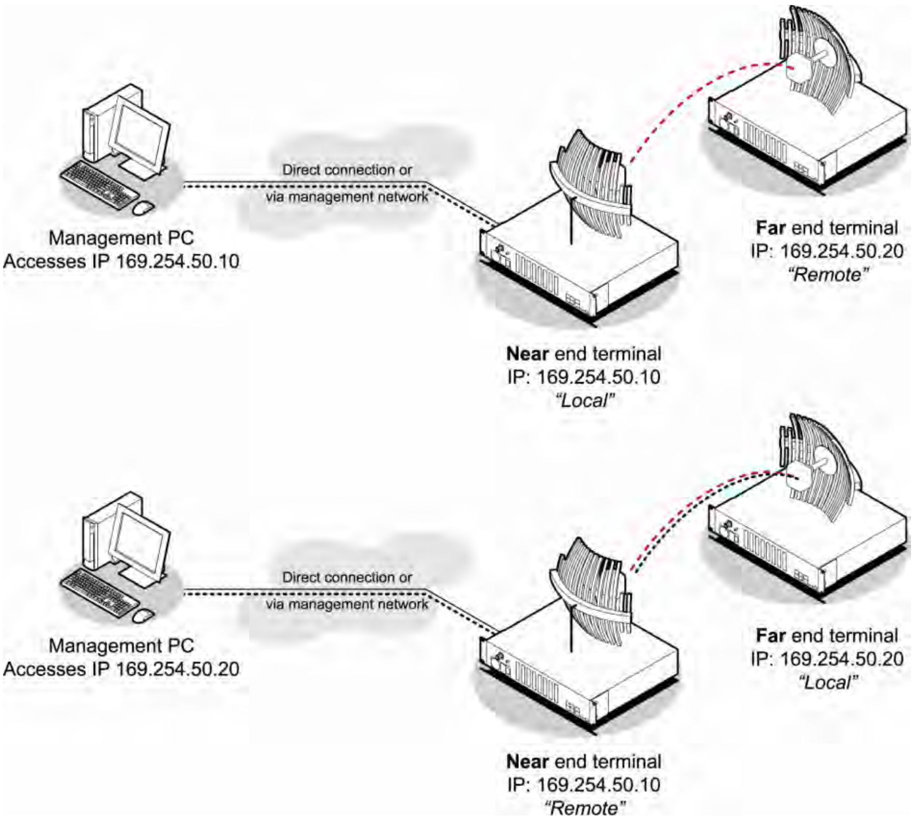
The **Remote** terminal is the terminal that is at the other end of the link from the Local terminal and is displayed on the right hand side of the SuperVisor screen.

To prevent confusion when operating SuperVisor, determine the IP address of the Near end terminal and log into that terminal. This is now the Local terminal.

The distinction is important as:

- Some functions can only be carried out on the Local terminal.
- Having different configurations at each end of the link will disrupt communications between the terminals. In these circumstances it is important to make changes to the Far end terminal of the link first. The link is then lost only until the near end configuration is completed and communication restored.

  If the Near end terminal is modified first, the link is lost for much longer as staff will have to either physically visit the Far end terminal to restore the link, or restore the near end to match the far end, re-establish the link, then start the process again, this time with the Far end terminal first.



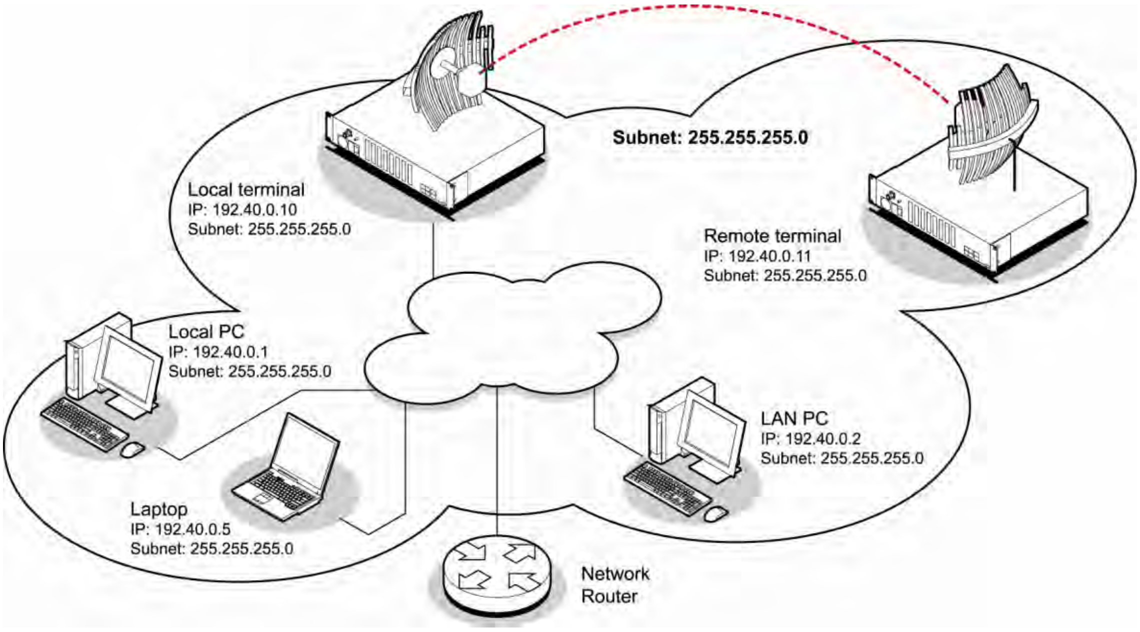
Network IP Addressing

Same Subnet as the Local PC

The following diagram shows a link interconnected on the same subnet as the local PC terminal used for configuration.

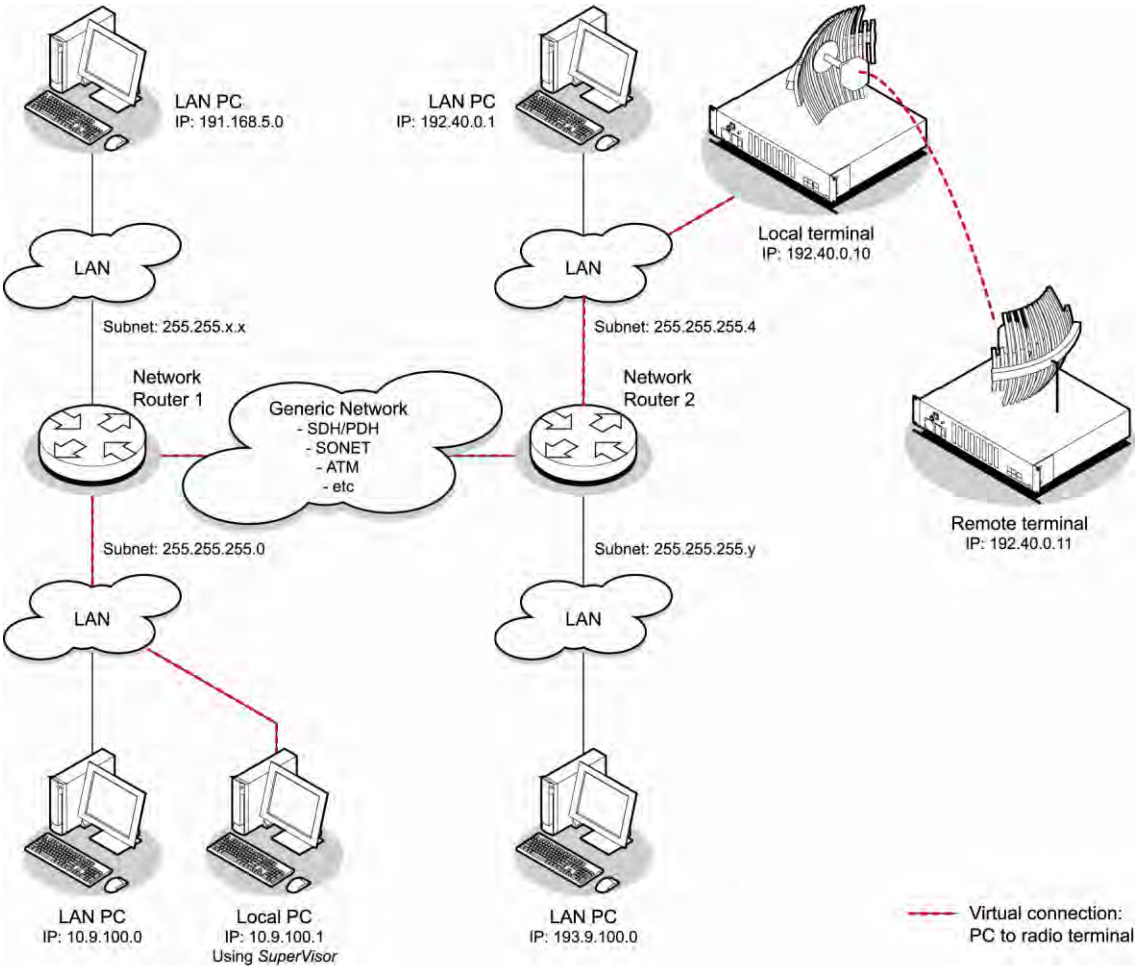
In this example, the local PC, as well as the local and remote terminals, are on the same subnet and therefore have the same subnet mask 255.255.255.0.

This will allow the PC and the terminals to communicate with each other.



Different Subnet as the Local PC

The following diagram shows a link interconnected on a different subnet as the local PC used for configuration, and communicating through a network. This can be achieved on the condition that network router(s) 1 and 2 are programmed to recognize each other and the various subnets on the overall network.



7. Managing the Terminal

The command line setup menu can be used to:

- Provide basic access to the terminal to set IP addresses
- Check or set basic settings of the terminal

4RF SuperVisor is an embedded element manager for the Aprisa XE terminal which is used to:

- Configure radio and interface parameters
- Setup cross connections between traffic interfaces
- Monitor performance, terminal status and alarm details

The Setup Menu

1. Initiate the link by either applying power to the terminals or, if the terminals are already powered up, pressing the Enter key.

2. At the prompt, enter your selection:

Selection		Explanation
1)	Dump terminal configuration	This shows basic terminal data such as Terminal ID, IP data and radio parameters of TX and RX frequency, TX power, modulation type and channel size.
2)	Not used	
3)	Configure IP addresses	Use this if you want to set the IP address, subnet mask or gateway address of the local terminal.
4)	Configure SNMP	Use to display SNMP settings, setup the SNMP Access Controls and Trap Destinations and reset SNMP settings to defaults.
5)	Set hostname	Use this to set a name that can be used in conjunction with DNS.
6)	Configure remote terminal address	Use this to set the IP address of the remote terminal.
7)	Reset web server users	Deletes all existing usernames and passwords in the 'User Table' and restores default usernames and passwords.
8)	Not used	
9)	Reboot	Reboots the terminal.
10)	Configure Ethernet	Use this to display the Ethernet configuration and reset the Ethernet settings to the defaults.
11)	Password Protect Menu	Use this to password-protect the menu to prevent unauthorized users from modifying terminal settings. The password is setupxe.

To Get or Set the IP Address of a Terminal Using Setup

To get the IP address of a terminal using setup:

1. At the prompt, type 1 and enter.

The following information appears:

- the IP addresses of the local and remote terminals
- the subnet mask and gateway of the local terminal
- the TFTP of the remote terminal

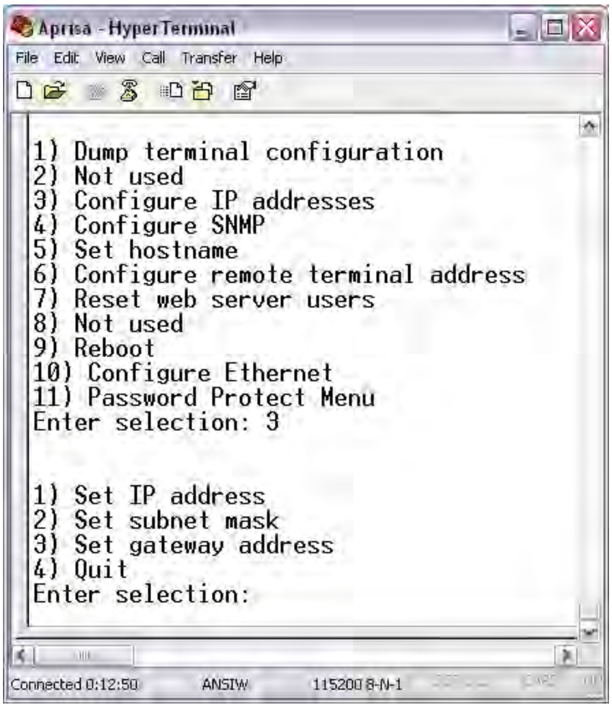
To set the IP address of a terminal using setup:

1. At the prompt, enter 1.
2. Enter 3 to configure the local terminal IP address.

   Set the following for the terminal using the standard format xxx.xxx.xxx.xxx:

   - 1) IP address
   - 2) Subnet mask
   - 3) Gateway address
3. Enter 4 (Quit) to return to the main menu.
4. Enter 6 to configure the remote terminal IP address.

Important: You must ensure that the IP addresses of the local and remote terminals are on the same subnet as the PC being used to configure the terminals.



5. Enter 4 (Quit) to return to the main menu.
6. Enter 9 (Are you sure y/n) to reboot the terminal.

SuperVisor

The SuperVisor management software is pre-loaded into an integrated web-server within the terminal.

SuperVisor runs on any Java-enabled web browser.

You can use SuperVisor to:

- display and configure terminal parameters
- view the terminal alarms
- monitor the performance and status of the link
- upgrade the terminal software
- save and load configuration files
- save performance and error information to a log file

SuperVisor Logging In

The maximum number of concurrent users that can be logged into a terminal is 5.

If SuperVisor is inactive for a period of 30 minutes, the terminal will automatically log out the user.

To log in to SuperVisor:

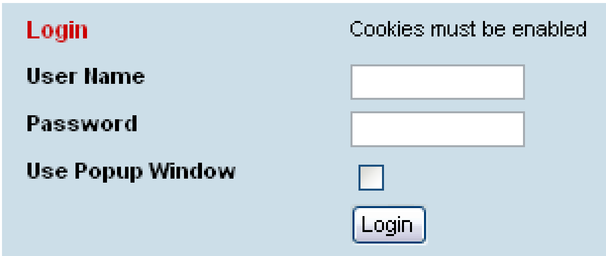
1. Open your web browser and enter the IP address of the terminal.

Note: If you haven't yet assigned IP addresses to the terminals, use the factory-configured IP addresses (see ‘Changing the Terminal’s IP Address’ on page 64).

If you don't know the IP address of the terminal, you can determine it using terminal emulation software (see ‘To Get or Set the IP Address of a Terminal Using Setup’ on page 58).

2. Login with the user name and password assigned to you.

Note: If unique user names and passwords have not yet been configured, use the default user names and passwords (see ‘Setting up users’ on page 65).



Important: After you login for the very first time, it is recommended that you change the default admin password for security reasons (see ‘Changing passwords’ on page 67).

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3. Tick the ‘Use Popup Window’ tick box if you want a separate browser window to launch after you have logged in. The login page remains open in one window allowing you to view or configure settings in another page. This is useful if you have more than one link to configure, for example, protected terminals.

4. When you have logged in, the Summary page shows a summary of both the Local and Remote terminals’ parameters.

SuperVisor Logging Out

As the maximum number of concurrent users that can be logged into a terminal is 5, not logging out correctly can restrict access to the terminal until the after the timeout period (30 minutes).

Logging out from a terminal will logout all users logged in with the same user name.

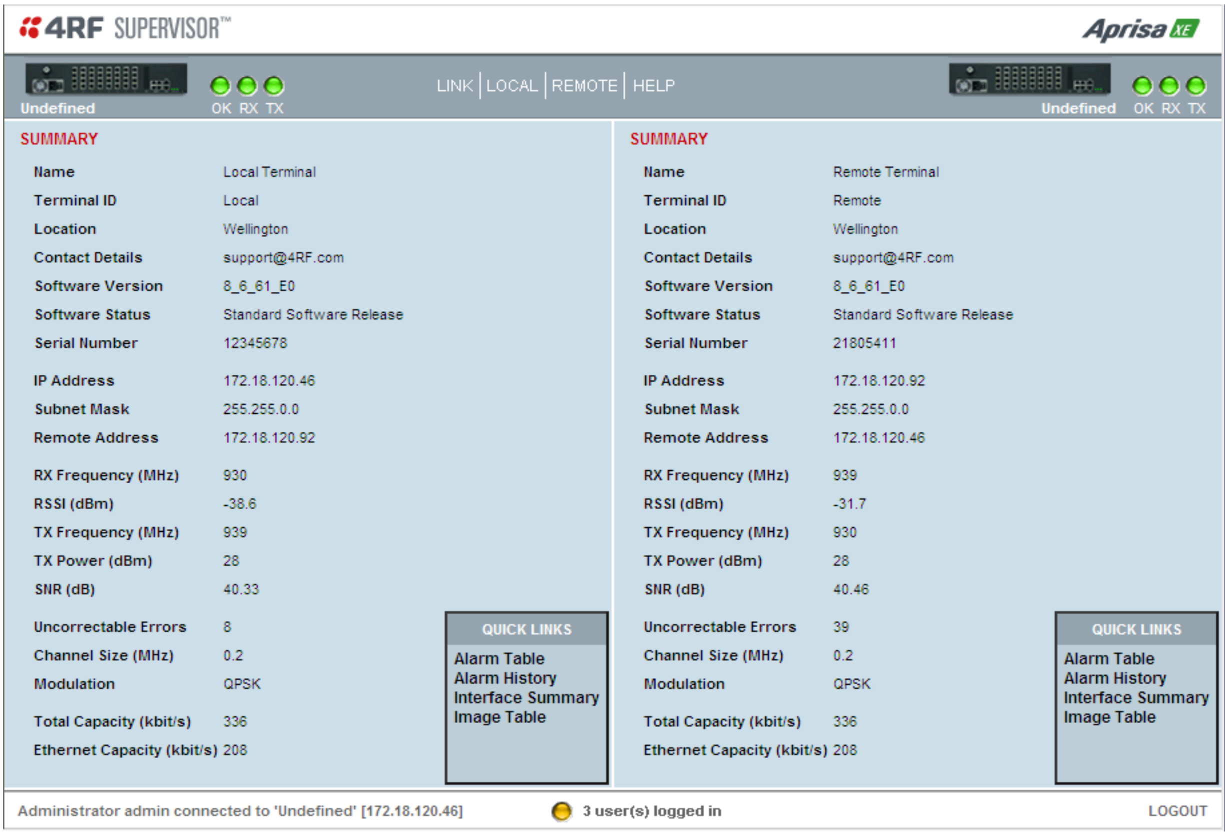
If the SuperVisor window is closed without logging out, the terminal will automatically log the user out after a timeout period of 30 minutes.

To log out of SuperVisor:

1. Click on the 'Logout' button on the Summary Bar.

SuperVisor Main Screen

The SuperVisor Main Screen presents a summary of both the local and remote terminals and the status of the terminal front panel LED indicators:



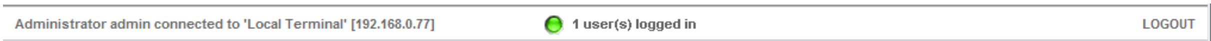
SuperVisor Menu Bar

The SuperVisor Menu Bar at the top of the screen shows the names of the terminals, the top level menus and three status indicators for both the local and remote terminals. These indicators reflect the status LED indicators on the front panel of terminal.

There are four menus available:

- Link - menu options for both terminals in a link
- Local - menu options for the local terminal in a link
- Remote - menu options for the remote terminal in a link
- Help - provides details about the terminal

SuperVisor Summary Bar



The SuperVisor Summary Bar at the bottom of the screen shows:

- The login name of the person currently logged in together with the name of the local terminal and its IP address.
- A login alarm that indicating that someone else has logged into and could be working on the same link. The LED is green for 1 user and yellow for more than 1 user.
- The number of users logged in to the link
- A SuperVisor logout button

Changing the Terminal's IP Address

You can use SuperVisor to change the IP address of the terminal from the default. Alternatively, you can assign the IP address using the SETUP port (see 'To Get or Set the IP Address of a Terminal Using Setup' on page 58).

To change the IP address of the terminals using SuperVisor:

1. Launch your web browser and connect to the terminal using the one of the factory-configured default IP addresses shown below:

	Terminal	IP address
Unprotected terminals	Terminal 1 (local)	169.254.50.10
	Terminal 2 (remote)	169.254.50.20
Protected terminals	Terminal 1, terminal A (local)	169.254.50.10
	Terminal 1, terminal B (local)	169.254.50.11
	Terminal 2, terminal A (remote)	169.254.50.20
	Terminal 2, terminal B (remote)	169.254.50.21

Note: The factory default settings for the subnets is 255.255.0.0; the gateway is 0.0.0.0.

2. Log into the terminal as the administrator with the user name 'admin' and the password 'admin'.

Note: For security reasons, change the admin password (see 'Changing passwords' on page 67) as soon as possible.

3. Select Link or Local or Remote > Terminal > Advanced and make the necessary changes.

Note: If this IP address change is being made over the RF link, it is important to change the far end of the link first.

4. Once you have changed the IP address of a terminal, you must perform a hard reboot of the terminal and then reconnect to it using the new IP address.

Setting Up Users

Note: You must login with 'admin' privileges to add, disable, delete a user or change a password.

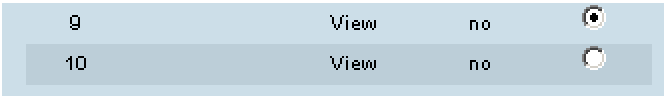
User groups

There are three pre-defined user groups to allocate access rights to users. These user groups have associated default user names and passwords of the same name.

User Group	Default User Name	Default Password	Access Rights
View	view	view	Users in this group can only view terminal parameters.
Modify	modify	modify	Users in this group can view and edit terminal parameters.
Admin	admin	admin	Users in this group have full access to all terminal parameters including the ability to add and change users.

Adding a User

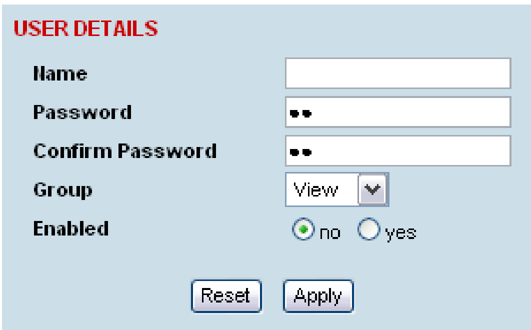
1. Select Local or Remote > Maintenance > User Admin > User Table.
2. Select an empty line (that isn't allocated to an existing user) and then click Edit.



3. Enter the user name.

   A user name can be up to 32 characters but cannot contain back slashes, forward slashes, spaces, tabs, single or double quotes.
4. Enter the Password and the Confirm Password.

   A password can be up to 32 characters but cannot contain back slashes, forward slashes, spaces, tabs, single or double quotes.
5. Select the group that they will belong to (View, Modify, or Admin).
6. If the user requires immediate access, enable the user by clicking on Yes.



7. Click Apply.

Note 1: The new user must be setup on both the Local and Remote terminals.

Note 2: For the changes to take effect, you must reboot the terminal (Local > Maintenance > Reboot).

Disabling a User

1. Select Local or Remote > Maintenance > User Admin > User Table.
2. Select the user who you want to disable.
3. Click Edit to display the User details and set Enabled to 'No'.
4. When you have made your changes, click Apply to apply changes or Reset to restore the previous configuration.

Note: For the changes to take effect, you must reboot the terminal (Local > Maintenance > Reboot).

Deleting a User

1. Select Local or Remote > Maintenance > User Admin > User Table.
2. Select the user you want to delete.
3. Click Edit to display the user details and delete the User Name and Password.
4. Reset the Group to 'View' and set Enabled to 'no'.
5. When you have made your changes, click Apply to apply changes or Reset to restore the previous configuration.

Note: For the changes to take effect, you must reboot the terminal (Local > Maintenance > Reboot).

Saving User Information

You can save the list of users to your PC and then load this file to another terminal. This is useful if you have multiple terminals to configure.

To save the user table to file:

1. Select Local > Maintenance > User Admin > Save User List.
2. Select the 'Save to disk' option in the dialog box that appears.
3. In the next dialog box that appears, navigate to the directory where you want to save the file, enter a suitable filename, and then click Save (The default name for this file is 'downloadUsers').

Note: If this dialog box does not appear, change your Internet security settings to allow downloads. You may also need to check your file download location setting.

To save the file to another terminal:

1. Select Local > Maintenance > User Admin > Load User List.
2. On the Upload Users page, select Browse and navigate to the file on your PC.
3. Click Apply.

   The User Table appears and you can edit users, as required.

Changing Passwords

1. Select Local or Remote > Maintenance > User Admin > User Table.

USER TABLE

Index	Name	Group	Enabled	Select
1	view	View	yes	
2	modify	Modify	yes	
3	admin	Admin	yes	
4		View	no	
5		View	no	
6		View	no	
7		View	no	
8		View	no	
9		View	no	
10		View	no	

Edit...

2. Select the user whose password you want to change and click Edit.
3. Enter the new Password and the new Confirm Password.

   A password can be up to 32 characters but cannot contain back slashes, forward slashes, spaces, tabs, single or double quotes.
4. When you have made your changes, click Apply.

Viewing User Session Details

Administrators can check who is currently logged in, the computer they are logging in from, and how long they have been logged in for.

Note: A 'session' is the period of time that begins when someone logs into the terminal and ends when they logout.

To view user session details:

1. Select Local > Maintenance > User Admin > Session Details.

SESSION DETAILS

User Name	Time (mins)	Last Access (mins)	Address
Tracy	1	0	192.168.0.104
Andrew	2	0	192.168.0.35
JohnSmith	2	0	192.168.0.104

The 'Session Details' shows a list of the current users:

- User Name: the User Name logged into the terminal.
- Time: the number of minutes the user has been logged in.
- Last Access: the number of minutes the user last accessed the terminal in this session.
- Address: the address of the computer or proxy server address logged into the terminal.

8. Configuring the Terminal

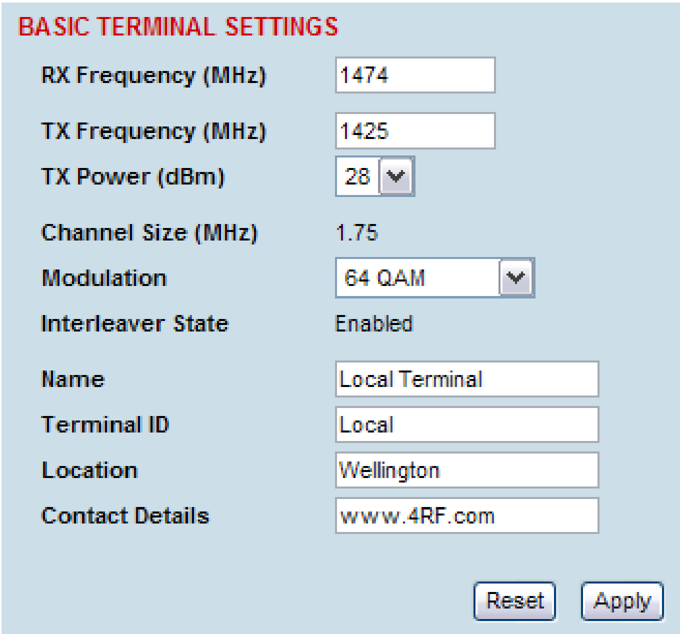
Configuring the RF Settings

The RF settings are factory-configured before dispatch to the customer requirements. However, you can change the RF settings, if required.

If two fundamental radio parameters (RX and TX frequency or modulation) are changed on the remote terminal in the same apply action (simultaneously), the first parameter change could break the communications link to the remote terminal and prevent the other commands from being actioned. There is a two second delay between receiving the command and actioning it to allow for subsequent commands to be received before the communications link is lost.

To configure RF settings:

Select Link or Local or Remote > Terminal > Basic:



Note: Transmit frequency, transmit power, channel size, modulation and antenna polarization would normally be defined by a local regulatory body and licensed to a particular user.

Refer to your site license details when setting these fields.

RX and TX Frequency

The local terminal transmit frequency must match the receive frequency of the remote terminal and the remote terminal transmit frequency must match the receive frequency of the local terminal.

When setting the RX and TX frequency with SuperVisor, the frequency entered is automatically resolved to the synthesizer step size for the terminal frequency band e.g. an ETSI 1400 MHz band frequency entry of 1474,010,000 Hz will be changed to 1474,012,500 Hz (see synthesizer step size in the table 'Frequency Bands' on page 287).

The RX and TX frequency entered must be:

- Within the frequency band limits of the chosen RF frequency band of the terminal as specified in 'Frequency Bands' on page 287. e.g. for an ETSI frequency band of 1400 MHz, the frequency band limits are 1350 to 1550 MHz.
- Within the TX / RX passband of the duplexer fitted in the terminal e.g. for a frequency band of 1400 MHz, the standard duplexer passband is 7 MHz and the TX / RX split is ≥ 48 MHz (see Duplexer (bandpass) 'Duplexers' on page 301).

  The duplexer passband and center frequencies are written on the duplexer label.

The TX and RX frequencies are validated against the duplexer parameters entered on SuperVisor Link or Local or Remote > Terminal > Duplexer (see 'Setting the Duplexer Parameters' on page 79).

If the TX or RX frequency entered is not valid i.e. outside the operating range of the duplexer, a warning message will popup. OK accepts the frequency entered and cancel rejects the frequency entered.

Important: Changing the remote terminal RX or TX frequency will disable all management communication to the remote terminal but by changing the local terminal to match the remote terminal, the radio link will be restored as will the management communication

BUT if the remote terminal RX or TX frequency is changed to be outside the operating range of the terminal, changing the local terminal to match the remote terminal will not restore the radio link and all management communication will be lost.

The remote terminal TX and RX frequencies cannot be changed simultaneously i.e. change one direction and 'Apply' the change and then change the other direction and 'Apply' the change.

To change both TX and RX frequencies:

1. Change the remote terminal RX frequency and 'Apply' the change. The radio link will fail.
2. Change the local terminal TX frequency to that of the remote RX frequency and 'Apply' the change. The radio link will restore.
3. Change the remote terminal TX frequency and 'Apply' the change. The radio link will fail.
4. Change the local terminal RX frequency to that of the remote TX frequency and 'Apply' the change. The radio link will restore.

Transmit power

The transmitter power is the power measured at the duplexer output port.

The transmitter power adjustment range varies depending on the Modulation type and frequency band of the terminal. For ETSI transmitter power range see 'Transmitter Power ETSI' on page 290.

Channel size

The RF channel size is a factory-configured setting determined by the Aprisa XE hardware option.

Modulation

Both terminals must be set to the same modulation type.

When you change the modulation type in an operational terminal, traffic across the link will be interrupted and you may need to change the cross connections capacity, as the Total Capacity of the radio link may be exceeded.

Interleaver state

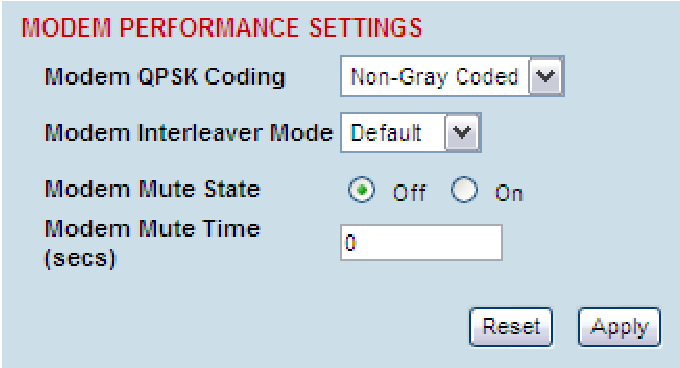
This Interleaver State displays the current state of the modem interleaver.

Interleaver State	Modem Interleaver Operation
Default	The modem interleaver is on for channel sizes of 250 kHz and greater and off for channel sizes of 200 kHz and less.
Enabled	The modem interleaver is on.
Disabled	The modem interleaver is off.

Modem Performance Settings

To view or change the modem performance settings:

Select Link or Local or Remote > Terminal > Modem



Modem QPSK Coding

When the Modulation type is set to QPSK, the default QPSK Coding setting is ‘Non-Gray Coded’ but the QPSK Coding can use ‘Gray Coded’ for interoperability with older hardware.

Modem Interleaver Mode

The Modem Interleaver improves modem bit error rate but increases the end to end link delay so the Modem Interleaver should be enabled where a low bit error rate is required and disabled where a low end to end link delay is required.

The ‘Default’ Modem Interleaver Mode setting is on for channel sizes of 250 kHz and greater and off for channel sizes of 200 kHz and less. The specification of end to end link delay for both interleaver on and off is given in the relevant RF Specification section. For ETSI Link Delays, see ‘Link Delays ETSI’ on page 292.

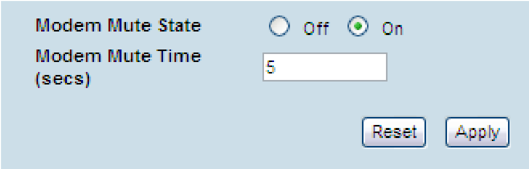
When you change the Modem Interleaver Mode in an operational terminal, traffic across the link will be interrupted.

Both terminals must be set to the same Modem Interleaver Mode.

Modem Mute Mode

The Aprisa XE radio always mutes its interface ports when the modem loses lock.

The Modem Mute feature mutes its interface ports when the modem Reed Solomon forward error correction capability can no longer correct errors.



This can occur when the signal strength of the RF link reduces to within about 2 dB of the theoretical sensitivity of the radio or when the radio is operating well above the sensitivity threshold but is in an environment subject to impulse noise interference on the RF path.

When the mute activates;

- On the analog cards, Q4EM, DFXS and DFXO, the audio path mutes and the signalling states go idle.
- On the digital cards, QV24 and HSS, it causes an all ones data pattern to be driven on the RXD output line and handshake lines such as RTS / CTS to their off states while on the QJET card it forces the ports to an AIS state.

The Modem Mute feature effectively reduces the radio receiver sensitivity by 2 to 3 dB from its published values but will prevent errors from corrupting the tributary audio circuits.

Modem Mute Time

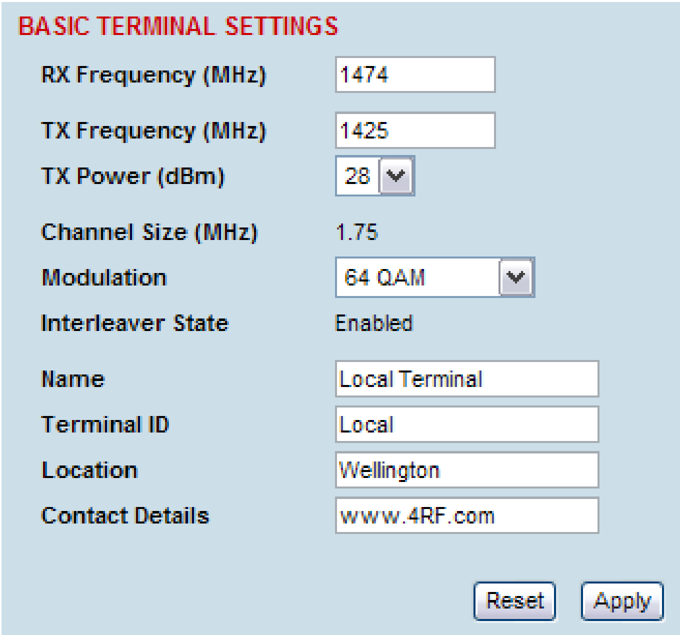
The Modem Mute Time determines the time the mute will persist after the last uncorrectable block is received. This can be set from 0 to 10 seconds in 0.1 second steps.

Note: The Modem Mute feature is only available if the radio modem is Rev D or later. If the radio has a Rev A, Rev B or Rev C modem, the modem mute functionality is not displayed in SuperVisor.

Entering Basic Terminal Information

To enter basic terminal information:

Select Link or Local or Remote > Terminal > Basic



Terminal Information

The data entry in these four fields can be up to 40 characters but cannot contain back slashes or double quotes.

1. Enter the terminal Name. This appears in the Terminal status and menu bar at the top of every page.

2. Enter a unique Terminal ID.

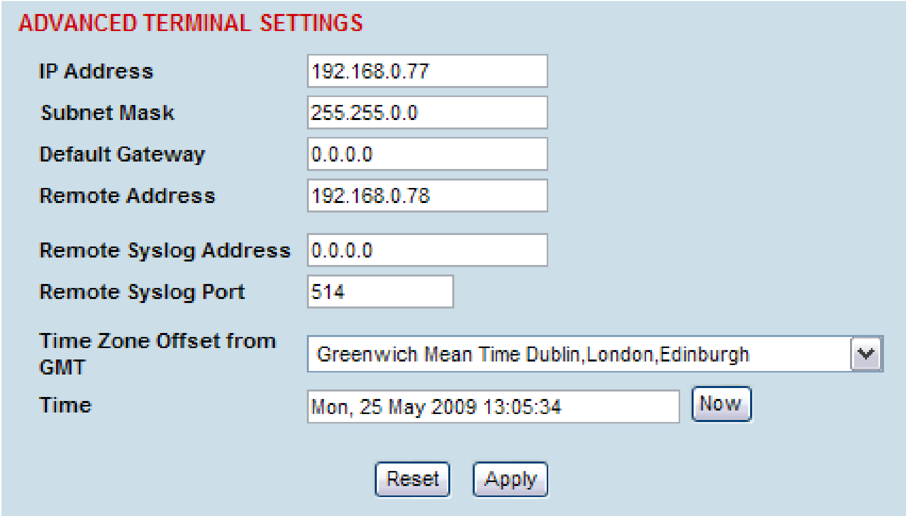
3. Enter the Location of the terminal.

4. Enter a contact name or an email address in Contact Details. The default value is 'support@4RF.com'.

5. Click Apply to apply changes or Reset to restore the previous configuration.

Configuring the IP Settings

Select Link or Local or Remote > Terminal > Advanced.



Advanced Terminal Settings

1. Enter the static IP Address for the terminal assigned by your site network administrator using the standard format xxx.xxx.xxx.xxx. The default IP address is in the range 169.254.50.xx.
2. Enter the Subnet Mask for the terminal using the standard format xxx.xxx.xxx.xxx. The default subnet mask is 255.255.0.0.
3. Enter the Default Gateway for the terminal, if required, using the standard format xxx.xxx.xxx.xxx (there is no default gateway set by default.)
4. Enter the IP address of the remote terminal using the standard format xxx.xxx.xxx.xxx (the default IP address is in the range 169.254.50.xx.)
5. If you are setting up for remote logging (see ‘Setting up for Remote Logging’ on page 255), enter the Syslog Address and the Syslog Port for the remote terminal.
6. In Time Zone Offset from GMT, select the time zone from the list (optional) .
7. To set the Time to the PC real-time clock, click Now.
8. Click Apply to apply changes or Reset to restore the previous configuration.

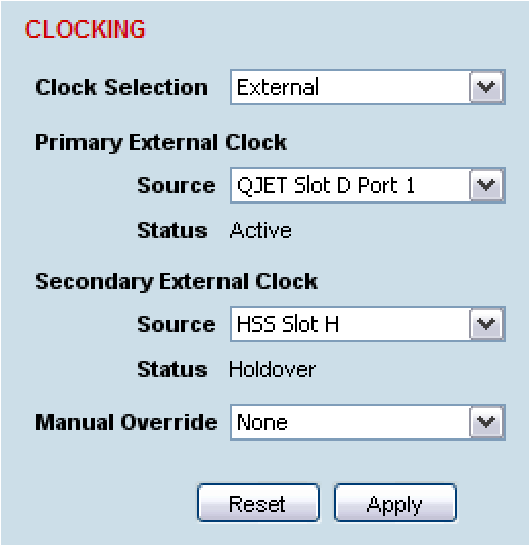
Setting the Terminal Clocking

To view the terminal clock status:

Select Link or Local or Remote > Terminal > Clocking

The current selected clock source and the current status of the primary and secondary external clocks are shown:

Clock Status	Clock Status Description
Inactive	This clock source is either not configured at all, or is not in current use
Active	This clock source is providing the clocking for the terminal
Holdover	This clock source is nominated as Primary or Secondary but is currently unavailable.

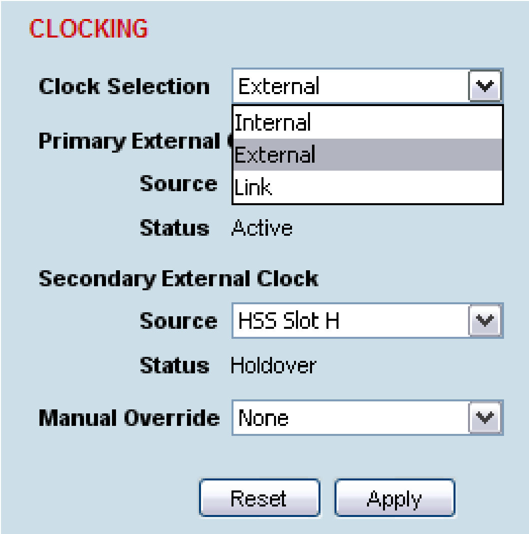


To select the terminal clock source:

The Clock Source selected for the terminal will be used to clock all interface ports requiring clocking and send a clocking signal over the RF link.

Select Link or Local or Remote > Terminal > Clocking > Clock Source and select one of the following:

Clock Source	Terminal Clocking
External	The terminal is clocked from the nominated interface port selected as the primary external clock or the secondary external clock.
Internal	The terminal is clocked from the terminal's internal clock.
Link	The terminal is clocked from the RF link.



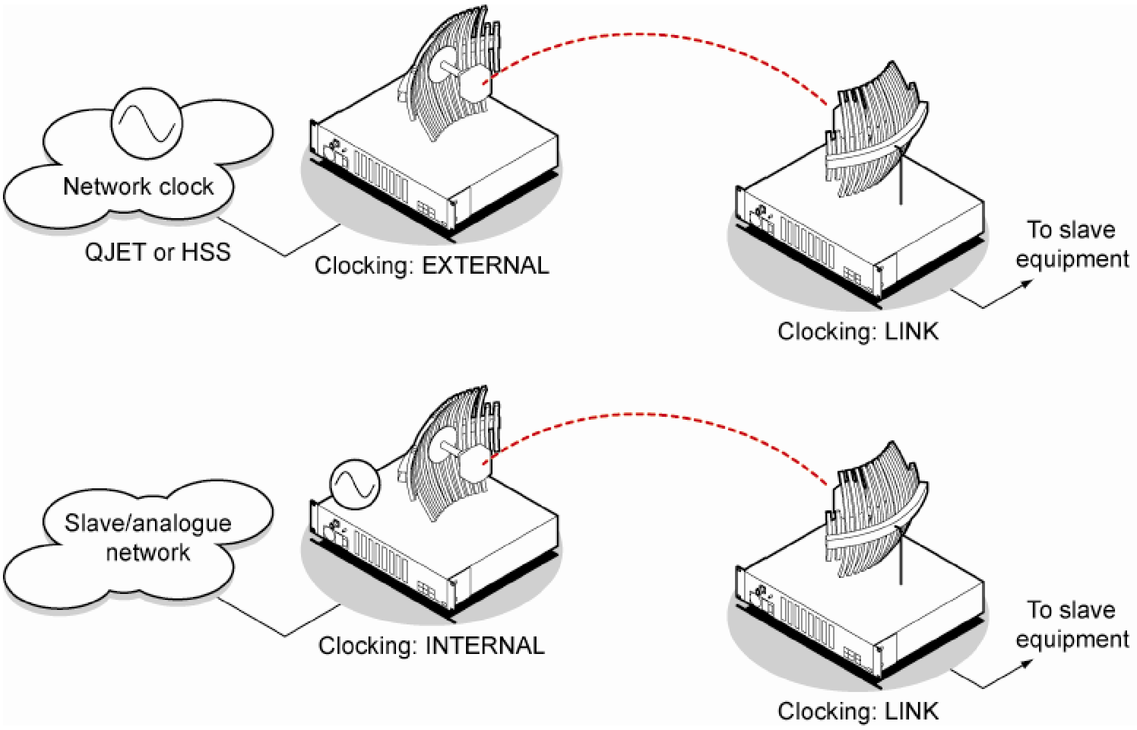
If the terminal Clock Source is set to External, the terminal will automatically clock from the nominated primary external clock source if that clock source is available.

If the nominated primary external clock source is not available, the terminal will clock from the nominated secondary external clock source if that clock source is available.

If the nominated secondary external clock source is not available, the terminal will clock from the internal clock source.

When a nominated external clock source becomes available (primary or secondary), the terminal will then clock from that clock source.

The terminal at one end of the link must have its clock source set to Internal or External and the terminal at the other end of the link must have its clock source set to Link.



To select the interface port for the external clock source (external clock source only):

Select the traffic interface ports nominated as Primary External Clock or Secondary External Clock sources.

The failure of both External Clock sources results in a major alarm.

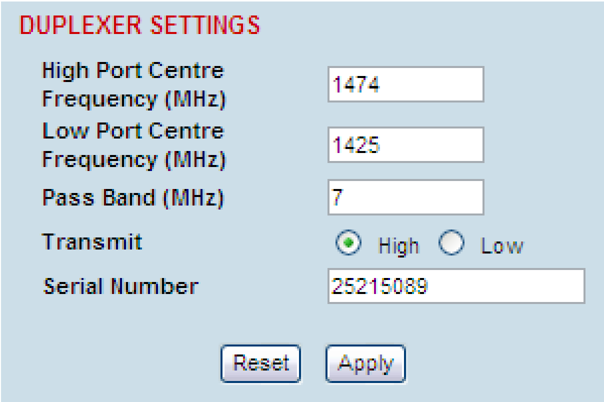
To manually override the automatic clock source selection (external clock source only):

Select either Switch to Primary or Switch to Secondary from the drop-down list, and click Apply.

Setting the Duplexer Parameters

To set the duplexer parameters:

Select Link or Local or Remote > Terminal > Duplexer



Duplexer Parameters

The terminal TX and RX frequencies entered are validated against the duplexer parameters entered on this page.

A valid high port frequency must be:

≤ (duplexer high port centre frequency + pass band/2 - channel size/2)

and

≥ (duplexer high port centre frequency – pass band/2 + channel size/2)

A valid low port frequency must be:

≤ (duplexer low port centre frequency + pass band/2 - channel size/2)

and

≥ (duplexer low port centre frequency – pass band/2 + channel size/2)

The duplexer parameters are entered in the factory but can be re-entered if the duplexer is changed in the field. The parameters required are shown on the duplexer label.

1. Enter the duplexer High port centre frequency and Low port centre frequency in MHz.

2. Enter the duplexer Pass band in MHz (the total passband e.g. if the duplexer passband is show as ± 3.5 MHz, the value entered is 7 MHz).

3. Select Transmit High or Transmit Low

Transmit High - the Transmitter is connected to the High Port of the duplexer.

Transmit Low - the Transmitter is connected to the Low Port of the duplexer.

4. Enter the duplexer Serial Number (used for record keeping only).

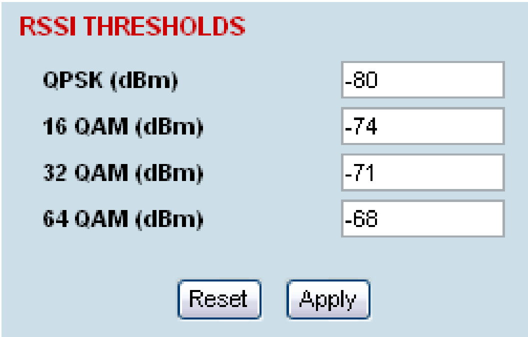
5. Click Apply to apply changes or Reset to restore the previous configuration.

Setting the RSSI Alarm Threshold

The threshold (in dB) at which the RSSI alarm activates can be set for each of the modulation types over the adjustment range of -40 dBm to -110 dBm and the default values are as per the following screen shot. The alarm threshold has a +1 dB hysteresis for the inactive state.

To set the RSSI alarm threshold:

Select Link or Local or Remote > Alarms > RSSI Thresholds



1. Enter the alarm threshold required for each of the modulation types.
2. Click Apply to apply changes or Reset to restore the previous configuration.

Configuring the External Alarms

Each terminal has two external alarm inputs and four external alarm outputs, terminated on the ALARM RJ-45 connector on the terminal front panel.

Each external alarm input can activate the Major / Minor terminal alarm or be mapped to a remote terminal external alarm output.

The ‘Alarm On When’ (active alarm state) for both inputs can be configured for 'External Source On' or 'External Source Off' (default is External Source On).

Each external alarm output can be triggered by a local terminal Major / Minor alarm or a remote terminal Major / Minor alarm or either of the remote external alarm inputs.

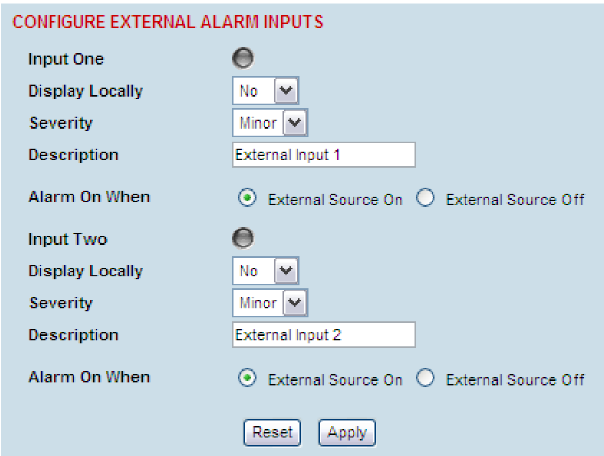
The ‘Relay Closed When’ for the four outputs can be configured for 'Alarm On' or 'Alarm Off' (default is Alarm Off).

Configuring the External Alarm Inputs

To configure the External Alarm Inputs:

Select Link or Local or Remote > Alarms > Ext Alarm Inputs

Note: When the MHSB mode is enabled on the terminal, the external alarm input 2 is used for protection switch control so is not available for user alarms.



The state of the local terminal external alarm input is always sent to the remote terminal and the external alarm input can be mapped to a remote terminal external alarm output.

Alarms present on a local terminal external alarm input will only be displayed in the remote terminal Alarm Table / Alarm History if it has been mapped to one of the remote terminal external alarm outputs.

1. Select the **Display Locally** setting for each alarm input.

Display Locally	External Alarm Input Function	
No	The external alarm input does not generate an alarm on the local terminal, does not appear in the ‘Alarm Table’ or ‘Alarm History’, and shows as grayed out on the ‘Alarm Summary’.	Default
Yes	The external alarm input generates an alarm on the local terminal, displays in the ‘Alarm Table’ and ‘Alarm History’ and the ‘Alarm Summary’.	

2. Select the **Severity** setting for each alarm input.

This option is only relevant when the ‘Display Locally’ option is set to ‘Yes’.

Severity	External Alarm Input Severity	
Minor	The external alarm input generates a minor alarm on the local terminal.	Default
Major	The external alarm input generates a major alarm on the local terminal.	

3. Enter a Description for each alarm input. The default is ‘External Input 1’ / ‘External Input 2’.

4. Select the **Alarm On When** setting for each alarm input.

Alarm On When	External Alarm Input State	
External Source On	The alarm is on (alarm active) when a source of voltage is applied to the external alarm input and current is flowing.	Default
External Source Off	The alarm is on (alarm active) when no source of voltage is applied to the external alarm input and hence no current is flowing.	

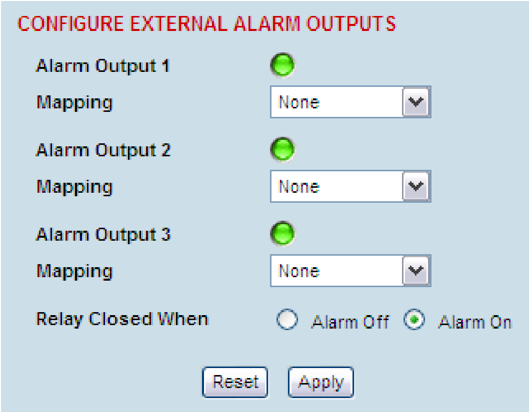
5. When you have made your changes, click Apply to apply changes or Reset to restore the previous configuration.

Configuring the External Alarm Outputs

To configure the External Alarm Outputs:

Select Link or Local or Remote > Alarms > Ext Alarm Outputs

Note: When the MHSB mode is enabled on the terminal, the external alarm output 4 is used for protection switch control so is not available for user alarms.



1. Select the **Mapping** required for each alarm output.

Mapping	External Alarm Output Function	
None	No external alarm output.	Default
Local Major	The external alarm is present when the local terminal has a major alarm.	
Local Minor	The external alarm is present when the local terminal has a minor alarm.	
Remote Major	The external alarm is present when the remote terminal has a major alarm.	
Remote Minor	The external alarm is present when the remote terminal has a minor alarm.	
Remote Input 1	The external alarm is present when the remote terminal external alarm input 1 is present.	
Remote Input 2	The external alarm is present when the remote terminal external alarm input 2 is present.	
Test Major	External alarm test function - major alarm This setting will output an alarm on the selected output but it will not show in the alarm table or on the OK LED of the radio (it is not a 'real' alarm). This alarm test will clear if radio reboots.	
Test Minor	External alarm test function - minor alarm This setting will output an alarm on the selected output but it will not show in the alarm table or on the OK LED of the radio (it is not a 'real' alarm). This alarm test will clear if radio reboots.	

2. Select the **Relay closed when** setting for the four alarm outputs.

Relay closed when	External Alarm Output State	
Alarm on	When the external alarm output relay contact is closed, the alarm is on (alarm active).	Default
Alarm off	When the external alarm output relay contact is closed, the alarm is off (alarm inactive).	

3. When you have made your changes, click Apply to apply changes or Reset to restore the previous configuration.

Configuring SNMP Settings

In addition to web-based management (SuperVisor), the terminal can also be managed using the Simple Network Management Protocol (SNMP). MIB files are supplied, and these can be used by a dedicated SNMP Manager, such as Castle Rock's SNMPc (www.castlerock.com), to access most of the terminal's configurable parameters.

However, it is recommended that SNMP is only used for status and alarm monitoring of your entire network. SuperVisor is the best means to configure individual terminals.

For communication between the SNMP manager and the terminal, Access Controls, Trap Destinations, and Community strings must be set up as described in the following sections.

A SNMP **Access Control** is the IP address of the terminal used by an SNMP manager or any other SNMP device to access the terminal. Entering an IP address of 'Any' (not case sensitive) or * will allow any IP address access to the terminal. A community string is sent with the IP address for security.

Commands are sent from the SNMP manager to the terminal to read or configure parameters of the terminal e.g. setting of interface parameters.

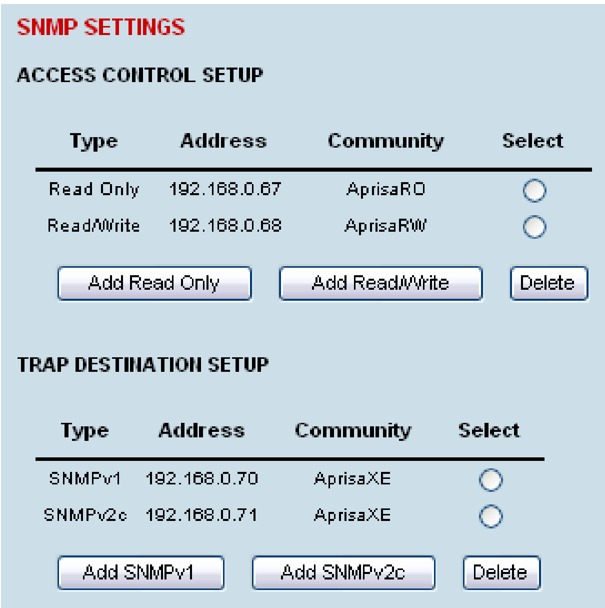
A SNMP **Trap Destination** is the IP address of a station running an SNMP manager. A community string is sent with the IP address for security.

Events are sent from the terminal to the SNMP manager e.g. alarm events.

A SNMP **Community String** is used to protect against unauthorized access (similar to a password). The SNMP agent (terminal or SNMP manager) will check the community string before performing the task requested in the SNMP message . Trap Destinations and Access Controls both use community strings for protection.

To configure Trap Destinations and Access Controls:

Select Local > Maintenance > SNMP > SNMP Settings



Note: SNMP Settings can only be setup on the local terminal.

SNMP Access Controls

To add an access control:

1. Click on the ‘Add Read Only’ button to enter a Read Only access control or click on the ‘Add Read/Write’ button to enter a Read/Write access control.

2. Enter the IP address of each SNMP manager allowed access to the terminal (read/write access control shown). The IP address entered must be a valid dot delimited IP address.

Entering an IP address of ‘Any’ or * will allow any IP address access to the terminal.

3. Enter the community string for the access control.

The Community string is usually different for Read Only and Read/Write operations.

There is no default 'public' community string for an access control, but a 'public' community string can be entered which will have full MIB access, including the 4RF MIB.

4. Click Add.

To delete an access control:

1. Select the access control you want to delete and click Delete.

2. Click OK to delete the access control or Cancel to abort the delete.

SNMP Trap Destinations

To add a trap destination:

1. Click on the ‘Add SNMPv1’ button to enter a SNMPv1 trap destination or click on the ‘Add SNMPv2c’ button to enter a SNMPv2c trap destination.

   The differences between SNMPv1 and SNMPv2c are concerned with the protocol operations that can be performed. Selection of SNMPv1 and SNMPv2c must match the setup of the SNMP manager.

2. Enter the IP address of the server to which you want SNMP traps sent (SNMPv1 trap destination shown). The IP address entered must be a valid dot delimited IP address.

3. Enter the community string for the trap destination.

   There is no default 'public' community string for a trap destination, but a 'public' community string can be entered.

4. Click Add.

To delete a trap destination:

1. Select the trap destination you want to delete and click Delete.

2. Click OK to delete the trap destination or Cancel to abort the delete.

Viewing the SNMP Traps

Any event or alarm in the SNMP objects list can be easily viewed. This also enables you to verify, if required, that SNMP traps are being sent.

Select Local > Maintenance > SNMP > View Traps.

VIEW SNMP TRAPS - MOST RECENT FIRST

Up Time	(50734553) 5 days, 20:55:45.53
Trap OID	aprisaXEV24ControlLineLossEvent
aprisaXEEventCardSlot.0	slotG
aprisaXEEventCardPort.0	portTwo
aprisaXEEventAlarmStatus.0	noAlarmPresent
Up Time	(50734547) 5 days, 20:55:45.47
Trap OID	aprisaXEV24ControlLineLossEvent
aprisaXEEventCardSlot.0	slotG
aprisaXEEventCardPort.0	portOne
aprisaXEEventAlarmStatus.0	noAlarmPresent

Viewing the SNMP MIB Details

This is useful to see what MIB (Management Information Base) objects the terminal supports.

Select Link or Local or Remote > Maintenance > SNMP > View MIB Details.

VIEW MIB DETAILS

MIB Identifier	Description
mib-2.31	The MIB module to describe generic objects for network interface sub-layers
snmpMIB	The MIB module for SNMPv2 entities
mib-2.49	The MIB module for managing TCP implementations
ip	The MIB module for managing IP and ICMP implementations
mib-2.50	The MIB module for managing UDP implementations
vacmBasicGroup	View-based Access Control Model for SNMP.
snmpFrameworkMIBCompliance	The SNMP Management Architecture MIB.
snmpModules.11.3.1.1	The MIB for Message Processing and Dispatching.
snmpModules.15.2.1.1	The management information definitions for the SNMP User-based Security Model.
fourRFCommon	4RF Common MIB
fourRFAprisaXE	4RF AprisaXE specific MIB

Saving the Terminal's Configuration

Note: To save cross connection configurations, see page 155.

To save a configuration:

1. Ensure you are logged in with either 'modify' or 'admin' privileges.
2. Select Local > Maintenance > Config Files > Save MIB.
3. Select the 'Save to disk' option in the dialog box that appears.
4. In the next dialog box that appears, navigate to the directory where you want to save the file, enter a suitable filename, and then click Save (The default name for this file is backupForm).

Note 1: If this dialog box does not appear, change your Internet security settings to allow downloads. You may also need to check your default download location.

Note 2: Pop-ups must be enabled on you PC for this function to work (see ‘PC Settings for SuperVisor’ on page 50).

To load a configuration into a terminal:

Important: Only load a saved configuration file to another terminal that has exactly the same configuration (RF variant and interface cards).

1. Ensure you are logged in with either 'modify' or 'admin' privileges.
2. Select Local or Remote > Maintenance > Config Files > Load MIB.

3. Click Browse and then navigate to the file and select it.
4. Click Upload to load the configuration file into the terminal.

9. Configuring the Traffic Interfaces

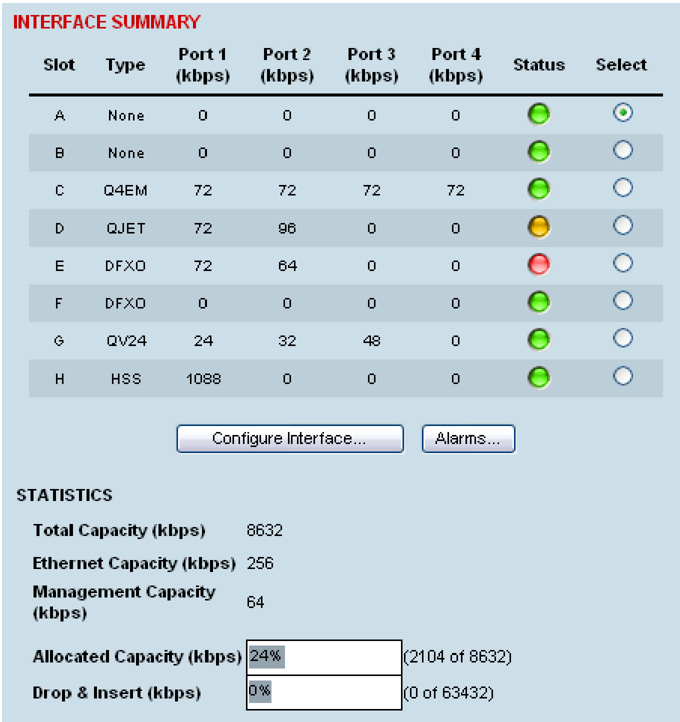
Important: When configuring a link, it is important that you configure the remote terminal first as the new configuration may break the management connection to the remote terminal.

Once the remote terminal has been configured, the local terminal should be configured to match the remote terminal.

Viewing a Summary of the Interfaces

To view a summary of the interfaces fitted:

Select Link or Local or Remote > Interface > Interface Summary.



INTERFACE SUMMARY

Slot	Type	Port 1 (kbps)	Port 2 (kbps)	Port 3 (kbps)	Port 4 (kbps)	Status	Select
A	None	0	0	0	0		
B	None	0	0	0	0		
C	Q4EM	72	72	72	72		
D	QJET	72	96	0	0		
E	DFXO	72	64	0	0		
F	DFXO	0	0	0	0		
G	QV24	24	32	48	0		
H	HSS	1088	0	0	0		

Configure Interface... Alarms...

STATISTICS

Total Capacity (kbps)	8632
Ethernet Capacity (kbps)	256
Management Capacity (kbps)	64
Allocated Capacity (kbps)	24% (2104 of 8632)
Drop & Insert (kbps)	0% (0 of 63432)

The Interface Summary page shows:

- The interface type for each slot that has been configured with the capacity used by each port.
- **Total Capacity**. The total capacity of the radio link.
- **Ethernet Capacity**. The capacity allocated to the Ethernet traffic over the radio link. This includes the user and management capacity assigned.
- **Management Capacity**. The capacity allocated to the management conduit over ethernet.
- **Radio Capacity**. The percentage of the total capacity of the radio link that has been allocated to traffic interfaces.
- **Drop and insert capacity**. The percentage of the total drop and insert capacity used for local drop and insert cross connections. The total drop and insert capacity is 65536 kbit/s minus the assigned radio link capacity.

Some interfaces also require extra bandwidth to be allocated to transport signalling, such as CTS / DTR handshaking or E&M signals. The cross connections application automatically allocates capacity for signalling when it is needed.

Configuring the Traffic Interfaces

Important: Before you can configure the traffic interfaces, the interface cards must be already installed (see 'Installing Interface Cards' on page 235).

Configuring each traffic interface involves the following steps (specific instructions for each interface card follow this page).

First, specify the port settings for the Remote terminal:

1. Select Remote > Interface > Interface Summary, select the interface card and click Configure Interface.
2. Select the port you want to configure and modify the settings, as necessary.
3. Click Apply to save the changes you have made.

Now specify the port settings for the Local terminal:

1. Select Local > Interface > Interface Summary, select the interface card and click Configure Interface.
2. Select the port you want to configure and modify the settings, as necessary.
3. Click Apply to save the changes you have made.

Once you have done this, you will need to configure the traffic cross-connects (see 'Configuring the traffic cross connections' on page 145) for each interface card.

Ethernet Switch

In the default mode, the Ethernet switch passes IP packets (up to 1522 bytes) as it receives them. However, using SuperVisor you can configure VLAN, QoS and port speed settings to improve how IP traffic is managed.

This is useful for operators who use virtual networks to segment different groups of users or different types of traffic in their network. These groups can be maintained across the radio link thus ensuring users in one virtual network cannot access data in other virtual networks.

The switch also has a high-speed address lookup engine, supporting up to 2048 preferential MAC addresses as well as automatic learning and aging. Traffic is filtered through this table and only traffic destined for the remote end is sent across the link improving bandwidth efficiency.

Note: You need ‘modify’ or ‘admin’ privileges to configure the Ethernet for VLAN and Quality of Service (QoS).

VLAN tagging

By default, all user and management traffic is allocated the same VLAN across the link.

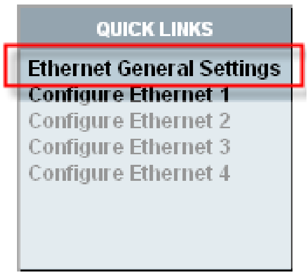
Alternatively, you can assign each of the four Ethernet ports to a VLAN. Each VLAN can be configured to carry user traffic, or user traffic and radio management traffic. The VLAN tagging conforms to IEEE 802.1Q standard.

Configuring the Ethernet switch for VLAN tagging

1. Select Link or Local or Remote > Interface > Ethernet Settings.

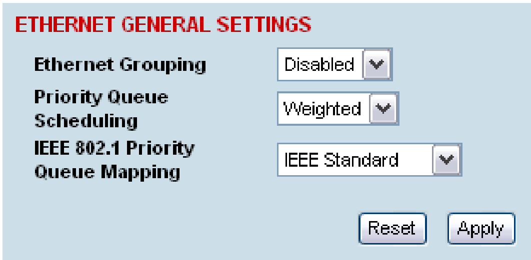
Note: Always configure the remote terminal before the local terminal

2. In the Quick Links box at the bottom of the page, click Ethernet General Settings.



3. From Ethernet Grouping drop-down list select 'Enabled' ('Disabled' is the default setting; Ethernet traffic is not segregated).

Important: Changing this setting will disrupt Ethernet traffic.



4. Click Apply to apply changes or Reset to restore the previous configuration.

You now need to select the VLAN groups for each of the four Ethernet ports.

Specifying the VLAN ID for the Ethernet Ports

Each Ethernet port can be configured with one of five VLAN IDs. You can configure each of the physical ports, numbered 1 to 4 with a VLAN ID (numbered User1 to User4 and User+Mgmt).

These VLAN IDs are applied at the ingress port and only used internally across the link. The VLAN ID is removed when traffic exits the switch at the egress port. Data entering the Ethernet switch on ports 1 to 4 or the internal management port can only exit on ports that are associated with the same VLAN ID as the ingress port.

For example, the physical RJ-45 port 1 may be on VLAN 3 at the local end, but at the remote end, the physical RJ-45 port 4 may be associated with VLAN 3. Traffic entering the local end on port 1 will exit the remote end on port 4.

To allow the radio link to transport traffic using existing VLAN ID information, the radio adds an extra VLAN ID over the top of an existing VLAN ID (double-tagging). This extra VLAN ID is added at the ingress port and removed at the egress port. This adds 4 bytes to the packet and the maximum packet size supported by the radio is 1526 bytes.

Note 1: Tagged flows can only have one port per VLAN ID on each terminal.

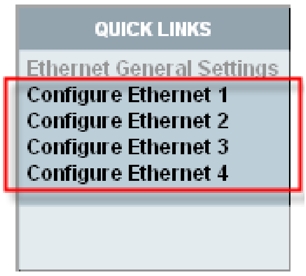
Note 2: The ethernet switch only supports packets up to 1522 bytes in size at the ingress port.

---

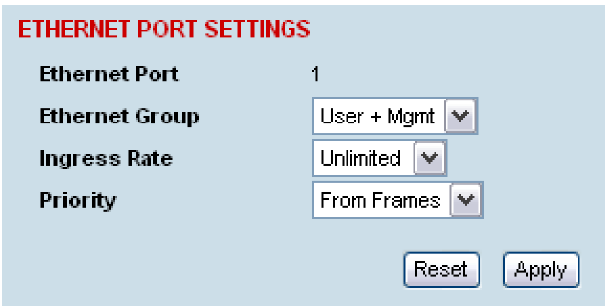
1. Select Link or Local or Remote > Interface > Ethernet Settings.

   Note: Always configure the remote terminal before the local terminal

2. In the Quick Links box at the bottom of the page, select the port you want to configure:



3. The Ethernet Port Settings page appears for the port you selected:



4. From the Ethernet Group drop-down list, select the VLAN group to which you want this port to belong.

   Important: To access radio management traffic, you need to allocate one of the VLANs to ‘User and Management’. It is strongly recommended that you indicate which port or group of ports is associated to the management traffic first.

5. Click Apply.
6. Repeat steps 1-4 for the Ethernet switch in the other terminal in the link.

Quality of Service

Quality of Service (QoS) enables network operators to classify traffic passing through the Ethernet switch into prioritized flows.

Each port can have a priority tag set at the ingress port, or it can be read directly from the Ethernet traffic. When read directly from the Ethernet traffic, the following fields are used to determine the traffic's QoS priority.

- The IEEE 802.1p Priority information in the IEEE 802.3ac Tag.
- The IPv4 Type of Service field.
- The IPv6 Traffic Class field.

You can select one of two queuing methods:

- IEEE 802.1p standard method
- Cisco-proprietary method

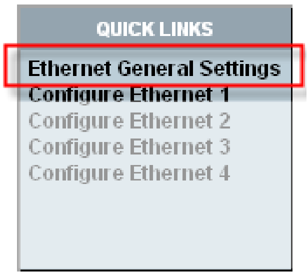
The queuing method determines how the traffic is prioritized.

Each port has four egress queues (queues 0-3) of differing priorities. Queue 0 is the lowest priority and Queue 3 is the highest priority.

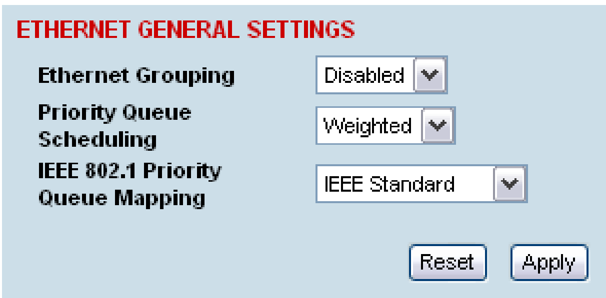
Configuring the Ethernet Switch for QoS

1. Select Link or Local or Remote > Interface > Ethernet Settings.

2. In the Quick Links box at the bottom of the page, click Ethernet General Settings.



The Ethernet General Settings page:



3. Leave Ethernet Grouping set to 'Disabled' (unless you want to enable VLAN tagging).

4. Select the Priority Queue Scheduling.

There are two methods for transmitting the Ethernet traffic queues across the link:

- Strict: the queue is transmitted based on the priority. The first queue transmitted is the highest priority queue and the terminal will not transmit any other traffic from any other queue until the highest priority queue is empty. Then the next highest priority queue is transmitted, and so on.
- Weighted (default): each of the queues will transmit a number of packets based on a weighting. The following table shows how the weighting is applied to each queue.

Queue	Priority	Number of packets transmitted
Queue 3	Highest Priority	8 packets
Queue 2		4 packets
Queue 1		2 packets
Queue 0	Lowest Priority	1 packets

5. Select the IEEE 802.1 Priority Queue Mapping.

This determines the standard (or scheme) used for prioritizing traffic into one of four queues numbered 0 to 3 (3 being the highest priority queue).

There are two possible methods for queuing the ethernet traffic. One is based on the IEEE 802.1D standard (which is the default setting), and the other is based on the Cisco-proprietary method.

The following table shows how traffic is queued using the two methods:

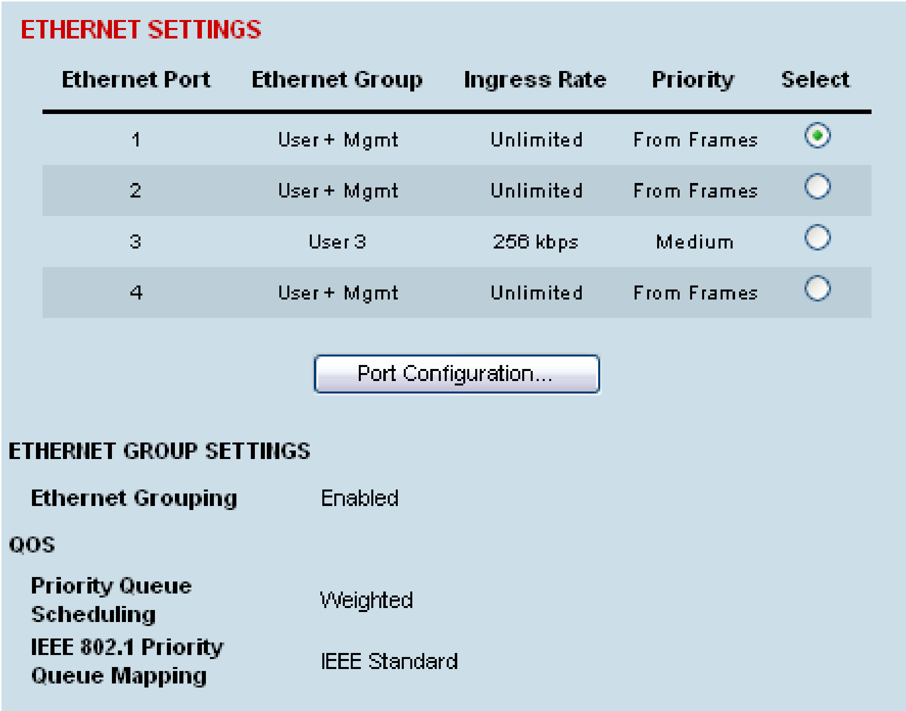
		Output Queue	
Priority	**Traffic Type**	**Cisco Priority Queuing**	**IEEE 802.1D Priority Queuing**
0 (default)	Best Effort	0	1
1	Background	0	0
2	Spare	1	0
3	Excellent Effort	1	1
4	Controlled Load	2	2
5	'Video' < 100ms latency and jitter	2	2
6	'Video' < 10ms latency and jitter	3	3
7	Network Control	3	3

Configuring the Ethernet Ports for QoS

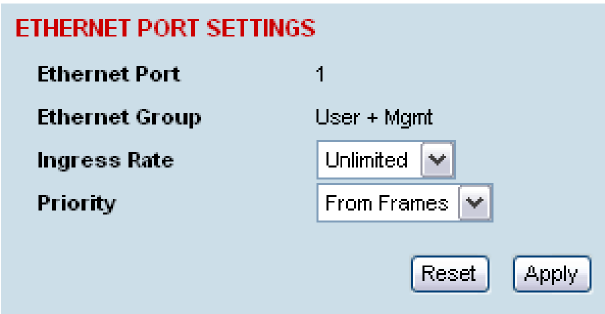
Each Ethernet port can be configured for Ingress Rates and Priority queues.

To configure the Ethernet ports for QoS:

1. Select Link or Local or Remote > Interface > Ethernet Settings.



2. Select the port you want to configure and click Port Configuration.



3. Select the required Ingress Rate for this port.

   The ingress rate (input data rate) limits the rate that traffic is passed into the port. Operators can protect the terminal's traffic buffers against flooding by rate-limiting each port.

Ingress Rate	
Unlimited	Default
128 kbit/s	
256 kbit/s	
512 kbit/s	
1 Mbit/s	
2 Mbit/s	
4 Mbit/s	
8 Mbit/s	

4. Select the Priority for all Ethernet data entering this port.

   The priority specifies where the priority control information is sourced from.

   From Frames

   Traffic is prioritized into one of the following traffic types (numbered 0 to 7) by the originating device or application. Generally, the higher the priority, the higher the priority rating.

   However, in the IEEE standard queuing scheme, the ordering of the priority is 1, 2, 0, 3, 4, 5, 6, 7. In this case 0 has a higher priority than 1 and 2.

   If priority control information is present in the Ethernet header, this information is used to priorities the traffic but if there is no priority control information in the Ethernet header, the IP header is used to priorities the traffic.

   Low, Medium, High, Very High

   The priority rating you select is applied to all traffic on the port and is applied to all traffic irrespective of traffic type and the priority control information in the traffic.

5. Click Apply to apply changes or Reset to restore the previous configuration.

Viewing the Status of the Ethernet Ports

Select Link or Local or Remote > Interface > Switch Summary.

ETHERNET HUB STATUS

Port	Speed	Duplex	Status
1	100 Mbps	Full	Active
2	10 Mbps	Half	Active
3	10 Mbps	Half	Inactive
4	10 Mbps	Half	Inactive

For each port the following is shown:

- Speed — the data rate (in Mbit/s) of the port.
- Duplex — whether half or full duplex.
- Status — whether there is a cable plugged into the port (active) or not (inactive).

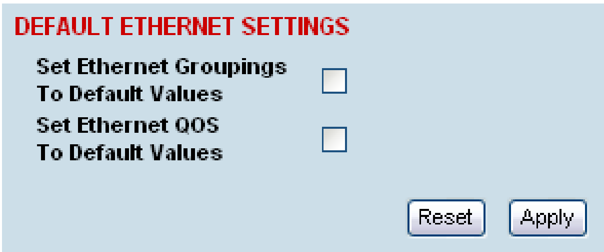
Note: The Ethernet ports on the terminal are set to auto-configure the speed and duplex for the best performance.

Resetting the Ethernet Settings

You can easily reset the VLAN and QoS settings to the default values, if required. This is useful if you want the Ethernet switch to operate in the default mode, that is, IP packets are passed across the link as received.

Note: You can also do this using the Setup menu (see page 57.).

1. Select Link or Local or Remote > Interface > Default Ethernet Settings.



Set Ethernet Groupings To Default Values.

This resets the Ethernet Grouping setting to 'Disabled', which means that the Ethernet switch no longer operates as a VLAN. In addition, all the Ethernet ports will default to the 'User and Management' Ethernet Group.

Set Ethernet QoS To Default Values.

This resets the ingress rate for all the ports to 'Unlimited' and the priority to 'From Frames'. In addition, the Ethernet QoS settings are reset to the defaults: Priority Queue Scheduling reverts to 'Weighted' and IEEE 802.1 Priority Queue Mapping reverts to 'IEEE Standard'.

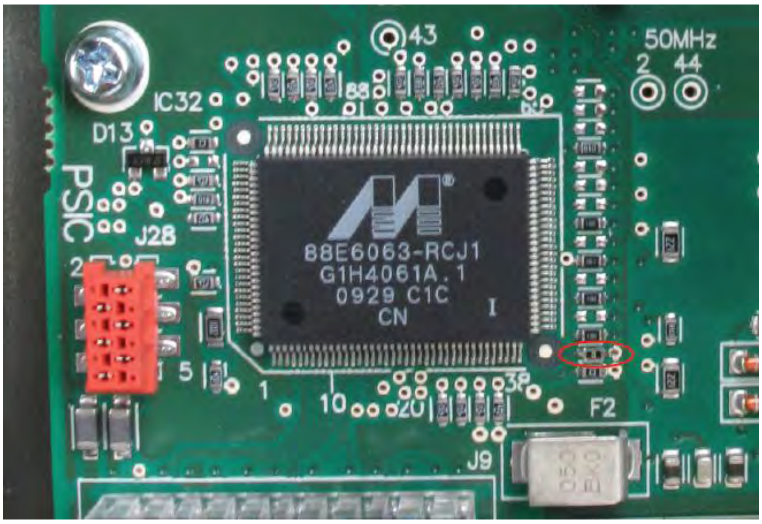
2. Click Apply to apply changes or Reset to restore the previous configuration.

Ethernet Port Startup

In previous Aprisa XE software versions, the Ethernet switch ports where enabled when the radio powered up.

In software version 8.6.53, the mode of operation was changed to disable the Ethernet switch ports until the radio software has completed booting. This enhancement has been implemented to meet customer requirements.

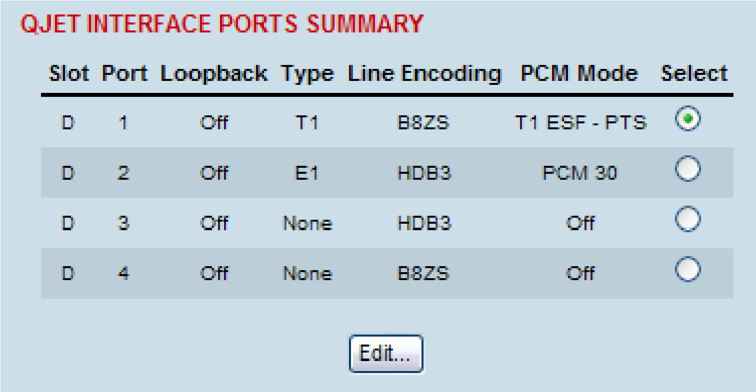
A hardware modification is required to the Aprisa XE motherboard to enable this enhancement (0 ohm resistor fitted).



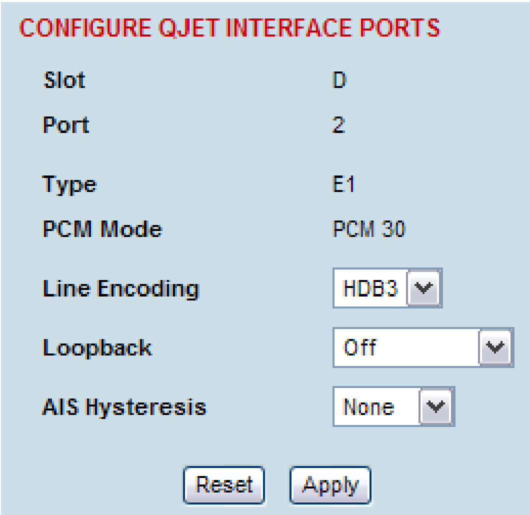
If the Aprisa XE motherboard hardware modification has been done, the Aprisa XE software version 8.6.53 or greater will be required to operate the radio. If Aprisa XE software prior to this version is used, the Ethernet ports will not enable. For this reason, an Aprisa XE running software version 8.6.53 cannot be downgraded to an earlier software version.

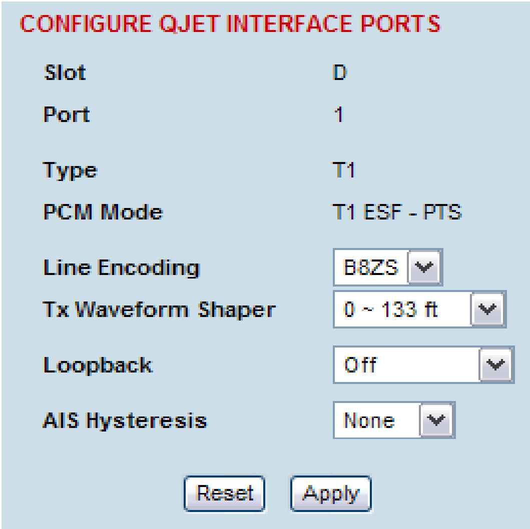
QJET Port Settings

1. Select Link or Local or Remote > Interface > Interface Summary, then select the QJET interface and click Configure Interface.



2. Select the QJET port to be configured and click Edit.





3. Set the QJET Line Encoding:

   For an E1 port, set the E1 Line Encoding as required to either HDB3 or AMI. The default is HDB3.

   For a T1 port, set the T1 Line Encoding as required to either B8ZS or AMI. The default is B8ZS.

4. Set the QJET T1 Tx Waveform Shaper (T1 only).

The Tx Waveform Shaper applies 1/√f pre-emphasis to the transmit waveform to ensure the waveform meets the G.703 pulse mask at the interconnect point. Waveform shaping assumes the use of 22 gauge (0.32 mm^2) twisted-pair cable. The default is 0 ~ 133 ft.

Cable Length Range	
0 ~ 133 ft	Default
133 ~ 266 ft	
266 ~ 399 ft	
399 ~ 533 ft	
533 ~ 655 ft	

5. Loopback controls the port loopbacks (see 'Interface Loopbacks' on page 242).

Setting	Function
Off	No port loopback
Line Facing	Port traffic from the customer is transmitted over the RF link but is also looped back to the customer
Radio Facing	Traffic received from the RF link is passed to the customer port but is also looped back to be transmitted over the RF link

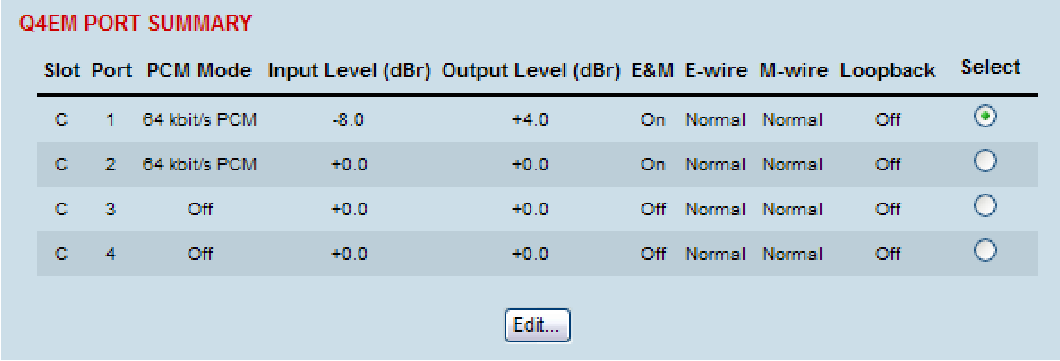
Note: The QJET E1 / T1 port green LED flashes when the loopback is active.

6. AIS Hysteresis sets the number of seconds after a Modem LOS that AIS is sent.

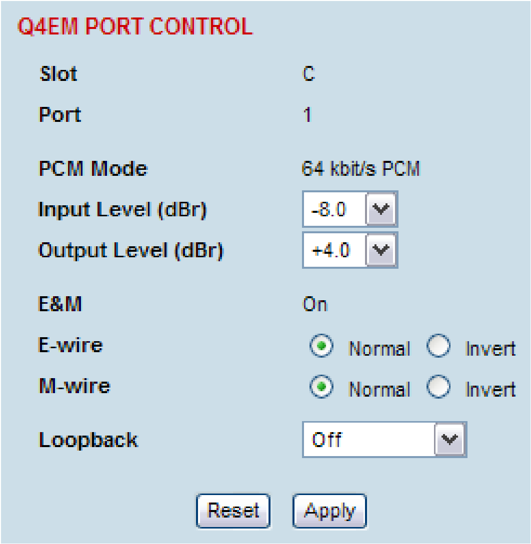
7. Click Apply to apply changes or Reset to restore the previous configuration.

Q4EM Port Settings

1. Select Link or Local or Remote > Interface > Interface Summary, select the Q4EM interface, and click Configure Interface.



2. Select the Q4EM port to be configured, and click Edit.



'Slot' shows the slot the Q4EM interface card is plugged into in the terminal (A – H).

'Port' shows the interface port number (1-4).

'PCM Mode' shows the current mode assigned to the port by the cross connect.

'E&M' shows if the E&M signalling on the port has been activated by the cross connect.

'Loopback' controls the 4 wire analogue port loopbacks.

3. Set the Q4EM Output level and the Input level required.

Signal Direction	Level adjustment range	Default setting
Input level (L_i)	-14.0 dBr to +4.0 dBr in 0.5 dB steps	+0.0 dBr
Output level (L_o)	-14.0 dBr to +4.0 dBr in 0.5 dB steps	+0.0 dBr

It is important that analogue signals presented from the Q4EM interface be normalized to fit within the ± 127 quantizing steps of the encoder. This is done by adjusting the circuit levels relative to the 0 dBm (± 118 peak code) for example:

- If a nominal input level of -6.0 dBm is applied to the Q4EM interface input port, the Q4EM Input Level must be set to -6.0 dBr. This will effectively amplify the sent signal by 6.0 dB to produce a digital signal with a ± 118 peak code (0 dBm).
- If a nominal output level of -6.0 dBm is required from the Q4EM interface output port, the Q4EM Output Level must be set to -6.0 dBr. This will effectively attenuate the received decoded signal by 6 dB.

4. Set the Q4EM E wire interface to either Normal or Inverted.

   This determines the state of the CAS bit relative to the state of the E wire:

E wire output	CAS bit Normal (default)	CAS bit Inverted
Output Active	0	1
Output Inactive	1	0

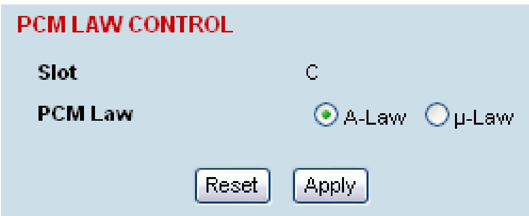
5. Set the Q4EM M wire interface to either Normal or Inverted.

   This determines the state of the CAS bit relative to the state of the M wire:

M wire input	CAS bit Normal (default)	CAS bit Inverted
Input Active	0	1
Input Inactive	1	0

6. Click Apply to apply changes or Reset to restore the previous configuration.
7. Select Q4EM PCM Law Control from the Quick Links box.

   This option sets the companding law used by the four ports on the Q4EM card.



- A-Law is used internationally (default).
- µ-Law is used in North America and Japan.

Note: The PCM Law Control controls all four ports on the Q4EM card. To run a mixture of µ-Law and A-Law interfaces, multiple Q4EM cards are necessary.

8. Loopback controls the port loopbacks (see ‘Interface Loopbacks’ on page 242).

Setting	Function
Off	No port loopback
Line Facing	Port traffic from the customer is transmitted over the RF link but is also looped back to the customer
Radio Facing	Traffic received from the RF link is passed to the customer port but is also looped back to be transmitted over the RF link

Loop Interface Circuits

DFXO / DFXS Loop Interface Circuits

Function

The function of DFXO / DFXS 2 wire loop interface circuits is to transparently extend the 2 wire interface from the exchange line card to the telephone / PBX, ideally without loss or distortion.

The DFXO interface simulates the function of a telephone and a DFXS interface simulates the function of an exchange line card. These circuits are known as 'ring out, dial in' 2 wire loop interface circuits.

Network Performance

The overall Network Performance is dependant on the number of D-A and A-D conversions and 2 wire to 4 wire / 4 wire to 2 wire conversions in the end to end circuit (telephone to telephone). To achieve the best overall Network Performance, the number of D-A and A-D conversions and 2 wire to 4 wire / 4 wire to 2 wire conversions should be minimized.

Circuit Performance

The circuit quality achieved with a 2 wire voice circuit is very dependant on the external interface parameters and the interconnecting copper line.

Short interconnecting copper lines (< 100 meters), have little effect on the circuit performance so the interface parameters have the dominant affect on circuit performance.

As the length of the interconnecting copper line is increased, the attenuation of the analogue signal degrades circuit performance but also the impedance of the copper line also has a greater effect on the circuit performance. For this reason, complex line impedance networks (e.g. TBR21, TN12) were created which model the average impedance of the copper network.

The factors that affect the quality of the circuit achieved are;

DFXO interface

- The degree of match between the DFXO line termination impedance, the impedance of the interconnecting copper line and the exchange line card line termination impedance. This affects the return loss.
- The degree of match between the DFXO line termination impedance, the impedance of the interconnecting copper line and the exchange line card hybrid balance impedance. This affects the exchange line card transhybrid balance.
- The degree of match between the DFXO hybrid balance impedance, the impedance of the interconnecting copper line and the exchange line card line termination impedance. This affects the DFXO transhybrid balance.
- The circuit levels of both the DFXO and the exchange line card.

DFXS interface

- The degree of match between the DFXS line termination impedance, the impedance of the interconnecting copper line and the telephone line termination impedance. This affects the return loss.
- The degree of match between the DFXS line termination impedance, the impedance of the interconnecting copper line and the telephone hybrid balance impedance. This affects the telephone transhybrid balance.
- The degree of match between the DFXS hybrid balance impedance, the impedance of the interconnecting copper line and the telephone line termination impedance. This affects the DFXS transhybrid balance.
- The circuit levels of both the DFXS and the telephone.

Line Termination Impedance

The line termination impedance (Zt) is the impedance seen looking into the DFXO or DFXS interface. The line termination impedance is not the same as the hybrid balance impedance network (Zb) but can be set to the same value.

Changing the DFXO / DFXS impedance setting on the Aprisa XE changes both the line termination impedance and the hybrid balance impedance to the same value.

Hybrid Balance Impedance

The hybrid balance impedance (Zb) is the impedance network on the opposite side of the hybrid from the DFXO / DFXS line interface. The purpose of this network is to balance the hybrid to the impedance presented to the DFXO / DFXS line interface.

Changing the DFXO / DFXS impedance setting on the Aprisa XE changes both the line termination impedance and the hybrid balance impedance to the same value.

Transhybrid loss

Transhybrid loss is a measure of how much analogue signal received from the remote terminal is passed across the hybrid and sent to the remote terminal.

The transhybrid loss is maximized when the hybrid balance impedance matches the impedance presented to the DFXO / DFXS line interface. An optimized hybrid minimizes circuit echo.

Circuit Levels

The 8 bit digital word for each analogue sample encoded (A law), has a maximum of 255 quantizing code steps, a maximum of + 127 for positive signals and a minimum of - 127 for negative signals. No signal is represented by the code step 0.

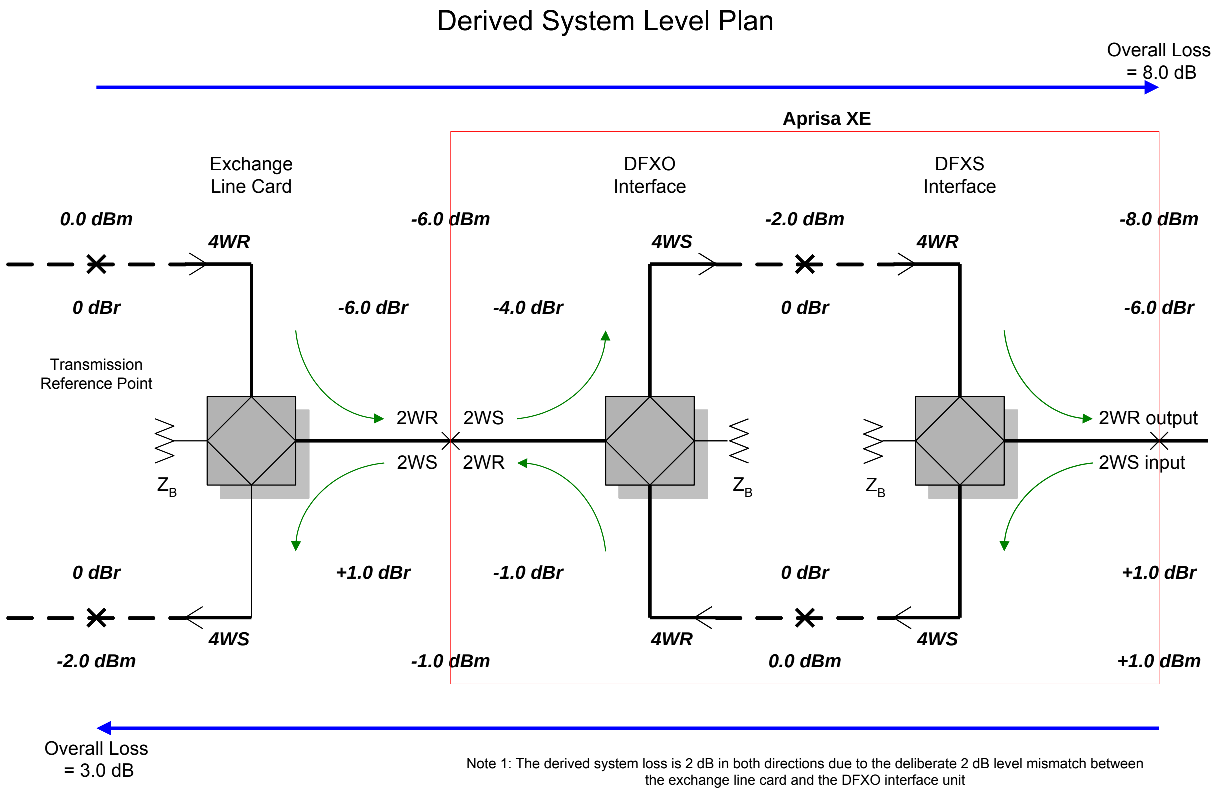
A nominal level of 0 dBm generates a peak code of ± 118 which allows up to + 3.14 dBm0 of headroom before the maximum step of 127 is obtained. Any level greater than + 3.14 dBm0 will be distorted (clipped) which will cause severe problems with analogue data transmission.

It is therefore important that analogue signals presented from the DFXO / DFXS line interface be normalized to fit within the ± 127 quantizing steps of the encoder. This is done by adjusting the circuit levels relative to the 0 dBm (± 118 peak code) for example:

- If a nominal input level of +1 dBm is applied to the DFXS line interface, the DFXS Input Level must be set to +1.0 dBr. This will effectively attenuate the sent signal by 1 dB to produce a digital signal with a 118 peak code (0 dBm).
- If a nominal output level of -6 dBm is required from the DFXS line interface, the DFXS Output Level must be set to -6.0 dBr. This will effectively attenuate the received signal by 6 dB.

The circuit levels and the transhybrid loss of both ends of the circuit, also determine the stability of the circuit. If the circuit levels are too high and the transhybrid loss figures achieved are too low, the circuit can have a positive loop gain and can recirculate (sometimes called singing).

Typically, an end to end 2 wire voice circuit is engineered to have a 2-3 dB loss in both directions of transmission.



E1 CAS to DFXS Circuits

Function

E1 CAS to DFXS circuits can be provisioned over an Aprisa XE link by using a DFXS interface card at the customer end of the link and a QJET at the exchange end of the link. The QJET E1 interface connects to an exchange or PBX Digital Trunk Interface (DTI) to provide FXS foreign exchange circuits.

The Aprisa XE can interconnect at E1 to an exchange / PBX DTI if the DTI is capable of providing standard 1 bit channel associated signalling (CAS).

Forward	Af	Backward	Ab
Idle	1	Idle	1
Ringing	0	Loop (Off hook)	0

The signalling functions provided with a 1 bit CAS protocol are:

- Ring cadence transmission
- Ring trip
- Off hook
- Switch hook flash
- Decadic dialling

The speech path functions as normal and provides:

- Transmission of tones (e.g. dial tone, ring tone)
- Caller ID
- DTMF dialling
- Speech

Setup

Cross connect the voice channel between the QJET and the DFXS card.

Cross connect the signalling (A bit only) using ‘4 wire compatible’ mode between the QJET and the DFXS card.

Configure the E1 spare CAS bits to be compatible with the DTI (see ‘QJET Spare CAS Bit Control’ on page 165). The standard spare bit states are B = 1, C = 0, D = 1.

DFXS to DFXS Hotline Circuits

Function

A ‘Hotline’ circuit can be provisioned over an Aprisa XE link by using a DFXS interface card at both ends of the link. When one phone goes off hook, the other phone rings and vice versa.

A 1 bit CAS protocol is used to signal between the DFXS interfaces:

Forward	Af	Backward	Ab
Idle	1	Idle	1
Ringing	0	Loop (Off hook)	0

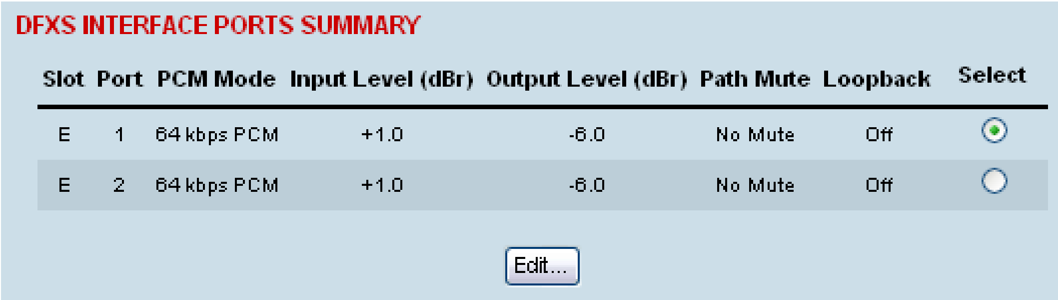
Setup

Cross connect the voice channel on both DFXS cards.

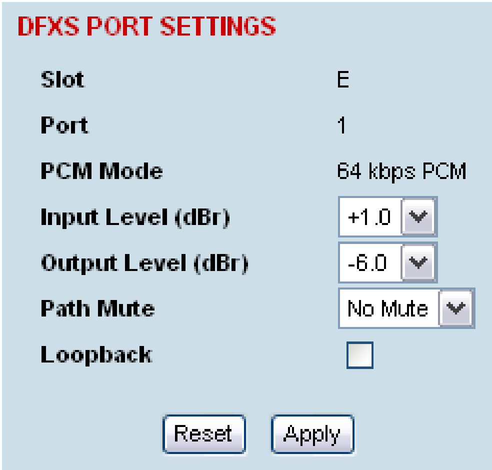
Cross connect the signalling (A bit only) using ‘4 wire compatible’ mode on both DFXS cards.

DFXS Port Settings

1. Select Link or Local or Remote > Interface > Interface Summary, then select the DFXS interface and click Configure Interface.



2. Select the DFXS port to configure, and click Edit.



'Slot' shows the slot the DFXS interface card is plugged into in the terminal (A – H).

'Port' shows the interface port number (1-2).

‘PCM Mode’ shows the current mode assigned to the port by the cross connect.

‘Loopback’ loops back the port digital paths to return the port analogue signal back to the customer.

‘Path Mute’ mutes the TX or RX digital path. This function is used to mute the return direction of transmission during A-A intrinsic performance testing as recommended in ITU G.712 para 1.2 Port definitions.

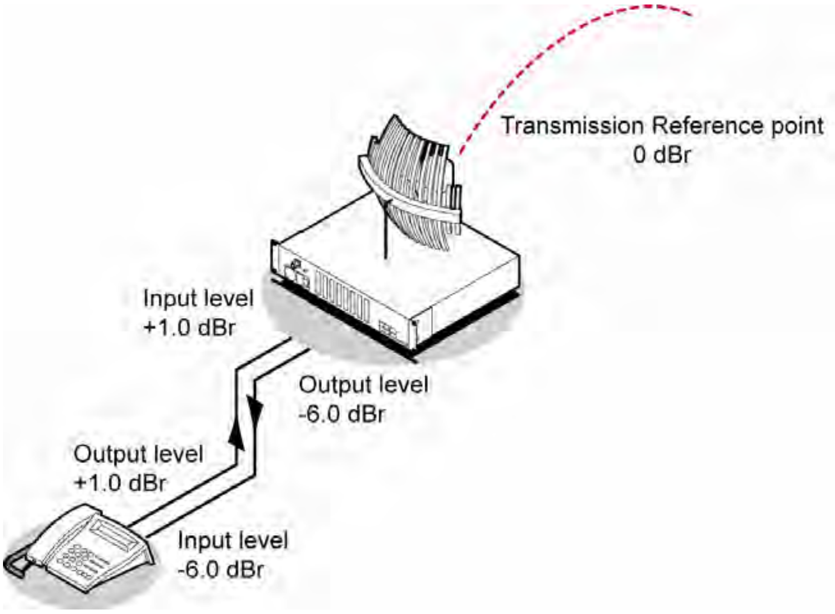
Path Mute	Description	
No Mute	Normal signal transmission in both directions	Default
Mute TX	Mutes the transmit digital path i.e. the signal from the DFXS to the DFXO is muted	
Mute RX	Mutes the receive digital path i.e. the signal from the DFXO to the DFXS is muted	

3. Set the DFXS Input Level and the Output Level required:

Signal Direction	Level adjustment range	Default setting
Input Level (L_i)	-9.0 dBr to +3.0 dBr in 0.5 dB steps	+1.0 dBr
Output Level (L_o)	-9.5 dBr to +2.5 dBr in 0.5 dB steps	-6.0 dBr

In the example shown below, the Customer Premises Equipment is a telephone connected to a DFXS card.

The levels are set based on the system using a 0 dBr transmission reference point.



DFXS Input Level setting

The telephone has a nominal output level of +1 dBr. To achieve a transmission reference point transmit level of 0 dBr, the DFXS Input Level is set to +1 dBr (effective T pad loss of 1 dB).

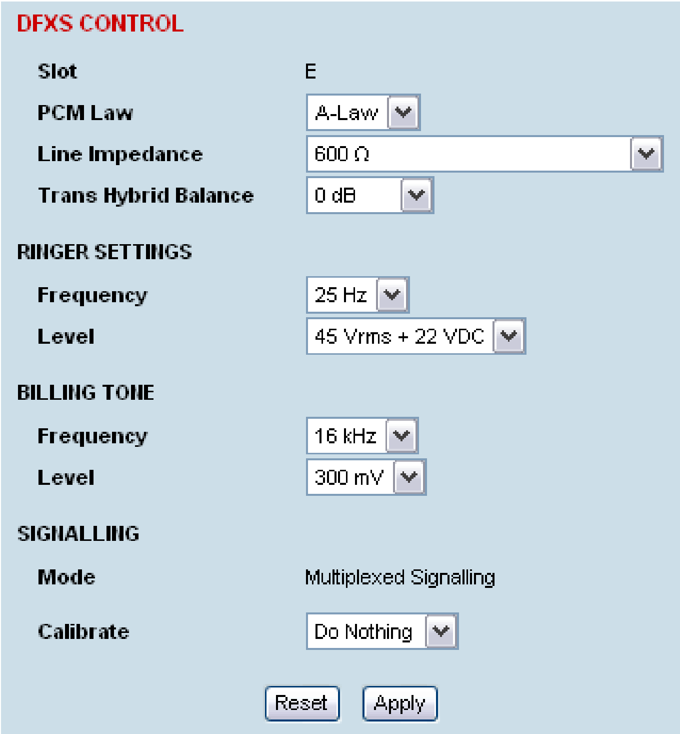
DFXS Output Level setting

The telephone has a nominal input level of -6 dBr. With a transmission reference point received level of 0 dBr, the DFXS Output level is set to -6 dBr (effective R pad loss of 6 dB).

4. Click Apply to apply changes or Reset to restore the previous configuration.

5. Select the DFXS Control.

The DFXS Control page sets values for both ports on the DFXS card. The cards are shipped with the default values shown in the illustration below:



'Slot' shows the slot the DFXS interface card is plugged into in the terminal (A – H).

6. Select the DFXS PCM Law.

This option sets the companding law used by both ports on the DFXS card.

- A-Law is used internationally (default)
- µ-Law is used in North America and Japan.

Note: To run a mixture of µ-Law and A-Law interfaces, multiple DFXS cards are necessary.

---

7. Select the DFXS Line Impedance

This option sets the DFXS line termination impedance and the hybrid balance impedance to the same value.

Selection	Description	
600 Ω	Standard equipment impedance	Default
600 Ω + 2.16 uF	Standard equipment impedance with low frequency roll-off	
900 Ω	Typically used on loaded cable pairs	
900 Ω + 2.16 uF	Typically used on loaded cable pairs with low frequency roll-off	
TN12	Standard complex impedance for Australia	
TBR21	Widely deployed complex impedance	
BT3	Standard complex impedance for New Zealand	

- On a short line (< 100 meters), the selected impedance should match the impedance of the phone (off-hook).
- On a long line (> 1000 meters), the selected impedance should match the impedance of the phone (off-hook) as seen through the line.

If you are not sure what the expected impedance value should be, check with the CPE equipment supplier.

8. Set the DFXS Transhybrid Balance (usually not required to change).

The default Transhybrid Balance value (0 dB), provides the best circuit performance where the balance impedance (set by the Line Impedance setting) matches the impedance of the line.

You should only adjust the transhybrid balance when the balance impedance does not match the actual line impedance. You can achieve small circuit improvements using this option.

9. Set the DFXS Ringer Frequency.

This option sets the DFXS Ringing Frequency.

Selection	Description	
17 Hz	Used in older networks	
25 Hz	Standard ringing frequency	Default
50 Hz	Used by some telephone exchanges	

10. Set the DFXS Ringer Output Voltage.

This option sets the DFXS open circuit Ringing Output Voltage which is sourced via an internal ringing resistance of 178 Ω per port.

The DC offset on the AC ringing signal enables ring trip to occur with a DC loop either during ringing cycles. The normal DC line feed voltage enables ring trip to occur with a DC loop in the silent period between the ringing cycles.

Selection	Description	
60 Vrms + 0 VDC	Outputs 60 VRMS ringing with no DC offset Maximum ringing voltage for high ringing load applications but no DC ring trip	
55 Vrms + 10 VDC	Outputs 55 VRMS ringing with a 10 VDC offset Medium ringing load applications	
50 Vrms + 18 VDC	Outputs 50 VRMS ringing with a 18 VDC offset Above average ringing load applications	
45 Vrms + 22 VDC	Outputs 45 VRMS ringing with a 22 VDC offset Typical application	Default
40 Vrms + 24 VDC	Outputs 40 VRMS ringing with a 24 VDC offset Lowest terminal power consumption	

11. Select the DFXS Billing Tone Frequency.

This option sets the frequency of billing tone generation. If you are not sure what the expected frequency of the billing tone should be, check with the exchange equipment supplier.

Selection	Description	
12 kHz	Use if the CPE requires a 12 kHz billing tone signal	
16 kHz	Use if the CPE requires a 16 kHz billing tone signal	Default

12. Select the DFXS Billing Tone Level.

This option sets the DFXS billing tone output level which is defined as the voltage into 200 Ω with a source impedance equal to the Line Impedance setting.

The billing tone voltage into 200 Ω is limited by the maximum open circuit voltage of 1 Vrms. The drop down list reflects the maximum allowable billing tone output voltage for the Line Impedance setting selected.

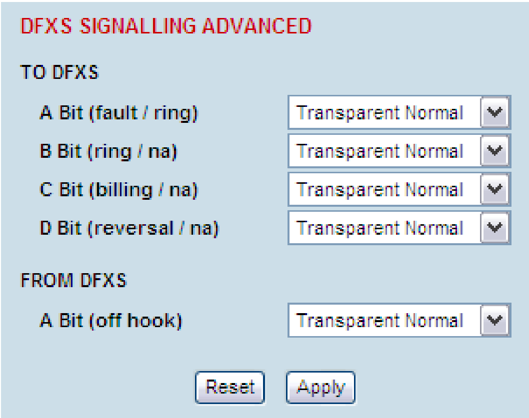
Selection	Description	
400 mV rms	Billing tone voltage setting available for line impedances of TN12, BT3 and TBR21.	
300 mV rms	Billing tone voltage setting available for line impedances of TN12, BT3, TBR21 and 600 Ω.	Default
200 mV rms	Billing tone voltage setting available for line impedances of TN12, BT3, TBR21, 600 Ω and 900 Ω.	
100 mV rms	Billing tone voltage setting available for all line impedance settings.	

13. The DFXS billing tone Attack Ramp time can be adjusted to reduce the interference which can be produced when a signal turns on quickly. The attack ramp time is how long the billing tone generator takes to ramp up to full level when it is turned. The default ramp time is 1 ms.

14. The DFXS Signalling Advanced options are used to control the four CAS bits ABCD in the DFXO to DFXS direction of transmission and one CAS bit A in the DFXS to DFXO direction of transmission. This option sets the signalling for both DFXS card ports.

Transparent Normal mode is used for normal traffic and Transparent Inverted mode can be used for special signalling requirements when a function needs to be reversed e.g. to change the idle polarity of the DFXS line feed voltage.

Forced modes are used to disable particular functions e.g. when polarity reversals are not required. They can also be used for system testing e.g. to apply DFXS continuous ringing output



Selection	Description	
Transparent Normal	Normal transparent transmission of the CAS bit	Default
Transparent Inverted	Transparent transmission of the CAS bit but inverts the polarity.	
Forced Normal	Sets the CAS bit to 1 (inactive).	
Forced Inverted	Sets the CAS bit to 0 (active).	

DFXO to DFXS

CAS Bit	Forced Normal	Forced Inverted
A bit (fault)	Sets the CAS A bit to 1 continuous fault state	Sets the CAS A bit to 0 no fault state
B bit (ring)	Sets the CAS B bit to 1 no DFXS ringing output.	Sets the CAS B bit to 0 continuous DFXS ringing output.
C bit (billing)	Sets the CAS C bit to 1 no DFXS billing tone output.	Sets the CAS C bit to 0 continuous DFXS billing tone output.
D bit (reversal)	Sets the CAS D bit to 1 no DFXS polarity reversal	Sets the CAS D bit to 0 continuous DFXS polarity reversal

From DFXS to DFXO

CAS Bit	Forced Normal	Forced Inverted
A bit (off hook)	Sets the CAS A bit to 1 no DFXO off hook	Sets the CAS A bit to 0 continuous DFXO off hook

QJET to DFXS

CAS Bit	Forced Normal	Forced Inverted
A bit (ring)	Sets the CAS A bit to 1 no DFXS ringing output.	Sets the CAS A bit to 0 continuous DFXS ringing output.
B bit (na)	Not Applicable	Not Applicable
C bit (na)	Not Applicable	Not Applicable
D bit (na)	Not Applicable	Not Applicable

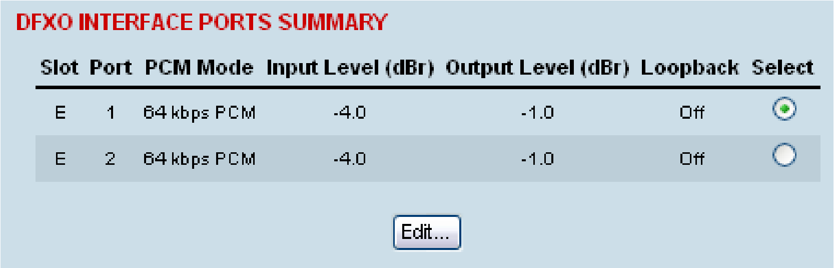
From DFXS to QJET

CAS Bit	Forced Normal	Forced Inverted
A bit (off hook)	Sets the CAS A bit to 1 Idle state to E1 port	Sets the CAS A bit to 0 Off hook state to E1 port

15. Click Apply to apply changes or Reset to restore the previous configuration.

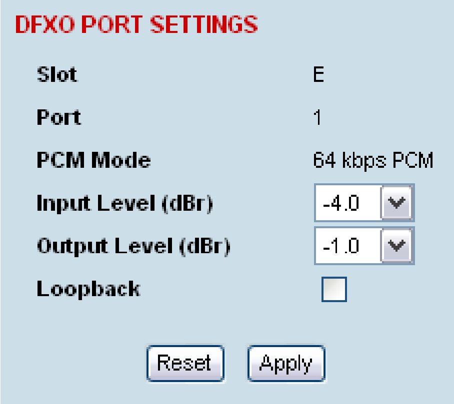
DFXO Port Settings

1. Select Link or Local or Remote > Interface > Interface Summary, then select the DFXO interface and click Configure Interface.


DFXO INTERFACE PORTS SUMMARY

Slot	Port	PCM Mode	Input Level (dBr)	Output Level (dBr)	Loopback	Select
E	1	64 kbps PCM	-4.0	-1.0	Off	
E	2	64 kbps PCM	-4.0	-1.0	Off	

2. Select the DFXO port to configure, and click Edit.



'Slot' shows the slot the DFXO interface card is plugged into in the terminal (A – H).

'Port' shows the interface port number (1-2).

‘PCM Mode’ shows the current mode assigned to the port by the cross connect.

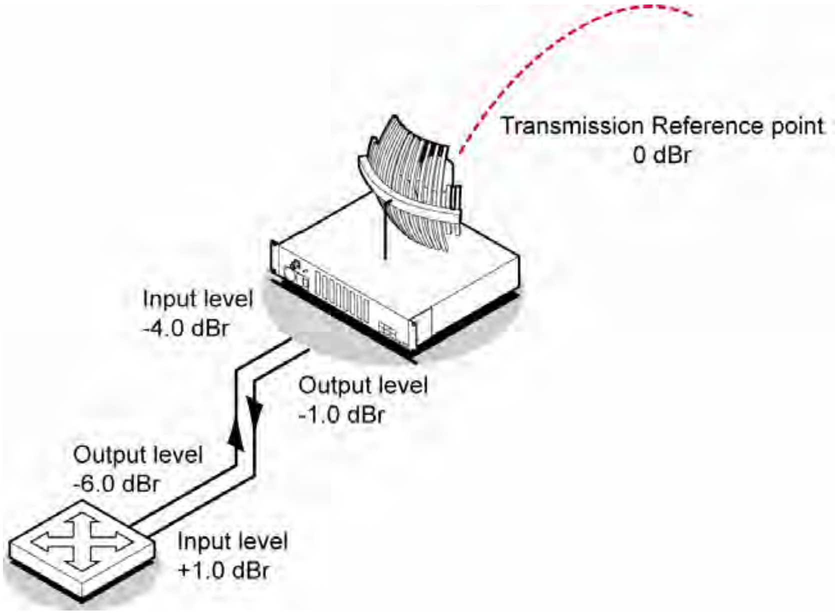
‘Loopback’ loops back the port digital paths to return the port analogue signal back to the customer.

3. Set the DFXO Input Level and the Output Level required:

Signal Direction	Level adjustment range	Default setting
Input Level (L_i)	-10.0 dBr to +1.0 dBr in 0.5 dB steps	-4.0 dBr
Output Level (L_o)	-10.0 dBr to +1.0 dBr in 0.5 dB steps	-1.0 dBr

In the example shown below, the PSTN exchange line card is connected to a DFXO card.

The levels are set based on the system using a 0 dBr transmission reference point.



DFXO Input Level setting

The exchange line card has a nominal output level of -6 dBr. To achieve a digital reference point transmit level of -2.0 dBm0, the DFXO input level is set to -4.0 dBr (effective T pad gain of 4.0 dB).

The deliberate 2 dB of loss between the exchange line card and the DFXO provides a 2 dB of overall circuit loss between the DFXO and the DFXS.

DFXO Output Level setting

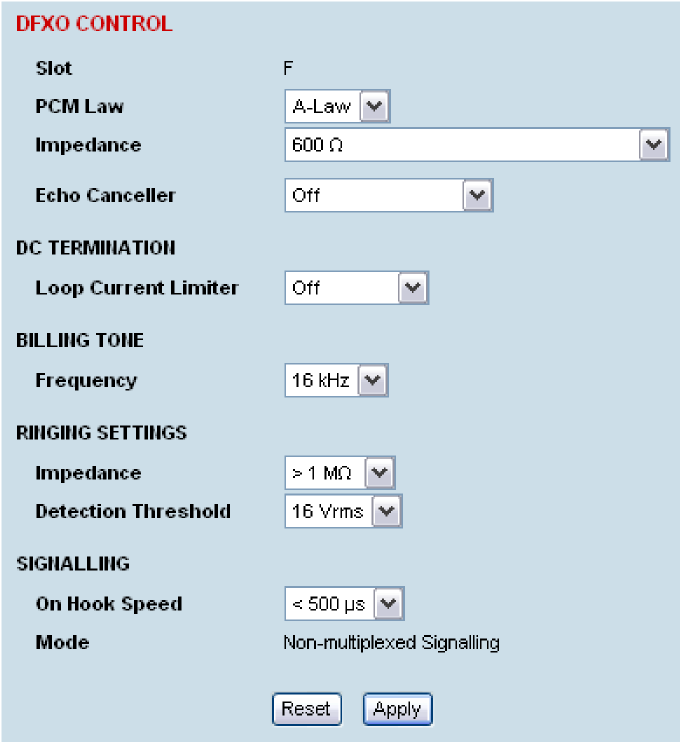
The exchange line card has a nominal input level of +1.0 dBr. With a transmission reference point received level of -2.0 dBm0, the DFXO output level is set to -1.0 dBr (effective R pad loss of 1.0 dB).

The deliberate 2 dB of loss between the exchange line card and the DFXO provides a 2 dB of overall circuit loss between the DFXS and the DFXO.

4. Click Apply to apply changes or Reset to restore the previous configuration.

5. Select the DFXO Control.

   The DFXO Control page sets values for both ports on the DFXO card. The cards are shipped with the default values shown in the illustration below:



   'Slot' shows the slot the DFXO interface card is plugged into in the terminal (A – H).

6. Select the DFXO PCM Law.

   This option sets the companding law used by both ports on the DFXO card.

   - A-Law is used internationally (default)
   - µ-Law is used in North America and Japan.

Note: To run a mixture of µ-Law and A-Law interfaces, multiple DFXO cards are necessary.

7. Select the DFXO Impedance

This option sets the DFXO line termination impedance and the hybrid balance impedance to the same value.

Selection	Description	
600 Ω	Standard equipment impedance	Default
600 Ω + 2.16 uF	Standard equipment impedance with low frequency roll-off	
900 Ω	Typically used on loaded cable pairs	
900 Ω + 2.16 uF	Typically used on loaded cable pairs with low frequency roll-off	
TN12	Standard complex impedance for Australia	
TBR21	Widely deployed complex impedance	
BT3	Standard complex impedance for New Zealand	
BT Network	Standard complex impedance for UK	
China	Standard complex impedance for China	

- On a short line (< 100 metres), the selected impedance should match the impedance of the exchange line card.
- On a long line (> 1000 metres), the selected impedance should match the impedance of the exchange line card as seen through the line.

If you are not sure what the expected impedance value should be, check with the exchange equipment supplier.

8. Enable the DFXO Echo Canceller if required.

The DFXO Echo Canceller provides up to 64 ms of echo cancellation. This feature is only available on Rev D (and later) DFXO cards.

Analogue data devices e.g. modems send a disable signal to disable any echo canceller in circuit while it trains its own echo canceller. There are two possible disable signals. ITU G.164 specifies a disable signal of a single 2100 Hz tone and ITU G.165 specifies a disable signal of 2100 Hz tone with phase reversals every 450 ms.

Selection	Description	
Off	No echo canceller operation.	Default
On	Echo canceller operational but without disabling.	
Auto Disable G.164	Echo canceller operational with automatic disabling using ITU G.164 2100 Hz tone.	
Auto Disable G.165	Echo canceller operational with automatic disabling using ITU G.165 2100 Hz tone with phase reversals every 450 ms.	

9. Set the DFXO Loop Current Limiter.

This option turns on a current limiter which limits the maximum current that can be drawn from the exchange line card by the DFXO interface.

As a general rule, only one interface should current limit so if the exchange interface current limits, the DFXO interface should be set to current limit off.

Selection	Description	
Off	Use if the exchange line interface uses current limiting.	Default
On (60 mA)	Use if the exchange line interface does not use current limiting. The DFXO limits the line loop current to 60 mA.	

Note: The DFXO provides an early warning over current alarm 'fxoCurrentOvld' if the loop current exceeds 100 mA for 2 seconds. This alarm clears when the loop current is less than 90 mA.

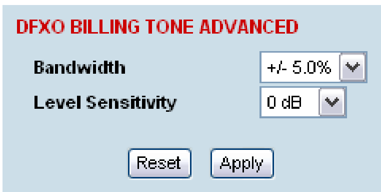
The DFXO also provides an over current safety shut down limit which removes its line loop if the loop current exceeds 160 mA.

10. Select the DFXO Billing Tone Frequency.

This option sets the frequency of billing tone detection. If you are not sure what the expected frequency of the billing tone should be, check with the exchange equipment supplier.

Selection	Description	
12 kHz	Use if the exchange outputs 12 kHz billing tone	
16 kHz	Use if the exchange outputs 16 kHz billing tone	Default

11. The DFXO Billing Tone Advanced sets the billing tone Bandwidth and the billing tone Level Sensitivity.



The DFXO billing tone Bandwidth determines the bandwidth of the band pass filter that is used by the billing tone detector in terms of +/- % of the billing tone frequency.

The adjustment range is +/- 1.5% to +/- 7.5% and the default value is +/- 5.0%.

The DFXO billing tone Level Sensitivity determines the DFXO detection sensitivity.

The adjustment range is 0 dB (metering detection threshold of -17 dBm measured across 200 Ω) to 27 dB (metering detection threshold of -40 dBm measured across 200 Ω) in 1 dB steps and the default value is 0 dB.

12. Select the DFXO On Hook Speed.

This option sets the slope of the transition between off-hook and on-hook.

Selection	Description	
< 500 µs	Off-hook to on-hook slope of < 500 µs	Default
3 ms	Off-hook to on-hook slope of 3 ms ± 10% that meets ETSI standard	
25 ms	Off-hook to on-hook slope of 25 ms± 10% used to reduce transient interference in copper cable	

13. Select the DFXO ringer Impedance.

This option sets the DFXO ringing input impedance as seen by a sine wave ringing signal applied to the DFXO 2 wire port at the frequency of ringing.

Selection	Description	
> 1 MΩ	DFXO input impedance to ringing of > 1 MΩ	Default
> 12 kΩ	DFXO input impedance to ringing of > 12 kΩ	

14. Select the DFXO ringer Detection Threshold.

This option sets the DFXO ringing detect threshold.

Selection	Description	
16 Vrms	DFXO detects ringing voltages of 16 Vrms or greater (does not detect ringing below 13 Vrms)	Default
26 Vrms	DFXO detects ringing voltages of 26 Vrms or greater (does not detect ringing below 19 Vrms)	
49 Vrms	DFXO detects ringing voltages of 49 Vrms or greater (does not detect ringing below 40 Vrms)	

It is recommended that the ringer Detection Threshold be set to 49 Vrms if a DFXO ringer impedance of > 12 kΩ is selected.

Note: The Signalling Mode is set in the Cross Connections application (see page 171).

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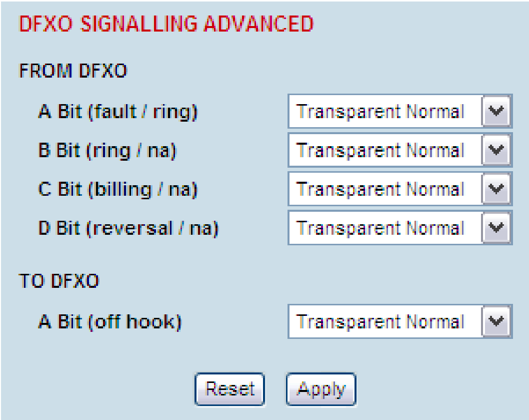
15. The DFXO Signalling Advanced options are used to control the four CAS bits ABCD in the DFXO to DFXS direction of transmission and one CAS bit A in the DFXS to DFXO direction of transmission. This option sets the signalling for both DFXO card ports.

Transparent Normal mode is used for normal traffic and Transparent Inverted mode can be used for special signalling requirements when a function needs to be reversed e.g. to change the idle polarity of the DFXS line feed voltage.

Forced modes are used to disable particular functions e.g. when polarity reversals are not required. They can also be used for system testing e.g. to apply DFXO continuous off hook



Selection	Description	
Transparent Normal	Normal transparent transmission of the CAS bit	Default
Transparent Inverted	Transparent transmission of the CAS bit but inverts the polarity.	
Forced Normal	Sets the CAS bit to 1.	
Forced Inverted	Sets the CAS bit to 0.	

From DFXO to DFXS

CAS Bit	Forced Normal	Forced Inverted
A bit (fault)	Sets the CAS A bit to 1 continuous fault state	Sets the CAS A bit to 0 no fault state
B bit (ring)	Sets the CAS B bit to 1 no DFXS ringing output.	Sets the CAS B bit to 0 continuous DFXS ringing output.
C bit (billing)	Sets the CAS C bit to 1 no DFXS billing tone output.	Sets the CAS C bit to 0 continuous DFXS billing tone output.
D bit (reversal)	Sets the CAS D bit to 1 no DFXS polarity reversal	Sets the CAS D bit to 0 continuous DFXS polarity reversal

DFXS to DFXO

CAS Bit	Forced Normal	Forced Inverted
A bit (off hook)	Sets the CAS A bit to 1 no DFXO off hook	Sets the CAS A bit to 0 continuous DFXO off hook

QJET to DFXS

CAS Bit	Forced Normal	Forced Inverted
A bit (ring)	Sets the CAS A bit to 1 no DFXS ringing output.	Sets the CAS A bit to 0 continuous DFXS ringing output.
B bit (na)	Not Applicable	Not Applicable
C bit (na)	Not Applicable	Not Applicable
D bit (na)	Not Applicable	Not Applicable

From DFXS to QJET

CAS Bit	Forced Normal	Forced Inverted
A bit (off hook)	Sets the CAS A bit to 1 Idle state to E1 port	Sets the CAS A bit to 0 Off hook state to E1 port

16. Click Apply to apply changes or Reset to restore the previous configuration.

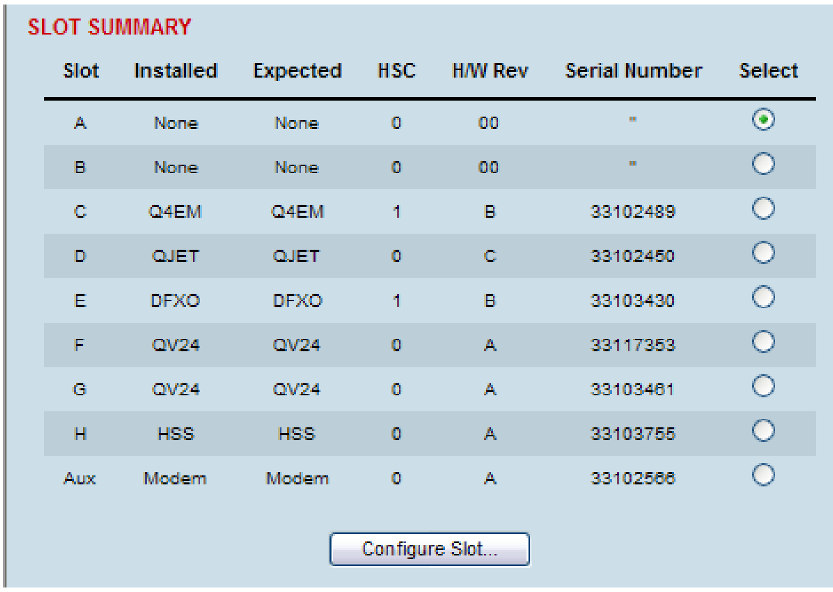
QV24 Serial Interface Card

There are two modes of operation of the QV24 Serial Interface Card; QV24 asynchronous and QV24S synchronous. The mode is changed with the Slot Summary.

Changing the QV24 mode changes all four ports on the interface card.

To change the QV24 mode:

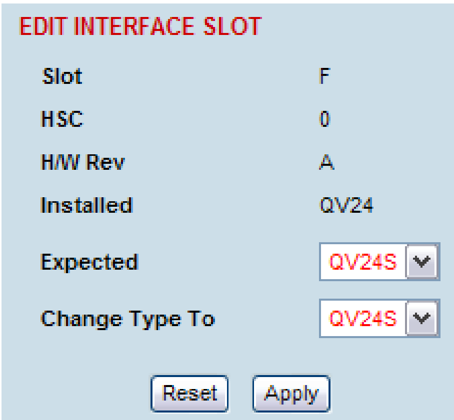
1. Select Link or Local or Remote > Interface > Slot Summary, then select the QV24 interface slot and click Configure Slot.



SLOT SUMMARY

Slot	Installed	Expected	HSC	H/W Rev	Serial Number	Select
A	None	None	0	00	-	
B	None	None	0	00	-	
C	Q4EM	Q4EM	1	B	33102489	
D	QJET	QJET	0	C	33102450	
E	DFXO	DFXO	1	B	33103430	
F	QV24	QV24	0	A	33117353	
G	QV24	QV24	0	A	33103461	
H	HSS	HSS	0	A	33103755	
Aux	Modem	Modem	0	A	33102566	

2. Select the QV24 mode required with Expected.

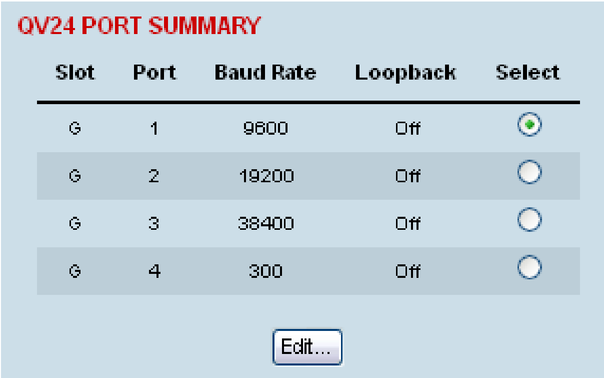


3. Select the QV24 mode required with Change Type To and click Apply.
4. Reboot the terminal with a Hard Reboot (see 'Rebooting the Terminal' on page 233).

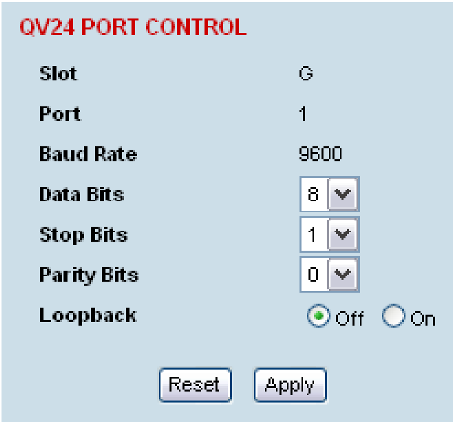
QV24 Port Settings

A QV24 interface is always configured as a DCE.

1. Select Link or Local or Remote > Interface > Interface Summary, then select the QV24 interface and click Configure Interface.



2. Select the QV24 port to configure, and click Edit.



'Slot' shows the slot the QV24 interface card is plugged into in the terminal.

'Port' shows the interface port number (1-4).

‘Baud Rate’ shows the current baud rate assigned to the port by the cross connect.

‘Loopback’ loops back the port data to the customer (default is no loopback).

3. Set the number of Data Bits (default is 8 bits).
4. Set the number of Stop Bits (default is 1 bit).
5. Set the number of Parity Bits (default is 0 bits).

6. Click Apply to apply changes or Reset to restore the previous configuration.

Tip: The Quick Links box provides links to other related pages.

QV24S Port Settings

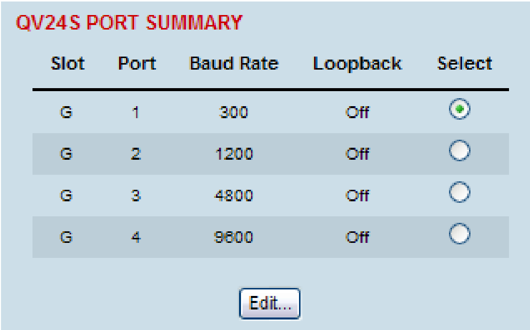
There are two modes of operation of the QV24S synchronous, synchronous and over sampling modes.

A QV24S interface is always configured as a DCE.

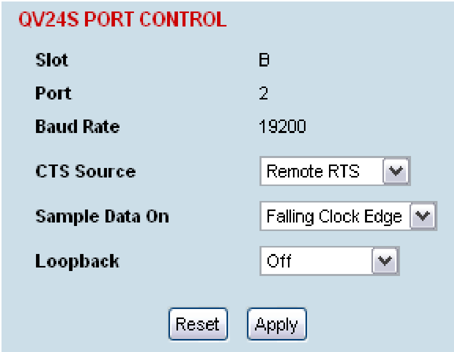
Synchronous Mode

In synchronous mode, interface data is synchronously mapped to radio capacity using proprietary subrate multiplexing. QV24S interfaces are required at both ends of the circuit.

1. Select Link or Local or Remote > Interface > Interface Summary, then select the QV24S interface and click Configure Interface.



2. Select the QV24S port to configure, and click Edit.



'Slot' shows the slot the QV24S interface card is plugged into in the terminal.

'Port' shows the interface port number (1-4).

‘Baud Rate’ shows the current baud rate assigned to the port by the cross connect.

3. The CTS Source defines the mode in which the CTS signal responds to the remote DTE. Three options are available:

CTS Source	Function
Remote RTS	The local CTS follows the remote RTS signal. In the case of radio link failure (when cross connected over the link) the signal goes to OFF.
Local RTS	The local CTS signal follows the local RTS. The status of the link does not impact on the CTS signal.
On Permanent	The local CTS is in a permanent ON (+ve) state. This does not go to OFF if the link fails.

Note that the CTS behaviour is not impacted by the operation of the card loopbacks.

4. The Sample Data On defines the received clock edge on which the received data is clocked into the port. Two options are available:

Sample Data On	Function
Falling Clock Edge	The falling edge of the XTXC is used to clock data into the port.
Rising Clock Edge	The rising edge of the XTXC is used to clock data into the port.

5. 'Loopback' loops back the port data to the customer (default is no loopback).

6. Click Apply to apply changes or Reset to restore the previous configuration.

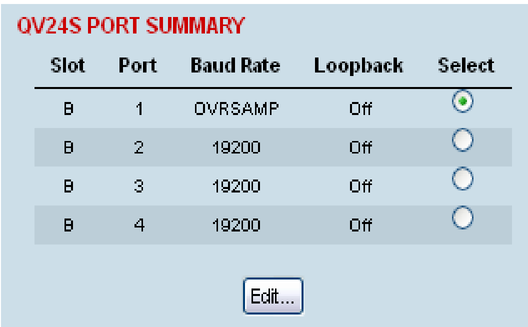
Over Sampling Mode

In over sampling mode, 64 kbit/s of radio capacity is allocated to the circuit and the incoming interface data is sampled at a fixed 64 kHz. This timeslot can be cross connected to an E1 or T1. This over sampling mode can be operated up to 19.2 kbit/s.

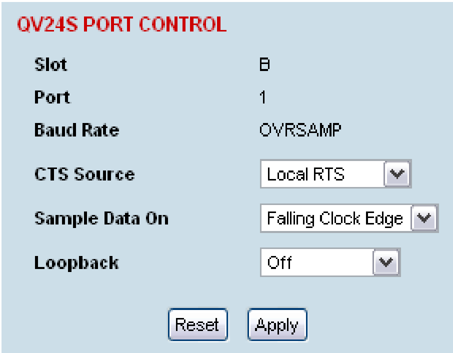
There will be some unavoidable distortion in mark space ratios (jitter) of the transported V.24 circuit. This effect will become progressively more significant as the baud rate of the V.24 circuit increases or the number of data conversions increases.

In over sampling mode, the DTE clock input is not used and there is no DCE output clock available.

1. Select Link or Local or Remote > Interface > Interface Summary, then select the QV24S interface and click Configure Interface.



2. Select the QV24S port to configure, and click Edit.



'Slot' shows the slot the QV24S interface card is plugged into in the terminal.

'Port' shows the interface port number (1-4).

A Baud Rate of ‘OVRSAMP’ indicates that the QV24S has been configured for synchronous over sampling mode in the Cross Connections application.

3. The CTS Source defines the mode in which the CTS signal responds to the remote DTE. Two options are available:

CTS Source	Function
Local RTS	The local CTS signal follows the local RTS. The status of the link does not impact on the CTS signal.
On Permanent	The local CTS is in a permanent ON (+ve) state. This does not go to OFF if the link fails.

Note that the CTS behaviour is not impacted by the operation of the card loopbacks.

4. The Sample Data On defines the received clock edge on which the received data is clocked into the port. Two options are available:

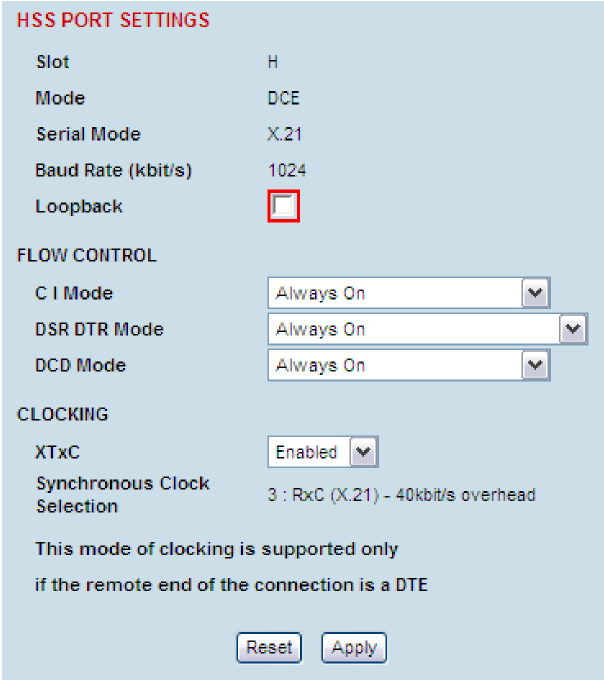
Sample Data On	Function
Falling Clock Edge	The falling edge of the XTXC is used to clock data into the port.
Rising Clock Edge	The rising edge of the XTXC is used to clock data into the port.

5. ‘Loopback’ loops back the port data to the customer (default is no loopback).

6. Click Apply to apply changes or Reset to restore the previous configuration.

HSS Port Settings

1. Select Link or Local or Remote > Interface > Interface Summary, then select HSS (High-speed Synchronous Serial) interface and click Configure Interface.



'Slot' shows the slot the HSS interface card is plugged into in the terminal (A – H).

'Mode' shows the interface mode provided by the HSS interface (either DTE or DCE). If there is no interface cable plugged into the HSS port, the ‘Mode’ will show ‘No Cable’.

'Serial Mode' shows interface type provided by the HSS interface (X.21, V.35 etc). If there is no interface cable plugged into the HSS port, the ‘Serial Mode’ will show ‘None’.

‘Baud Rate (kbit/s)’ shows the current baud rate assigned to the port by the cross connect.

‘Loopback’ loops back the port data to the customer (default is no loopback).

‘Synchronous Clock Selection’ shows the current clocking mode assigned to the port by the cross connect.

2. Set the HSS **RTS CTS Mode** as required.

   The RTS CTS mode controls the state of the outgoing interface RTS CTS control line.

   When the HSS interface is DCE, the outgoing control line is CTS. When the HSS interface is DTE, the outgoing control line is RTS.

Note: Refer to ‘HSS Handshaking and Clocking’ on page 135 for additional information on setting the recommended handshaking mode for each application.

3. Set the HSS **DSR DTR Mode** as required.

   The DSR DTR mode controls the state of the outgoing interface DSR DTR control line.

   When the HSS interface is DCE, the outgoing control line is DSR. When the HSS interface is DTE, the outgoing control line is DTR.

4. Set the HSS **DCD Mode** as required.

   The DCD mode controls the state of the outgoing interface DCD control line.

   This setting is only relevant if the HSS interface is DCE.

5. Enable or disable the HSS **XTxC** control, as required.

   Depending on the clocking mode (see ‘HSS Handshaking and Clocking’ on page 135) selected, altering this setting will allow the terminal clock to be substituted for the external XTxC signal.

6. Click Apply to apply changes or Reset to restore the previous configuration.

HSS Handshaking and Clocking Modes

This section provides detailed information on selecting the recommended HSS handshaking and clocking modes for the HSS interface card (see 'HSS port settings' on page 133).

HSS Handshaking and Control Line Function

HSS X.21 Compatibility

In general X.21 usage, the C and I wires function as handshaking lines analogous to RTS/CTS handshakes. For switched carrier applications, the I wire is used to emulate carrier indications (DCD) function.

HSS RTS / CTS Mode

Set the RTS CTS Mode as required according to the table below. This field controls the state of the outgoing interface control line.

- When the HSS interface is DCE, the outgoing control line is CTS.
- When the HSS interface is DTE, the outgoing control line is RTS.

RTS CTS Mode	HSS as a DCE	HSS as a DTE	Comment
Always Off	CTS driven to off state	RTS driven to off state	
Always On	CTS driven to on state	RTS driven to on state	
Follows Carrier	CTS follows the state of the RF link	RTS follows the state of the RF link	To follow carrier is to indicate the state of synchronization of the RF link
Follows Carrier + Remote RTS/CTS	CTS follows the state of the RF link and the remote terminal RTS input control line if the remote is a DCE. If the remote HSS is a DTE, then CTS follows the state of the RF link and the remote HSS CTS input.	RTS follows the state of the RF link and the remote terminal RTS input control line. The remote HSS can only be a DCE.	Control line pass-through mode where RTS and CTS are carried over the link from end to end. The carrier (as above) plus the remote terminal input control line must be present to output the local control line signal. The HSS Control bit in the Cross Connections application must be set for the remote signalling to operate.
Follows Carrier + Remote DCD	CTS follows the state of the RF link if the remote HSS is a DCE. If the remote HSS is a DTE, then CTS follows the state of the RF link and the remote HSS DCD input control line.		This setting is only applicable when the local HSS card in the local terminal is a DCE. The HSS Control bit in the Cross Connections application must be set for the remote signalling to operate.

HSS DSR / DTR Mode

Set the DSR DTR Mode as required according to the table below. This field controls the state of the outgoing interface control line.

- When the HSS interface is DCE, the outgoing control line is DSR
- When the HSS interface is DTE, the outgoing control line is DTR

DSR DTR Mode	HSS as a DCE	HSS as a DTE	Comment
Always Off	DSR driven to off state	DTR driven to off state	
Always On	DSR driven to on state	DTR driven to on state	
Follows Carrier	DSR follows the state of the RF link	DTR follows the state of the RF link	To follow carrier is to indicate the state of synchronization of the RF link.
Follows Carrier + Remote DSR/DTR	DSR follows the state of the RF link and the remote terminal DSR control line if the remote terminal is a DTE, or the remote DTR if the remote terminal is a DCE.	DTR follows the state of the RF link and the remote terminal DTR control line if the remote terminal is a DCE. The remote HSS can only be a DCE.	Control line pass-through mode where DSR and DTR are carried over the link from end to end. The carrier (as above) plus the remote terminal input control line must be present to output the local control line signal. The HSS Control bit in the Cross Connections application must be set for the remote signalling to operate.

HSS DCD Mode

Set the DCD Mode as required according to the table below. This setting is only relevant in DCE mode.

DCD Mode	HSS as a DCE	HSS as a DTE	Comment
Always Off	DCD driven to off state	NOT applicable	
Always On	DCD driven to on state		
Follows Carrier + Remote DCD	DCD follows the state of the RF link and the remote terminal DCD input control line if the remote HSS is a DTE. If the remote terminal is a DCE, then DCD only follows the state of the RF link.		Control line pass-through mode where DCD is carried over the link from end to end. The carrier (as above) plus the remote terminal input control line must be present to output the local control line signal. The HSS Control bit in the Cross Connections application must be set for the remote signalling to operate.
Follows Carrier + Remote RTS	DCD follows the state of the RF link and the remote terminal RTS input control line when the remote HSS is a DCE.		For switched carrier applications this provides RTS-DCD pass through (DCE to DCE configuration) and DCD-DCD pass-through (DTE to DCE configuration).

Set the XTxC Enabled control as required. Depending on the synchronous clock selection mode selected, disabling XTxC will allow the terminal clock to be substituted for the external XTxC signal.

HSS Synchronous Clock Selection Modes

The following section describes in detail each of the recommended HSS Synchronous Clock Selection modes for both DTE to DCE and DCE to DCE modes of operation.

The HSS clocking can be configured for clocking types of Internal clocking, pass-through clocking, and primary / secondary master clocking. The topology of the client network determines the clock mode that is used.

Note: Modes 3 and 4 provide only physical layer support, not X.21 protocol support.

Terminal 1 HSS as a DTE and terminal 2 HSS as a DCE - 'Pipe Mode'

Mode	Synchronous Clock Selection mode	Clocking Type
0	Internal Clocks - No overhead	Not supported
1	RxC + XTxC - 40 kbit/s overhead	Not supported
2	RxC + TxC - 56 kbit/s overhead	Pass-through clocking
3	RxC (X.21) - 40 kbit/s overhead	Pass-through clocking (X.21 only)
4	RxC (X.21) - No overhead	Not supported
5	XTxC → RxC - 40 kbit/s overhead	Not supported
6	RxC → RxC - No overhead	Primary/ Secondary Master clocking
7	RxC → RxC - 40 kbit/s overhead	Pass-through clocking

Terminal 1 HSS as a DCE and terminal 2 HSS as a DCE - 'Cloud Mode'

Mode	Synchronous Clock Selection mode	Clocking Type
0	Internal Clocks - No overhead	Internal clocking
1	RxC + XTxC- 40 kbit/s overhead	Not supported
2	RxC + TxC- 56 kbit/s overhead	Not supported
3	RxC (X.21) - 40 kbit/s overhead	Not supported
4	RxC (X.21) - No overhead	Internal clocking (X.21 only)
5	XTxC → RxC - 40 kbit/s overhead	Pass-through clocking
6	RxC → RxC - No overhead	Not supported
7	RxC → RxC - 40 kbit/s overhead	Not supported

HSS Clocking Types

HSS internal clocking

Internal clocking relies on the (highly accurate) terminal system clock, that is, it does not allow for any independent clocks coming in from client equipment.

For this mode, all incoming clocks must be slaved to a clock emanating from the HSS card.

HSS pass-through clocking

The HSS card is capable in hardware of passing two clocks from one side of a link to the other. Passing a clock means that the difference between the client clock(s) and the terminal clock is transferred across the link continuously. Passing a single clock in each direction requires 40 kbit/s additional link overhead, passing two clocks from DTE to DCE requires 56 kbit/s overhead, whereas relying on internal clocking requires no overhead.

Network topology determines if passing a clock makes sense. Passing a clock is used where a client's incoming clock must be kept independent of the clock sourced by the HSS card. The only time it makes sense to pass two clocks is when a client DCE in one of the HSS modes provides two independent clocks, that is, the HSS is set to Clock Mode 2.

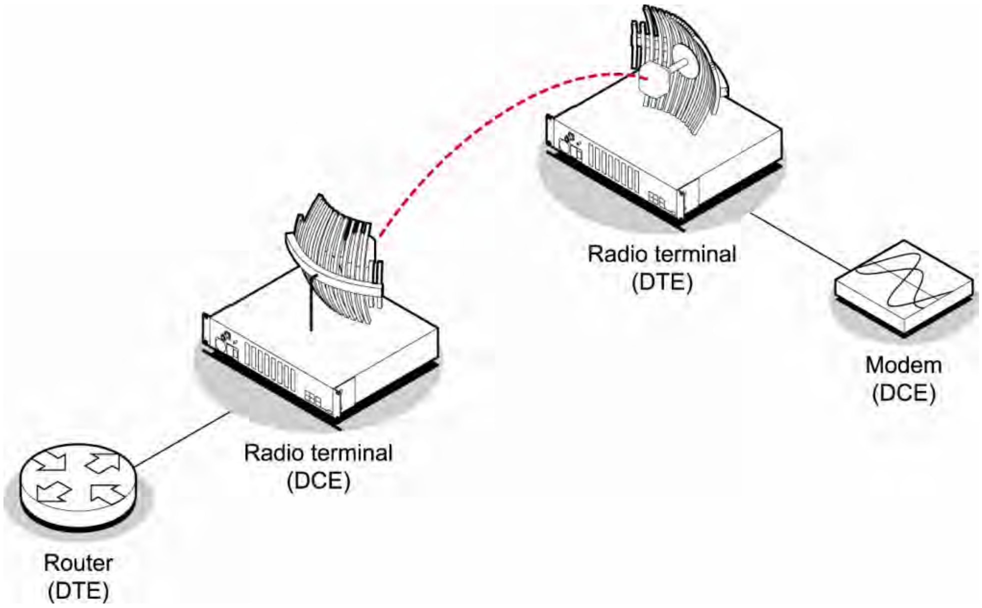
Pass-through clocking does not require using the HSS incoming clock as a Primary or Secondary master clock for the link, but does not preclude it either.

HSS primary / secondary master clocking

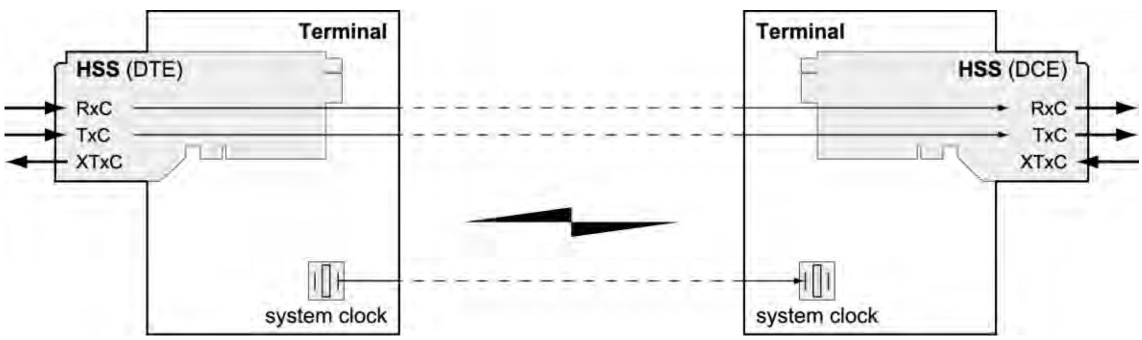
When implementing an external clock master, all other interfaces in the terminal and internal system timings are slaved to this external clock. The remote terminal is also slaved to this master clock. This master clock must be within 100 ppm of the accuracy of the terminal system clock, otherwise the terminal will revert to using its internal clock. Ideally, the external clock should be much better than 100 ppm.

Mode 6 is offered for those network topologies that require RxC and TxC to be locked. For example, this is useful when interworking with an Aprisa SE HSS interface.

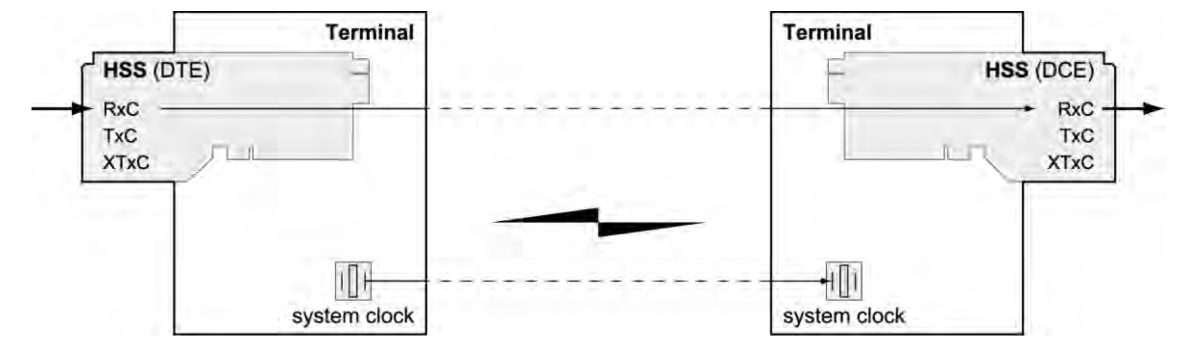
HSS Clocking DTE to DCE 'Pipe Mode'



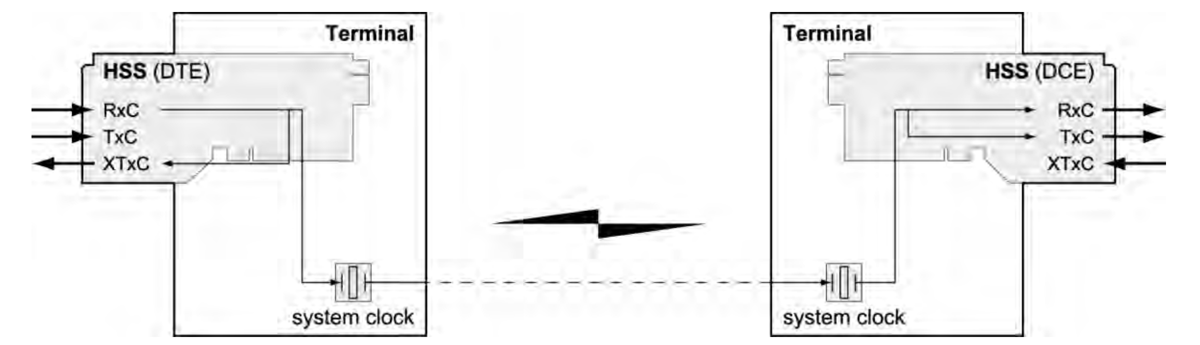
DTE to DCE Mode 2: RxC + TxC - 56 kbit/s overhead (Pass-through clocking)			
DTE clocks used	**DCE clocks used**	**Clock passing**	**Comment**
RxC and TxC	RxC and TxC	56 kbit/s of overhead is used to transport RxC and TxC from HSS DTE to HSS DCE.	This is the preferred dual external clock system. Both clocks travel in the same direction from DTE to DCE. This mode is used when it is important that the externally supplied RxC and TxC are maintained independently. This is almost only required in cascaded (that is, multi-link) networks. This mode cannot be used in conjunction with any interface conversion to / from X.21.



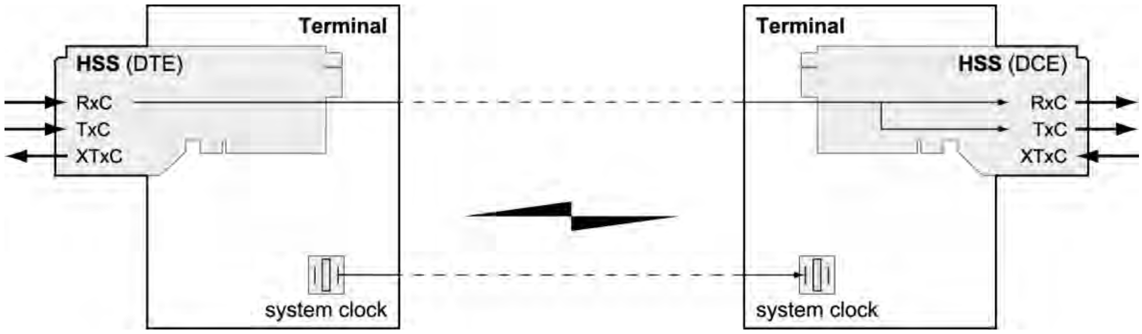
DTE to DCE Mode 3: RxC (X.21) - 40 kbit/s overhead (Pass-through clocking)			
DTE clocks used	**DCE clocks used**	**Clock passing**	**Comment**
RxC	RxC	40 kbit/s of overhead used to transport RxC from the DTE to DCE.	Preferred option for X.21.



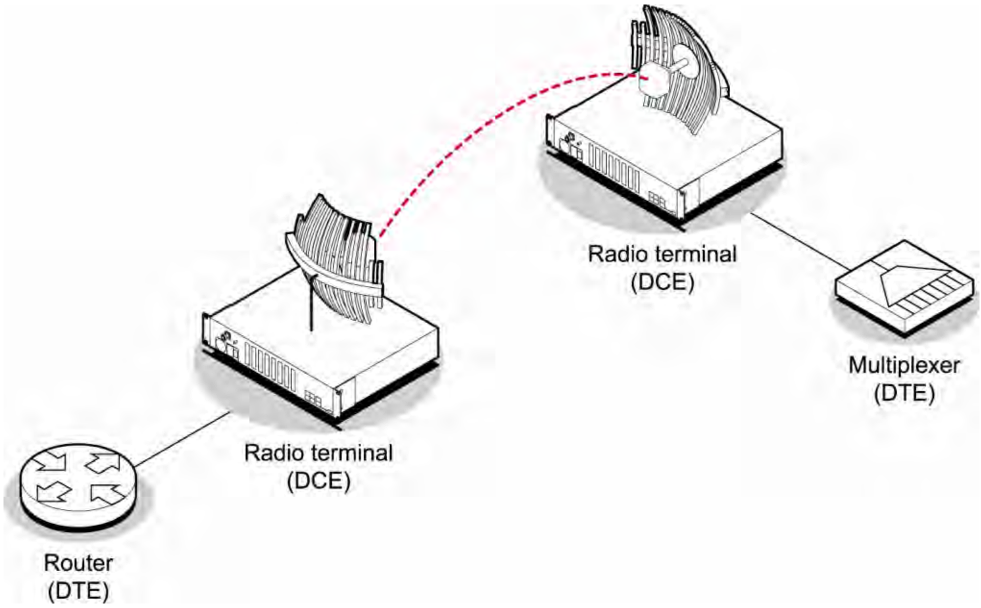
DTE to DCE Mode 6: RxC → RxC - No overhead (Primary/ Secondary Master clocking)			
DTE clocks used	**DCE clocks used**	**Clock passing**	**Comment**
RxC and TxC	RxC and TxC	The DTE XTxC is derived from the RxC and is used to generate the terminal external clock. The DCE generates RxC and TxC from the terminal clock.	HSS becomes the External master clock, avoiding explicit clock passing, but foregoing the use of passing a clock in either direction (Modes 1, 5). The DTE HSS card must be set as the External clock for the terminal.



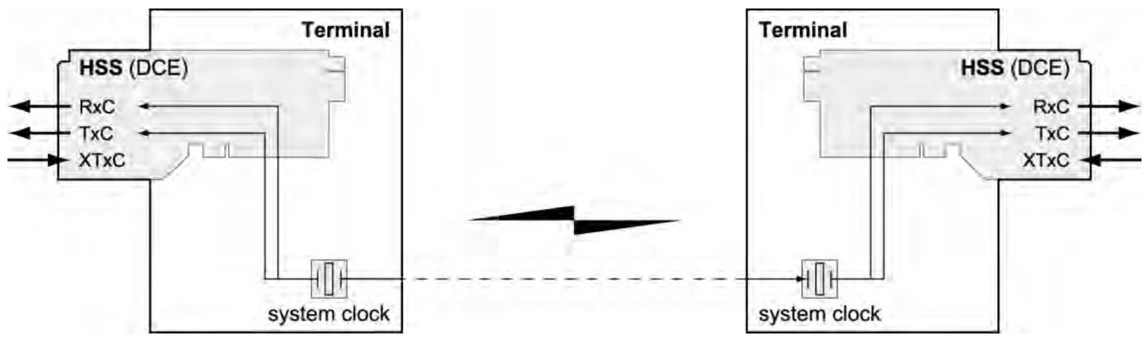
DTE to DCE Mode 7: RxC → RxC - 40 kbit/s overhead (Pass-through clocking)			
DTE clocks used	**DCE clocks used**	**Clock passing**	**Comment**
RxC and TxC	RxC and TxC	40 kbit/s of overhead used to transfer RxC from the DTE to the DCE RxC and TxC.	Receiver derived clock system.



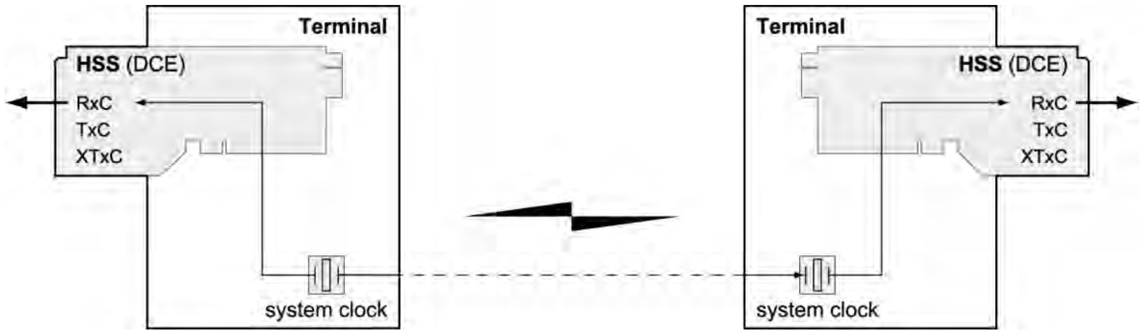
HSS Clocking DCE to DCE 'Cloud Mode'



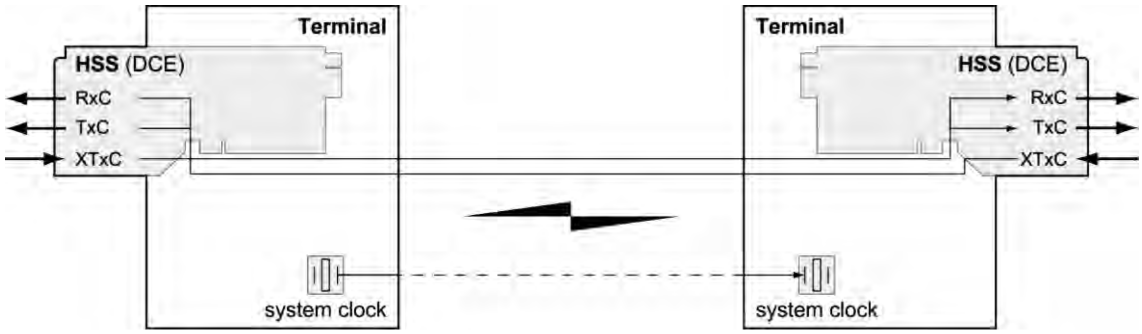
DCE to DCE Mode 0: Internal clocks - No overhead (internal clocking)		
DCE clocks used	**Clock passing**	**Comment**
RxC, TxC, XTxC	Both RxC and TxC are derived from the terminal clock.	Default setting. All clocks sourced internally. XTxC will be used if it is detected.



DCE to DCE Mode 4: <u>RxC (X.21) - No overhead</u> (internal clocking)		
DCE clocks used	**Clock passing**	**Comment**
RxC	RxC is derived from the terminal clock.	Suggested for X.21 Cloud Configuration. Single clock X.21 system.



DCE to DCE Mode 5: <u>XTxC → RxC - 40 kbit/s overhead</u> (Pass-through clocking)		
DCE clocks used	**Clock passing**	**Comment**
RxC, TxC, XTxC		XTxC is transported to RxC and TxC in both directions



10. Cross Connections

Embedded Cross Connect Switch

The embedded cross-connect switch distributes capacity to each of the interfaces.

Traffic can be distributed to any of the possible 32 interface ports as well as the integrated Ethernet interface. This provides the flexibility to reconfigure traffic as the network demand changes, or groom user traffic onto E1 / T1 bearers between equipment.

The maximum number of simultaneous cross connections per terminal is 256. During cross connection activation, a progress bar shows the number of ports that have activated.

Link Capacity Utilization

Cross connections are able to utilize all of the available capacity of the link on lower capacity radio links (< 2048 kbit/s gross capacity, i.e. up to 500 kHz, 16 QAM). However, as higher capacity radio links allocate bandwidth for E1 / T1 timeslot connections on 64 kbit/s boundaries, some capacity may be unusable (< 64 kbit/s).

The Cross Connections Application

The Cross Connections application is a software application that is used to:

- manage the cross connections switches within the terminals
- create cross connections between the traffic interface ports within one terminal or between the near end and far end terminals via the radio bearer
- create cross connections between symmetrical traffic interface ports with the symmetrical connection wizard
- get the current cross connection configuration from the terminal
- send and activate the cross connection configuration
- save and load configuration files

The Cross Connections System Requirements

The Cross Connections application requires the following minimum PC requirements:

- 1024 x 768 screen resolution
- Ethernet interface
- Java Virtual Machine

Installing the Cross Connections Application

The Cross Connections application is usually started directly from SuperVisor without the need for installation.

However, if you want to use the Cross Connections application offline (without any connection to the terminals), you can install it on your PC. Working offline enables you to simulate new cards or terminal capacities. The cross connections can then be configured and the resulting configuration file saved for later deployment.

To install the Cross Connections application on your PC, navigate to the Cross Connect directory on the supplied CD and copy the application (ccapp_exe_x_x_x.jar where x is the version) to a suitable place on your PC hard disk.

Your PC 'File Types' must associate a *.jar file with the Executable Jar File so that when the *.jar file is clicked on (or double clicked on), it will be executed with Javaw.exe. If clicking on (or double clicking on) the jar file does not bring up the Cross Connections application, the 'File Types' needs to be setup in your PC.

- Go to 'My Computer / Tools / Folder Options / File Types' and click 'New'.
- Type 'Jar' in the 'File Extension' box and click OK.
- Click 'Change' and 'Select a program from a list'
- Select 'Javaw.exe' and click OK.

Opening the Cross Connections Application

To open the Cross Connections application from within SuperVisor:

Select Link > Interface > Cross Connections

To open the Cross Connections application without SuperVisor:

Navigate to the installed cross connections application file C-capp_exe_8_6_7.jar and double click on it.

Note: This assumes that you have copied the cross connections application to your PC so you can work offline (without any connection to the terminals).

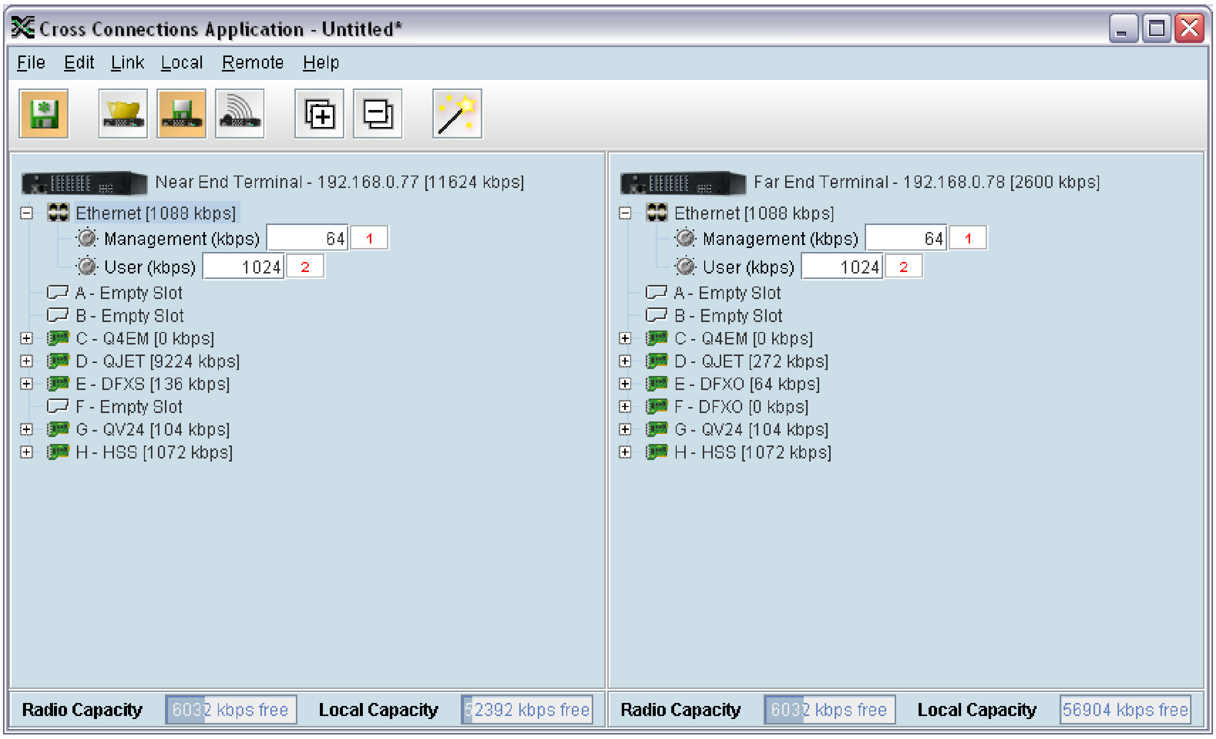
The Cross Connections Page

The Cross Connections page is split into two panes with each pane displaying one terminal. The local terminal is displayed in the left pane and the remote terminal is displayed in the right pane.

The local terminal is defined as the terminal that SuperVisor is logged into (not necessarily the near end terminal).

The cards displayed depend on the type of cards and where they are inserted in the chassis.

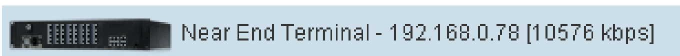
To view all the ports for each interface card, click on the expand all ports button .



Tool Tips are available by holding the mouse pointer over objects on the screen.

Total Assigned Link Capacity

The current total assigned capacity (radio link and drop and insert) is shown (in kbit/s) beside the terminal name and IP address:



Radio Link and Local Drop And Insert Capacity

At the bottom of the Cross Connections page, the capacity pane displays the Radio and Local drop and insert capacities for both the local and remote terminals.

The **Radio Capacity** field shows the available radio link capacity (6032 kbit/s shown) and the shaded bar graph shows the capacity used for cross connections over the radio link (2600 kbit/s) between the terminals as a percentage of the total capacity of the radio link (30 % used).

The total capacity of the radio link is determined by the channel size and the modulation type of the radio link.

The **Local Capacity** field shows the available capacity for local or drop and insert cross connections (52392 kbit/s shown) and the shaded bar graph shows the capacity used for local cross connections (4512 kbit/s) as a percentage of the total local capacity (7 % used).

The total local capacity is 65536 kbit/s minus the used radio capacity.

Tool tip messages show the breakdown of the radio and local capacity usage:

The following is an example of the messages shown:

Radio Capacity

Radio Bandwidth Usage (over the air)

8632 kbit/s total

2600 kbit/s used (30%) of total radio capacity

6032 kbit/s free

Local Capacity

Local capacity usage (for connecting ports on the same terminal)

65536 kbit/s total

8632 kbit/s reserved for radio (13%) of total local capacity

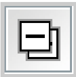
4512 kbit/s used for local (7%) of total local capacity

52392 kbit/s free

Tip: On a screen set to 1024 by 768 resolution, this capacity information may be obscured by the task bar if the Windows task bar is docked at the bottom of the screen. To view the capacity pane clearly, either shift the task bar to another screen edge, make it auto-hide, or increase the screen resolution.

Cross Connections Toolbar

The cross connections toolbar has buttons for commonly-used functions.

Button	Explanation
	Saves the cross connection configuration file to disk. The button turns amber when you have made changes that have not yet been saved.
	Gets the cross connection configuration from the local and remote terminals.
	Saves the cross connection configuration to the local and remote terminals. The button turns amber when you have made changes that have not yet been sent to the terminal.
	Activates the cross connections on the local and remote terminals. Turns amber when there are cross connections that have been sent but not yet activated.
	Expands all the ports for all the interface cards.
	Collapses all the ports for all the interface cards.
	Opens the symmetrical connections wizard.

Setting the Terminal's IP Address

If the Cross Connections application is launched from SuperVisor, the terminal IP addresses are set automatically by SuperVisor, but if the application is launched from your PC independent of SuperVisor, you will need to set the application Local and Remote IP addresses to the addresses of the Local and Remote terminals you wish to connect to.

To set the application local or remote IP address:

1. Right-click over the terminal name or IP address and select Set Address.

2. Select Local or Remote > Set Address

3. Enter the IP address of the terminal in the dialog box and click OK.

Management and User Ethernet Capacity

The maximum ethernet capacity of an Aprisa XE terminal is dependant on the motherboard version:

Motherboard Version	Maximum Ethernet Capacity
Rev C	32768 kbit/s
Rev D	49152 kbit/s

The maximum ethernet capacity available is the lesser of the maximum ethernet capacity or the available radio link capacity.

The management ethernet capacity and user ethernet capacity must be identical on both terminals for the ethernet link to work correctly.

Management Ethernet Capacity

A management ethernet cross connection between the local and remote terminals is created automatically using the default capacity of 64 kbit/s (connection number = 1). This connection is essential for remote terminal management communication.

The minimum management ethernet capacity requirement for correct management operation over the radio link is 8 kbit/s but if the terminal in on a network with large numbers of broadcast packets, the management may not be able to function.

The management capacity must be set in multiples of 8 kbit/s and the maximum assignable is 64 kbit/s.

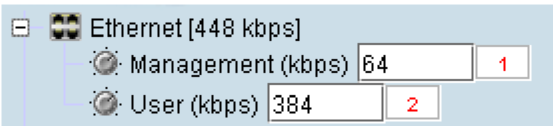
User Ethernet Capacity

A user ethernet cross connection between the local and remote terminals is created automatically using the default capacity of 0 kbit/s (connection number = 2).

The user ethernet capacity must be set in multiples of 8 kbit/s.

The maximum user ethernet capacity available is the maximum ethernet capacity available minus the management ethernet capacity setting.

To set the management ethernet or the user ethernet capacity:



Enter the required kbit/s in the local terminal capacity field. The associated remote terminal capacity field will update automatically.

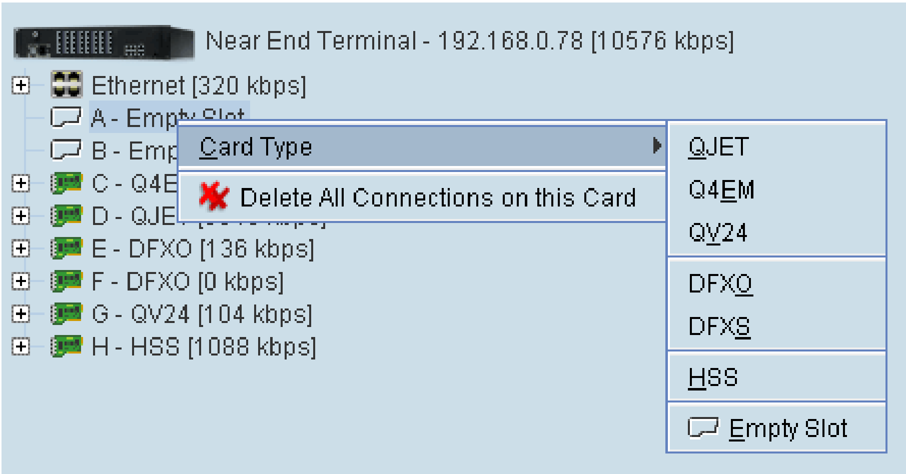
The red numbers, in the mapping connection boxes, are known as connection numbers and are allocated automatically by the Cross Connections application.

Setting Card Types

Note: You only need to do this when creating configurations offline (that is, there is no connection to the terminal). When you are connected to the terminal, the Cross Connections application automatically detects the card types fitted in the terminal slots.

You can specify the card type for any of the slots (A-H).

1. Right-click a slot.

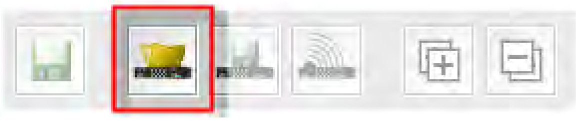


2. Select Card Type and then select the interface card.

Getting Cross Connection Configuration from the Terminals

You can get the entire existing cross connection configuration from the terminals.

1. Download the existing cross connections (if any) from the local and remote terminals by clicking 'Get cross connection configuration from terminal'.



Creating Cross Connections

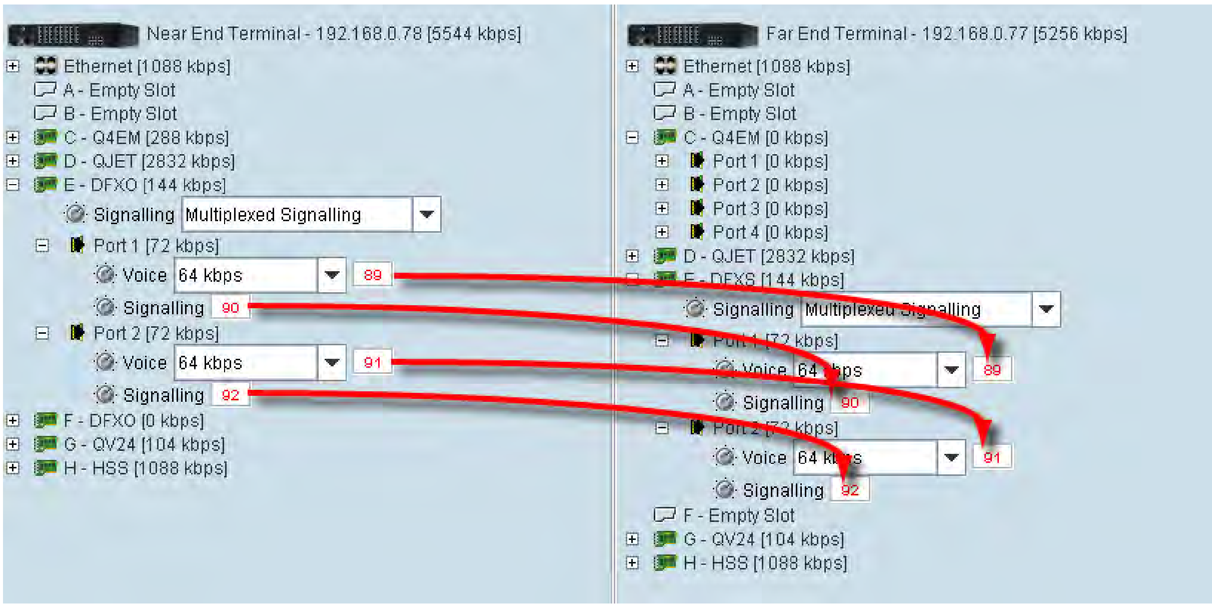
Point to point cross connections

Three examples of point to point cross connections are shown below:

Example 1

One 2 wire DFXO interface on the near end terminal slot E port 1 is cross connected via the radio link to a 2 wire DFXS on the far end terminal slot E port 1. This cross connection includes the four bits of signalling (ABCD bits) but as the DFXO / DFXS signalling is configured for 'multiplexed', the four bits are multiplexed into one bit over the radio link. This cross connection uses 72 kbit/s of radio link capacity, 64 kbit/s for the voice and 8 kbit/s for the signalling bit.

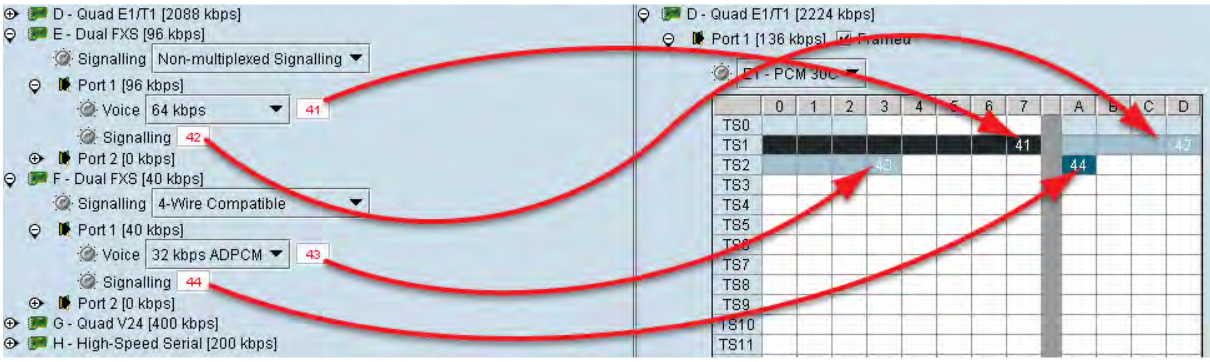
The port 2s of the same DFXO / DFXS cards are cross connected using the same method.



Example 2

One 2 wire DFXS interface on the near end terminal slot E port 1 is cross connected via the radio link to a framed E1 on the far end terminal slot D port 1 in timeslot 1. This cross connection includes four bits of signalling as the DFXS signalling is configured as 'non-multiplexed signalling' (ABCD bits). This cross connection uses 96 kbit/s of radio link capacity, 64 kbit/s for the voice and 32 kbit/s for the signalling bits.

Another 2 wire DFXS interface on the near end terminal slot F port 1 is cross connected via the radio link to a framed E1 on the far end terminal slot D port 1 in timeslot 2. This cross connection includes one bit of signalling as the DFXS signalling is configured in '4 wire compatible' mode (A bit only). This cross connection uses 40 kbit/s of radio link capacity, 32 kbit/s for the ADPCM voice and 8 kbit/s for the signalling bit.



Example 3

One 2 wire DFXS interface on the near end terminal slot E port 1 is cross connected via the radio link to a framed E1 on the far end terminal slot D port 1 in timeslot 1. This cross connection includes one bit of signalling as the DFXS signalling is configured as 'multiplexed' signalling. This cross connection uses 72 kbit/s of radio link capacity, 64 kbit/s for the voice and 8 kbit/s for the signalling bit.

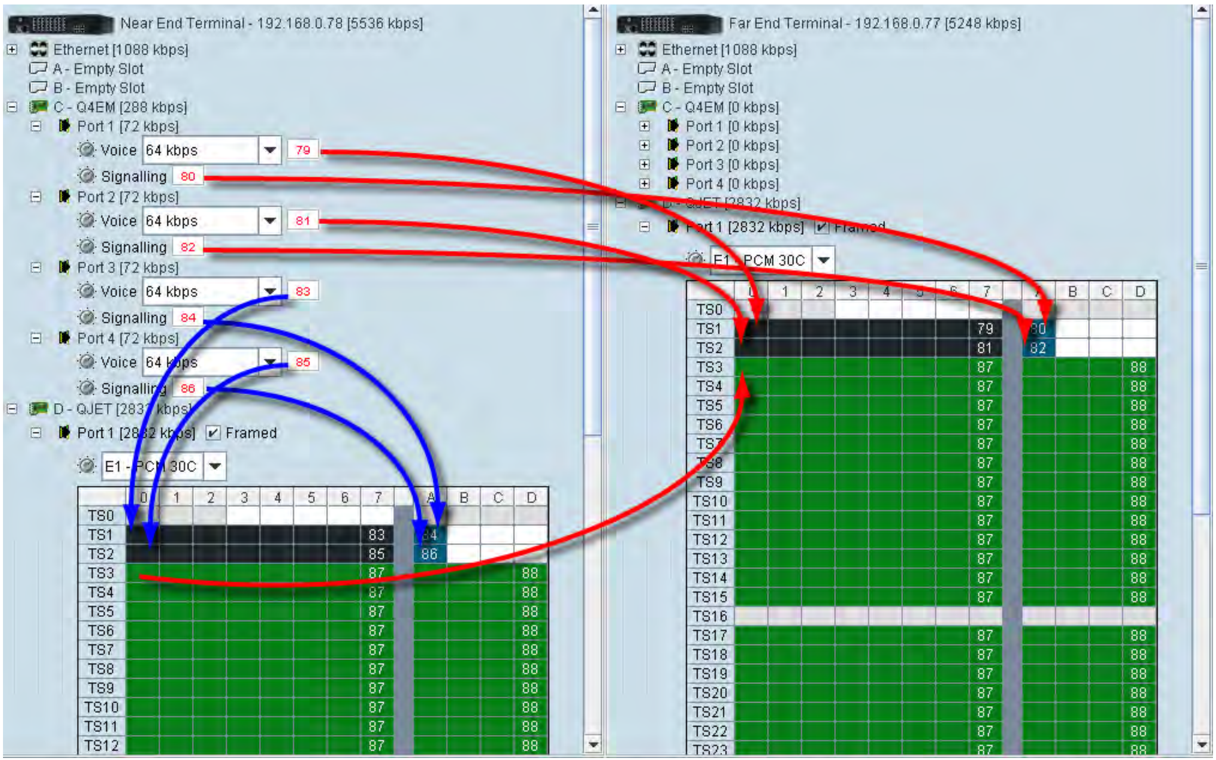
Local Drop and Insert Cross Connections

An example of a local drop and insert cross connection is shown below:

Two 4 wire E&M interfaces on the near end terminal slot C ports 3 & 4 are dropped out of a framed E1 on the near end terminal slot D port 1 in timeslots 1 & 2. This cross connection includes one bit of signalling (A bit).

Another two 4 wire E&M interfaces on the near end terminal slot C ports 1 & 2 are inserted into the radio link to a framed E1 on the far end terminal slot D port 1 in timeslots 1 & 2. This cross connection includes one bit of signalling (A bit).

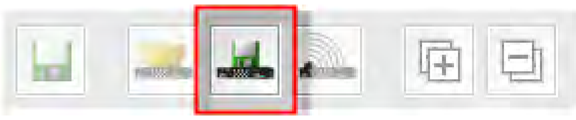
The remaining framed E1 on the near end terminal slot D port 1 timeslots are transported over the radio link to the framed E1 on the far end terminal slot D port 1. This cross connection includes four bits of signalling (ABCD bits).



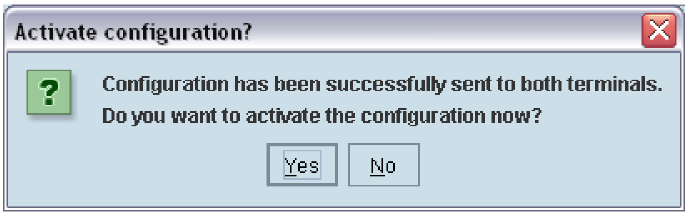
Sending Cross Connection Configuration to the Terminals

You can send the entire cross connection configuration to the terminals.

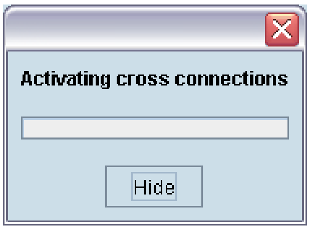
1. To send the new cross connection configuration into the terminals, click ‘Send cross connection configuration to terminal’.



2. When the transfer is successfully complete, a message appears asking if you want to activate the configuration now.



If you click Yes, a message appears showing the activation progress.



If you click No, you can activate the new cross connection configuration later by clicking ‘Activate cross connection configuration’.

Saving Cross Connection Configurations

You can save the entire cross connection configuration to file so that you can restore it to the same link (if this is ever required), or transfer it to another link if you want them to be identical.

1. Click on ‘Save cross connection configuration file to disk’ or select File > Save.
2. Navigate to the directory where you want to save the file, enter the filename in the dialog box and then click Save.
3. Once you have specified a filename and a directory save any further changes by clicking Save.

Using Existing Cross Connection Configurations

To load a previously-saved cross connection configuration from an existing file:

1. Select File > Open.
2. Navigate to the file and select it, and then click Open.

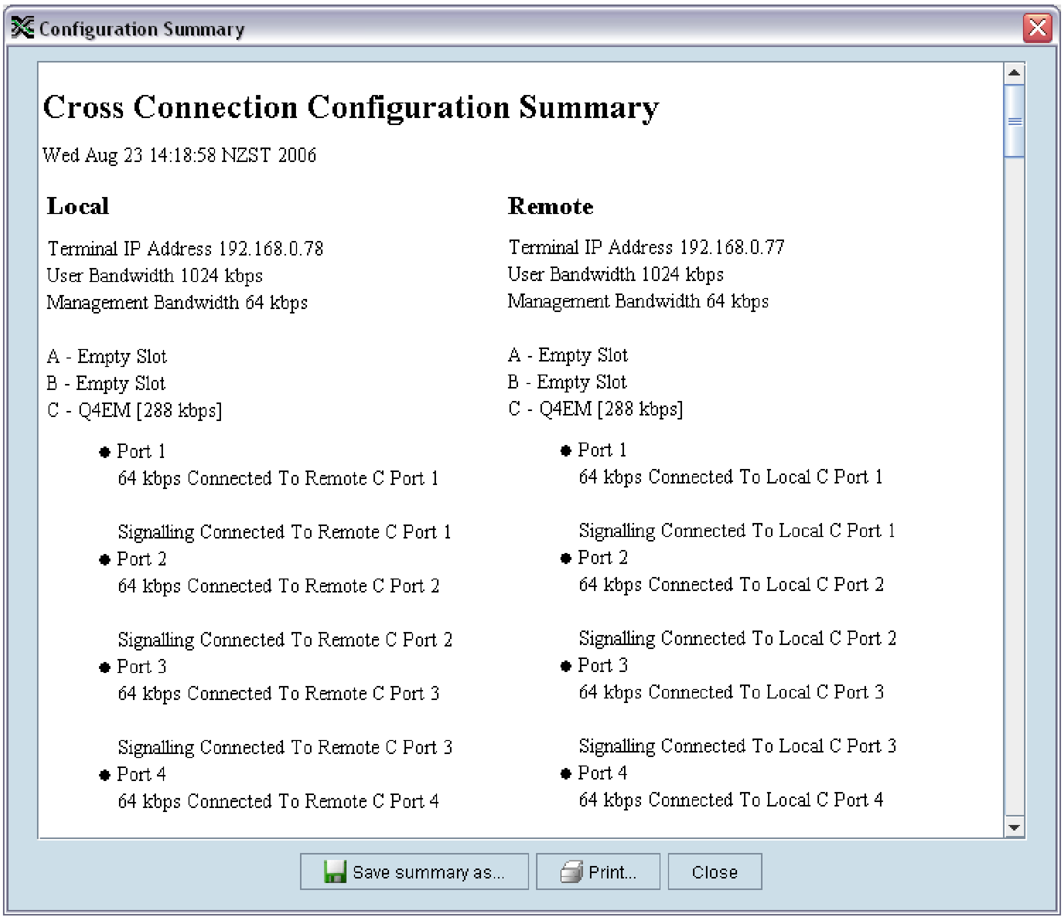
Printing the Cross Connection Configuration

You can print out a summary of the cross connection configuration so that you can file it for future reference. Using the printout, you can recreate the cross connection configuration.

If you don't have the configuration saved to disk see 'Saving cross connection configurations' on page 155, or use it to review the cross connections without connecting to the terminal.

The cross connection configuration summary shows information for the local and remote terminals such as:

- The IP address and terminal name
- The interface card fitted in each slot
- How the ports are configured



To preview the cross connection configuration summary:

Select File > Preview Configuration Summary.

In this dialog box you can:

- Save the summary to disk (as an HTML file) by clicking Save Summary As.
- Print the summary by clicking Print.
- Copy and paste the information into another application (for example, spreadsheet, email, and word processor) by right-clicking over the summary and selecting Select All. Then right-click over the summary again and select Copy.

To print the cross connection configuration summary:

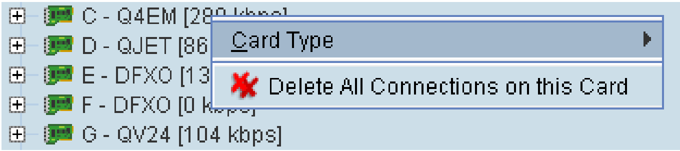
Select File > Print Configuration Summary.

Deleting Cross Connections

Note: It is not possible to delete the management and user Ethernet cross connections. These are made automatically and are required for correct terminal operation.

To delete cross connections for an interface card:

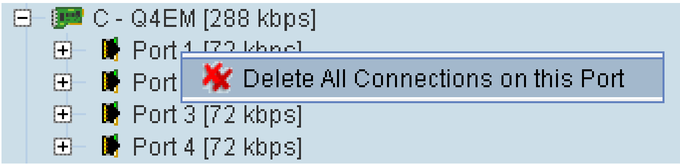
1. Right-click over an interface card.



2. Select Delete All Connections on this Card.

To delete the cross connections associated with a particular port:

1. Right-click over a port.



2. Select Delete All Connections on this Port.

To delete all the cross connections for a terminal:

1. Right-click over the terminal name and IP address.

2. Select Delete All Connections on this Terminal.

Configuring the Traffic Cross Connections

Once you have configured the interface cards (see 'Configuring the traffic interfaces' on page 91), you can configure the traffic cross connections between compatible interfaces.

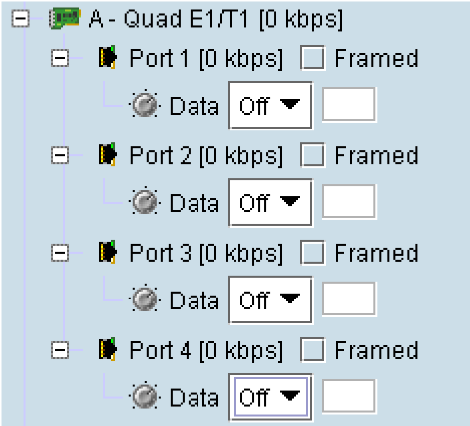
Compatible Interfaces

Cross connections can be made between any compatible interfaces of equal data rates. Compatible interfaces are shown in the table below:

	Ethernet (management)	Ethernet (user)	QJET E1 Unframed	QJET T1 Unframed	QJET E1 Framed PCM 31	QJET E1 Framed PCM 30	QJET T1 SF - PTS	QJET T1 SF - DMS	QJET T1 ESF - PTS	QJET T1 ESF - DMS	Q4EM voice only	Q4EM with E&M	QV24 with signalling	DFXO	DFXS	HSS data	HSS signalling
Ethernet (management)	✓																
Ethernet (user)		✓															
QJET E1 Unframed			✓														
QJET T1 Unframed				✓													
QJET E1 Framed PCM 31					✓	✓					✓	✓	✓	✓	✓	✓	✓
QJET E1 Framed PCM 30					✓	✓					✓	✓	✓	✓	✓	✓	✓
QJET T1 SF - PTS							✓										
QJET T1 SF - DMS								✓		✓	✓	✓	✓			✓	✓
QJET T1 ESF - PTS									✓								
QJET T1 ESF - DMS								✓		✓	✓	✓	✓	✓	✓	✓	✓
Q4EM voice only					✓	✓		✓		✓	✓						
Q4EM with E&M					✓	✓		✓		✓		✓		✓	✓		
QV24 with signalling					✓	✓		✓		✓			✓				
DFXO					✓	✓				✓		✓			✓		
DFXS					✓	✓				✓		✓		✓	✓		
HSS data					✓	✓		✓		✓						✓	
HSS signalling					✓	✓		✓		✓							✓

QJET Cross Connections

Expand the E1 / T1 display by clicking on the relevant icons.



The QJET card can operate in several modes allowing you greater flexibility in tailoring or grooming traffic. The Data type selection are Off, E1, or T1 rates.

Note: An unframed E1 / T1 port requires 5 bits (or 40 kbit/s) of overhead traffic per port for synchronization.

An unframed E1 port with 2048 kbit/s of traffic requires 2088 kbit/s of link capacity.

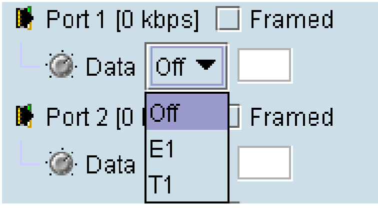
An unframed T1 port with 1544 kbit/s of traffic requires 1584 kbit/s of link capacity.

For each port that you want to put into service, choose the required mode (either Unframed or Framed):

Unframed Mode

Leave the Framed checkbox unticked.

Select the required Data type from the drop-down list E1 or T1.

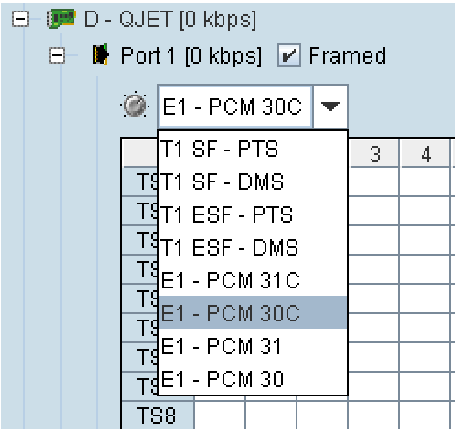


Local drop and insert connections are not possible between Unframed E1 / T1 ports.

Framed Mode

Tick the Framed checkbox.

Select the required framed mode from the drop-down list:



Local drop and insert connections are possible between framed E1 ports on the same interface card or E1 ports on different interface cards.

Local drop and insert connections are possible between framed T1 ports on the same interface card or T1 ports on different interface cards.

Local drop and insert connections are not possible between framed E1 ports and framed T1 ports.

E1 Framed Modes

Framed Mode	Description
E1 – PCM 30	Provides 30 timeslots to transport traffic. Timeslot 16 carries channel associated signalling data (CAS).
E1 – PCM 31	Provides 31 timeslots to transport traffic. Timeslot 16 can be used for common channel signalling or to transport traffic.
E1 – PCM 30C	Same as E1 – PCM 30 mode but supports CRC-4.
E1 - PCM 31C	Same as E1 – PCM 31 mode but supports CRC-4.

E1 CRC-4 (cyclic redundancy check) is used to ensure correct frame alignment and also used to gather E1 performance statistics e.g. Errored Seconds (ES), Severely Errored Seconds (SES).

The first three bits of timeslot 0 NFAS (bits 0,1 & 2) and all of timeslot 0 FAS are not transported across the link, but rather terminated and regenerated at each terminal.

The last five bits of timeslot 0 NFAS (bits 3 – 7) are the National Use Bits (NUBs) which can be cross connected locally or over the link.

E1 - PCM 30 mode

E1 - PCM 30 modes are used when access to the signalling bits (ABCD) is required, for example:

- Splitting a PCM 30 E1 into two separate PCM 30 E1s
- Cross connecting signalling from DFXS, DFXO or Q4EM interfaces into an PCM 30 E1
- Drop and Insert connections between PCM 30 E1s

In PCM 30 / PCM 30C mode, the timeslot table left column is used to map timeslot bits and the timeslot table right column is used to map CAS bits (ABCD) for signalling. Timeslot 16 is reserved to transport the CAS multi frame.

One use of this mode is to connect the 4 wire E&M interfaces to third-party multiplexer equipment over the E1 interface using CAS in TS16 to transport the E&M signalling.

To configure this mode correctly, you must have a detailed knowledge of the CAS signalling modes for the third-party equipment to ensure the signalling bits are compatible and configured to interoperate.

E1 - PCM 31 mode

E1 - PCM 31 modes are used to cross connect timeslots bits without the signalling bits (ABCD).

TS16 can be cross connected between E1 ports (to transport the entire CAS multi frame) or used for common channel signalling or to transport traffic.

The timeslot table left column is used to map timeslot bits but the timeslot table right column for CAS bits (ABCD) is not used.

T1 Framed Modes

Framed Mode	Description
T1 SF - PTS	Provides 24 timeslots to transport traffic using the G.704 12 frame Super Frame with Pass Thru Signalling (PTS). There is no CRC capability with the SF.
T1 SF - DMS	Provides 24 timeslots to transport traffic using the G.704 12 frame Super Frame with DeMultiplexed Signalling (CAS AB bits). There is no CRC capability with the SF.
T1 ESF - PTS	Provides 24 timeslots to transport traffic using the G.704 24 frame Extended Super Frame with Pass Thru Signalling (PTS) and CRC.
T1 ESF - DMS	Provides 24 timeslots to transport traffic using the G.704 24 frame Extended Super Frame with DeMultiplexed Signalling (CAS ABCD bits) and CRC.

T1 SF - PTS mode

T1 SF - PTS mode provides 24 timeslots to transport traffic using the G.704 12 frame Super Frame without demultiplexing the signalling.

Pass Thru Signalling provides cross connection of the entire framed T1 timeslot between T1 ports (including the inherent robbed bit signalling). This is the most efficient method of transporting a framed T1 over the radio link as no additional radio link capacity is required to transport the signalling because the CAS is not demultiplexed.

To maintain multi frame alignment between two framed T1 ports, a FPS (Frame Pattern Sync) bit is required to be cross connected between the two framed T1 ports. This FPS bit requires an additional 8 kbit/s of radio link capacity.

The timeslot table left column is used to map timeslot bits but the timeslot table right column for CAS bits (ABCD) is not used.

T1 SF - PTS mode is used when access to the signalling bits is not required but are transported between T1s, for example:

- Drop and Insert connections between Super Frame T1s or data interfaces

T1 SF – DMS mode

T1 SF – DMS mode provides 24 timeslots to transport traffic using the G.704 12 frame Super Frame with four state demultiplexed signalling using the AB bits each with a bit rate of 333 bit/s.

DeMultiplexed Signalling allows the cross connection of framed T1 ports to other interface ports e.g. to a Q4EM or HSS. An additional 8 kbit/s of radio link capacity is required to transport each CAS bit over the radio link.

The mapping left column is used to map timeslot bits and the timeslot table right column is used to map the CAS A&B bits for signalling (C&D bits are not used).

T1 SF – DMS mode is used when access to the signalling bits is required, for example:

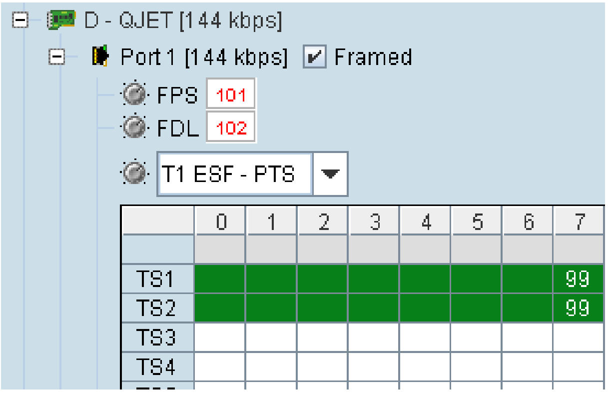
- Cross connecting signalling from a Q4EM interfaces into a 12 frame Super Framed T1.
- Drop and Insert connections between Super Framed T1s or data interfaces

T1 ESF - PTS mode

T1 ESF - PTS mode provides 24 timeslots to transport traffic using the G.704 24 frame Extended Super Frame without demultiplexing the signalling.

Pass Thru Signalling provides cross connection of the entire framed T1 timeslot between T1 ports (including the inherent robbed bit signalling). This is the most efficient method of transporting a framed T1 over the radio link as no additional radio link capacity is required to transport the signalling because the CAS is not demultiplexed.

To maintain multi frame alignment between two framed T1 ports, a FPS (Frame Pattern Sync) bit is required to be cross connected between the two framed T1 ports. This FPS bit requires an additional 8 kbit/s of radio link capacity.



The FDL (Facility Data Link) can be cross connected between the two framed T1 ports if required. This FDL bit requires an additional 8 kbit/s of radio link capacity.

The timeslot table left column is used to map timeslot bits but the timeslot table right column for CAS bits (ABCD) is not used.

T1 ESF - PTS mode is used when access to the signalling bits is not required but are transported between T1s, for example:

- Drop and Insert connections between 24 frame Extended Super Framed T1s or data interfaces

T1 ESF - DMS

T1 ESF - DMS mode provides 24 timeslots to transport traffic using the G.704 24 frame Extended Super Frame with sixteen state demultiplexed signalling using the ABCD bits each with a bit rate of 333 bit/s.

DeMultiplexed Signalling allows the cross connection of framed T1 ports to other interface ports e.g. to a Q4EM or HSS. An additional 8 kbit/s of radio link capacity is required to transport each CAS bit over the radio link.

The FDL (Facility Data Link) can be cross connected between the two framed T1 ports if required. This FDL bit requires an additional 8 kbit/s of radio link capacity.

The mapping left column is used to map timeslot bits and the timeslot table right column is used to map the CAS ABCD bits for signalling.

T1 ESF - DMS mode is used when access to the signalling bits is required, for example:

- Cross connecting signalling from DFXS, DFXO or Q4EM interfaces into a 24 frame Extended Super Framed T1 using ‘non-multiplexed’ signalling from the interface.
- Drop and Insert connections between 24 frame Extended Super Framed T1s or data interfaces

QJET Spare CAS Bit Control

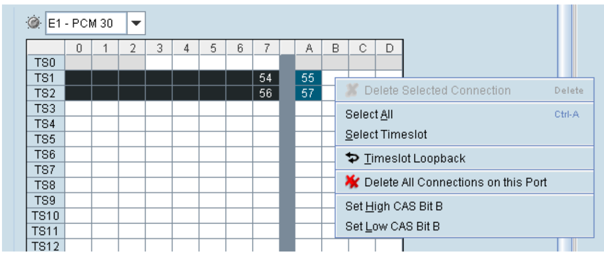
The Aprisa XE can currently provide E1 CAS to DFXS circuits using the 1 bit '4 wire compatible' signalling mode (uses the CAS A bit) but to enable some exchange DTIs to operate, the state of the spare CAS bits sent to the exchange must be preset.

The available CAS bits can be preset to High (1) or Low (0) for the QJET framed modes of E1 - PCM30, E1 - PCM30C, T1 SF - DMS and T1 ESF – DMS for all timeslots of the port.

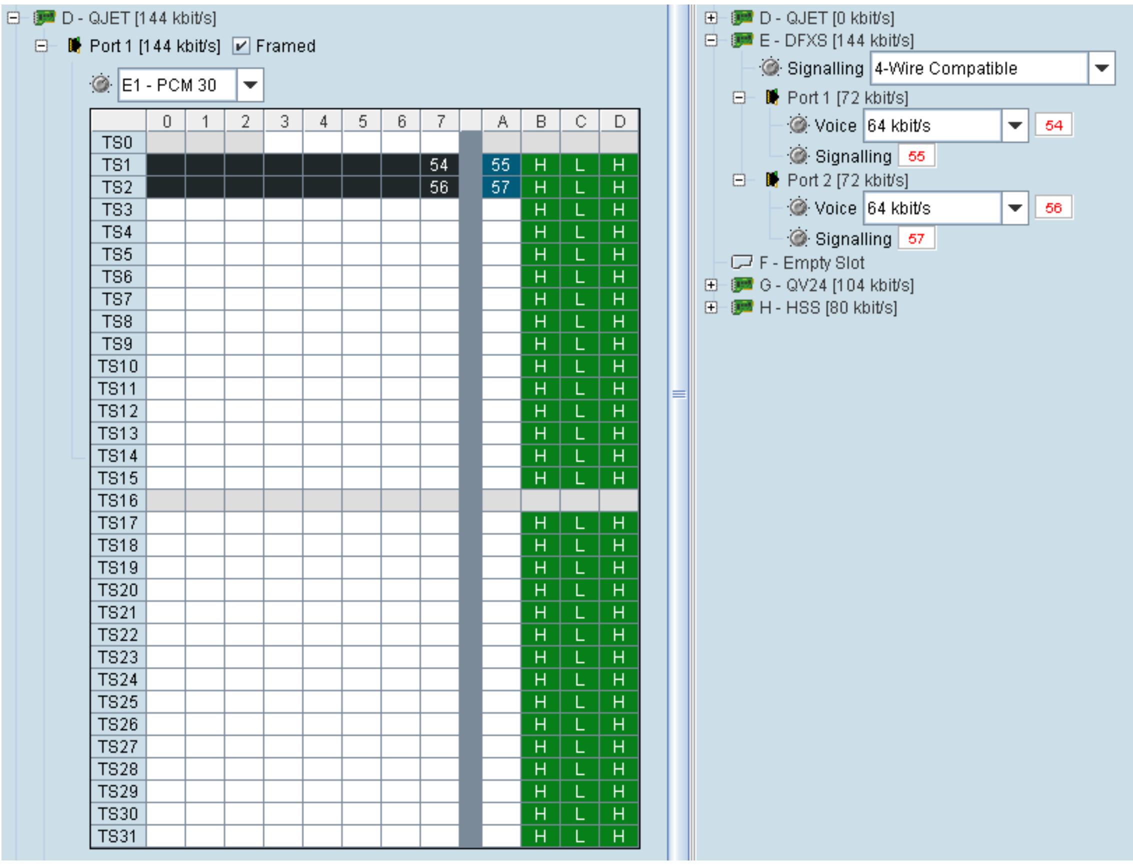
To preset the spare CAS bits:

Right click on the CAS bit required to be set.

Select 'Set High CAS Bit x' or 'Set Low CAS Bit x'.



The screen shot shows the standard configuration where the DFXS signalling using 1 bit '4 wire compatible' signalling mode is mapped to the QJET CAS A bit and the 'spare' CAS bits are preset to the standard 1 bit protocol spare bit pattern of BCD = 101.



Selecting and Mapping Bits and Timeslots

This section describes how to select and map:

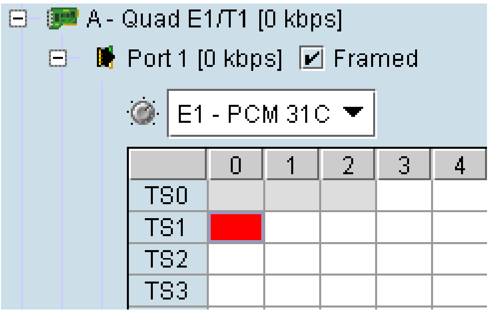
- a single bit
- multiple bits
- a 64 kbit/s timeslot
- multiple timeslots

Selecting a Single Bit

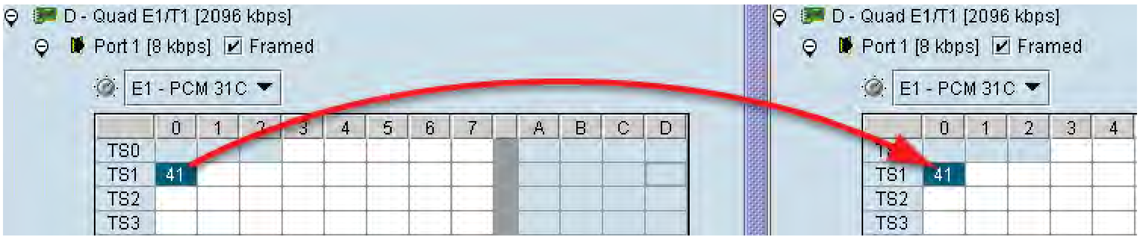
Each timeslot is represented by 8 rectangles (each representing a single bit). Each bit can carry 8 kbit/s.

One or more consecutive bits can be selected in a timeslot if a rate of greater than 8 kbit/s is required.

1. Click on the rectangle that represents the bit you require. It will turn red.



2. Click and drag this bit to the rectangle representing the bit on the interface you want it to be connected to, and release the mouse button.

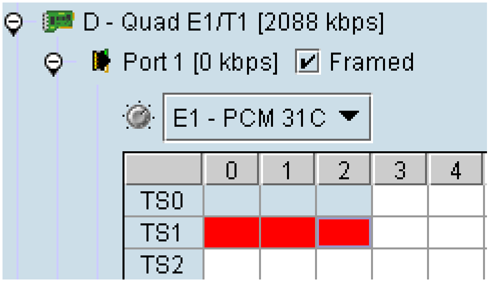


The red rectangle will be replaced by the allocated connection number at each interface.

Selecting Multiple Bits

It is possible to select multiple consecutive bits if circuit capacity of greater than 8 kbit/s is required.

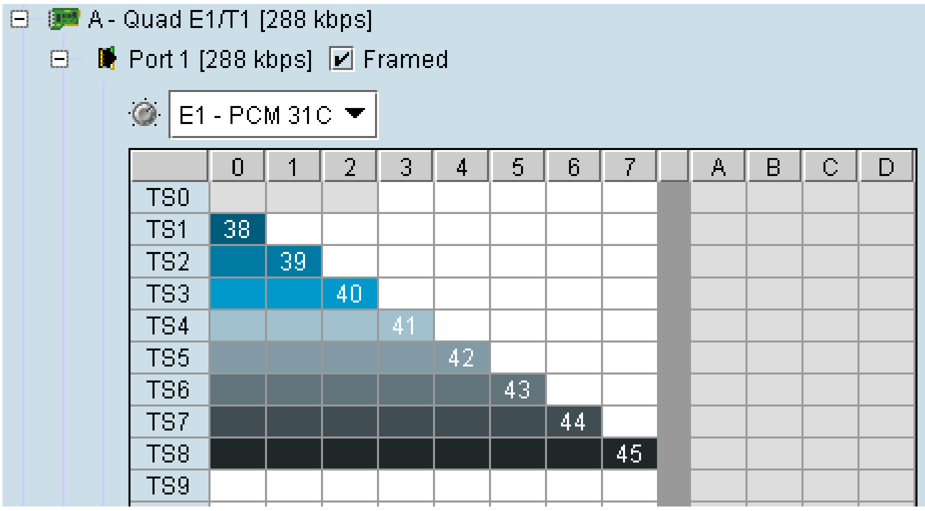
1. Click the first bit, and then hold down the Ctrl key while selecting the remaining bits.



2. Click and drag the whole block by clicking the bit on the left hand side of your selection, and drag to the required interface. Release the mouse button.

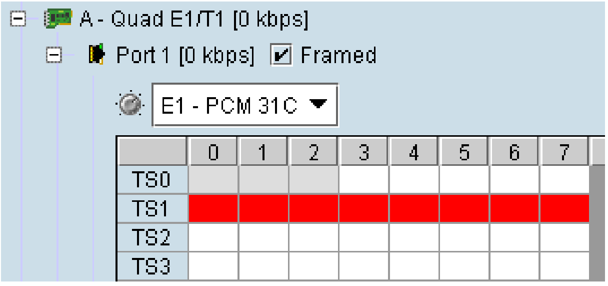
Tip: It is also possible to select multiple bits by holding down the Shift key, and dragging across the required rectangles.

Differing numbers of bits display in different colors when the cross-connect is completed:

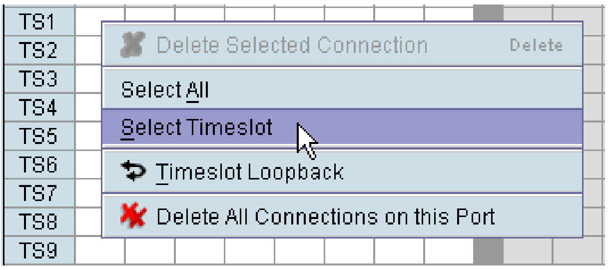


Selecting a 64 kbit/s Timeslot

1. Click on the TSX timeslot number (where X is the desired timeslot from 1 to 31).



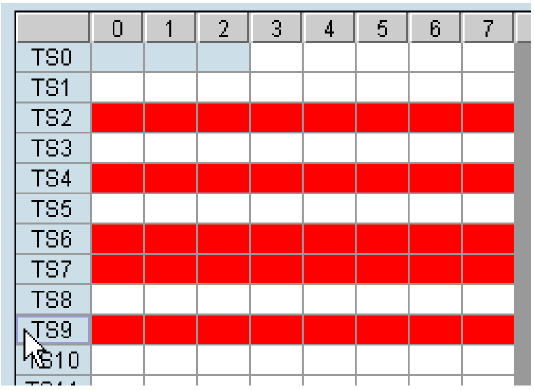
Alternatively, right-click over any of the bits in the timeslot, and click on Select Timeslot.



2. Drag and drop in the normal way to complete the cross connection.

Selecting Multiple Non Consecutive Timeslots

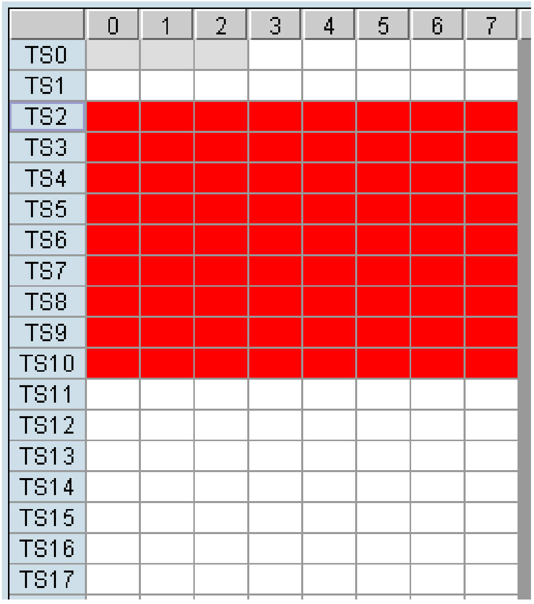
1. Click on one TSn timeslot number (where n is the desired timeslot 1 to 31).
2. Hold down the Ctrl key while clicking on each of the required timeslot numbers.



3. Drag and drop in the normal way to complete the cross connection.

Selecting Multiple Consecutive Timeslots

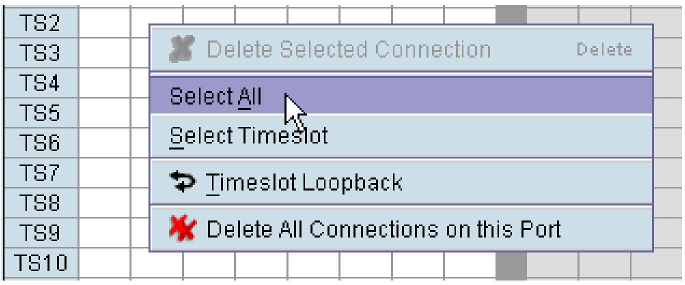
1. Click on the first TSn timeslot number (where n is the desired timeslot 1 to 31).
2. Hold down the Shift key while clicking on the last required timeslot number.



3. Drag and drop in the normal way to complete the cross connection.

Selecting All Timeslots in a Port

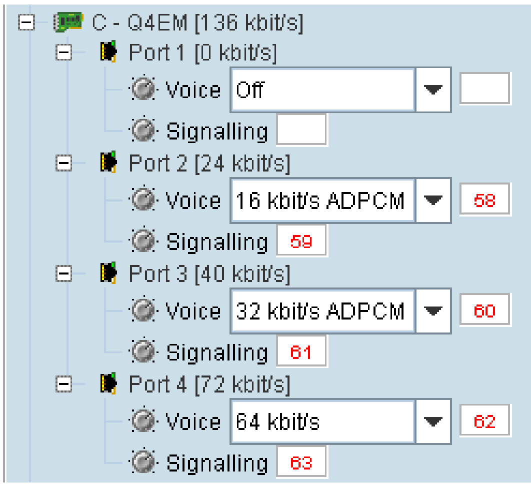
1. Right-click over any of the rectangles.



2. Click Select All.

Q4EM Cross Connections

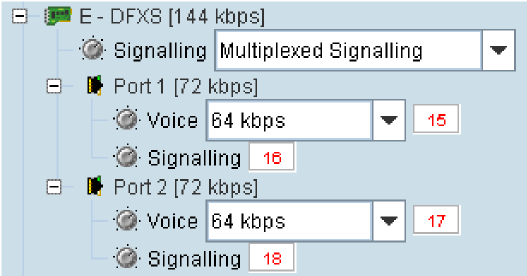
1. Expand the Q4EM display by clicking the relevant ⊞ icon.



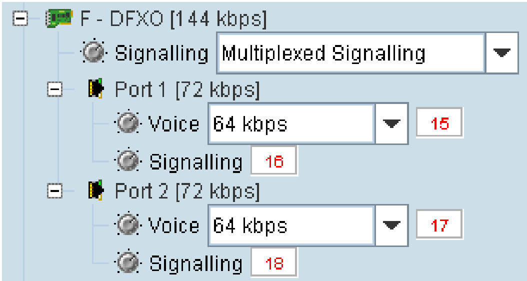
2. Set the Voice capacity by selecting 16, 24, 32, or 64 kbit/s rates.
3. Drag and drop from the **Voice** mapping connection box to the required partner interface to create the voice cross connection.
4. If E&M signalling is required, drag and drop from the **Signalling** mapping connection box to the required partner interface to create the E&M cross connection.

DFXS and DFXO Cross Connections

1. On one side of the link, expand the DFXS display, as required, by clicking ⊞.



2. On the other side of the link, expand the corresponding DFXO display, as required, by clicking ⊞.



3. For the DFXS card and corresponding DFXO card, select the Signalling **type** as required, according to the table below. The CAS signalling between DFXO / DFXS interfaces uses 4RF proprietary allocation of control bits.

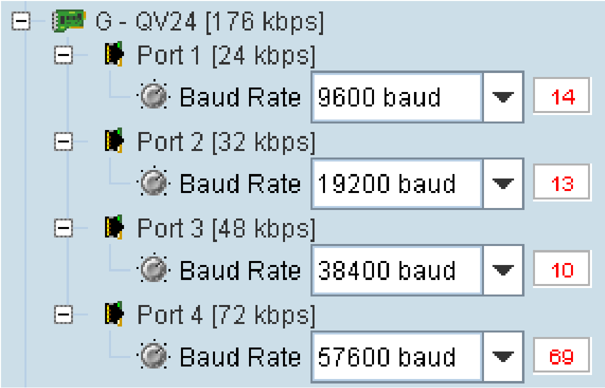
   The **Signalling** type affects both ports of the DFXO / DFXS interface. If a mixture of signalling types is required, then multiple DFXO / DFXS cards are needed.

Signalling	Application	Overhead
Multiplexed (default)	Multiplexers the four ABCD bits from the interface into a single 8 kbit/s channel. Use when interworking DFXO to DFXS, between an XE and a SE radio or when limited bandwidth is available. This signalling type cannot be used for interworking between framed E1 / T1 and voice interfaces.	8 kbit/s
Non-multiplexed	Transports each of the four ABCD bits in separate 8 kbit/s channels. Use when interworking DFXO to DFXS, or when signalling bits are mapped into an E1 / T1 timeslot.	32 kbit/s
4 wire compatible	1 bit CAS using only the A bit in both directions of transmission. Use when interworking the DFXS to Q4EM, DFXO to Q4EM, DFXS to DFXS or DFXS to QJET for DTI circuits.	8 kbit/s

4. Set the Voice capacity and create the Voice connection by dragging and dropping between the mapping connection boxes of the DFXO and DFXS corresponding ports.
5. Link the **Port** Signalling connection by dragging and dropping between the mapping connection boxes of the DFXO and DFXS corresponding ports. The DFXO / DFXS control signals (off hook, ring, etc) will not function without this connection.

QV24 Cross Connections

1. Expand the QV24 displays, as required, by clicking the relevant ⊞ icons.



2. Select the Port Baud Rate as required (default is 9600).

3. Drag and drop to the required partner interface to create the V.24 Data connection.

   If the partner interface is a QJET:

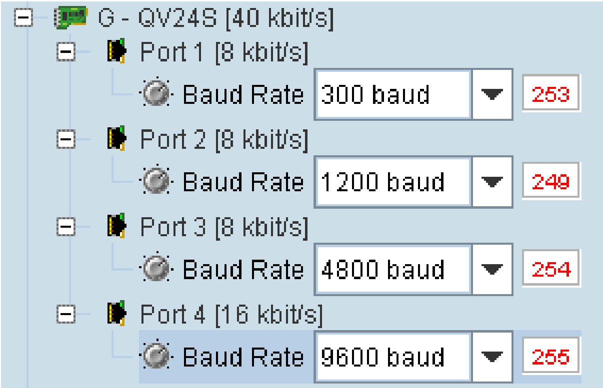
   - If the V.24 Baud Rate selected is 38400 is less, drag from the QV24 mapping connection box to the QJET timeslot. The correct QJET capacity for the baud rate selected will automatically be assigned.
   - If the V.24 Baud Rate selected is greater than 38400, select the QJET capacity required, as per the following table, and drag from the QJET to the QV24 mapping connection box.

Baud Rate	Bits Required	Bit Rate
300 - 7200	2	16 kbit/s
9600 - 14400	3	24 kbit/s
19200 - 23040	4	32 kbit/s
28800	5	40 kbit/s
38400	6	48 kbit/s
57600	9	72 kbit/s
115200	16	128 kbit/s

QV24S Cross Connections

Synchronous Mode

1. Expand the QV24S displays, as required, by clicking the relevant ⊞ icons.



2. Select the Port Baud Rate as required (default is 9600).

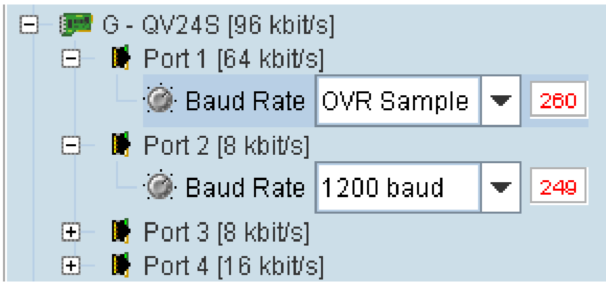
3. Drag and drop to the required partner interface to create the V.24 Data connection.

   If the partner interface is a QJET, drag from the QV24S mapping connection box to the QJET timeslot. The correct QJET capacity for the baud rate selected will automatically be assigned.

Baud Rate	Bits Required	Bit Rate
300 - 4800	1	8 kbit/s
9600	2	16 kbit/s
19200	4	32 kbit/s

Over Sampling Mode

1. Expand the QV24S displays, as required, by clicking the relevant ⊞ icons.

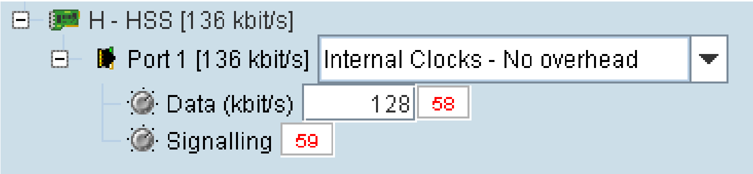


2. Set the Port Baud Rate to OVR Sample.

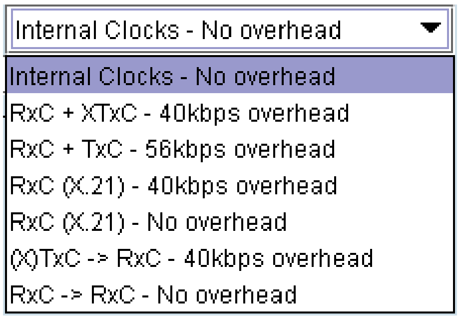
3. Drag and drop to the required E1 / T1 partner interface to create the data connection.

HSS Cross Connections

1. Expand the HSS displays, as required, by clicking the relevant ⊞ icons.



2. Select the **Synchronous Clock Selection** mode (see 'HSS Synchronous Clock Selection Modes' on page 138).



3. Set the **Data** rate to a value between 8 and 2048 (in multiples of 8 kbit/s).

   The net data rate available to the user is defined by Data Rate – overhead

   e.g. a date rate set to 2048 kbit/s with an overhead of 40 kbit/s provides a user data rate of 2008 kbit/s.

4. Drag and drop to the required partner interface to create the HSS Data connection.

   If the partner interface is a QJET, select the capacity on the QJET and drag it to the HSS Data mapping connection box.

   The QJET capacity selected must be the sum of the data rate required plus the overhead rate selected.

5. Drag and drop to the required partner interface to create the HSS Signalling cross connection. A minimum of 8 kbit/s of capacity is required and must be set symmetrically at both ends of the link.

Cross Connection Example

This is an example of cross connection mapping:

Circuit	Local port	Remote port	Capacity (kbit/s)	Connection numbers
Radio management			64	1
User Ethernet			1024	2
4 wire E&M circuit	Q4EM port 1 (slot C)	Q4EM port 1 (slot C)	72	7/15
Unframed E1 data	QJET port 1 (slot D)	QJET port 1 (slot D)	2088	65
Unframed T1 data	QJET port 2 (slot D)	QJET port 2 (slot D)	1584	66
2 wire loop Interface	DFXO port 1 (slot E)	DFXS port 1 (slot E)	72	8/32
V.24 data circuit 9600	QV24 port 1 (slot G)	QV24 port 1 (slot G)	24	14
HSS data circuit 1024 kbit/s	HSS port 1 (slot H)	HSS port 1 (slot H)	1088	31/16

Symmetrical Connection Wizard

The Cross Connections application has a Symmetrical Connection Wizard which simplifies the cross connection configuration when the terminals are fitted with symmetrical / matching interface types.

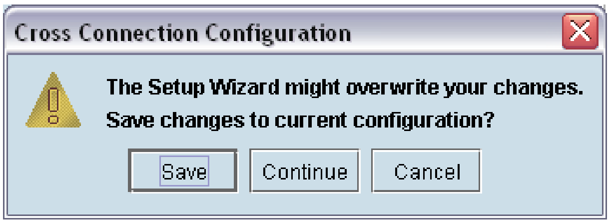
A symmetrical connection is a connection between the local and the remote terminal where the local slot, card type, port and connection details are identical to those of the remote terminal.

The only exception is DFXO / DFXS connections where DFXO cards are considered to match DFXS cards (as they normally interwork).

Framed E1 / T1 CAS connections, drop-and-insert connections, and connections that do not involve entire timeslots, are considered to be asymmetrical.

Starting the Cross Connections Wizard

When starting the connection wizard with unsaved changes, the following popup dialog should appear



Click on 'Save' if you wish to save the current configuration to a file. Clicking on 'Continue' will continue with the wizard and overwrite any changes made when the wizard finishes.

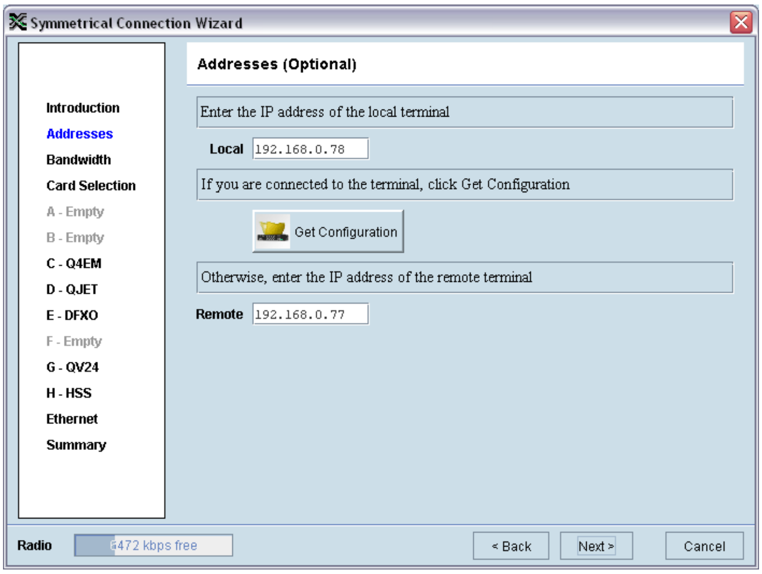
The wizard can be cancelled at any time by clicking on the 'Cancel' button or by closing the window.

Cross Connections Wizard Navigation

Click on the Next button to progress through the connection wizard. The current stage is indicated in the navigation bar on the left. You can jump directly to a stage by clicking on the stage required.

Setting the Cross Connections IP Address

If the local or remote terminal IP addresses have been setup, they will be displayed in the Local and Remote fields. If the IP addresses are not displayed, enter the IP addresses of the local and remote terminals.

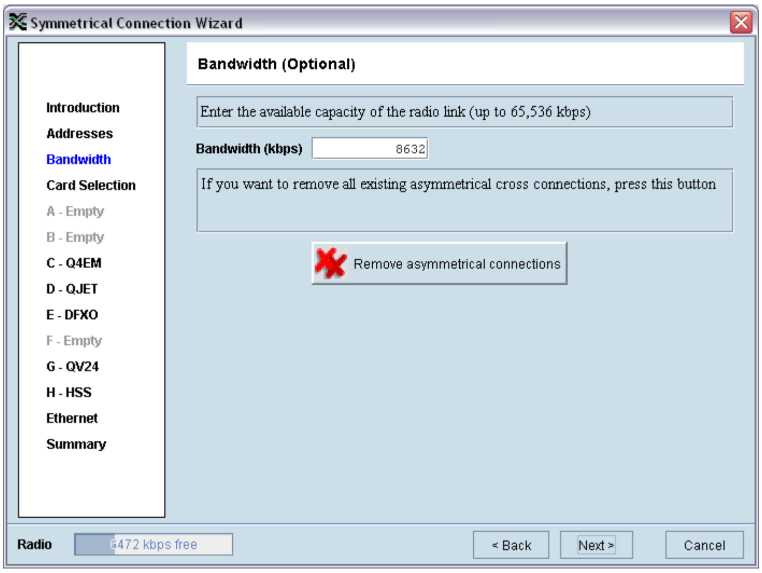


Click on 'Get Configuration' to upload the existing cross connections configuration from the local terminal. The Radio bandwidth bar will show the available bandwidth and will be updated as bandwidth is assigned to cards.

Setting the Cross Connections Bandwidth

If the Cross Connections Application is opened from SuperVisor, the Total Capacity of the radio link will be shown in the Bandwidth field.

If the Cross Connections Application is opened as a stand alone application, the Total Capacity of the radio link will be need to be entered in the Bandwidth field.

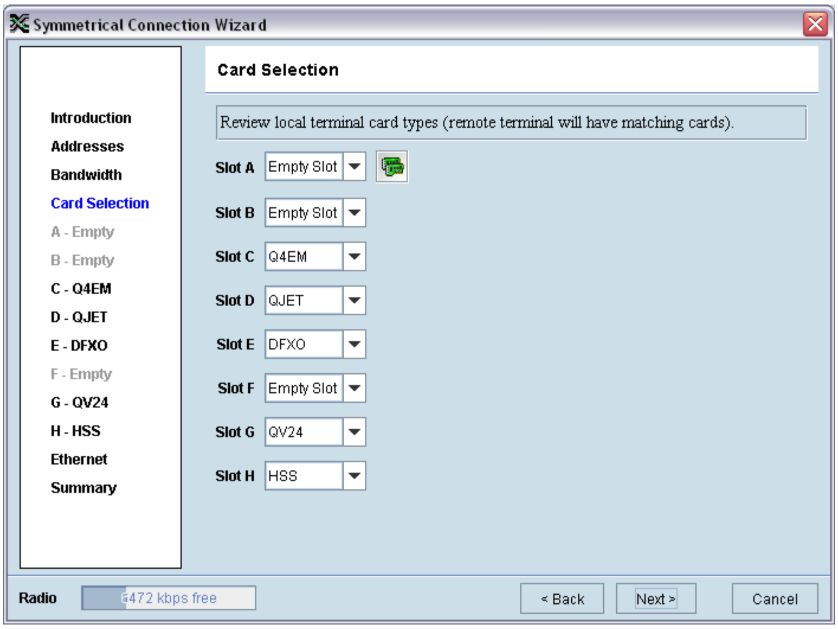


The 'Remove asymmetrical connections' button will be active if there are existing asymmetrical cross connections. If you want to remove existing asymmetrical cross connections, click on this button. The Radio bandwidth bar will update accordingly.

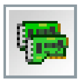
Cross Connections Card Selection

If the Cross Connections Application is opened from SuperVisor, existing cards installed in the local terminal that match cards installed in the remote terminal will be displayed. Mismatched cards will be shown as 'Empty Slot'.

If the Cross Connections Application is opened as a stand alone application, select the card types that will be fitted in the terminal.



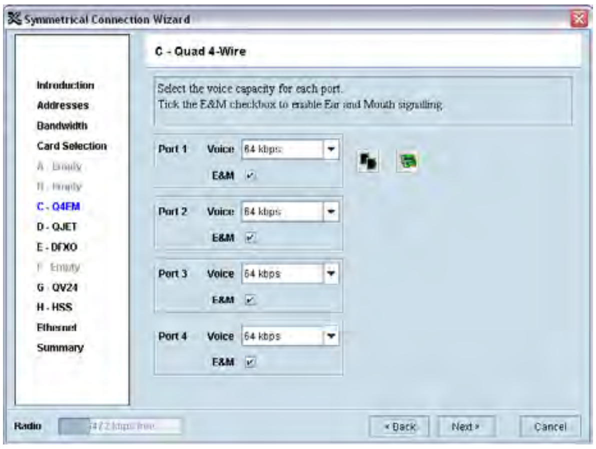
To copy the card type selected in Slot A to all the other slots (B – H), click on the Copy Card button. This assumes that the same interface card types are fitted in all the card slots.



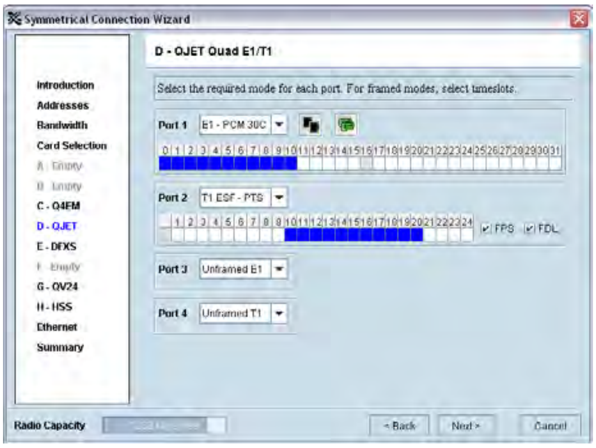
Cross Connections Interface Configurations

Setup the interface configurations as per the wizard instructions. Existing asymmetrical connections will be replaced with symmetrical connections if an interface parameter is changed.

Q4EM

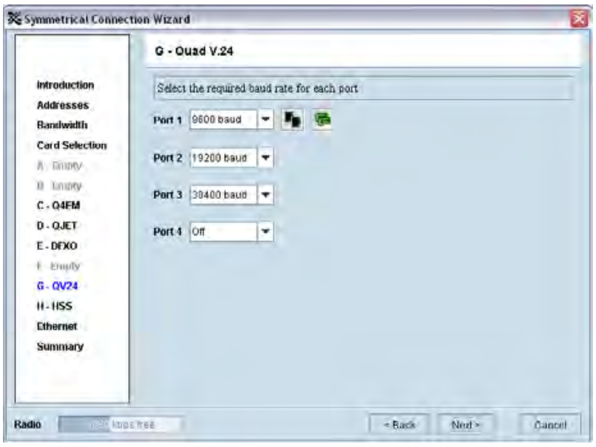


QJET

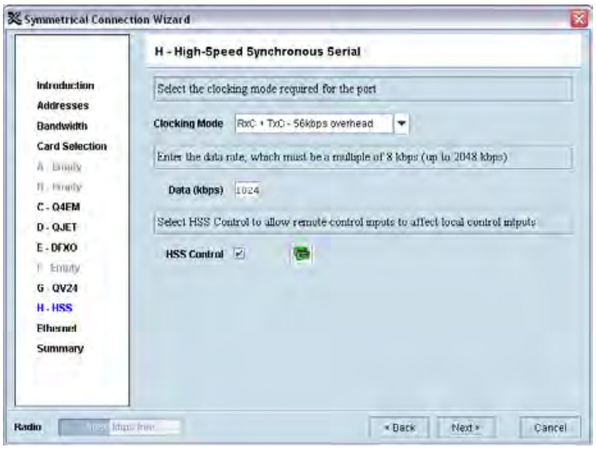


DFXO / DFXS

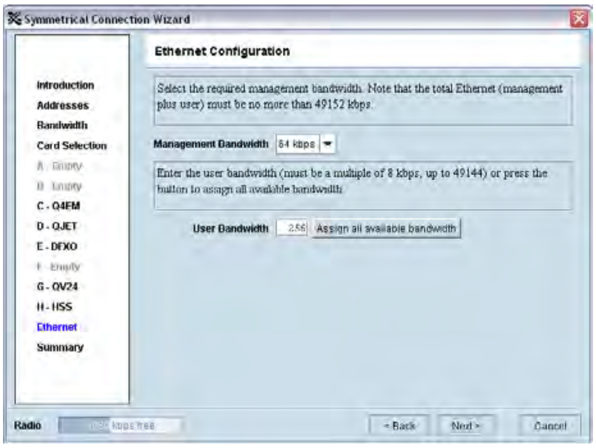
QV24



HSS

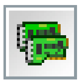


Ethernet

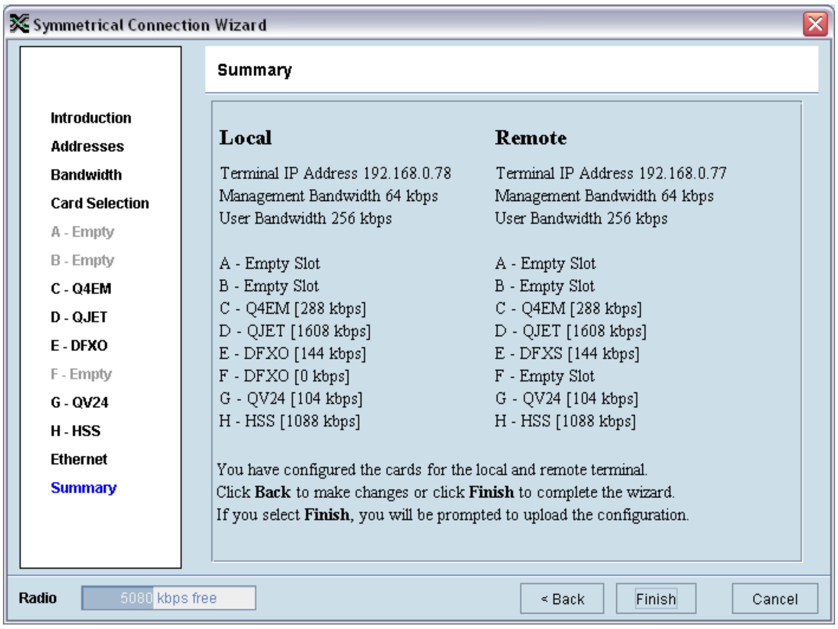


To copy the port configuration selected in Port 1 to all the other ports on the card, click on the Copy Port button.

To copy the card configuration to all other cards of the same type fitted in the terminal, click on the Copy Card button. This can save time when setting up multiple cards of the same type.



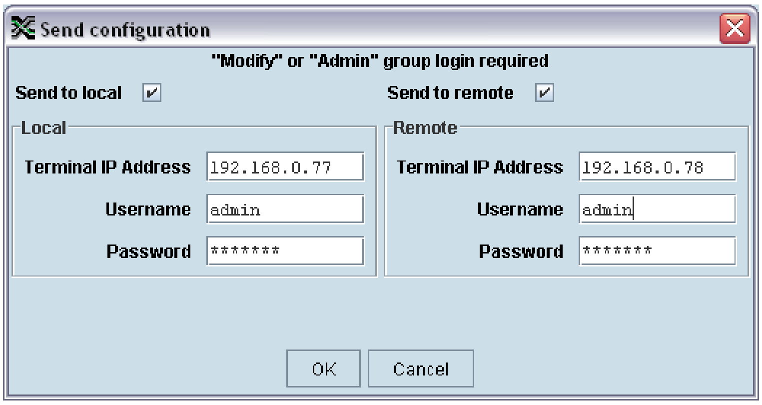
Symmetrical Connection Summary



Click Finish.

Send Symmetrical Connection Configuration

Click OK to send the configuration to the terminals.



The process is completed.

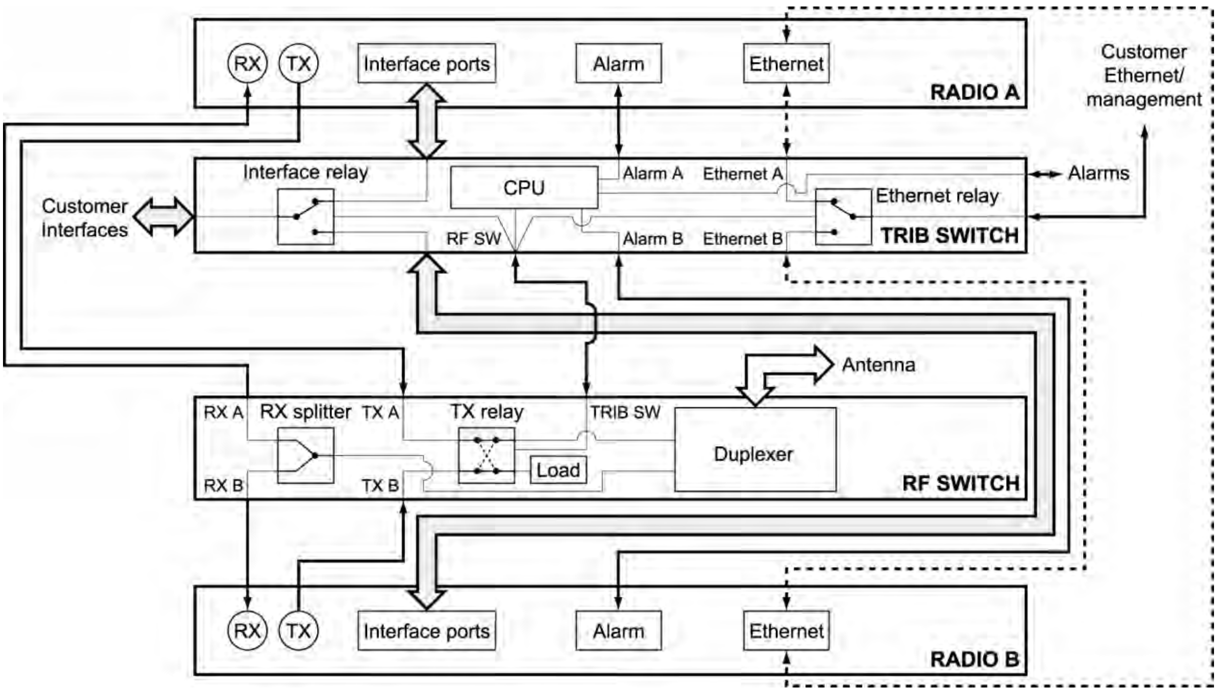
Note: The wizard may change the connection numbers of existing connections.

11. Protected Terminals

Monitored Hot Stand By (MHSB)

This section describes configuring the protected terminal in MHSB mode.

A protected terminal in MHSB mode comprises two radios interconnected using a MHSB switch. This MHSB switch comprises one RF switch and up to four tributary switches depending on the number of tributaries requiring switching:



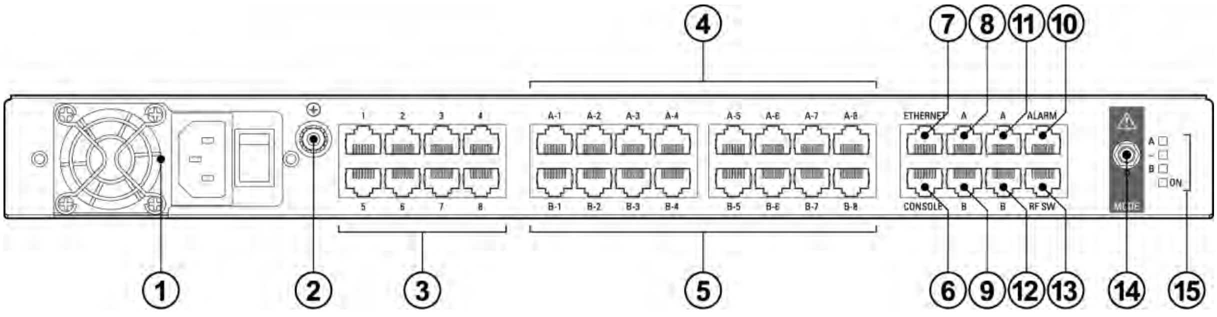
The MHSB switch protect terminals against any single failure in one radio. It also monitors the alarm output of each radio and switches between radios if major radio link alarms occur. The MHSB switch will not allow a switch to a faulty radio.

The MHSB switch uses a CPU to monitor the alarm status received from both the connected radios' alarm ports. When a relevant major radio link alarm is detected on the active radio (that is, transmitter, receiver, power supply or modem), the CPU switches a bank of relays that switches all the interfaces and the transmit port from the main radio to a functioning stand-by radio. The stand-by radio now becomes the active radio.

The MHSB switch has a hysteresis of 30 seconds to prevent switching on short alarm transients.

The tributary switch and the RF switch are both a 19-inch rack-mount 1U high chassis. The MHSB switch option is available for all Aprisa XE frequency bands.

Tributary Switch Front Panel

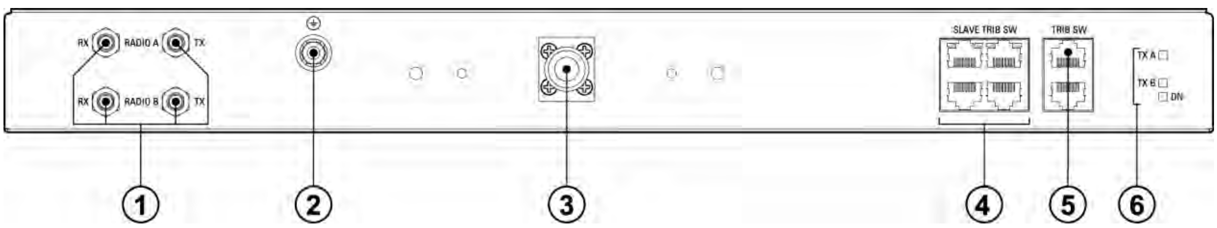


No.	Description	Explanation
1	Power supply input	Input for DC power or AC power
2	Protective earth	M5 terminal intended for connection to an external protective conductor for protection against electric shock in case of a fault
3	Interface ports	Port for connecting to customer interface equipment
4	Radio A interfaces	These connect to the interface ports on radio A
5	Radio B interfaces	These connect to the interface ports on radio B
6	Console	For factory use only
7	Ethernet	Port for connecting to customer Ethernet network. This port is also used to set up and manage the radios remotely over an IP network
8	Radio A Ethernet	Connects to an Ethernet port on radio A
9	Radio B Ethernet	Connects to an Ethernet port on radio B
10	Alarms	Alarm input/output connections for customer equipment
11	Radio A alarms	Connects to the alarm port on radio A
12	Radio B alarms	Connects to the alarm port on radio B
13	RF SW	Provides power and signalling to the RF switch
14	Mode switch	Three-position locking toggle switch to set the MHSB switch into automatic mode or radio A / radio B test mode
15	LEDs	Mode and status LEDs

Tributary Protection Switch LEDs

LED	Colour	Appearance	Explanation
A	Green	Solid	The radio is active and is OK
	Green	Flashing	The radio is in standby mode and is OK
	Red	Solid	The radio is active and there is a fault
	No colour (off)	-	The tributary switch is in 'slave' mode and the switching is controlled by the master tributary switch
	Red	Flashing	The radio is in standby mode, and there is a fault
B	Green	Solid	The radio is active and is OK
	Green	Flashing	The radio is in standby mode and is OK
	Red	Solid	The radio is active and there is a fault
	No colour (off)	-	The tributary switch is in 'slave' mode and the switching is controlled by the master tributary switch
	Red	Flashing	The radio is in standby mode, and there is a fault
~	Green	Solid	The tributary protection switch is in 'auto' mode
	Green	Flashing	The tributary protection switch is in 'slave' mode
	Red	Solid	The tributary protection switch is in 'manual' mode (A or B)
On	Blue	Solid	Indicates that there is power to the tributary protection switch

RF Switch Front Panel



No.	Description	Explanation
1	Radio QMA	QMA connectors for connecting the protected radios
2	Protective earth	M5 terminal intended for connection to an external protective conductor for protection against electric shock in case of a fault
3	Antenna port	N-type female connector for connection to the antenna feeder cable. This view shows an internally mounted duplexer. If an external duplexer is fitted, the antenna port will be on the external duplexer
4	Slave tributary switch outputs	Connects to secondary tributary switch for control of additional interfaces
5	Tributary switch	Connects the RF switch to the tributary switch (the master if more than one tributary switch is required)
6	LEDs	Status LEDs

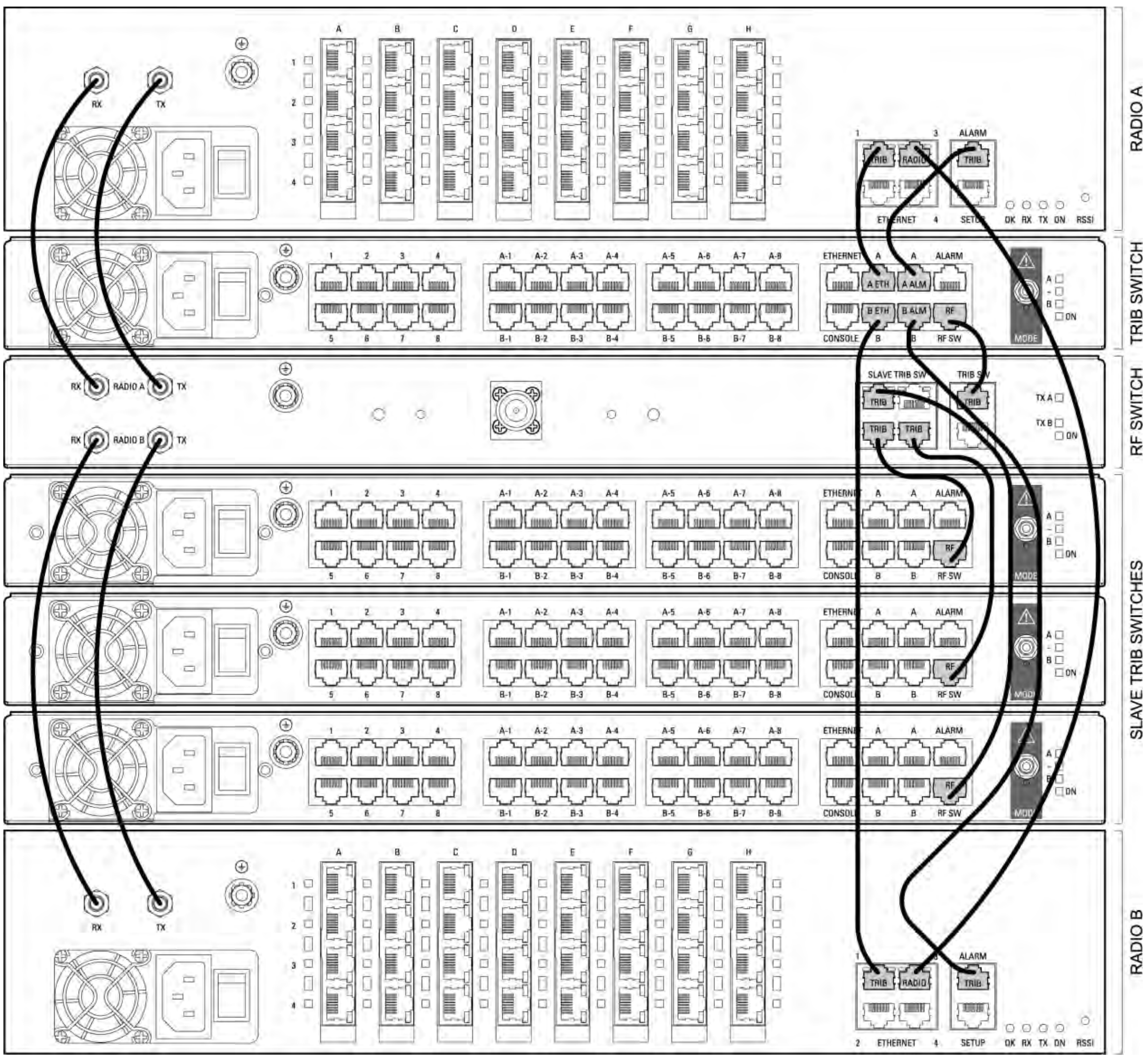
RF Protection Switch LEDs

LED	Colour	Appearance	Explanation
Tx A	Green	Solid	RF is being received from radio A
Tx B	Green	Solid	RF is being received from radio B
On	Blue	Solid	Indicates that there is power to the RF protection switch

Slave Tributary Switches

Each tributary switch protects up to eight ports. Up to three slave tributary switches may be added to a MHSB terminal to protect up to 32 ports. Each slave tributary switch is interconnected by means of the slave tributary switch ports on the RF switch, as shown below.

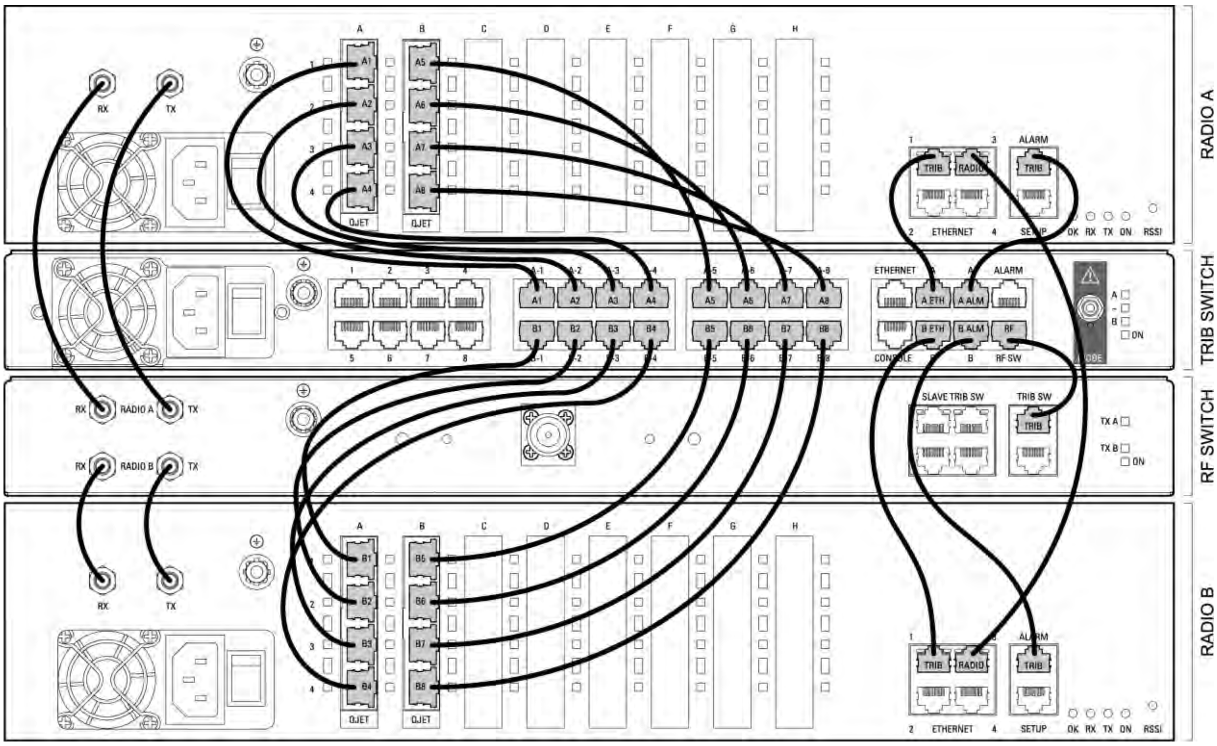
Note: A tributary switch that is operating as a slave (rather than a master) has a RJ-45 V.24 loopback connector plugged into the console port. If the connector is missing, contact Customer Support. Alternatively, you can make this connector. Follow the standard pinouts for a V.24 RJ-45 connection (see 'QV24 Interface connections' on page 273).



MHSB Cabling

The two radios are interconnected as follows:

CAUTION: Do not connect Transmit to Receive or Receive to Transmit as this may damage the radio or the MHSB switch.



Cables supplied with MHSB

The following cables are supplied with a MHSB terminal:

- Ethernet interface: RJ-45 ports standard TIA-568A patch cables .
- Alarm interface: RJ-45 ports standard TIA-568A patch cables.
- RF ports: two QMA male patch cables are supplied.

MHSB Power Supply

See 'DC Power Supply' on page 37 and 'AC Power Supply' on page 40.

Configuring the Radios for Protected Mode

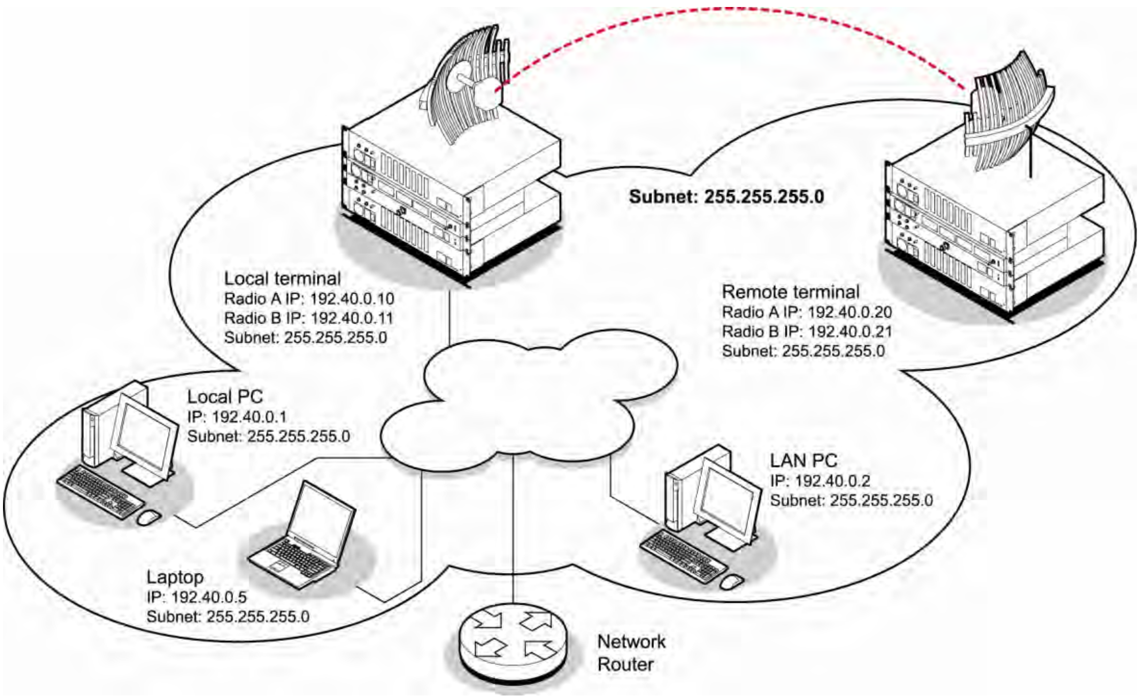
The MHSB switch does not require any special software. However, the radios connected to the MHSB switch must be configured to work with the MHSB switch. This sets the alarm outputs and inputs to function in MHSB mode.

You must configure the interfaces of both radios connected to the MHSB switch identically. To perform this, you can either connect directly to the radio or use the test mode of the MHSB switch.

MHSB Terminal IP Addresses

Before configuring the link, you must ensure that the two independent links have correctly configured IP address details.

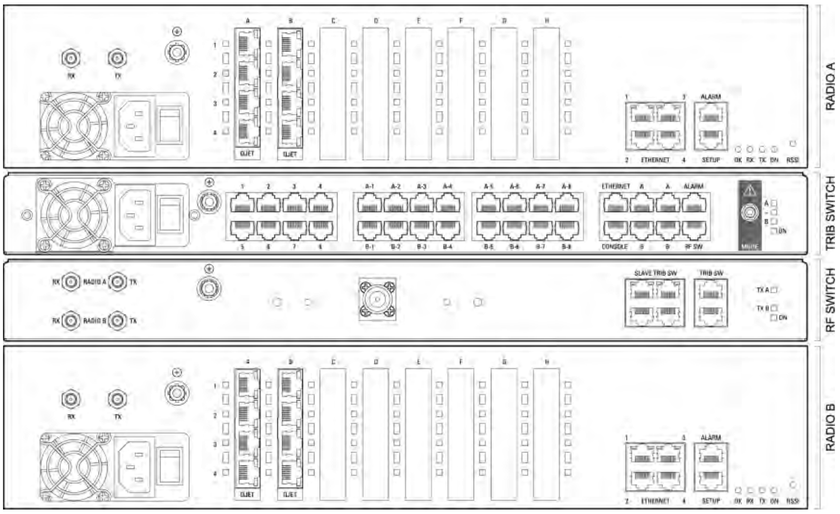
All four radios in the protected link must be on the same subnet.



Example of MHSB IP addressing

Mounting the MHSB Radios and Switches

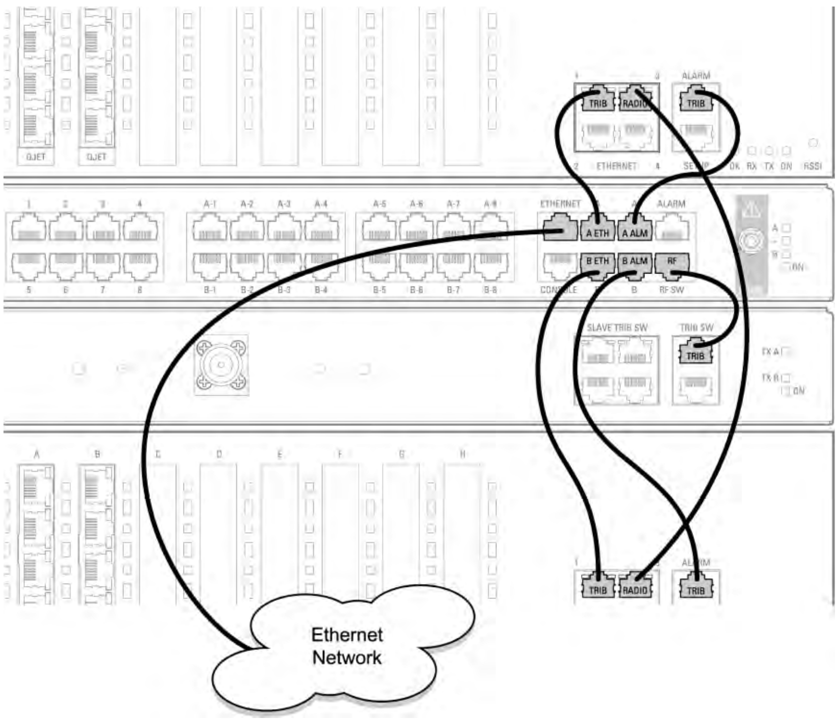
Once the IP addresses are correctly configured, it is important to connect the A and B radios' Ethernet and Alarm ports correctly. In general, mount radio A above the MHSB switch and radio B below the MHSB switch:



There is an Ethernet connection between any of the four Ethernet ports on each radio and the Ethernet port on the Tributary switch. There is also a connection between radio A and radio B, which ensures Ethernet traffic is maintained if a radio loses power.

The Ethernet port on the protection switch can be connected to an Ethernet hub or switch to allow multiple connections.

Important: The management Ethernet capacity on each of the four radios in the protected terminal must be identical for remote communications to work and there should only be one IP connection to the management network (via the tributary switch Ethernet port).



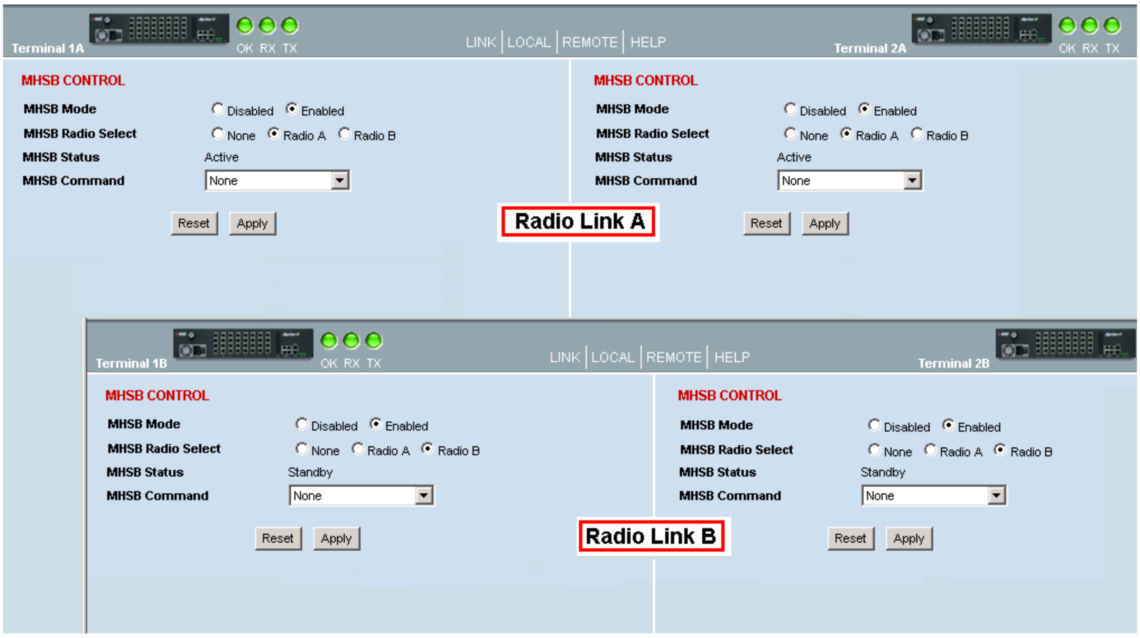
Configuring the Terminals for MHSB

It is recommended that you configure the local and remote A side first, then the local and remote B side. Both the local A and B radios must be configured identically, and both the remote A and B radios must be configured identically.

Tip: As illustrated below, you may find it helpful to have two browser sessions running simultaneously. You can then easily see both the A and B sides of the protected link.

To configure MHSB operation:

1. Select Link > Maintenance > MHSB.



2. Enable MHSB mode.

3. Select whether the radio is A or B.

Ensure that the radio connected to the A side of the protection switch (normally above the MHSB switch) is set to Radio A and the radio connected to the B side of the protection switch (normally below the MHSB switch) is set to Radio B.

In the event of a power outage, the radios will switch over to the A side of the protection switch when the power is restored. The A side is also the default active side.

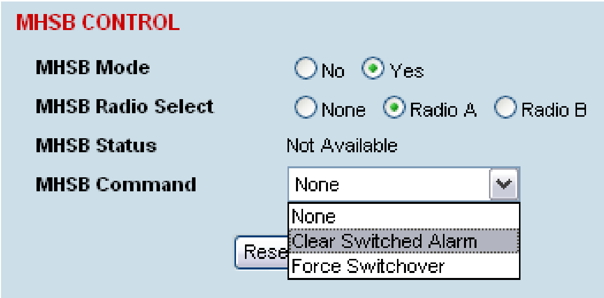
4. When you have made your changes, click Apply to apply changes or Reset to restore the previous configuration.

5. Repeat steps 2 to 4 for the other side of the protected link.

Clearing MHSB Alarms

If a switchover event occurs, the OK LED on the front panel and on the Terminal status and menu bar in SuperVisor changes to amber.

1. Select Clear Switched Alarm from the MHSB Command drop-down list.



2. Click Apply to apply changes or Reset to reset the page.

Note: When MHSB mode is enabled, external alarm input 2 is used by the protection system to carry alarms from the protection switch to the radio. In MHSB mode, therefore, only external alarm input 1 is available for user alarms.

Hitless Space Diversity (HSD)

HSD provides hitless RF receive path protection and hot standby transmitter redundancy. It is typically deployed for paths where high path availability is required.

An Aprisa XE hitless space diversity terminal comprises two radio terminals, radio A and radio B.

Radio A is the primary radio which is fitted with the interface cards and connects to antenna A.

Antenna A always carries the transmitted signal and the received signal for Radio A.

Radio B is the secondary radio the receiver of which connects to antenna B. The transmitter in this radio is the standby transmitter.

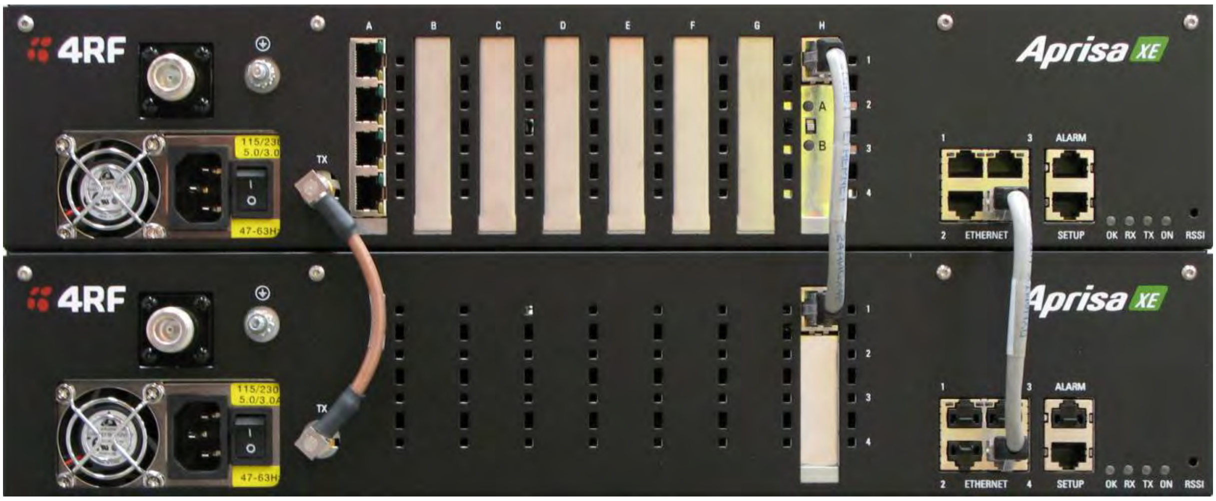
In the event of a radio A active transmitter failure, radio B transmitter becomes active.

Antenna B only carries the received signal for Radio B. This antenna is physically separated on the tower by a pre-determined distance from Antenna A.

As both radios have a receive path, traffic from the path with the best received bit error rate is routed to the customer interfaces in radio A.

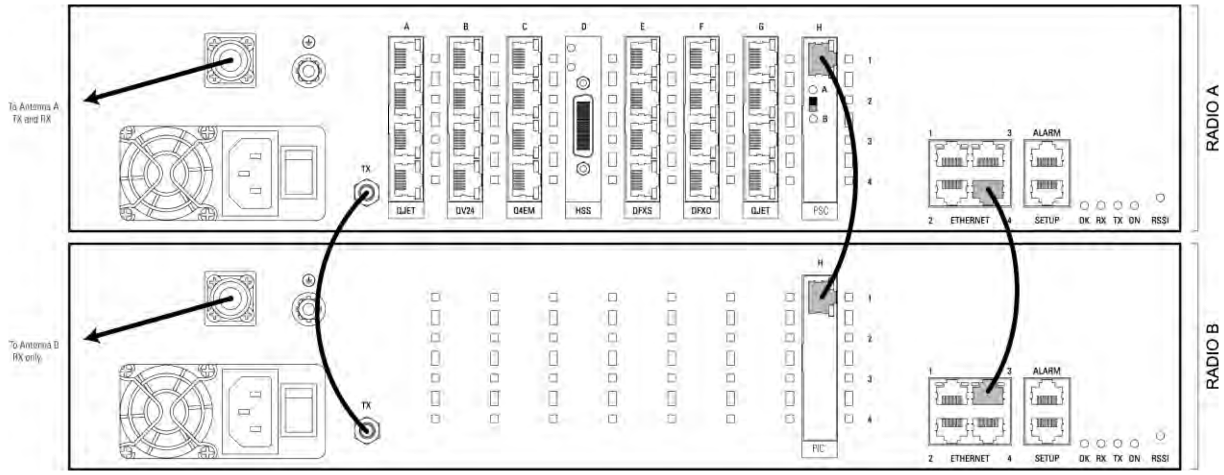
In an HSD terminal, a HSD Protection Switch Card (PSC) is always fitted in slot H in Radio A and a HSD Protection Interface Card (PIC) is always fitted in slot H in Radio B. The PSC card has a card front switch which controls the hardware setting of the HSD system Active Radio (Auto Select, Radio A or Radio B).

Customer interfaces are provided on radio A only in interface slots A to G. Interface connections to Ethernet and the external alarm inputs and outputs are also provided on radio A only.



HSD Terminal Cabling

The two HSD radios are interconnected as follows:



Cables Supplied with HSD Terminal

The following cables are supplied with a HSD terminal:

RF cable

A 110 mm QMA female to QMA female low loss RF cable is required to interconnect between the TX ports of both radio A and radio B. This cable carries the radio B transmitter output to the radio A transmitter switch.

Ethernet Cable

A 200 mm RJ45 to RJ45 Ethernet cable between the Ethernet ports of radio A and radio B. This cable carries management IP traffic between radio A and radio B.

Traffic Cable

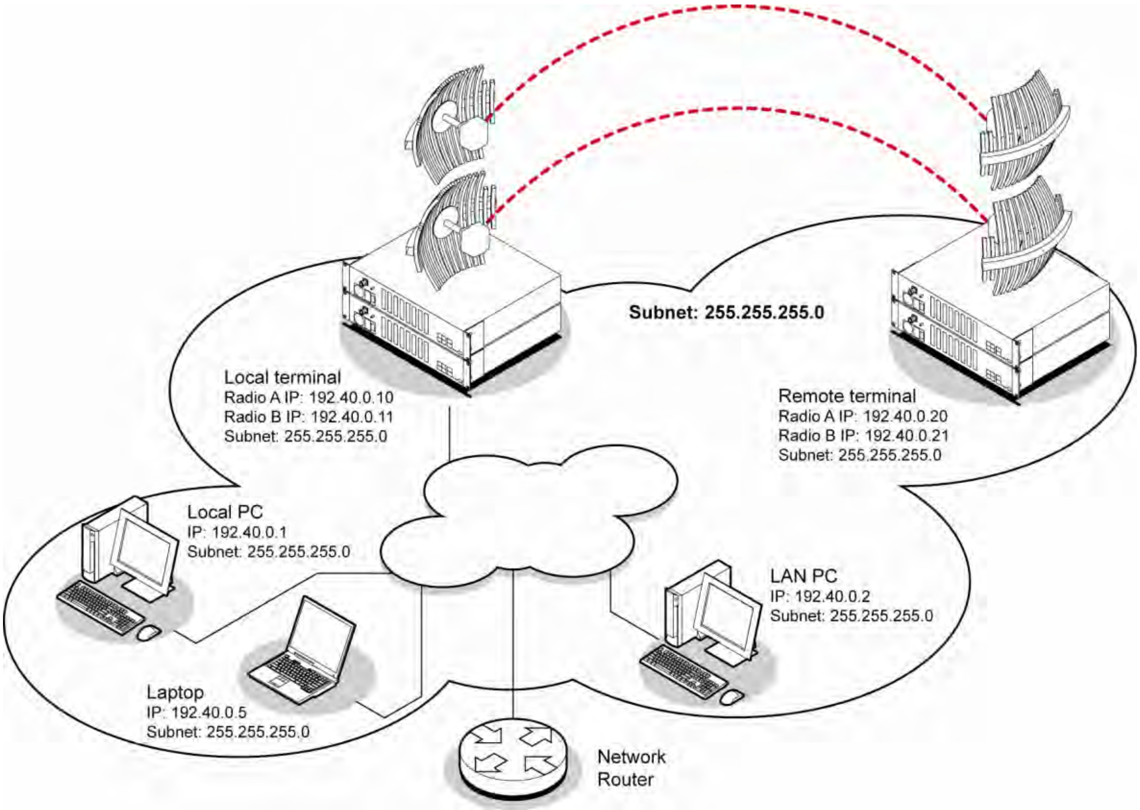
A 200 mm RJ45 to RJ45 Ethernet cable between the PSC and PIC. This cable carries all user traffic between Radio A and Radio B.

HSD Terminal IP Addresses

Each radio in the HSD link is assigned a unique IP address. All four radios in the HSD link must be on the same subnet.

The IP address of the four terminals can only be changed by logging into the relevant radio A or radio B.

When the IP addresses have been setup, an ethernet connection to any of the four radios can access all four radios in the HSD link. The usual ethernet connection is to the near end Radio A (see 'IP Addressing of Terminals' on page 53).



Example of IP addressing

Configuring HSD Terminals

To simplify the management and configuration of the HSD terminals, SuperVisor provides four windows which display the parameters for all four radios, the local and remote, radios A and B. The HSD System menu item displays the four windows.

When a parameter is changed in the four window mode, the relevant parameter is automatically changed to the same setting on the corresponding radio e.g. if a radio A modulation type is changed, the radio B modulation type is also changed to the same setting.

The Local and Remote menus continue to display the parameters for the local and remote radios for the near end terminal logged into.

The majority of SuperVisor HSD System pages contain the same parameters and controls as the standard 1+0 XE terminal. The main exceptions are the HSD Control page and the HSD Performance Summary page.

HSD Active Radio Control

The HSD system ‘Active Radio’ control determines if the selection of Radio A or Radio B is automatic or manual. This controls both the radio transmitters and receivers.

The Active Radio can be set with the hardware switch on the PSC card front or with the SuperVisor software control. The last change of hardware / software control determines the state of the HSD system.

The SuperVisor software control will always reflect the state of the HSD system.

After terminal startup or reboot, the state of the PSC mode switch determines the setting used by the system and the SuperVisor software control is set to reflect the state of the HSD system.

The PSC card has two card front LEDs which indicate the status of the HSD system:

PSC Mode Switch	Hardware Control Change		Software Control Change	
	LED A	LED B	LED A	LED B
Radio A	Solid Amber	Off	Flashing Amber	Off
Auto Select	Solid Green	Solid Green	Flashing Amber	Flashing Amber
Radio B	Off	Solid Amber	Off	Flashing Amber

To set the HSD controls:

1. Select HSD System > Maintenance > Control.

2. Set the Active Radio parameter.

Active Radio	Mode of Operation
Auto Select (default)	Automatic mode: The hitless receive will select traffic from the receive path of best performance The HSD system will switch to the standby transmitter if the active transmitter fails (TX failure alarm)
Radio A Only	Manual selection of radio path A only for both the transmitter and receiver i.e. no automatic switching
Radio B Only	Manual selection of radio path B only for both the transmitter and receiver i.e. no automatic switching

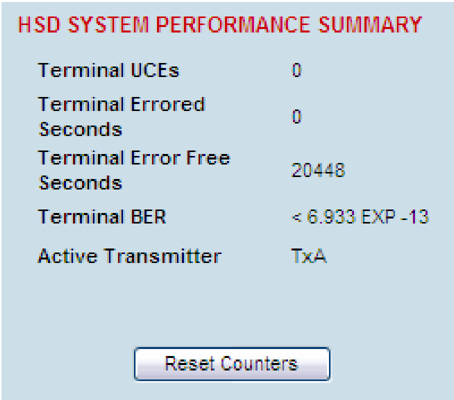
Note: There is no timeout for a manual selection of the Active Radio setting (Radio A only or Radio B only) but a ‘Mode Switch Software Override’ alarm will warn if the software has overwritten the PSC Mode Switch.

3. Set the Parameter Compare Checking.

Parameter Compare Checking	Option
On (default)	Any mismatch in parameters shown in Terminal Settings between Radio A and Radio B will generate a Parameter Mismatch alarm.
Off	No Parameter Mismatch alarm will be generated.

To view the HSD System Performance Summary:

1. Select HSD System > Performance > Summary.



Field	Explanation
Terminal UCEs	The total number of HSD terminal uncorrectable blocks since the last reset
Terminal Errored seconds	The total number of HSD terminal operational seconds with errored traffic since the last reset
Terminal Error free seconds	The total number of HSD terminal error free operational seconds since the last reset
Terminal BER	The system will report an estimated HSD terminal Bit Error Rate up to a maximum of 1 in 10^{21}
Active Transmitter	Dislays the current active transmitter (TxA or TxB)

Click Reset Counters to reset the error counters to zero.

12. In-Service Commissioning

Before You Start

When you have finished installing the hardware, RF and the traffic interface cabling, the system is ready to be commissioned. Commissioning the terminal is a simple process and consists of:

1. Powering up the terminals
2. Configuring both the local and remote terminals using SuperVisor
3. Aligning the antennas
4. Synchronizing the terminals
5. Testing the link is operating correctly. As a minimum, conduct the suggested tests to ensure correct operation. More extensive testing may be required to satisfy the end client or regulatory body requirements.
6. Connecting up the client or user interfaces

What You Will Need

- Appropriately qualified commissioning staff at both ends of the link.
- Safety equipment appropriate for the antenna location at both ends of the link.
- Communication equipment, that is, mobile phones or two-way radios.
- SuperVisor software running on an appropriate laptop, computer, or workstation at one end of the link.
- Tools to facilitate loosening and re-tightening the antenna pan and tilt adjusters.
- Predicted receiver input levels and fade margin figures from the radio link budget (You can use Surveyor (see ‘Path planning’ on page 23) to calculate the RSSI, fade margin, and availability).

Applying Power to the Terminals

WARNING:

Before applying power to a terminal, ensure you have connected the safety earth and antenna cable.

Apply power to the terminals at each end of the link.

When power is first applied, all the front panel LEDs will illuminate red for several seconds as the system initializes.

After the system is initialized, the OK LED on the front panel should illuminate green and if the terminals are correctly configured, the TX and RX LED should also be illuminated green.

If the RX LED is:

Red	the antennas are may be significantly mis-aligned with no signal being received
Amber	the antennas may be roughly aligned with some signal being received
Green	the antennas are well-aligned and adequate signal is being received to create a reliable path

If the TX LED is:

Red	the transmitter is faulty
Amber	there is a fault in the antenna connection or feeder cable
Green	the transmitter is working normally

Review the Link Configurations Using SuperVisor

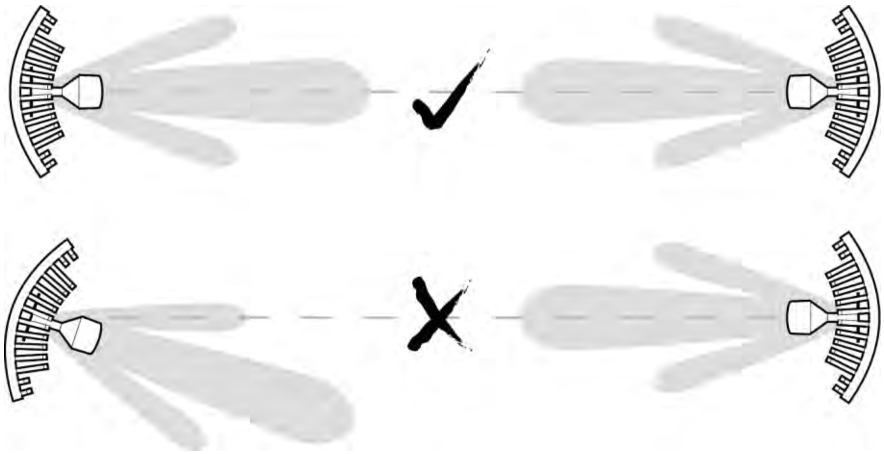
1. Connect a PC, with SuperVisor installed, to both terminals in the link.
2. Log into the link.
3. Select Link > Summary and confirm the following basic information:
   - Terminal IP address(es)
   - Terminal TX and RX frequencies
   - RSSI (dBm)
   - TX power (dBm)
   - SNR (dBm)

Note: If the terminals have not already been configured, refer to 'Configuring the terminal' on page 69, 'Configuring the traffic interfaces' on page 91, and 'Configuring the traffic cross connections' on page 145.

Antenna Alignment

For any point-to-point link, it is important to correctly align the antennas to maximize the signal strength at both ends of the link. Each antenna must be pointing directly at the corresponding antenna at the remote site, and they must both be on the same polarization. The antennas are aligned visually, and then small adjustments are made while the link is operating to maximize the received signal.

Directional antennas have a radiation pattern that is most sensitive in front of the antenna, in line with the main lobe of the radiation pattern. There are several other lobes (side lobes) that are not as sensitive as the main lobe in front of the antenna.



For the link to operate reliably, it is important that the main lobes of both antennas are aligned. If any of the side lobes are aligned to the opposite antenna, the received signal strength of both terminals will be lower, which could result in fading. If in doubt, check the radiation patterns of the antennas you are using.

Checking the Antenna Polarization

Check that the polarization of the antennas at each end of the link is the same.

Antenna polarization of grid antennas are normally indicated by an arrow or with ‘H’ and ‘V’ markers (indicating horizontal and vertical).

On Yagi antennas, ensure the orientation of the elements are the same at each end of the link.

Transmit frequency and power, and antenna polarization would normally be defined by a regulatory body, and typically licensed to a particular user. Refer to your license details when setting the antenna polarization.

Visually Aligning Antennas

1. Stand behind the antenna, and move it from side to side until it is pointing directly at the antenna at the remote site. The remote antenna may be made more visible by using a mirror, strobe light, or flag.

   If the remote end of the link is not visible (due to smoke, haze, or local clutter, etc), align the antenna by using a magnetic compass. Calculate the bearing using a scale map of the link path.

   When setting the antenna on the desired bearing ensure that you use the appropriate true-north to magnetic-north offset. Also ensure that the compass reading is not affected by standing too close to metallic objects.

2. Once the antenna is pointing at the remote antenna, tighten the nuts on the U-bolt or antenna clamp just enough to hold it in position. Leave the nuts loose enough so that small adjustments can still be made. Check that the antenna is still pointing in the correct direction.
3. Move the antenna up or down until it is pointing directly at the remote site.
4. Tighten the elevation and azimuth adjustment clamps.
5. Mark the position of the antenna clamps so that the antenna can be returned to this rough aim point easily when accurately aligning the antennas.
6. Repeat steps 1-5 at the opposite site.

Note: Low gain antennas need less adjustment in elevation as they are simply aimed at the horizon. They should always be panned horizontally to find the peak signal.

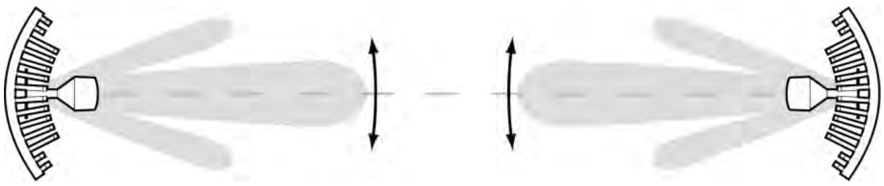
Accurately Aligning the Antennas

Once the antennas are visually aligned, accurately align both antennas by carefully making small adjustments while monitoring the RSSI. This will give the best possible link performance.

Note: Remember that it is important to align the main radiation lobes of the two antennas to each other, not any side lobes. It may be easier to perform this procedure if you can communicate with someone at the remote site by telephone, mobile, or two-way radio.

---

1. Connect a laptop PC running SuperVisor software and power up the terminals at both ends of the link. Select Link > Performance > Summary so that you can see the RSSI indication for the local terminal. Alternatively, use the RSSI test point on the front panel together with a multimeter (see 'Measuring the RSSI' on page 202).
2. Move the antenna through a complete sweep horizontally (known as a 'pan') either side of the point established in the visual alignment process above. Note down the RSSI reading for all the peaks in RSSI that you discover in the pan.
3. Move the antenna to the position corresponding to the maximum RSSI value obtained during the pan. Move the antenna horizontally slightly to each side of this maximum to find the two points where the RSSI drops slightly.
4. Move the antenna halfway between these two points and tighten the clamp.
5. If the antenna has an elevation adjustment, move the antenna through a complete sweep (known as a 'tilt') vertically either side of the point established in the visual alignment process above. Note down the RSSI reading for all the peaks in RSSI that you discover in the tilt.
6. Move the antenna to the position corresponding to the maximum RSSI value obtained during the tilt. Move the antenna slightly up and then down from the maximum to find the two points where the RSSI drops slightly.
7. Move the antenna halfway between these two points and tighten the clamp.
8. Recheck the pan (steps 2-4) and tighten all the clamps firmly.



9. Perform steps 1-8 at the remote site.

Measuring the RSSI

Measure the RSSI value with a multimeter connected to the RSSI test port on the front of the terminal (see 'Front panel connections and indicators' on page 31).

1. Insert the positive probe of the multimeter into the RSSI test port, and clip the negative probe to the chassis of the terminal (earth).
2. Pan and tilt the antenna until you get the highest VDC reading. The values shown in the table below relate the measured VDC to the actual received signal level in dBm regardless of bandwidth and frequency.

RSSI test port value (VDC)	RSSI reading (dBm)	RSSI test port value (VDC)	RSSI reading (dBm)	RSSI test port value (VDC)	RSSI reading (dBm)
0.000	- 100	0.675	- 73	1.350	- 46
0.025	- 99	0.700	- 72	1.375	- 45
0.050	- 98	0.725	- 71	1.400	- 44
0.075	- 97	0.750	- 70	1.425	- 43
0.100	- 96	0.775	- 69	1.450	- 42
0.125	- 95	0.800	- 68	1.475	- 41
0.150	- 94	0.825	- 67	1.500	- 40
0.175	- 93	0.850	- 66	1.525	- 39
0.200	- 92	0.875	- 65	1.550	- 38
0.225	- 91	0.900	- 64	1.575	- 37
0.250	- 90	0.925	- 63	1.600	- 36
0.275	- 89	0.950	- 62	1.625	- 35
0.300	- 88	0.975	- 61	1.650	- 34
0.325	- 87	1.000	- 60	1.675	- 33
0.350	- 86	1.025	- 59	1.700	- 32
0.375	- 85	1.050	- 58	1.725	- 31
0.400	- 84	1.075	- 57	1.750	- 30
0.425	- 83	1.100	- 56	1.775	- 29
0.450	- 82	1.125	- 55	1.800	- 28
0.475	- 81	1.150	- 54	1.825	- 27
0.500	- 80	1.175	- 53	1.850	- 26
0.525	- 79	1.200	- 52	1.875	- 25
0.550	- 78	1.225	- 51	1.900	- 24
0.575	- 77	1.250	- 50	1.925	- 23
0.600	- 76	1.275	- 49	1.950	- 22
0.625	- 75	1.300	- 48	1.975	- 21
0.650	- 74	1.325	- 47	2.000	- 20

Checking Performance

The amount of testing performed on the completed installation will depend on circumstances. Some customers may need to prove to a local licensing regulatory body that the link complies with the license provisions. This may require special telecommunications test equipment to complete these tests. Most customers simply want to confirm that their data traffic is successfully passing over the link, or that the customer interfaces comply with known quality standard.

However, the most important performance verification checks are:

- Receive input level
- Fade margin
- Long-term BER

Checking the Receive Input Level

The received signal strength at the local terminal is affected by many components in the system and has a direct relationship with the resulting performance of the link. A link operating with a lower than expected signal strength is more likely to suffer from degraded performance during fading conditions. The receive input level of a link is normally symmetrical (that is, similar at both ends).

1. Compare the final RSSI figure obtained after antenna alignment with that calculated for the link.
2. If the RSSI figure is in excess of 3 dB down on the predicted level, recheck and correct problems using the table below and then recheck the RSSI. Alternatively, recheck the link budget calculations.

Possible cause	Terminal(s)
Is the terminal operating on the correct frequency?	Local & remote
Is the remote terminal transmit power correct?	Remote
Are all the coaxial connectors tight?	Local & remote
Is the antenna the correct type, that is, gain and frequency of operation?	Local & remote
Is the antenna polarized?	Local & remote
Is the antenna aligned?	Local & remote
Is the path between the terminals obstructed?	

Note: If following the above steps does not resolve the situation, contact Customer Support for assistance.

3. Record the RSSI figure on the commissioning form.
4. Repeat steps 1 to 2 for the other end of the link.

Checking the Fade Margin

The fade margin is affected by many components in the system and is closely related to the received signal strength. A link operating with a lower than expected fade margin is more likely to suffer from degraded performance during fading conditions. A reduced fade margin can be due to operating the link too close to the noise floor, or the presence of external interference. The fade margin of a link can be asymmetrical (that is, different at each end).

Possible causes of low fade margin are as follows:

Problem	Terminal
Low receive signal strength (see above table)	Local and Remote
Interfering signals on the same, or very close to, the frequency of the local terminal receiver.	Local
Intermodulation products that land on the same or very close to the frequency of the local terminal receiver.	Local or Remote
Operating near the local receiver noise floor	Local

To check the fade margin:

1. Confirm (and correct if necessary) the receive input level (see the previous test).

Note: If the receive input level is lower than expected, the fade margin may also be low.

2. Select Link > Performance > Summary and check the current BER of the link in its normal condition is better than 10^{-6} (If necessary, clear out any extraneous errors by clicking Reset Counters).
3. Check the signal to noise (S/N) indication on the Link > Performance > Summary page. This shows the quality of the signal as it is being processed in the modem. It should typically be better than 30 dB. If it is less than 25 dB, it means that either the RSSI is very low or in-band interference is degrading the S/N performance.
4. Temporarily reduce the remote site's transmit power using either an external attenuator or SuperVisor (Remote > Terminal > Basic).

Note: Ideally, the transmit power of the remote site should be reduced by up to 20 dB, which will require the use of an external 50 ohm coaxial attenuator capable of handling the transmit power involved. In the absence of an attenuator, reduce the transmit power using SuperVisor.

5. Check and note the current BER of the link in its now faded condition (Again, if necessary, clear out any extraneous errors (introduced by the power reduction step above) by clicking Reset Counters).
6. Compare the unfaded and faded BER performance of the link (steps 2 and 4). Continue to reduce the remote transmit power until either the BER drops to 10^{-6} or the remote transmitter power has been reduced by 20 dB.

Note: The fade margin of the link is expressed as a number (of dB) that the link can be faded (transmitter power reduced) without reducing the BER below operating specifications ($1 * 10^{-6}$ BER). A 20 dB fade margin is adequate for most links.

7. Record the fade margin and SNR results on the commissioning form.

Note: If the transmit power is reduced using SuperVisor rather than an external attenuator, the fade margin should be recorded as ‘Greater than x dB’ (where x = the power reduction).

8. Restore the remote terminal transmit power to normal.
9. Repeat steps 1 to 7 for the other end of the link.

Note: If following all the guidelines above does not resolve the situation, contact Customer Support for assistance.

Checking the Long-Term BER

The BER test is a measure of the stability of the complete link. The BER results of a link can be asymmetrical (that is, different at each end).

1. Select Link > Performance > Summary and check the current BER and error counters of the link. If necessary, clear out any extraneous errors by selecting Reset Counters.
2. Wait 15 minutes, and check the BER display and error counters again. If there are a small number of errors and the BER is still better than 1 x 10^{-9}, continue the test for 24 hours. If there are a significant number of errors, rectify the cause before completing the 24 hour test.

Note: It is normal to conduct the BER test in both directions at the same time, and it is important that no further work be carried out on the equipment (including the antenna) during this period.

3. The BER after the 24 hour test should typically be better than 1 x 10^{-8}.
4. Record the BER results on the commissioning form.

Bit Error Rate Tests

A Bit Error Rate (BER) test can be conducted on the bench, (see ‘Bench Setup’ on page 43).

Attach the BER tester to the interface port(s) of one terminal, and either another BER tester or a loopback plug to the corresponding interface port of the other terminal.

This BER test can be carried out over the Ethernet, E1 / T1, V.24 or HSS interfaces. It will test the link quality with regard to user payload data.

CAUTION: Do not apply signals greater than -20 dBm to the antenna as they can damage the receiver. In a bench setup, there must be 60 - 80 dB at up to 2 GHz of 50 ohm coaxial attenuation (capable of handling the transmit power) between the terminals’ antenna connectors.

Additional Tests

Depending on license requirements or your particular needs, you may need to carry out additional tests, such as those listed below.

Refer to the relevant test equipment manuals for test details.

Test	Test equipment required
TX power output measurements (at TX and duplexer outputs)	Power meter
TX spectrum bandwidth	Spectrum analyzer
TX spectral purity or harmonic outputs	Spectrum analyzer
TX center frequency	Frequency counter or spectrum analyzer
Bulk capacity BER test	BER tester
LAN throughput or errors	LAN tester
G.703 / HDB3 waveforms	Digital oscilloscope
Serial interface BER	BER tester
Audio quality	PCM4 or SINAD test set

Checking the Link Performance

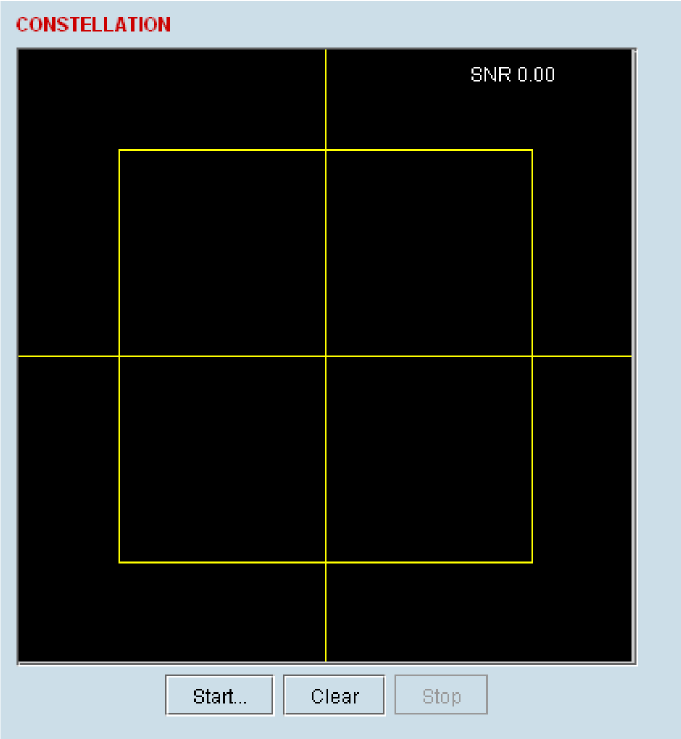
For a graphical indication of the link performance, you can use the constellation analyzer.

The 'dots' are a graphical indication of the quality of the demodulated signal. Small dots that are close together indicate a good signal. If the dots become spaced further apart, this indicates that the signal quality is degrading. This signal quality degradation can be caused by low Rx signal level due to, for example:

- external interference
- failure of any of the following: modem, receiver, far end transmitter, an antenna (either end), a feeder or connector (for example, due to water damage)
- path issues such as multipath fading or obstructions

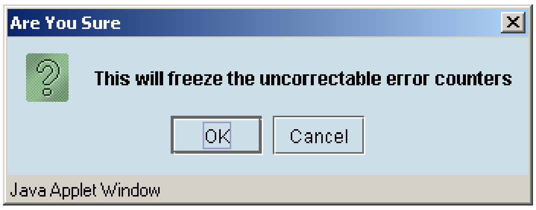
To check the performance of the link using the constellation analyzer:

1. Select Link or Local or Remote > Performance > Constellation.



2. Click Start to start the constellation analyzer.

   While the constellation analyzer is running, the terminal will temporarily stop collecting error performance statistics. If you want to run the constellation analyzer anyway, click OK when you see this warning message:



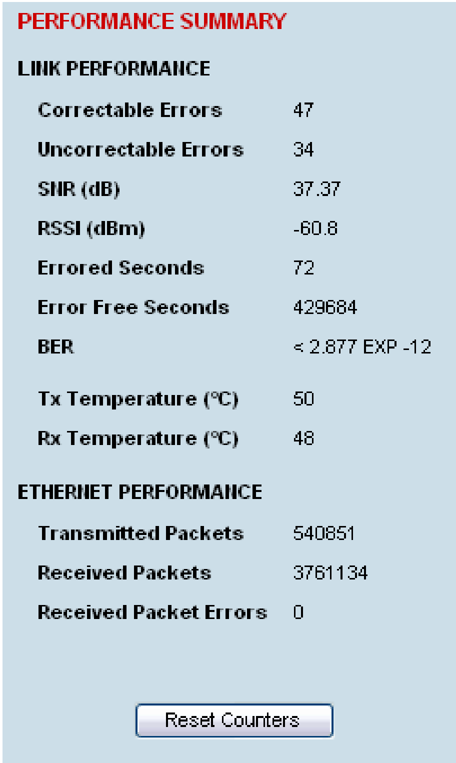
3. Click Stop to stop the constellation analyzer.

   The terminal automatically resumes collecting error performance statistics.

Viewing a Summary of the Link Performance

To view the performance summary for a terminal:

Select Link or Local or Remote > Performance > Summary.



Field	Explanation
Link Performance	
Correctable errors	The total number of correctable blocks since the last reset
Uncorrectable errors	The total number of uncorrectable blocks since the last reset
SNR (dB)	The Signal to Noise Ratio of the link in dB
RSSI (dBm)	The Received Signal Strength Indication at the Rx input in dBm
Errored seconds	The total number of operational seconds with errored traffic since the last reset
Error free seconds	The total number of error free operational seconds since the last reset
BER	The system will report an estimated Bit Error Rate up to a maximum of 1 in 10^{21}
TX temperature	The measured temperature in the transmitter module in °C
RX temperature	The measured temperature in the receiver module in °C
Ethernet performance	
Transmitted packets	The total number of transmitted Ethernet packets
Received packets	The total number of received Ethernet packets
Received packet errors	The total number of packets received with errors

Click Reset Counters to reset the error counters to zero.

Saving the History of the Link Performance

Link performance history data is stored in a rolling buffer which can be saved as a *.cvs file (default filename is savedPerformanceHistory.csv). The maximum history data buffer is 1 week of 1 hour records and the last hour is displayed in minute records.

The parameters saved are:

- Date / Time
- SNR (minimum over period)
- SNR (average over period)
- SNR (maximum over period)
- RSSI (minimum over period)
- RSSI (average over period)
- RSSI (maximum over period)
- BER (value at end of period)
- UCEs count (value at end of period)
- Transmitter temperature (value at end of period)

To save the history of the link performance for a terminal:

Select Local > Performance > Save History.

Example of file (simulated fade data):

PREVIOUS WEEK

TIME	SNR min (dB)	SNR avg (dB)	SNR max (dB)	RSSI min (dBm)	RSSI avg (dBm)	RSSI max (dBm)	BER	UCEs	Tx Temp (deg C)
Mon Apr 6 09:44:50 2009	35.14	35.26	35.39	-54.00	-54.00	-54.00	3.40E-12	144	50
Mon Apr 6 10:44:50 2009	35.14	35.26	35.40	-54.00	-53.90	-53.90	3.39E-12	144	50
Mon Apr 6 11:44:50 2009	35.14	35.26	35.40	-54.00	-53.90	-53.90	3.38E-12	144	50
Mon Apr 6 12:44:51 2009	15.31	25.77	58.54	-114.00	-77.00	-54.00	1.58E-05	1045	50
Mon Apr 6 13:44:51 2009	22.52	22.75	22.89	-84.10	-83.70	-83.60	6.92E-06	9912	51
Mon Apr 6 14:44:51 2009	16.20	26.05	54.61	-87.10	-77.40	-60.20	9.67E-05	72125	52
…									

PREVIOUS HOUR

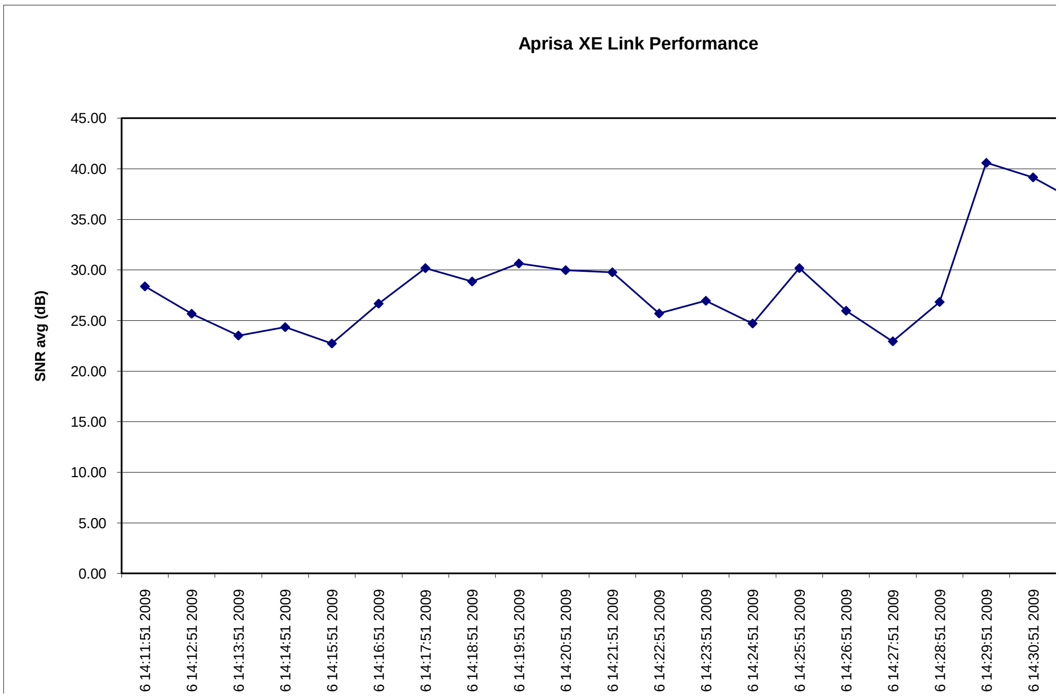
TIME	SNR min (dB)	SNR avg (dB)	SNR max (dB)	RSSI min (dBm)	RSSI avg (dBm)	RSSI max (dBm)	BER	UCEs	Tx Temp (deg C)
Mon Apr 6 14:11:51 2009	22.52	28.38	22.75	-84.10	-78.19	-83.80	5.89E-06	22821	52
Mon Apr 6 14:12:51 2009	22.55	25.67	22.75	-84.10	-80.89	-83.80	5.86E-06	23369	52
Mon Apr 6 14:13:51 2009	22.50	23.52	22.75	-84.10	-83.07	-83.70	5.84E-06	23847	52
Mon Apr 6 14:14:51 2009	22.50	24.35	22.78	-84.10	-82.23	-83.70	5.81E-06	24338	52
Mon Apr 6 14:15:51 2009	22.54	22.73	22.77	-84.10	-83.86	-83.80	5.78E-06	24855	52
Mon Apr 6 14:16:51 2009	22.52	26.67	22.75	-84.10	-79.90	-83.80	5.75E-06	25374	52
Mon Apr 6 14:17:51 2009	22.48	30.19	22.79	-84.10	-76.38	-83.70	5.73E-06	25918	52
Mon Apr 6 14:18:51 2009	22.49	28.87	22.74	-84.10	-77.68	-83.80	5.71E-06	26473	52
Mon Apr 6 14:19:51 2009	22.48	30.65	22.74	-84.10	-75.94	-83.80	5.68E-06	27007	52
Mon Apr 6 14:20:51 2009	22.50	29.99	22.75	-84.00	-76.59	-83.80	5.66E-06	27561	52
Mon Apr 6 14:21:51 2009	22.61	29.78	22.76	-84.00	-76.82	-83.80	5.64E-06	28167	52
Mon Apr 6 14:22:51 2009	22.46	25.70	22.74	-84.10	-80.86	-83.90	5.62E-06	28717	52
Mon Apr 6 14:23:51 2009	22.46	26.96	22.75	-84.10	-79.61	-83.80	5.59E-06	29237	52
Mon Apr 6 14:24:51 2009	22.47	24.71	22.75	-84.10	-81.86	-83.80	5.57E-06	29776	52
Mon Apr 6 14:25:51 2009	22.48	30.19	22.73	-84.10	-76.36	-83.80	5.55E-06	30368	52
Mon Apr 6 14:26:51 2009	22.49	25.97	22.75	-84.20	-80.61	-83.80	5.53E-06	30942	52
Mon Apr 6 14:27:51 2009	16.20	22.94	54.61	-87.10	-83.76	-83.90	7.30E-06	71751	52
Mon Apr 6 14:28:51 2009	16.23	26.84	49.90	-87.00	-73.31	-60.30	6.67E-03	72125	52
Mon Apr 6 14:29:51 2009	35.10	40.60	35.24	-60.50	-54.96	-60.30	1.70E-03	72125	52
Mon Apr 6 14:30:51 2009	35.08	39.17	35.28	-60.50	-56.40	-60.30	9.13E-04	72125	52
Mon Apr 6 14:31:51 2009	35.07	36.63	35.26	-60.50	-58.95	-60.20	6.11E-04	72125	52
Mon Apr 6 14:32:51 2009	35.06	36.68	35.24	-60.60	-58.90	-60.30	4.52E-04	72125	52
Mon Apr 6 14:33:51 2009	35.06	35.34	35.25	-60.60	-60.24	-60.30	3.56E-04	72125	52
Mon Apr 6 14:34:51 2009	35.09	36.28	35.24	-60.50	-59.28	-60.30	2.92E-04	72125	52
Mon Apr 6 14:35:51 2009	35.07	42.56	35.28	-60.60	-53.03	-60.30	2.46E-04	72125	52
…									

To save the alarm history from the Remote terminal, login to the Remote terminal and Select Local > Alarms > Save History.

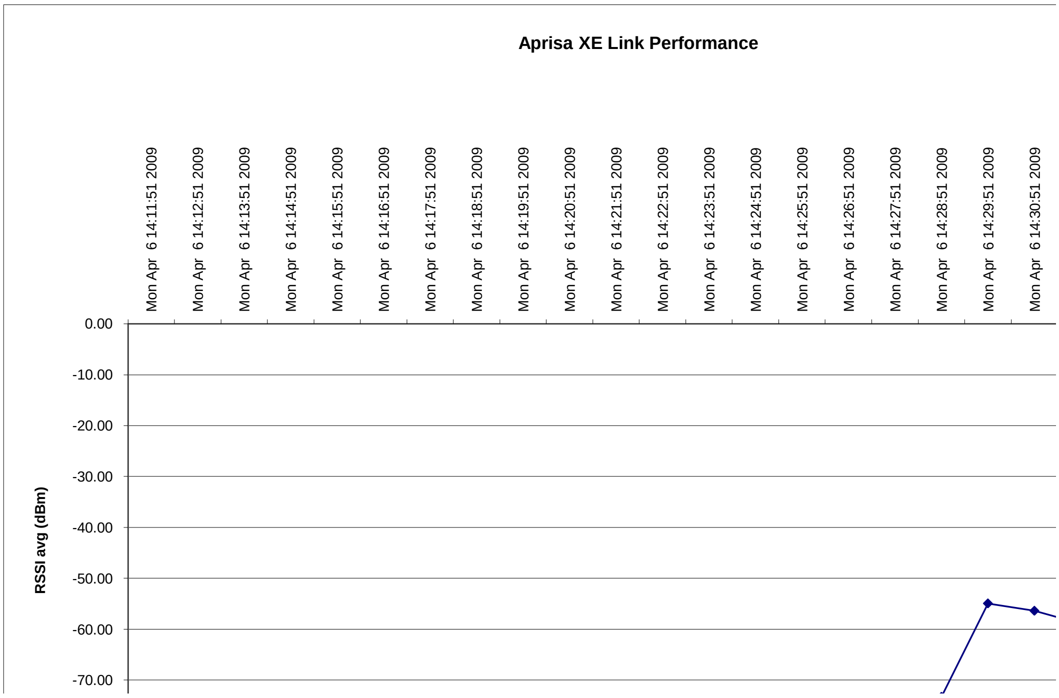
To create an Excel chart of the link performance for a terminal:

1. Open the *.csv file with Excel.
2. Select the ‘Time’ column and the column you wish to graph e.g. ‘SNR avg (dB)’ or ‘RSSI avg (dBm)’
3. Select ‘Insert Chart’ from the Excel menu.

Graph of Date / Time vs the average SNR



Graph of Date / Time vs the average RSSI



To clear the history of the link performance for a terminal:

Select Link or Local or Remote > Performance > Clear History.

13. Maintenance

There are no user-serviceable components within the terminal.

All hardware maintenance must be completed by 4RF or an authorized service centre.

Do not attempt to carry out repairs to any boards or parts.

Return all faulty terminals to 4RF or an authorized service centre.

For more information on maintenance and training, please contact Customer Services.

CAUTION: Electro Static Discharge (ESD) can damage or destroy the sensitive electrical components in the terminal.

Routine Maintenance

Every six or twelve months, for both ends of the link, you should record the RSSI and SNR levels as well as checking the following:

Item	What to check or look for
Equipment shelter environment	Water leaks Room temperature Excessive vibration Vermin damage
Terminal mounting	Firmly mounted
Antenna cable connections	Tight and dry
Antenna cable and its supports	Not loose or suffering from ultra-violet degradation
Antenna and its mounting hardware	Not loose, rusty or damaged
Safety earth	Connections tight Cabling intact
DC system	Connections tight Voltage in normal limits
Batteries (if installed)	Connections tight Electrolyte levels normal

Terminal Upgrades

You can upgrade all software for both terminals remotely (through a management network), which eliminates the need to physically visit either end of the link.

A terminal is upgraded by accessing a running TFTP server (see 'TFTP Upgrade Process' on page 221). All the required files are uploaded from the TFTP server into the terminal and then activated following a terminal reboot.

System files can be manually uploaded (see 'Uploading System Files' on page 226').

Inventory File

Software release 8.2.10 and all future software releases, contains an inventory file (similar to a manifest file) which is used to validate the software files in the terminal.

To view the Software Status of the terminal:

Select Link, Local or Remote > Summary

Software status	Function
Standard Software Release	The software status indicates 'Standard Software Release' if the following system software files have not been changed since the last TFTP Upgrade. • Kernel image file • Software image file • Firmware image files • Configuration files
Modified Software Release	The software status indicates 'Modified Software Release' if the system software files have been changed since the last TFTP Upgrade. This could be caused by: • an image file which has been uploaded to the terminal since the last TFTP upgrade which is not part of that upgrade. • an image file which was part of the last TFTP upgrade but was subsequently deleted.

Upgrade Prerequisites

To minimize disruption of link traffic and prevent your terminals from being rendered inoperative, please follow the procedures described in this section together with any additional information or instructions supplied with the upgrade package.

Before upgrading the terminal, ensure that you have saved the configuration file (see 'Saving the terminal's configuration' on page 89) as well as the cross connection configuration (see 'Saving cross connection configurations' on page 155).

The Remote terminal upgrade process will be faster if the bandwidth allocated to the management ethernet capacity is maximized.

The terminal software must be identical at both ends of the link.

At the end of the terminal upgrade process, the versions of image files (kernel software, and firmware) that were in use before the upgrade are still in the terminal. You can restore them, if required, by editing the image tables and reactivating the old files (see 'Changing the Status of an Image ' on page 232).

IMPORTANT NOTE: Ensure you are logged into the Near end terminal as Admin before you start an upgrade.

Software Upgrade Process

Unzip and save the following folders to your hard drive:

- 8.6.77 Software
- tftpd32.exe

The following steps are required for the software upgrade process:

1. Identify the correct TFTP upgrade type (see 'Identifying the Correct TFTP Upgrade Type' on page 217).
2. If the terminals are operating software prior to 8.3.40:

   Upload the Root File System (see 'Uploading the Root File System' on page 216)

   Upload the Motherboard Images (see 'Uploading the Motherboard Images' on page 216).

   Reboot the terminal.
3. Go through the steps of the TFTP upgrade process (see 'TFTP Upgrade Process' on page 221).
4. Upgrade for new FXO/FXS and modem images
5. Reboot the terminal.
6. Clear the Java and web browser caches (see 'Step 7: Clear the Java and web browser caches' on page 223).

If the TFTP upload process fails, an 'Upload Fail' alarm is raised. If the TFTP upload process fails due to a power failure, the alarm is raised upon power recovery.

Uploading the Root File System

Note: Uploading of image files can only be performed to the local terminal i.e. not via the link to the remote terminal.

1. Logon to the local terminal as admin.
2. Go to SuperVisor > Local > Maintenance > Upload > Software.
3. Browse to the 8.6.77 Software folder and select ‘C-CC-R-8_6_7.img’.
4. Click Upload and wait for the upload status to display Succeeded.
5. Activate the ‘C-CC-R-8_6_7.img’ with SuperVisor Local > Maintenance > Image Table (see ‘Changing the Status of an Image File’ on page 232).

Uploading the Motherboard Images

The E1 and E2 motherboard images do not update as part of the TFTP upgrade.

Check if the correct motherboard images are loaded with SuperVisor Local > Maintenance > Image Table.

Example: Radio on V8.4.60 with a Rev C motherboard.

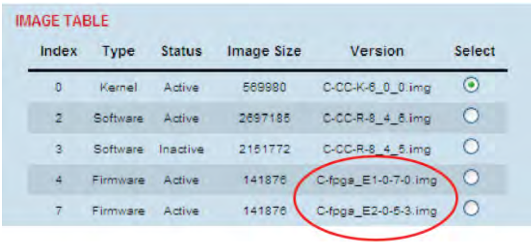


IMAGE TABLE

Index	Type	Status	Image Size	Version	Select
0	Kernel	Active	569980	C-CC-K-6_0_0.img	
2	Software	Active	2697185	C-CC-R-8_4_6.img	
3	Software	Inactive	2151772	C-CC-R-8_4_5.img	
4	Firmware	Active	141876	C-fpga_E1-0-7-0.img	
7	Firmware	Active	141876	C-fpga_E2-0-5-3.img	

The Motherboard Firmware images for this software version are:

Motherboard Type	Image Files Required
Rev C	C-fpga_E1-0-7-0.img (Motherboard 1 C-fpga_E2-0-5-3.img (Motherboard 2)
Rev D	C-fpga_E1-1-7-3.img (Motherboard 1 C-fpga_E2-1-5-4.img (Motherboard 2)

If the motherboard image files are not correct, upload the relevant image files.

Note: Uploading of image files can only be performed to the local terminal i.e. not via the link to the remote terminal.

1. Logon to the local terminal as admin
2. Go to SuperVisor > Local > Maintenance > Upload > Firmware.
3. Browse to the 8.6.77 Software folder and select ‘C-fpga_Ex-x-x-x.img’.
4. Click Upload and wait for the upload status to display Succeeded.
5. Activate the ‘C-fpga_Ex-x-x-x.img’ with SuperVisor Local > Maintenance > Image Table (see ‘Changing the Status of an Image File’ on page 232).

Identifying the Correct TFTP Upgrade Type

The correct TFTP upgrade type will depend on both the Bootloader Version and the Software Version Type.

Aprisa XE terminals running the older bootloader software (bootloader version 0) have a limitation on the number of software images that can be loaded simultaneously into a terminal.

Identifying the Bootloader Version

Determine which bootloader version your terminal is running by using the SuperVisor menu item Maintenance > Support Summary and look for the 'Bootloader Version' number:

(1) If your terminal is running bootloader version 1 or greater, use the TFTP full upgrade process.

(2) If your terminal is running bootloader version 0 and running a software version prior to 7.0.6, use the TFTP partial upgrade process.

(3) If your terminal is running bootloader version 0 and running a software version 7.0.6 or later, use the TFTP standard upgrade process.

(4) HSD terminals cannot run with bootloader version 0.

Identifying the Software Version Type

There are six different software version types; ETSI type 1, ETSI type 1 HSD, ETSI type 2, ETSI type 2 HSD, FCC Part 101 and FCC Part 90.

To determine which Software Version Type is currently installed on the terminal, take note of the 'Software Version' on SuperVisor Summary page. The last three characters indicate the Software Version Type.

Software Version	8_4_20_E0
Software Status	Standard Software Release
Serial Number	21801450

ETSI Compliance Body

8_6_77_E0	The E0 variant supports ETSI (Type 1) 1+0 and MHSB terminals with the same variants as Aprisa XE software version 8.4.40.
8_6_77_E1	The E1 variant supports ETSI (Type 2) 1+0 and MHSB terminals with the same variants as Aprisa XE software version 8.4.40 except for the 400 MHz 25 kHz and 50 kHz which has been replaced with 900 MHz 25 kHz and 50 kHz.
8_6_77_E0h	The E0h variant supports ETSI (Type 1) Hitless Space Diversity (HSD) terminals with the same variants as Aprisa XE software version 8.4.40.
8_6_77_E1h	The E1 variant supports ETSI (Type 2) Hitless Space Diversity (HSD) terminals with the same variants as Aprisa XE software version 8.4.40 except for the 400 MHz 25 kHz and 50 kHz which has been replaced with 900 MHz 25 kHz and 50 kHz.

FCC Compliance Body

8_6_77_F0	The F0 variant supports FCC part 90 1+0 and MHSB terminals.
8_6_77_F0h	The F0h variant supports FCC part 90 Hitless Space Diversity (HSD) terminals.
8_6_77_F1	The F1 variant supports FCC part 101 1+0 and MHSB terminals.
8_6_77_F1h	The F1h variant supports FCC part 101 Hitless Space Diversity (HSD) terminals.

Upgrade Version Files

The following table defines the purpose of the upgrade version files:

Upgrade Version File	Upgrade Type	Software Version Type
8_6_77_E0a	Full TFTP upgrade	ETSI TYPE 1
8_6_77_E0	Standard TFTP upgrade	ETSI TYPE 1
8_6_77_E0h	Standard TFTP upgrade	ETSI TYPE 1 HSD
8_6_77_E0p	Partial TFTP upgrade	ETSI TYPE 1
8_6_77_E1a	Full TFTP upgrade	ETSI TYPE 2
8_6_77_E1	Standard TFTP upgrade	ETSI TYPE 2
8_6_77_E1h	Standard TFTP upgrade	ETSI TYPE 2 HSD
8_6_77_E1p	Partial TFTP upgrade	ETSI TYPE 2
8_6_77_F0a	Full TFTP upgrade	FCC Part 90
8_6_77_F0	Standard TFTP upgrade	FCC Part 90
8_6_77_F1a	Full TFTP upgrade	FCC Part 101
8_6_77_F1	Standard TFTP upgrade	FCC Part 101

Installing RF Synthesizer Configuration Files

If you are upgrading from a software version prior to 7_1_x, you will need to install new RF synthesizer files, refer to 'Configuration Files' on page 226.

You can then upgrade the terminal using TFTP (see page 221).

Frequency Band	Synthesizer File(to be installed)	Comments
300, 400 MHz	XE_300_400_type_1_synth.cfg	BB synthesizer
300, 400 MHz	XE_300_400_type_2_synth.cfg	E3 synthesizer
300, 400 MHz	XE_300_400_type_3_synth.cfg	5 kHz sythesizer step
600, 700, 800, 900 MHz	XE_600_700_800_900_synth.cfg	
1400 MHz	XE_1400_synth.cfg	
1400 MHz	XE_1400TCVR_synth.cfg	New transceiver (introduced April 2012)
1800 MHz	XE_1800_synth.cfg	
2000, 2500 MHz	XE_2000_2500_synth.cfg	

TFTP Upgrade Process Types

TFTP partial upgrade process

Run the TFTP upgrade process by typing 8_6_77_E0p in the Upgrade Version field.

This will perform a partial upgrade which will delete unnecessary image files that might be taking up space in the Image Table (which could prevent a standard upgrade succeeding).

Reboot the terminal.

Run a TFTP standard upgrade process on the terminal.

Reboot the terminal again.

TFTP standard upgrade process

This TFTP standard upgrade process excludes FPGA images for the newly introduced revisions of the Modem, DFXO and DFXS cards.

Run the TFTP upgrade process by typing '8_6_77_E0' in the Upgrade Version field.

If the standard upgrade fails, it may be necessary to make space for the new images by manually deleting 'Inactive' firmware image files.

To delete a firmware image file, select the SuperVisor menu item Maintenance > Image Table, select the firmware image and click on Edit. Set the IMAGE DETAILS Command to 'Delete' and click 'Apply'.

Reboot the terminal.

Additional TFTP upgrade options have been provided to load the new images separately. Run the TFTP upgrade process using the file:

- 'F1_8_6_7' to load images for the newest DFXO and DFXS cards (rev D).
- 'F2_8_6_7' to load images for all revisions of DFXO and DFXS cards.
- 'F3_8_6_7' to load images for the newest Modem card (rev D).

Reboot the terminal again.

TFTP full upgrade process

Run the TFTP upgrade process for 1+0 and MHSB terminals by typing '8_6_77_E0a' in the Upgrade Version field.

Run the TFTP upgrade process for HSD terminals by typing '8_6_77_E0h' in the Upgrade Version field.

Reboot the terminal.

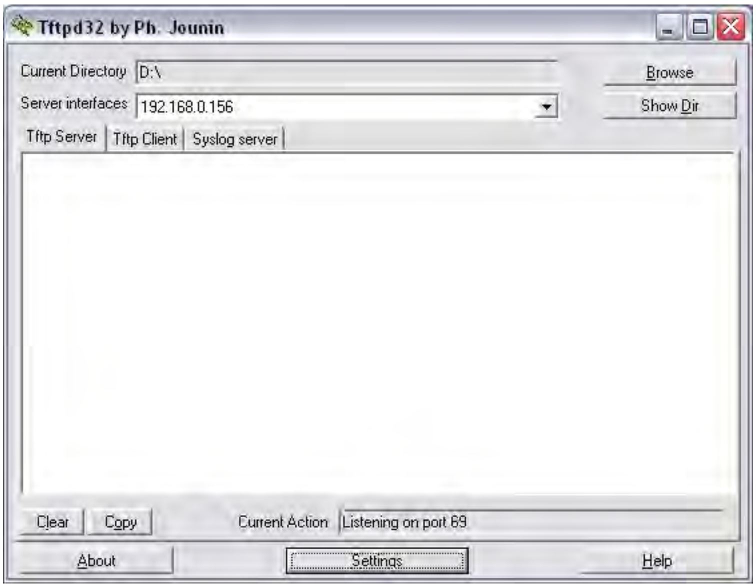
TFTP Upgrade Process

To upgrade a terminal using the TFTP:

1. Run the TFTP server.
2. Login to the Near end terminal / local terminal (see 'IP Addressing of Terminals' on page 53).
3. Run the TFTP upgrade process on the Remote terminal.
4. Reboot the Remote terminal.
5. Run the TFTP upgrade process on the Local terminal.
6. Reboot the Local terminal.
7. Clear the Java and web browser caches.

Step 1: Run the TFTP server

1. Double-click tftpd32.exe (located in the TFTPD directory) from the Aprisa CD supplied with the product. Leave the TFTPD32 application running until the end of the upgrade process.



2. Click Settings and make sure that both SNTP server and DHCP server are not selected (no tick), and click OK.

3. Click Browse and navigate to the root directory on the Aprisa CD (for example, D:\) supplied with the product, then click OK.

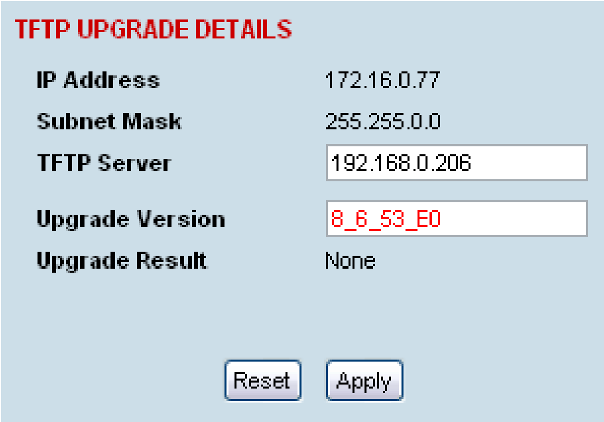
4. Note down the IP address of the TFTP server (shown in the Server Interfaces drop-down list in the TFTPD32 window) as you will need it later.

Step 2: Log into the Local terminal

Use SuperVisor to log into the Near end terminal (now the Local terminal) (see 'IP Addressing of Terminals' on page 53) with either 'modify' or 'admin' privileges.

Step 3: Run the TFTP upgrade process on the Remote terminal

1. Select Remote > Maintenance > Upload > TFTP Upgrade.



2. Enter the IP address of the TFTP server.
3. Enter the version number of the software that you are upgrading to as a three digit number separated by underscores, for example, 8_6_77_E0 for ETSI variants.
4. Click Apply and check the TFTP server for download activity.

   The Upgrade Result changes from 'Executing' to either 'Succeeded' or 'Failed'.

Note: This may take several minutes when upgrading the remote terminal.

If the upgrade has failed:

- The TFTP server IP address may be set incorrectly
- The 'Current Directory' on the TFTP server was not pointing to the location of the upload config file e.g. 'Rel_8_6_77_E0.cfg' .
- There may not be enough free space in the image table to write the file. Inactive images can be deleted (and the terminal rebooted) to free up space for the new image (see 'Changing the Status of an Image File' on page 232).

Step 4: Reboot the Remote terminal

Reboot the remote terminal before proceeding with the next step of the upgrade process (see 'Rebooting the Terminal' on page 233).

1. Select Remote > Maintenance > Reboot and select [Hard Reboot]

   Communications to SuperVisor remote page will fail until the remote terminal reboot has completed.

Step 5: Run the TFTP upgrade process on the Local terminal.

1. Select Local > Maintenance > Upload > TFTP Upgrade.
2. Enter the IP address of the TFTP server (that you noted earlier)
3. Enter the version number of the software (that you are upgrading to) for example, 8_6_77_E0.
4. Click Apply and check the TFTP server for download activity.

   The Upgrade Result changes from 'Executing' to either 'Succeeded' or 'Failed'.

   Note: This may take several minutes when upgrading the remote terminal.

Step 6: Reboot the Local terminal

Reboot the local terminal before proceeding with the next step of the upgrade process (see ‘Rebooting the Terminal’ on page 233).

1. Select Local > Maintenance > Reboot and select [Hard Reboot]
2. Log back into the Local terminal when the reboot has completed.

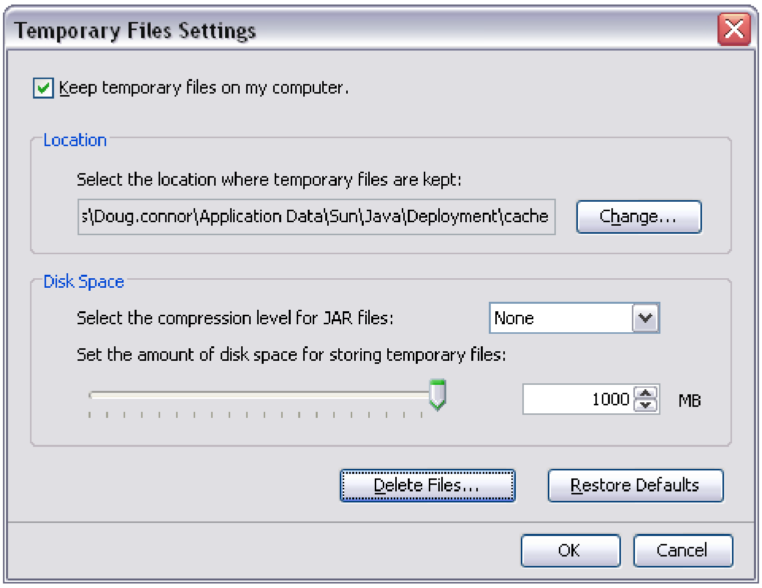
Step 7: Clear the Java and web browser caches

After upgrading the terminal you should clear the Java and web browser caches. The files stored in them may cause the SuperVisor and Cross Connections applications to display incorrectly.

To clear the Java cache (Windows XP, Java 1.6):

1. Select Start > Control Panel.
2. Select Java

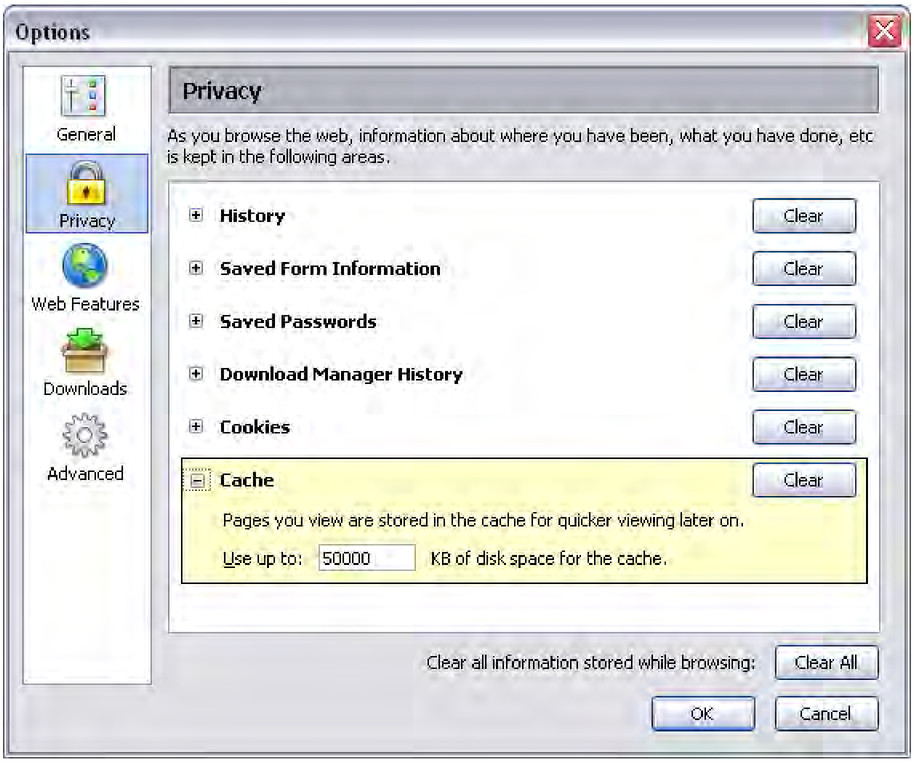
3. Click the General tab.
4. In the ‘Temporary Internet Files’, click Settings



5. Click on ‘Delete Files’ (‘Applications and Applets’ and ‘Trace and Log Files’ both ticked) and OK to confirm.

To clear your web browser cache (Mozilla Firefox 1.x and above):

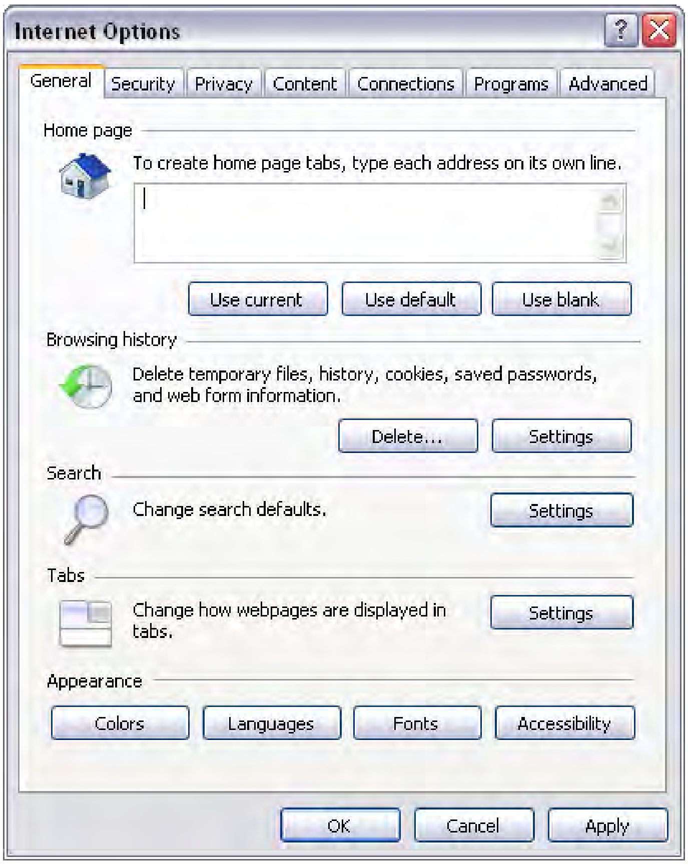
1. Select Tools > Options.
2. Select Privacy and then click Cache.



3. Click Clear to clear the cache, and then click OK to confirm.

To clear your web browser cache (Internet Explorer 7.0 and above):

1. Select Tools > Internet Options.
2. On the General tab



3. In Browsing history, click Delete
4. In the ‘Temporary Internet Files’, click Delete Files and Yes to confirm.

Uploading System Files

System files e.g. configuration files, kernel image files, software image files and firmware image files can be uploaded manually.

Note: You should only upgrade components that need changing. It is not always necessary, for instance, to replace kernel or software files when upgrading a single firmware file. If interdependency exists between file types, this will be made clear in the documentation that accompanied the update package.

Configuration Files

Configuration files (.cfg) are compressed archives containing a script to instruct the terminal on how to handle the other files in the archive.

Uploading of configuration files can only be performed to the Local Terminal (not via the link to the Remote Terminal).

RF synthesizer configuration files

The RF synthesizer configuration archive contains files that provide values for the transmitter and receiver synthesizers to operate across the supported frequency bands.

Synthesizer configuration filenames have the following format:

XE_(frequency bands)_synth.cfg e.g. XE_300_400_synth.cfg

Modem configuration files

The Modem configuration archive contains files that provide values for the Modem to operate at the various supported channel sizes and modulation types.

Modem configuration filenames have the following format:

modem_(version number).cfg e.g. modem_8_3_1.cfg (ETSI variants)

Cross-connect configuration files

The Cross-connect configuration archive contains the Cross Connections application program that can be launched from within SuperVisor.

Cross-connect configuration filenames have the following format:

C-crossconnect_(version number).cfg e.g. C-crossconnect_8_6_7.cfg

To upload a configuration file:

1. Select Local > Maintenance > Config Files > Upload Configuration
2. Browse to the location of the file required to be uploaded into the terminal *.cfg.
3. Click on Upload.

The normal response is Succeeded if the file has been loaded correctly.

A response of 'Failed' could be caused by:

- Not enough temporary space in the filesystem to uncompress the archive and execute the script
- A file or directory expected by the script not being present on the filesystem

4. Reboot the terminal using a 'Hard Reboot' (see 'Rebooting the Terminal' on page 233).

Image Files

Image files (.img) are loaded into the terminal and either contains code that is executed by the system processor, or contain instructions to configure the various programmable logic elements. The image file types that can be uploaded are:

- Kernel image files
- Software image files
- Firmware image files

Note: The Bootloader image file C-CC-B-(version number).srec and Flash File System image file C-CC-F-(version number).img can only be changed in the factory.

Uploading of image files can only be performed to the local terminal (not via the link to the remote terminal).

To upload and activate an image file:

1. Upload the required image file.

   If the Upload Status page show 'executing', then 'writing to flash', then 'Succeeded', then the file has been written into the image table correctly.

   UPLOAD STATUS

Upload Type	Software
File Name	C-CC-R-8_6_5.img
Status	Succeeded

   If the Upload Status is 'Failed', there may not be enough free space in the image table to write the file. Inactive images can be deleted (and the terminal rebooted) to free up space for the new image (see 'Changing the Status of an Image File' on page 232).

2. Set the status of the image to 'activate' (see 'Changing the Status of an Image ' on page 232).

   This actually sets the status to 'Selected' until after a terminal reboot.

3. Reboot the terminal using a 'Hard Reboot' (see 'Rebooting the Terminal' on page 233).

   This activates the selected image. The image table status will now show 'Active'.

   The previous image file status will now show as 'Inactive'.

Kernel image files

Kernel image files contain code that forms the basis of the microprocessor’s operating system. There can only ever be two kernel image files in the image table, the active and the inactive.

Kernel filenames have the following format:

C-CC-K-(version number).img e.g. C-CC-K-6_0_0.img

To upload a kernel image file;

1. Select Local > Maintenance > Upload > Kernel
2. Browse to the location of the file required to be uploaded into the terminal *.img.
3. Click on Upload.

4. Activate the image (see ‘Changing the Status of an Image File’ on page 232).
5. Reboot the terminal using a ‘Hard Reboot’ (see ‘Rebooting the Terminal’ on page 233).

Software image files

Software image files contain code that forms the basis of the terminal’s application and management software (including the Web-based GUI). There can only ever be two software image files in the image table, the active and the inactive.

Software image filenames have the following format:

C-CC-R-(version number).img e.g. C-CC-R-8_6_7.img

To upload a software image file;

1. Select Local > Maintenance > Upload > Software
2. Browse to the location of the file required to be uploaded into the terminal *.img.
3. Click on Upload.

Software image files may take one or two minutes to upload as they can be quite large (≈ 2 Mbytes). The size of this file has caused some Microsoft Internet Explorer proxy server setups to abort during the software update process. To avoid this problem, either set the proxy file size limit to 'unlimited' or avoid the use of the proxy altogether.

4. Activate the image (see ‘Changing the Status of an Image File’ on page 232).
5. Reboot the terminal using a ‘Hard Reboot’ (see ‘Rebooting the Terminal’ on page 233).

Firmware image files

Firmware image files contain instructions to configure the various programmable logic elements in the terminal. There can only ever be two firmware image files for the same HSC version in the image table, the active and the inactive.

Firmware image filenames have the following format:

C-fpga_ff-x-y-z.img e.g. C-fpga_E5-0-7-3.img

where ff indicates the function (motherboard, interface card, etc).

Function Number	Function
E1	Motherboard 1
E2	Motherboard 2
E5	QJET Interface Card
E7	Q4EM Interface Card
E8	DFXO Interface Card
E9	DFXS Interface Card
EA	Modem
EB	QV24 Interface Card
EC	HSS Interface Card
ED	PSC (component of HSD system)
EE	PIC (component of HSD system)
FA	HSD modem
FB	QV24 Sync Interface Card

where x indicates the HSC (hardware software compatibility) version.

where y indicates the firmware major revision number

where z indicates the firmware minor revision number

To upload a firmware image file;

1. Select Local > Maintenance > Upload > Firmware
2. Browse to the location of the file required to be uploaded into the terminal *.img.
3. Click on Upload.

4. Activate the image (see ‘Changing the Status of an Image File’ on page 232).
5. Reboot the terminal using a ‘Hard Reboot’ (see ‘Rebooting the Terminal’ on page 233).

Viewing the Image Table

To view the image table:

1. Select Link or Local or Remote > Maintenance > Image Table.

IMAGE TABLE

Index	Type	Status	Image Size	Version	Select
0	Kernel	Active	569980	C-CC-K-6_0_0.img	
2	Software	Active	2168552	C-CC-R-8_6_6.img	
3	Software	Inactive	2188007	C-CC-R-8_6_5.img	
4	Firmware	Inactive	20072	C-fpga_E1-1-7-4.img	
5	Firmware	Active	20046	C-fpga_E1-1-7-3.img	
6	Firmware	Inactive	64621	C-fpga_E2-1-5-4.img	
7	Firmware	Active	63793	C-fpga_E2-1-5-4.img	
8	Firmware	Active	76875	C-fpga_EA-0-5-2.img	
10	Firmware	Active	54268	C-fpga_EA-1-0-3.img	
12	Firmware	Active	87534	C-fpga_E5-0-8-5.img	
13	Firmware	Active	70744	C-fpga_E7-1-3-3.img	
14	Firmware	Active	70960	C-fpga_E7-2-3-3.img	
15	Firmware	Active	78820	C-fpga_E8-1-4-0.img	
16	Firmware	Active	78820	C-fpga_E8-2-4-0.img	
17	Firmware	Active	70519	C-fpga_E9-0-4-1.img	
18	Firmware	Active	70519	C-fpga_E9-1-4-2.img	
19	Firmware	Active	66969	C-fpga_EB-0-1-1.img	
20	Firmware	Active	45791	C-fpga_EC-0-1-4.img	
21	Firmware	Active	47191	C-fpga_EC-1-1-7.img	
22	Firmware	Active	65296	C-fpga_E7-5-0-2.img	
23	Firmware	Active	54443	C-fpga_E8-3-5-3.img	
24	Firmware	Active	54953	C-fpga_E8-4-5-3.img	
25	Firmware	Active	74992	C-fpga_E9-2-4-1.img	
26	Firmware	Active	75412	C-fpga_E9-3-4-1.img	
27	Firmware	Active	77806	C-fpga_FB-0-1-3.img	
28	Firmware	Active	18099	C-fpga_FA-1-1-0.img	
29	Firmware	Active	86373	C-fpga_ED-0-1-0.img	
30	Firmware	Active	19435	C-fpga_EE-0-1-0.img	

Edit...

The image table shows the following information:

Heading	Function
Index	A reference number for the image file
Type	The image type ‘Kernel’, ‘Software’ or ‘Firmware’.
Status	The status of the image; 'Active', 'Inactive', ‘Selected’, ‘Current (de-selected)’
Image Size	The image file size in bytes
Version	The image file name and version details

Note: Configuration file details do not appear in the image table.

Changing the Status of an Image File

To change the status of an image:

1. Select Link or Local or Remote > Maintenance > Image Table.

2. Select the image you wish to change and click Edit.

3. On the Image Details, select the status from the Command drop-down list and click Apply.

Status	Function
Active	The image is currently being used by the system.
Inactive	The image is not currently being used by the system and could be deleted.
Selected	The image is not currently being used by the system but has been activated and will become active following a terminal reboot.
Current (deselected)	The image is currently being used by the system but as another image has been selected, it will become inactive following a terminal reboot.

Rebooting the Terminal

The local or remote terminals can be rebooted by SuperVisor.

You can specify a 'Soft Reboot' which reboots the terminal without affecting traffic or a 'Hard Reboot' which reboots the terminal (similar to power cycling the terminal).

You can specify an immediate reboot or setup a reboot to occur at a predetermined time.

To reboot the terminal:

1. Select Link or Local or Remote > Maintenance > Reboot.

2. Select the **Reboot Type** field:

Reboot Type	Function
None	Does nothing.
Soft Reboot	Reboots the software but does not affect customer traffic.
Hard Reboot	Reboots the entire terminal and affects customer traffic. This reboot is similar cycling the power off and on.

3. Select the **Reboot Command** field:

Reboot Command	Function
None	Does nothing
Reboot Now	Execute the selected reboot now
Timed Reboot	Set the **Reboot Time** field to execute the selected reboot at a later date and time. This feature can be used to schedule the resulting traffic outage for a time that has least customer impact.
Cancel Reboot	Cancel a timed reboot.

4. Click Apply to execute the reboot or Reset to restore the previous configuration.

Support Summary

The support summary page lists key information about the terminal, for example, serial numbers, software version, frequencies and so on.

To view the support summary:

Select Link or Local or Remote > Maintenance > Support Summary.

SUPPORT SUMMARY

Serial Number	12345678
Software Version	8_6_61_E0
Software Status	Standard Software Release
IP Assignment	Static IP
IP Address	172.18.120.46
Subnet Mask	255.255.0.0
Remote Address	172.18.120.92
MAC Address	00:50:C2:6B:3A:06
Motherboard	13036835
Modem Config	28
Channel Size (MHz)	0.2

RX Frequency (MHz)	930
TX Frequency (MHz)	939
TX Power (dBm)	28
Modulation	QPSK
Clock Selection	Internal
Primary External Clock Source	Inactive
Secondary External Clock Source	Inactive
Bootloader Version	2
Tx Synth File Version	1
Rx Synth File Version	1
Tx Op Data Version	B01B01
Rx Op Data Version	B01A01

Index	Status	Version
0	Active	C-CC-K-6_0_0.img
2	Active	C-CC-R-8_6_6.img
5	Active	C-fpga_E1-1-7-3.img
7	Active	C-fpga_E2-1-5-4.img
8	Active	C-fpga_EA-0-5-2.img
10	Active	C-fpga_EA-1-0-3.img
12	Active	C-fpga_E5-0-8-5.img
13	Active	C-fpga_E7-1-3-3.img
14	Active	C-fpga_E7-2-3-3.img
15	Active	C-fpga_E8-1-4-0.img
16	Active	C-fpga_E8-2-4-0.img
17	Active	C-fpga_E9-0-4-1.img
18	Active	C-fpga_E9-1-4-2.img
19	Active	C-fpga_EB-0-1-1.img
20	Active	C-fpga_EC-0-1-4.img
21	Active	C-fpga_EC-1-1-7.img
22	Active	C-fpga_E7-5-0-2.img
23	Active	C-fpga_E8-3-5-3.img
24	Active	C-fpga_E8-4-5-3.img
25	Active	C-fpga_E9-2-4-1.img
26	Active	C-fpga_E9-3-4-1.img
27	Active	C-fpga_FB-0-1-3.img

Slot	Installed	Serial Number
Receiver	Receiver	13034734
Transmitter	Transmitter	13032689
A	QJET	33112037
Aux	Modem	13033842

Installing Interface Cards

CAUTION: You must power down the terminal before removing or installing interface cards.

Interface cards are initially installed in the factory to the customers' requirements however, during the life of the product, additional interface cards may need to be installed.

Unless the terminals are protected (see 'Protected terminals' on page 197), installing new interface cards involves a substantial interruption of traffic across the link. Staff performing this task must have the appropriate level of education and experience; it should not be attempted by inexperienced personnel.

To install an interface card:

1. Switch off the power to the terminal.
2. Prepare the terminal for new interface cards (see 'Preparing the Terminal for New Interface Cards' on page 236).
3. Install the interface card (see 'Installing an Interface Card' on page 238).
4. Power up the terminal.
5. Configure the slot (see 'Configuring a Slot' on page 240).

   A slot can be configured before installing a new interface card, or after the interface card is installed and the terminal power cycled.

6. Configure the cross connections. (see 'Configuring the traffic cross connections' on page 158)

Preparing the Terminal for New Interface Cards

To prepare the terminal for a new interface card:

1. Remove the terminal from service by first switching off the terminal power. For an AC powered terminal, remove the AC power connector. For a DC powered terminal, switch off the DC circuit breaker or supply fuse.

2. Remove all other cables from the terminal, marking their locations first, if necessary, to aid later restoration. The safety earth connection must be the last cable removed.

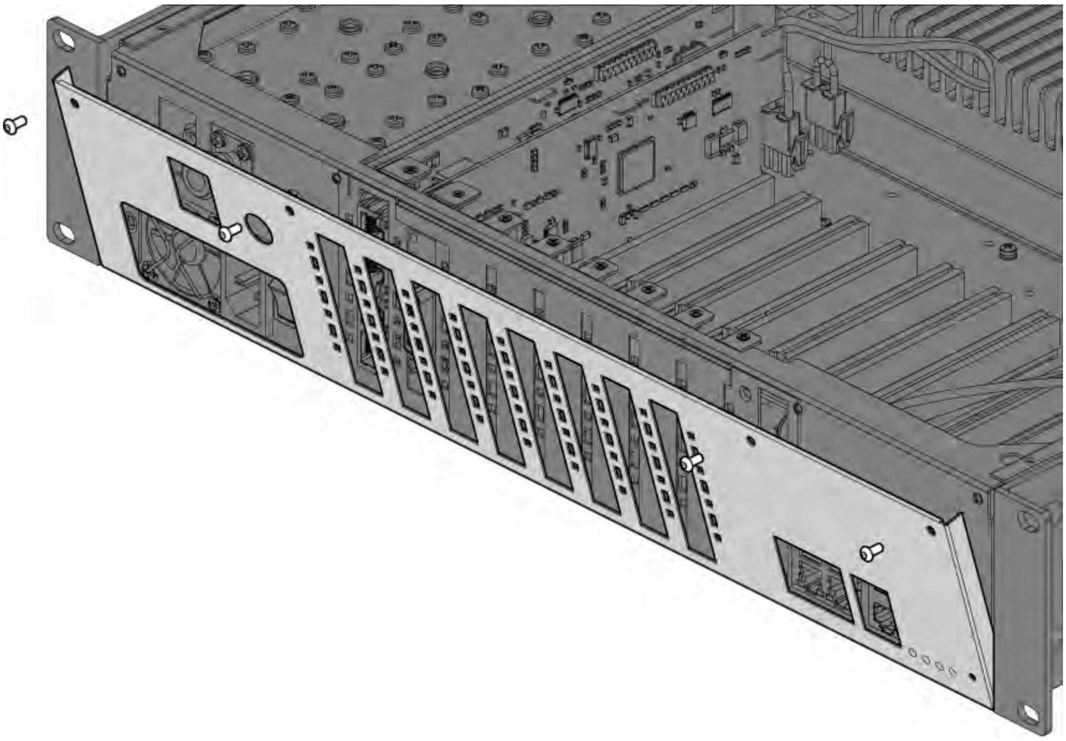
3. Ensure you have unobstructed access to the top and front of the terminal. Remove the terminal from the equipment rack, if required.

4. Remove the top cover of the terminal by removing two socket screws from the rear.

Note: The top cover slides back towards the rear of the chassis.

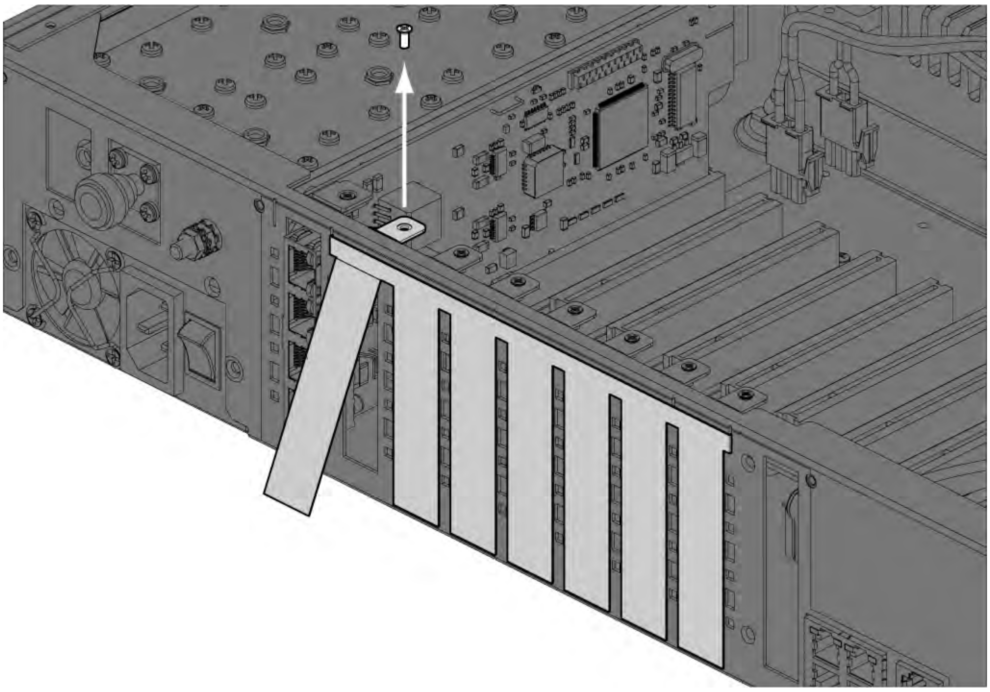
5. Remove the front fascia by removing the four front panel socket screws.

Note: The front fascia first hinges out to clear the antenna connector and earth stud, and is then removed by unclipping from the chassis and sliding downwards. See illustration below.

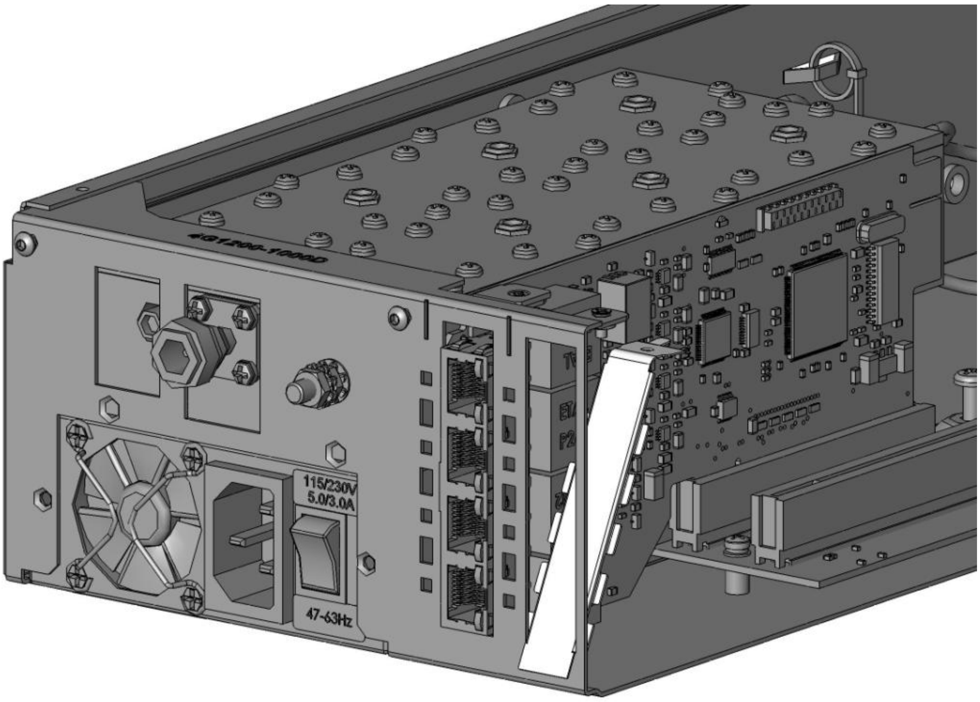


6. Remove the card securing screw from the required interface slot.
7. There are two types of interface slot blanking plates, the seven tab break off and the single slot type (newer type).

   If the blanking plate is the seven tab break off, remove the slot blanking tab by folding the tab to and fro until it breaks off.



   If the blanking plate is the single slot type, unclip the blanking plate from behind the slot (assuming that the card securing screw has already been removed).



Installing an Interface Card

To install an interface card:

1. Remove the interface card from its packaging and static-safe bag.

CAUTION: To avoid static damage to the terminal or the interface card being installed, use a static discharge wristband or similar antistatic device.

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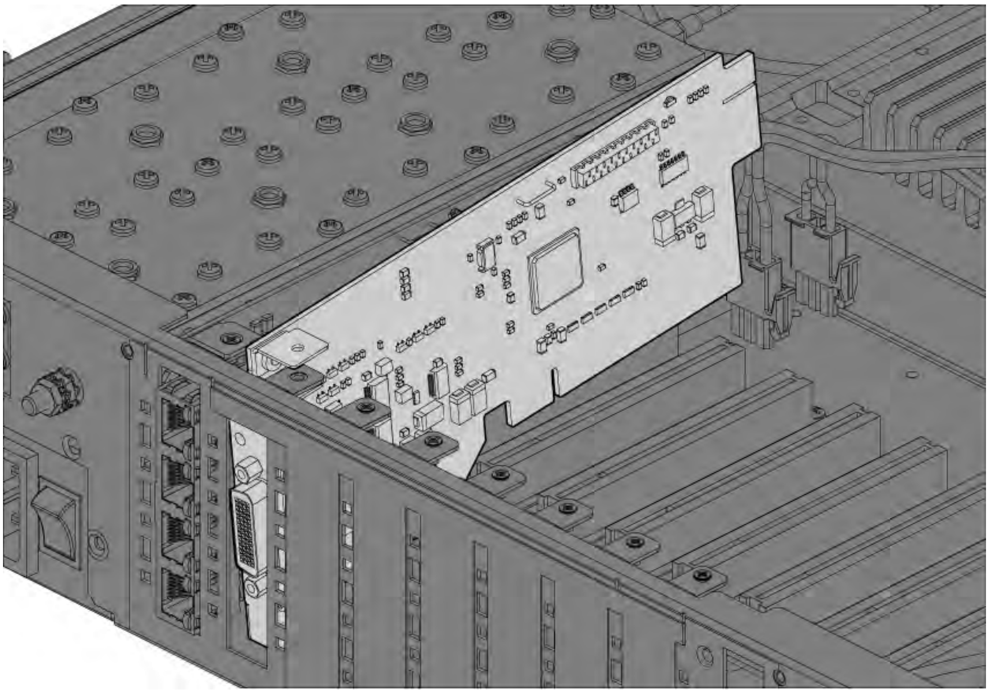
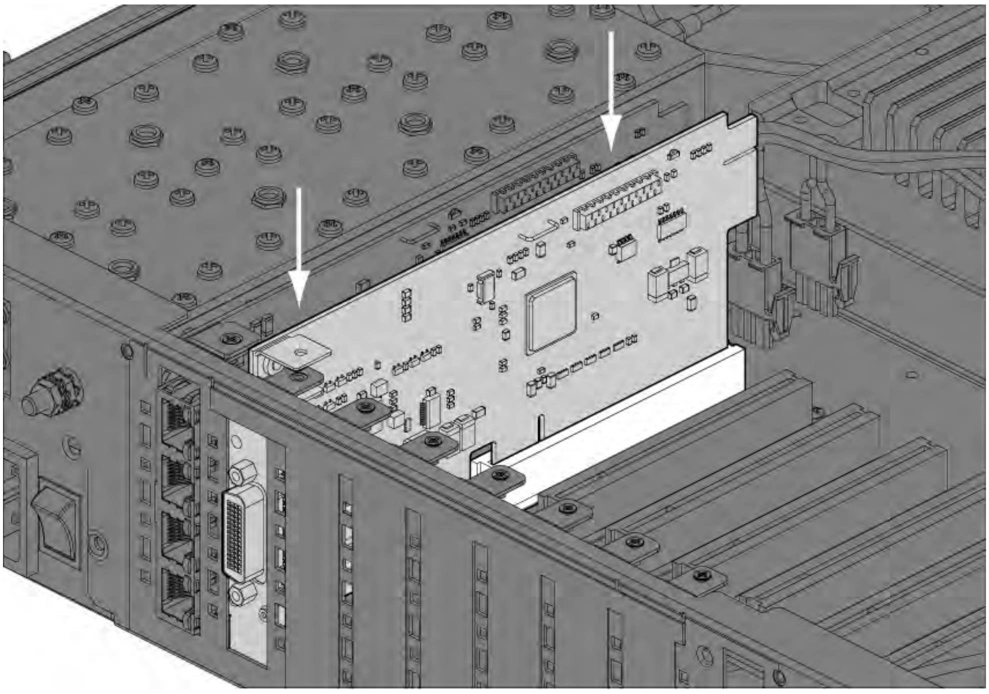
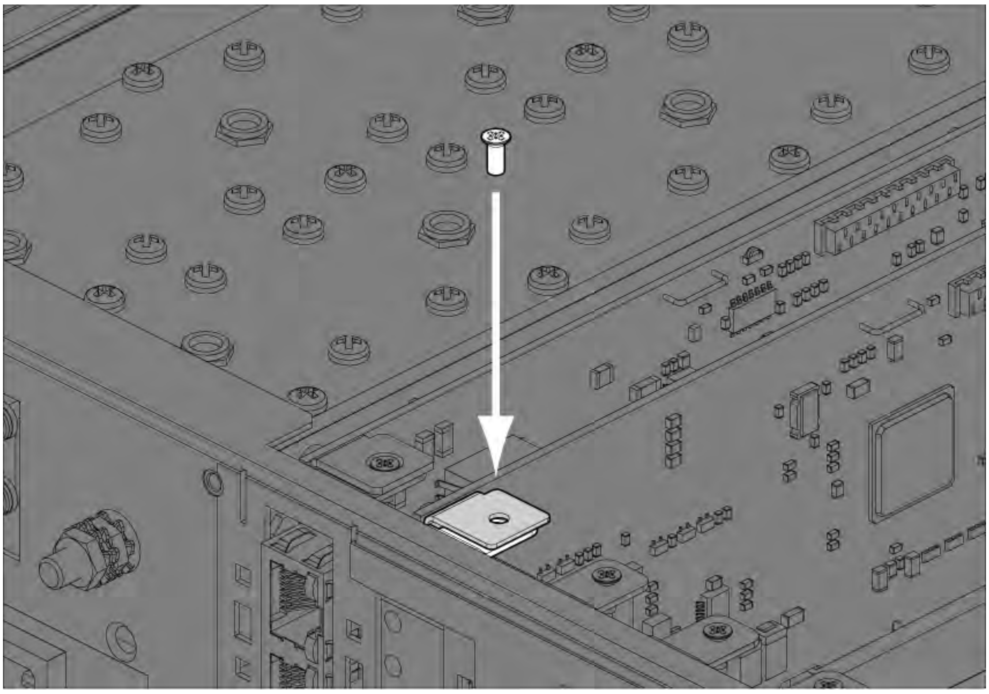
2. Offer the interface card into the chassis at an angle until the front panel of the card engages in the chassis.



3. Rotate the card in the chassis until it is level, and both parts of the card interface bus connector engage with the socket. Push down evenly on the interface card to seat it into the socket.

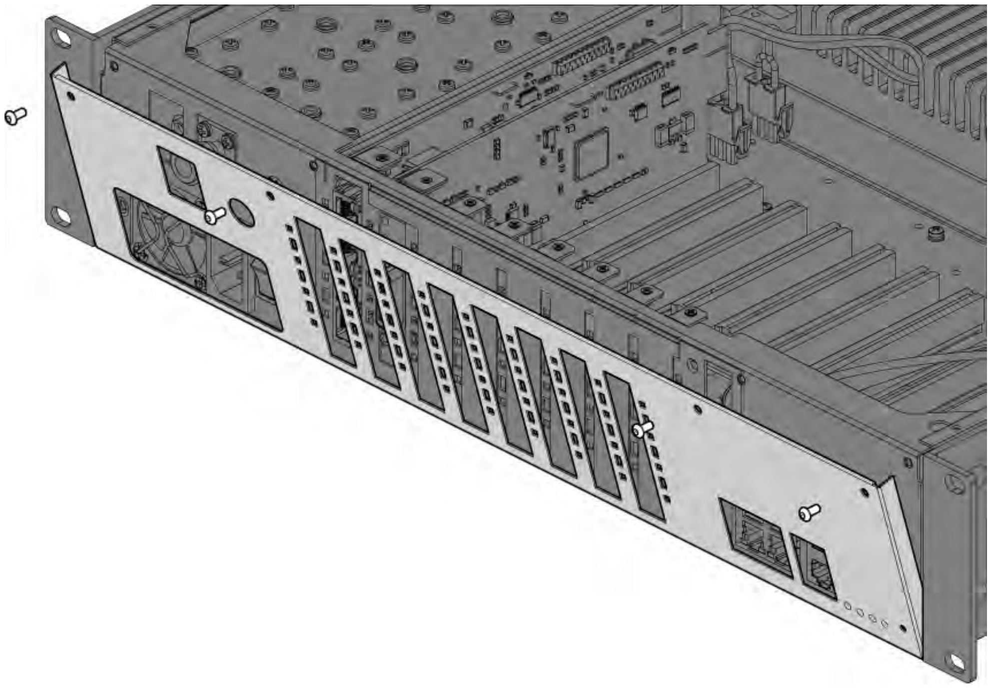


4. Replace the card securing screw.



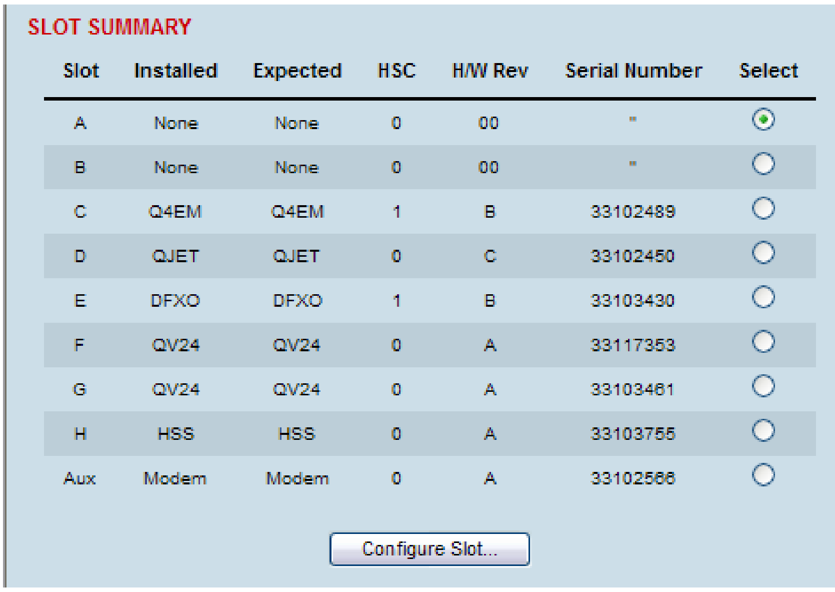
Note: Some interface cards may not have the bracket to accept the card securing screw.

5. Replace the fascia and top covers, restore all cables, and power up the terminal.



Configuring a Slot

1. Select Link or Local or Remote > Interface > Slot Summary.

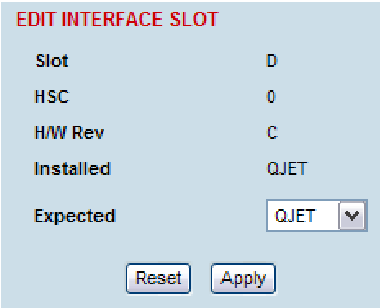


SLOT SUMMARY

Slot	Installed	Expected	HSC	H/W Rev	Serial Number	Select
A	None	None	0	00	-	◉
B	None	None	0	00	-	○
C	Q4EM	Q4EM	1	B	33102489	○
D	QJET	QJET	0	C	33102450	○
E	DFXO	DFXO	1	B	33103430	○
F	QV24	QV24	0	A	33117353	○
G	QV24	QV24	0	A	33103461	○
H	HSS	HSS	0	A	33103755	○
Aux	Modem	Modem	0	A	33102566	○

Configure Slot...

2. Select the required slot and click Configure Slot.



'Slot' shows the slot the interface card is plugged into in the terminal (A – H).

Details of the interface card currently installed in the slot are:

'HSC' (hardware software compatibility) A number used by the system software to determine which FPGA 'firmware image file' to use in the interface card installed.

'H/W Rev' (hardware revision).

'Installed' field shows the actual interface card installed in the slot. If there is no interface card installed in the slot, this field will show 'none'.

'Expected' shows interface card type that had been previously installed. Interface cards can be setup before they are installed in the terminal or after they are installed in the terminal.

3. To setup a new interface card in a slot, select the interface card type you want to fit (or has been fitted) from the 'Expected' drop-down menu.

Note: The transmitter, receiver and modem are configured in other sections (see 'Configuring the terminal' on page 69).

4. Click Apply to apply changes or Reset to restore the previous configuration.

14. Troubleshooting

Loopbacks

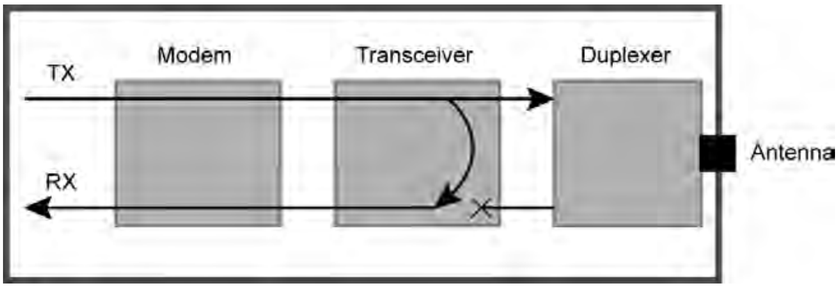
Loopbacks are used as a tool for testing or as part of the commissioning process and will affect customer traffic across the link.

The terminal supports three types of loopbacks:

- RF radio loopback
- Interface loopbacks, set at the interface ports
- Timeslot loopbacks

RF Radio Loopback

The RF radio loopback provides a loopback connection between the radio TX and radio RX. Each terminal is looped back independently.



All traffic entering the transmit stage of the transceiver is transmitted on the RF link but is also looped back to the receiver section of the transceiver. This loopback will affect all traffic through the terminal.

When the RF loopback is activated, both the radio RX and TX LEDs will flash.

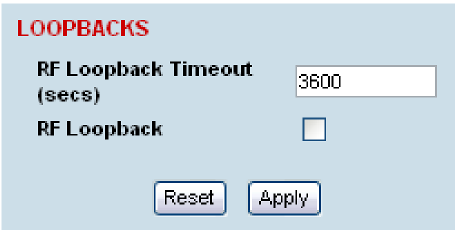
An RF loopback will automatically deactivate after the period set (in seconds) in the RF Loopback Timeout field. The default entry is 3600 seconds (60 minutes).

When an RF loopback is activated, the ethernet path is disabled to prevent ethernet loopbacks.

An RF loopback is deactivated if the terminal is rebooted.

To activate or deactivate the RF loopback:

Select Link or Local or Remote > Maintenance > Loopbacks.



To activate the RF loopback, tick the RF Loopback checkbox. Untick the checkbox to deactivate it.

Click Apply to apply changes or Reset to restore the previous configuration.

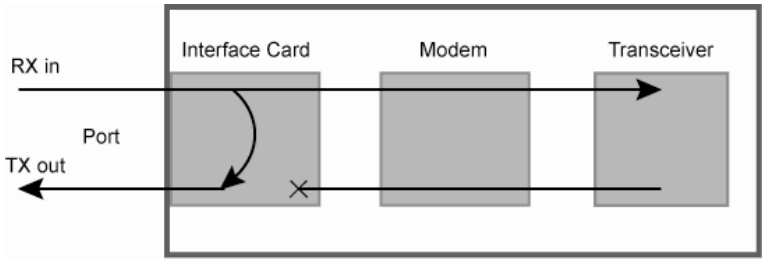
Interface Loopbacks

The interface loopback provides a loopback connection for the customer-connected equipment.

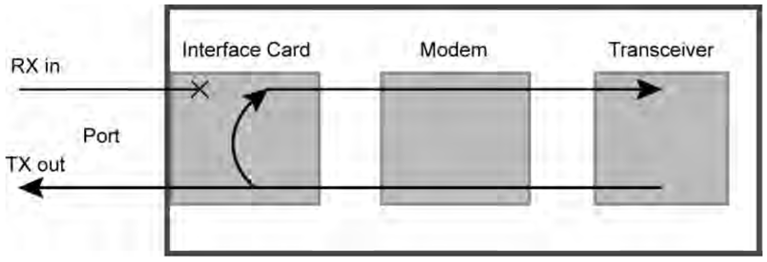
These loopbacks are applied on a port-by-port basis and can only be enabled on active ports i.e. the port has to be activated by assigning traffic to it by the Cross Connections application.

These are two types of interface loopbacks:

Line Facing – port traffic from the customer is transmitted over the RF link but is also looped back to the customer



Radio Facing – traffic received from the RF link is passed to the customer port but is also looped back to be transmitted over the RF link.

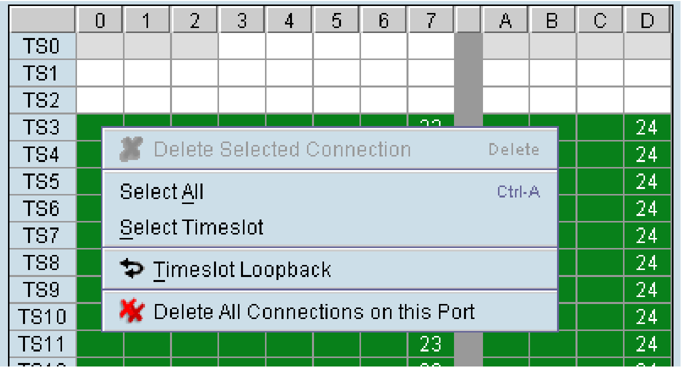


Loopback type	Description
QJET (whole tributary)	The QJET interface port has both Line Facing and Radio Facing loopbacks (see 'QJET Port Settings' on page 102). The interface card green LED flashes while the loopback is active.
QJET (individual timeslot)	The Cross Connections application can loopback framed E1 / T1 timeslots (see 'Timeslot Loopbacks' on page 243).
Q4EM port	The Q4EM interface port has both Line Facing and Radio Facing loopbacks (see 'Q4EM Port Settings' on page 104). The interface card yellow LED flashes while the loopback is active.
DFXO port	The DFXO interface Line Facing loopback loops back the port data to the customer. This loopback is performed on the digital path of the codec. The interface card yellow LED flashes while the loopback is active.
DFXS port	The DFXS interface Line Facing loopback loops back the port data to the customer. This loopback is performed on the digital path of the codec. The interface card yellow LED flashes while the loopback is active.
HSS port	The HSS interface Line Facing loopback loops back the port data to the customer. The interface card top green LED flashes while the loopback is active.
QV24 port	The QV24 interface Line Facing loopback will loop back the port data to the customer.
Ethernet	No loopback possible.

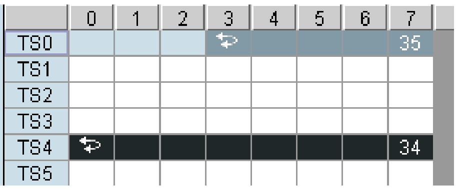
Timeslot Loopbacks

You can loopback framed E1 / T1 timeslots in the Cross Connections application.

1. Open the Cross Connections application.
2. Right-click the timeslot you want to loop back.



3. Select Timeslot Loopback - the looped timeslot will display in black:



Alarms

The LEDs (OK, RX, and TX) on the front panel illuminate either amber or red when there is a fault condition:

- Amber indicates a minor alarm that should not affect traffic across the link.
- Red indicates a major alarm condition that could affect traffic across the link.

A major or minor alarm can be mapped to the external alarm outputs (see 'Configuring the External Alarm Outputs' on page 83).

Diagnosing Alarms

To view the Alarm Summary and their current states:

Select Link or Local or Remote > Alarms > Summary.

Alarm	Explanation
Synthesizer Status	The selected transmit frequency is outside the tuning range of the transmitter synthesizer
Modem Lock	The terminal modem is not synchronized with the modem at the other end of the link
TX Temp Shutdown	The transmitter power amplifier temperature is greater than 75°C. The transmitter has shut down to prevent damage.
TX Temp Warning	The transmitter power amplifier temperature is greater than 70°C. The transmitter will continue to operate in this condition, but if the power amplifier temperature increases above 75°C, a major alarm condition is set and the transmitter will shut down to prevent further damage.
TX AGC Voltage	The transmitter power amplifier automatic gain control is out of limits for normal operation
TX Reverse Power	There is excessive reflected power at the transmitter port of the terminal, indicating a low return loss in the path between transmitter port and the antenna.
TX Return Loss Status	Indicates the difference between the transmitted power and the amount of power being reflected back into the terminal. The alarm will trigger when there is too much reflected power from the antenna that will degrade link performance.
RX RSSI	The RX RSSI alarm threshold is determined by the RSSI Thresholds for each of the modulation types (see ‘Setting the RSSI Alarm Threshold’ on page 80)
Fan 1	The internal cooling fan 1 is not operating
Fan 2	The internal cooling fan 2 is not operating
External Input 1 -2	Indicates an active alarm state on the the external alarm input
Alarm Output 1 - 4	Indicates an active alarm state on the the external alarm output
MHSB Switch	Indicates that the MHSB has switched over. The MHSB alarm is only shown if MHSB mode is enabled (see ‘Configuring the Terminals for MHSB’ on page 188).

To view detailed alarm information:

Select Link or Local or Remote > Alarms > Alarm Table

ALARM TABLE

Source	Type	Slot	Port	Severity	Time
QJET	LOS	D	4	Minor	Wed Aug 23 13:36:15 2006
QJET	LOS	D	3	Minor	Wed Aug 23 13:36:15 2006
QJET	LOS	D	2	Minor	Wed Aug 23 13:36:15 2006
QJET	LOS	D	1	Minor	Wed Aug 23 13:36:14 2006
Remote	remoteMinorAlarm	-----	----	Minor	Tue Aug 22 16:25:37 2006
DFXO	fxoUnplug	E	2	Major	Tue Aug 22 16:25:44 2006

The Alarm Table shows the source of the alarm and the type, the slot (and port, if applicable) where the alarm originated, the severity and the date and time the alarm occurred.

To further diagnose the cause of the alarm (see ‘Identifying Causes of Alarms’ on page 250, and ‘Alarm Types’ on page 275).

Viewing the Alarm History

The alarm history page shows the historical alarm activity for up to 50 alarms. This page refreshes every 30 seconds.

The alarm history for up to 100 alarms can be seen using SNMP (see ‘Configuring SNMP’ on page 85).

To view the alarm history:

Select Link or Local or Remote > Alarms > Alarm History.

ALARM HISTORY

Source	Type	Slot	Port	Severity	Status	Time
System	mbCardMismatch	A	----	Major	Cleared	Thu Jun 16 01:31:17 2005
System	mbCardMismatch	A	----	Major	Active	Tue Jun 14 23:38:02 2005
System	mdClkSyncFail	-----	----	Major	Cleared	Wed Jun 8 04:32:45 2005
Modem	mdDemodAlignmentLost	Aux	----	Major	Cleared	Wed Jun 8 04:32:42 2005
HSS	hssLoss	H	1	Minor	Cleared	Wed Jun 8 04:32:42 2005
Modem	mdTdmAlignmentLost	Aux	----	Major	Cleared	Wed Jun 8 04:32:42 2005
V24	v24CtrlLineLoss	G	4	Major	Cleared	Wed Jun 8 04:32:42 2005
V24	v24CtrlLineLoss	G	3	Major	Cleared	Wed Jun 8 04:32:42 2005
V24	v24CtrlLineLoss	G	2	Major	Cleared	Wed Jun 8 04:32:42 2005
V24	v24CtrlLineLoss	G	1	Major	Cleared	Wed Jun 8 04:32:42 2005
Modem	mdLOS	Aux	----	Major	Cleared	Wed Jun 8 04:32:42 2005
HSS	hssLoss	H	1	Minor	Active	Wed Jun 8 04:32:37 2005
System	mdClkSyncFail	-----	----	Major	Active	Wed Jun 8 04:32:36 2005
V24	v24CtrlLineLoss	G	4	Major	Active	Wed Jun 8 04:32:36 2005
V24	v24CtrlLineLoss	G	3	Major	Active	Wed Jun 8 04:32:36 2005
V24	v24CtrlLineLoss	G	2	Major	Active	Wed Jun 8 04:32:36 2005
V24	v24CtrlLineLoss	G	1	Major	Active	Wed Jun 8 04:32:36 2005
Modem	mdDemodAlignmentLost	Aux	----	Major	Active	Wed Jun 8 04:32:35 2005
Modem	mdTdmAlignmentLost	Aux	----	Major	Active	Wed Jun 8 04:32:35 2005
Modem	mdLOS	Aux	----	Major	Active	Wed Jun 8 04:32:35 2005

Field	Explanation
Source	The component within the terminal that generated the alarm
Type	The type of alarm (see ‘Alarm types and sources’ on page 275)
Slot	The slot where the alarm originated, if applicable
Port	The port where the alarm originated, if applicable
Severity	Whether the alarm was a major or minor alarm
Status	Whether the alarm is active or cleared
Time	The date and time when the alarm occurred

To clear the alarm history:

Select Local or Remote > Alarms > Clear History

This function clears all the alarm history including the 600 alarm rolling buffer (see ‘Saving the Alarm History’ on page 247).

Saving the Alarm History

The last 1500 alarms are stored in a rolling buffer which can be saved as a *.csv file.

To save the alarm history:

Select Local > Alarms > Save History

A File Download dialog box opens.

Click on Save to save the *.csv file to a folder or click on Open to open the file in the SuperVisor page.

Example of file:

Source	Type	Slot	Port	Severity	Status	Time	SNR (dB)	RSSI (dBm)
Modem	mdLOS	Aux	-	Major	Active	Tue Jan 22 12:45:54 2008	0	0
Modem	mdTdmAlignmentLost	Aux	-	Major	Active	Tue Jan 22 12:45:54 2008	0	0
Modem	mdDemodAlignmentLost	Aux	-	Major	Active	Tue Jan 22 12:45:54 2008	0	0
QV24	v24CtrlLineLoss	G	1	Major	Active	Tue Jan 22 12:45:55 2008	0	0
QV24	v24CtrlLineLoss	G	2	Major	Active	Tue Jan 22 12:45:55 2008	0	0
QV24	v24CtrlLineLoss	G	3	Major	Active	Tue Jan 22 12:45:55 2008	0	0
System	mdClkSyncFail	----	-	Major	Active	Tue Jan 22 12:45:57 2008	0	0
Modem	mdLOS	Aux	-	Major	Cleared	Tue Jan 22 12:45:57 2008	0	0
Modem	mdTdmAlignmentLost	Aux	-	Major	Cleared	Tue Jan 22 12:45:57 2008	0	0
Modem	mdDemodAlignmentLost	Aux	-	Major	Cleared	Tue Jan 22 12:45:57 2008	0	0
Transmitter	txADCChZeroLo	Transmitter	-	Minor	Active	Tue Jan 22 12:45:57 2008	0	0
Transmitter	txADCChZeroLo	Transmitter	-	Minor	Cleared	Tue Jan 22 12:45:58 2008	0	0
System	mdClkSyncFail	----	-	Major	Cleared	Tue Jan 22 12:45:58 2008	0	0
QV24	v24CtrlLineLoss	G	1	Major	Cleared	Tue Jan 22 12:45:59 2008	35.28	0
QV24	v24CtrlLineLoss	G	2	Major	Cleared	Tue Jan 22 12:45:59 2008	35.29	0
QV24	v24CtrlLineLoss	G	3	Major	Cleared	Tue Jan 22 12:45:59 2008	35.26	0
HSS	hssLoss	H	1	Minor	Active	Tue Jan 22 13:51:17 2008	35.28	-52.8
HSS	hssLoss	H	1	Minor	Cleared	Tue Jan 22 13:51:17 2008	35.27	-52.8
QJET	LOS	D	1	Minor	Active	Tue Jan 22 13:51:35 2008	35.29	-52.8

Note: Windows security settings can prevent the download of files. In this case, click on the windows security message and select the SuperVisor menu option again (Alarms > Save History).

To save the alarm history from the Remote terminal, login to the Remote terminal and Select Local > Alarms > Save History.

Viewing Interface Alarms

To view the alarms for a particular interface:

1. Select Link or Local or Remote > Interface > Interface Summary.
2. Select the desired interface card slot from the Interface Summary and click Alarms.

   This opens a page as shown below with a summary of the alarms on the interface card:

INTERFACE ALARM SUMMARY

Source	Type	Slot	Port	Severity
QJET	LOS	D	4	Minor
QJET	LOS	D	3	Minor
QJET	LOS	D	2	Minor
QJET	LOS	D	1	Minor

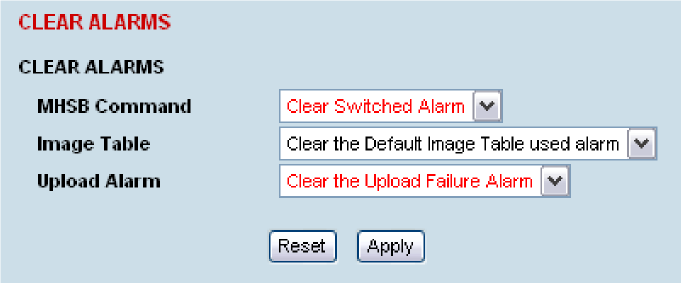
The following fields are displayed:

- Source: The type of interface card that generated the alarm
- Type: The type of interface alarm
- Slot: The slot of the interface card that generated the interface alarm
- Port: The port that generated the interface alarm
- Severity: Whether the interface alarm was major or minor

3. Return to the Interface Summary page by either selecting Options > Interface Summary or clicking Back in the browser window.

Clearing Alarms

Select Link or Local or Remote > Alarms > Clear Alarms



MHSB Command

If a MHSB switchover event occurs, the OK LED on the front panel changes to amber.

To clear the MHSB switchover alarm:

Select 'Clear Switched Alarm' from the MHSB Command drop-down list and click on Apply.

Image Table Alarm

An image table alarm occurs if a problem occurred during the boot process which may have left the image table in an inconsistent state.

To clear the image table alarm:

The default image table alarm: this indicates that the image table has been rebuilt from defaults. This can indicate that an incorrect build of software is running on the terminal.

Select 'Clear the Default Image Table used alarm' from the Image Table drop-down list and click on Apply.

In addition to clearing the image table alarm, you should verify that the active images in the image table are correct for the software release.

Upload Alarm

An Upload Alarm occurs if the TFTP Upgrade process fails. This can indicate that the upgrade process cannot find the TFTP server or cannot find the software version number entered.

To clear the upload alarm alarm:

Select 'Clear the Upload Failure Alarm' from the Upload Alarm drop-down list and click on Apply.

Identifying Causes of Alarms

The following are possible causes of an alarm.

LED	Colour	Possible causes
OK	Amber	A minor system alarm is set
	Red	A major system alarm is set
RX	Amber	Low RSSI or AGC limits have been exceeded
	Red	Receiver power supply or synthesizer failure
TX	Amber	AGC, transmitter temperature, forward power or reverse power limits have been exceeded
	Red	Transmit power supply or synthesizer failure

OK LED		
Colour	Alarm condition	Suggested action
Amber	Fan failure	Check that the fans are not blocked and can spin freely.
Amber	Interface card mismatch	Using SuperVisor, check that the expected interface card and the fitted interface card are the same.
Red	Modem lock	A modem lock alarm is generally seen when other conditions such as low RSSI are present. If there are no other alarms indicated, check the following: The terminal clocking is set up correctly. Both terminals are using the same modulation. Both terminals are using the same version of software. External RF Interference from equipment operating in adjacent channels. Check the constellation pattern for evidence of disturbances in the RF path. Compare RSSI with the expected values from the original path engineering calculation. Investigate any large differences. If the fault persists, contact your local representative.
Red	Interface alarms	Check that the E1 or Ethernet interface cables are fitted correctly and the equipment they are connected to is functioning correctly.

RX LED		
Colour	Alarm condition	Suggested action
Amber	Low RSSI	Check that all antenna and feeder cables are firmly connected and not damaged or kinked Check there is no damage to the antenna Check the TX power and alarm status of the remote terminal
Amber	Receiver AGC	Contact your local 4RF representative
Red	Receiver power supply	Contact your local 4RF representative

TX LED		
Colour	Alarm condition	Suggested action
Amber	Reverse power	Check that all antenna and feeder cables are firmly connected and not damaged or kinked Check there is no damage to the antenna Check that the Receiver and Transmitter ports are correctly connected to the High and Low ports of the duplexer
Red	Transmitter temperature	Check operation of cooling fan or fans Ensure the air grills on the sides of the terminal are clear Ensure the ambient air temperature around the equipment is less than 50˚C

E1 / T1 Alarm Conditions

The QJET interface yellow LED indicates:

- **Loss of signal (LOS)**

  A loss of signal alarm occurs when there is no valid G.703 signal at the E1 / T1 interface RX input from the downstream system.

  This alarm masks the LOF and AIS received alarms.

- **Loss Of Frame alignment (LOF)**

  A loss of frame alignment alarm occurs when the E1 / T1 interface RX input receives a valid G.703 signal (code and frequency) but does not receive a valid G.704 signal i.e. no frame alignment word, from the downstream system (in framed E1 / T1 modes only) (red alarm in framed T1 modes).

  This alarm masks the AIS received alarm.

- **Alarm Indication Signal (AIS)**

  An AIS received alarm occurs when AIS is received from the downstream system.

  An E1 / T1 interface will output AIS to the downstream system if the normal upstream traffic signal is not available e.g. loss of modem synchronization, loss of RF signal across the link (blue alarm in framed T1 modes).

- **Remote Alarm Indicator (RAI)**

  A remote alarm indicator occurs when RAI is received from the downstream system when it has an active LOS or LOF alarm (TS0 NFAS bit 3 in framed E1 modes and yellow alarm in framed T1 modes).

- **TS16 Loss of signal (TS16LOS)**

  A TS16 loss of signal alarm occurs when there is no valid TS16 signal at the E1 interface RX input from the downstream system (in E1 PCM 30 modes only).

- **TS16 Remote Multi-frame Alarm Indicator (RMAI)**

  A remote multiframe alarm indicator occurs when RMAI is received from the downstream system when it has an active TS16LOS alarm (TS16 F0 bit 6 in E1 PCM 30 modes only).

- **TS16 Alarm Indication Signal (TS16AIS)**

  A TS16 Alarm Indication Signal alarm occurs when AIS is received from the downstream system in TS16.

  An E1 interface will output the TS16 AIS signal to the downstream system if the normal TS16 multi-frame signal is not available (in E1 PCM 30 modes only).

The QJET interface green LED indicates:

The QJET interface green LED flashes when the E1 / T1 port loopback is active.

System Log

SuperVisor automatically keeps a log, known as 'syslog', which captures all alarms, errors and events for each terminal.

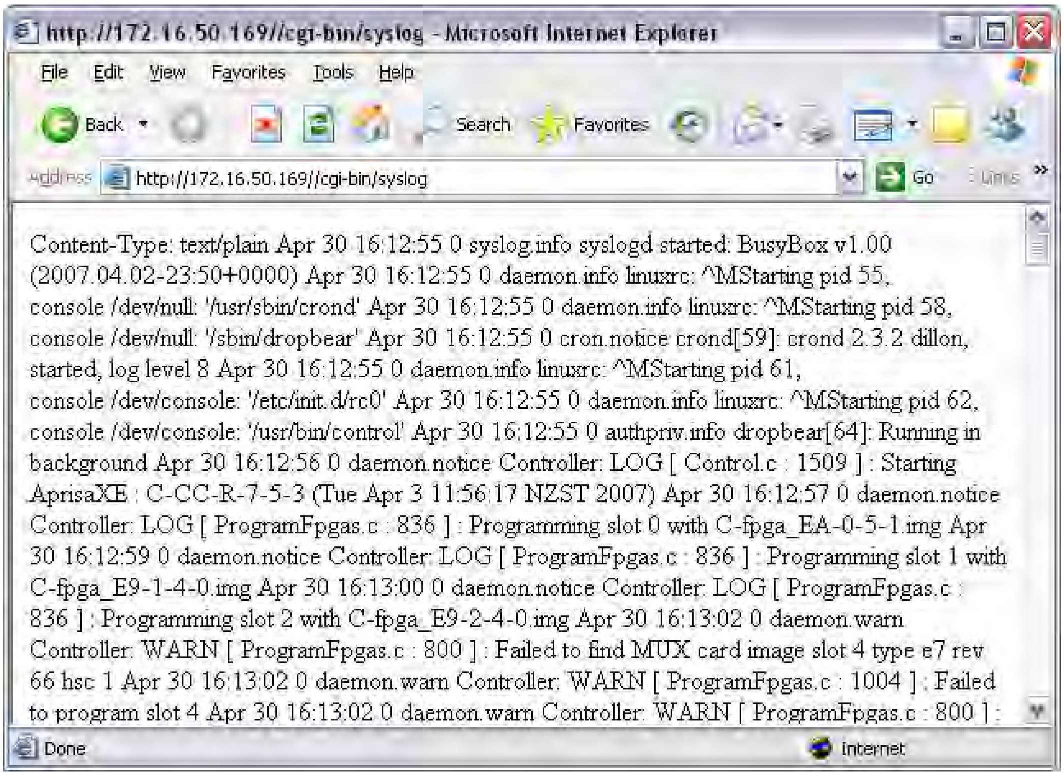
You can specify that the ‘syslog’ is saved to a particular file (see ‘Setting up for Remote Logging’ on page 255). You can then email this file to customer service, if requested, to enable them to fault-find more accurately.

Checking the Syslog

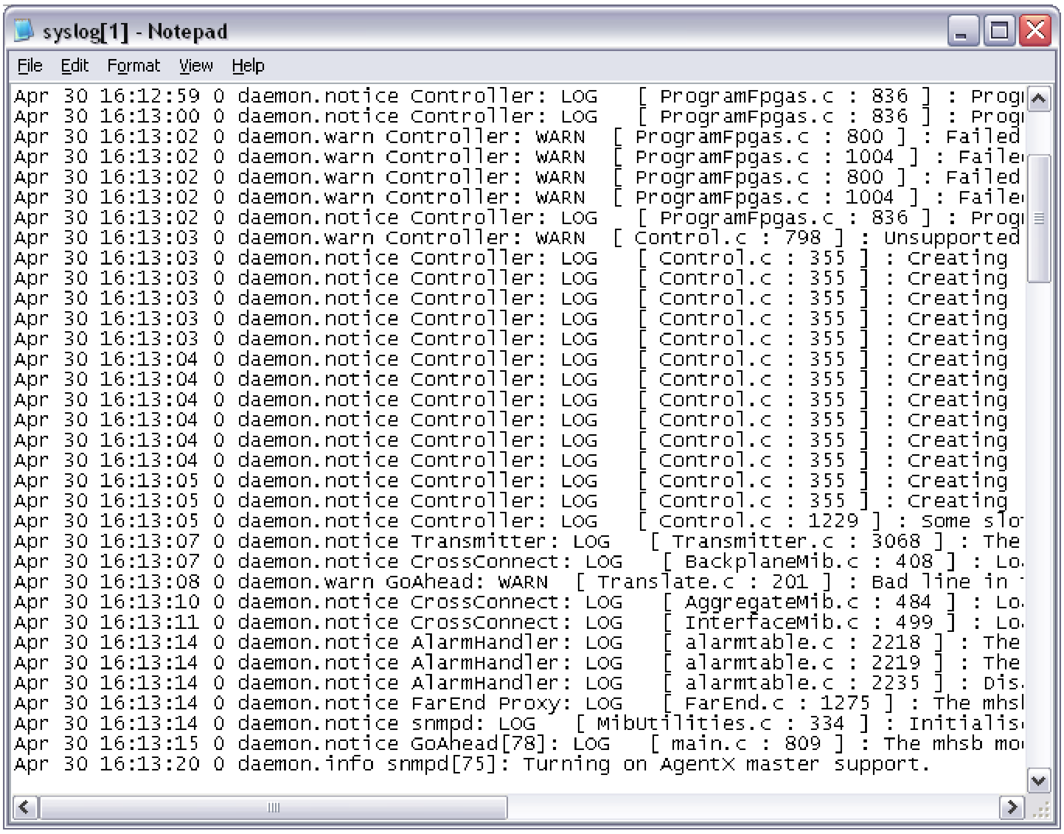
To view the Syslog:

1. Select Local > Performance > Logging > Syslog.

This opens a new window:



2. The system log is quite hard to decipher in Internet Explorer. If you're using Internet Explorer, select View > Source, which opens the file in a more legible layout in Notepad. Save or print this file, as required.




```
Apr 30 16:12:59 0 daemon.notice Controller: LOG   [ ProgramFpgas.c : 836 ] : Progı
Apr 30 16:13:00 0 daemon.notice Controller: LOG   [ ProgramFpgas.c : 836 ] : Progı
Apr 30 16:13:02 0 daemon.warn Controller: WARN  [ ProgramFpgas.c : 800 ] : Failed
Apr 30 16:13:02 0 daemon.warn Controller: WARN  [ ProgramFpgas.c : 1004 ] : Faile
Apr 30 16:13:02 0 daemon.warn Controller: WARN  [ ProgramFpgas.c : 800 ] : Failed
Apr 30 16:13:02 0 daemon.warn Controller: WARN  [ ProgramFpgas.c : 1004 ] : Faile
Apr 30 16:13:02 0 daemon.notice Controller: LOG   [ ProgramFpgas.c : 836 ] : Progı
Apr 30 16:13:03 0 daemon.warn Controller: WARN  [ Control.c : 798 ] : Unsupported
Apr 30 16:13:03 0 daemon.notice Controller: LOG   [ Control.c : 355 ] : Creating
Apr 30 16:13:03 0 daemon.notice Controller: LOG   [ Control.c : 355 ] : Creating
Apr 30 16:13:03 0 daemon.notice Controller: LOG   [ Control.c : 355 ] : Creating
Apr 30 16:13:03 0 daemon.notice Controller: LOG   [ Control.c : 355 ] : Creating
Apr 30 16:13:03 0 daemon.notice Controller: LOG   [ Control.c : 355 ] : Creating
Apr 30 16:13:04 0 daemon.notice Controller: LOG   [ Control.c : 355 ] : Creating
Apr 30 16:13:04 0 daemon.notice Controller: LOG   [ Control.c : 355 ] : Creating
Apr 30 16:13:04 0 daemon.notice Controller: LOG   [ Control.c : 355 ] : Creating
Apr 30 16:13:04 0 daemon.notice Controller: LOG   [ Control.c : 355 ] : Creating
Apr 30 16:13:04 0 daemon.notice Controller: LOG   [ Control.c : 355 ] : Creating
Apr 30 16:13:04 0 daemon.notice Controller: LOG   [ Control.c : 355 ] : Creating
Apr 30 16:13:05 0 daemon.notice Controller: LOG   [ Control.c : 355 ] : Creating
Apr 30 16:13:05 0 daemon.notice Controller: LOG   [ Control.c : 355 ] : Creating
Apr 30 16:13:05 0 daemon.notice Controller: LOG   [ Control.c : 1229 ] : Some slo
Apr 30 16:13:07 0 daemon.notice Transmitter: LOG   [ Transmitter.c : 3068 ] : The
Apr 30 16:13:07 0 daemon.notice CrossConnect: LOG   [ BackplaneMib.c : 408 ] : Lo
Apr 30 16:13:08 0 daemon.warn GoAhead: WARN  [ Translate.c : 201 ] : Bad line in
Apr 30 16:13:10 0 daemon.notice CrossConnect: LOG   [ AggregateMib.c : 484 ] : Lo
Apr 30 16:13:11 0 daemon.notice CrossConnect: LOG   [ InterfaceMib.c : 499 ] : Lo
Apr 30 16:13:14 0 daemon.notice AlarmHandler: LOG   [ alarmtable.c : 2218 ] : The
Apr 30 16:13:14 0 daemon.notice AlarmHandler: LOG   [ alarmtable.c : 2219 ] : The
Apr 30 16:13:14 0 daemon.notice AlarmHandler: LOG   [ alarmtable.c : 2235 ] : Dis
Apr 30 16:13:14 0 daemon.notice FarEnd Proxy: LOG   [ FarEnd.c : 1275 ] : The mhsl
Apr 30 16:13:14 0 daemon.notice snmpd: LOG   [ MibUtilities.c : 334 ] : Initialis
Apr 30 16:13:15 0 daemon.notice GoAhead[78]: LOG   [ main.c : 809 ] : The mhsb mo
Apr 30 16:13:20 0 daemon.info snmpd[75]: Turning on AgentX master support.
```

3. If you want to save the system log, you can save it from within Notepad (or Internet Explorer). Select File > Save As. Navigate to where you want to save the file. Enter a meaningful filename and select 'Text File' from the Save As Type drop-down list. Click Save.

You can specify that this file is automatically saved to a computer (see ‘Setting up for Remote Logging’ on page 255).

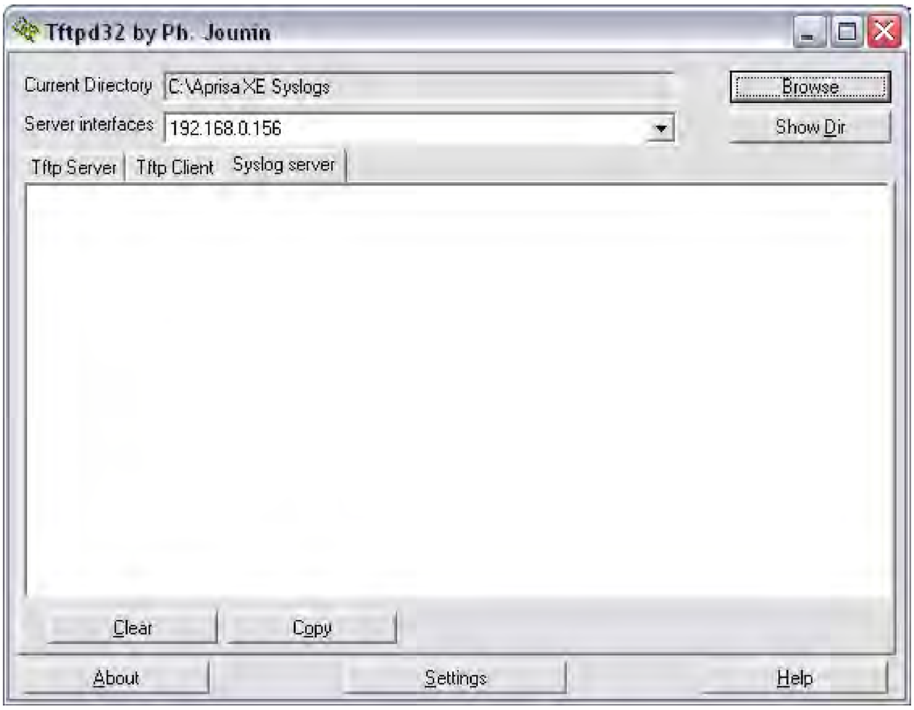
Setting up for Remote Logging

Note: When setting up to save the system log to a specific computer, be aware that the file is constantly updated and may get quite large quite quickly.

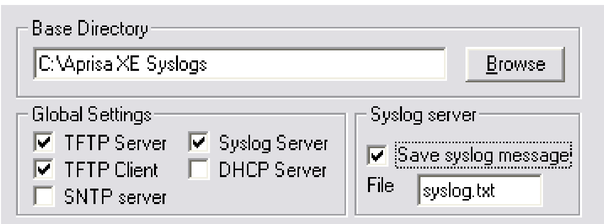
To set up a terminal for remote logging:

1. Copy the TFTP server application (tftpd32.exe, which is located in the TFTPD directory) from the terminal product CD into a suitable directory on the PC (for example, C:\Program Files\TFTP Server).
2. Create another directory where you want the system logs to be saved for example;

   C:\Aprisa XE Syslog
3. Double-click tftpd32.exe.



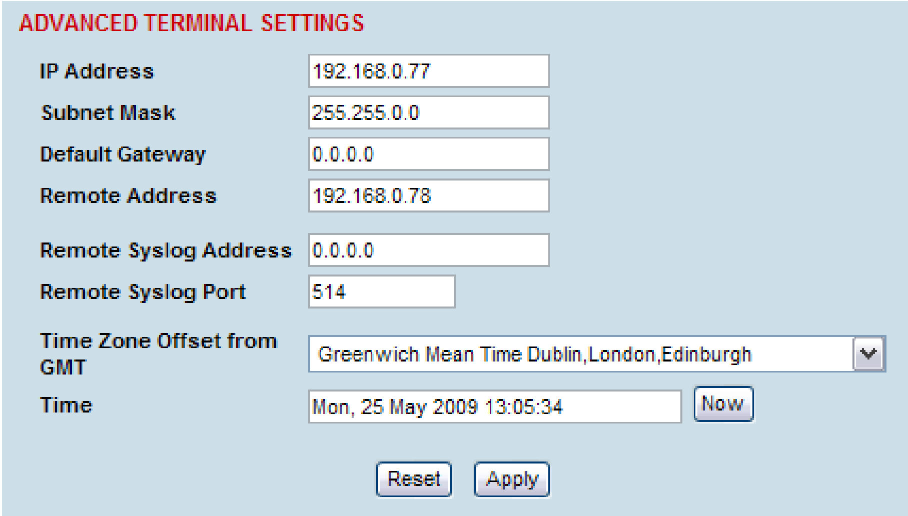
4. Click Settings and make sure that both 'Syslog Server' and 'Save syslog message' boxes are ticked.



5. Click Browse and select a directory where you want the Syslog file to be saved (created in step 2).

6. Click OK to close the Settings dialog box.

7. In SuperVisor, select Link or Link or Local or Remote > Terminal > Advanced.



8. In the Remote Syslog Address field, enter the IP address of the PC on which the Syslog server is running.

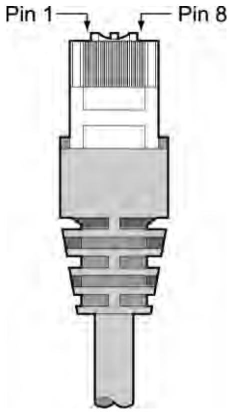
9. In the Remote Syslog Port field, enter 514.

10. Reboot the terminal (Link or Local or Remote > Maintenance > Reboot).

11. Open the directory where the system logs are being saved to. You should see a file called syslog.txt.

15. Interface Connections

RJ-45 Connector Pin Assignments

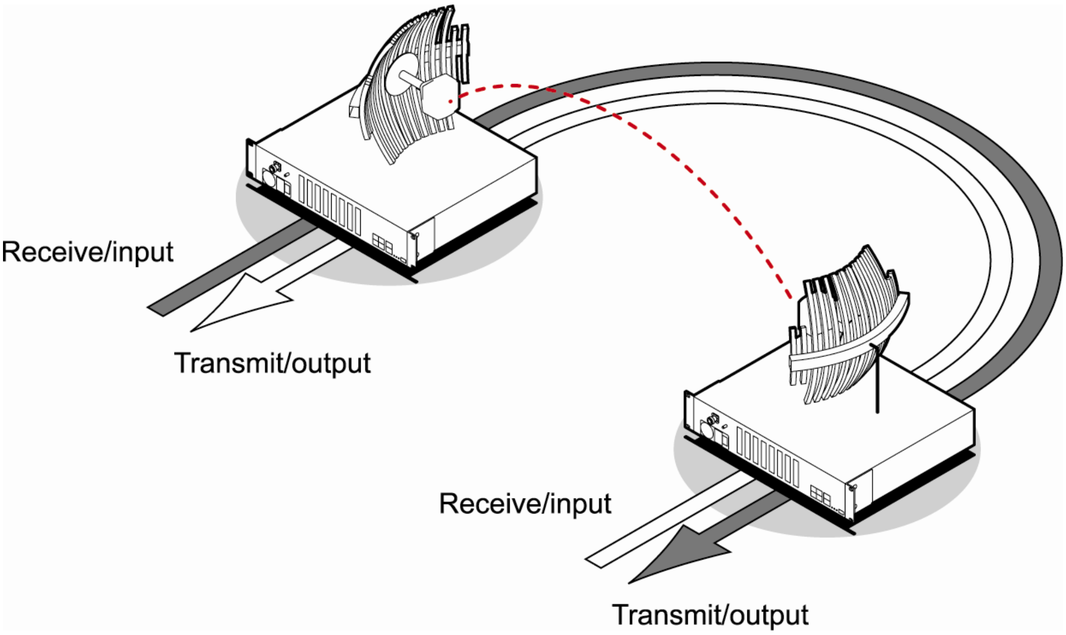


RJ-45 pin numbering

Interface Traffic Direction

All interface traffic directions and labels used in this manual refer to the direction relative to the terminal. Refer to the diagram below.

The traffic direction describes the transmit / receive paths and the direction of handshaking and clocking signals, depending on the interface.



QJET Interface Connections

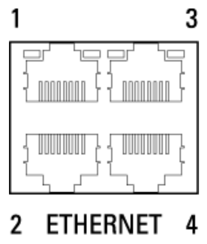
Pin number	Pin function	Direction	TIA-568A wire colour
1	Transmit	Output	Green/white
2	Transmit	Output	Green
3	Not used		Orange/white
4	Receive	Input	Blue
5	Receive	Input	Blue/white
6	Not used		Orange
7	Not used		Brown/white
8	Not used		Brown

RJ-45 connector LED indicators		
LED	**Status**	**Explanation**
Green	On	Normal operation
Yellow	On	Loss of signal (LOS) or Alarm Indication Signal (AIS) or Loss Of Frame alignment (LOF) in Framed modes
Green	Flashing	Port in loopback

The standard QJET interface is 120 ohm balanced.

External Balun transformers can be used to provide a 75 ohm unbalanced interface.

Ethernet Interface Connections

	Pin number	Pin function	Direction	TIA-568A wire colour
	1	Transmit	Output	Green/white
	2	Transmit	Output	Green
	3	Receive	Input	Orange/white
	4	Not used		Blue
	5	Not used		Blue/white
	6	Receive	Input	Orange
	7	Not used		Brown/white
	8	Not used		Brown

RJ-45 connector LED indicators		
LED	**Status**	**Explanation**
Green	On	Ethernet signal received
Green	Flashing	Indicates data traffic present on the interface

Note: Do not connect Power over Ethernet (PoE) connections to the Aprisa XE Ethernet ports as this will damage the port.

Q4EM Interface Connections

Pin number	Pin function	Direction	TIA-568A wire colour
1	M	Input	Green/white
2	M_1	Input	Green
3	Receive (Ra/R)	Input	Orange/white
4	Transmit (Tb/R1)	Output	Blue
5	Transmit (Ta/T1)	Output	Blue/white
6	Receive (Rb/T)	Input	Orange
7	E	Output	Brown/white
8	E_1	Output	Brown

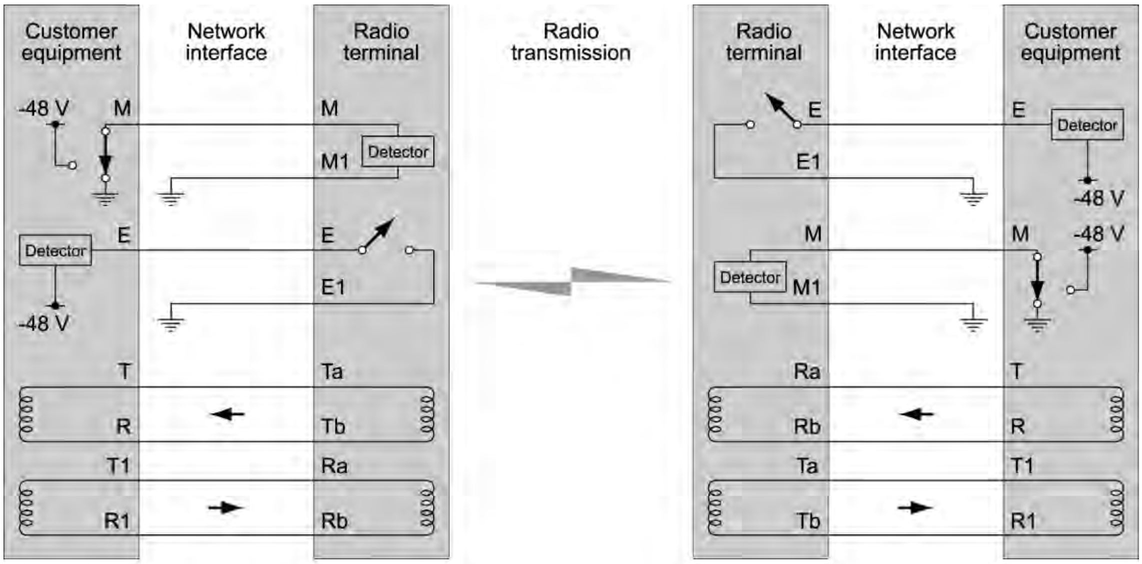
RJ-45 connector LED indicators		
LED	**Status**	**Explanation**
Green	Off	No external source applied to M wire (no M wire current flowing)
Green	On	External source applied to M wire (M wire current flowing)
Green	Flashing	The interface loopback is active
Yellow	Off	E wire relay contact open (no current in external device)
Yellow	On	E wire relay contact closed (current flowing in external device)

E&M Signalling Types

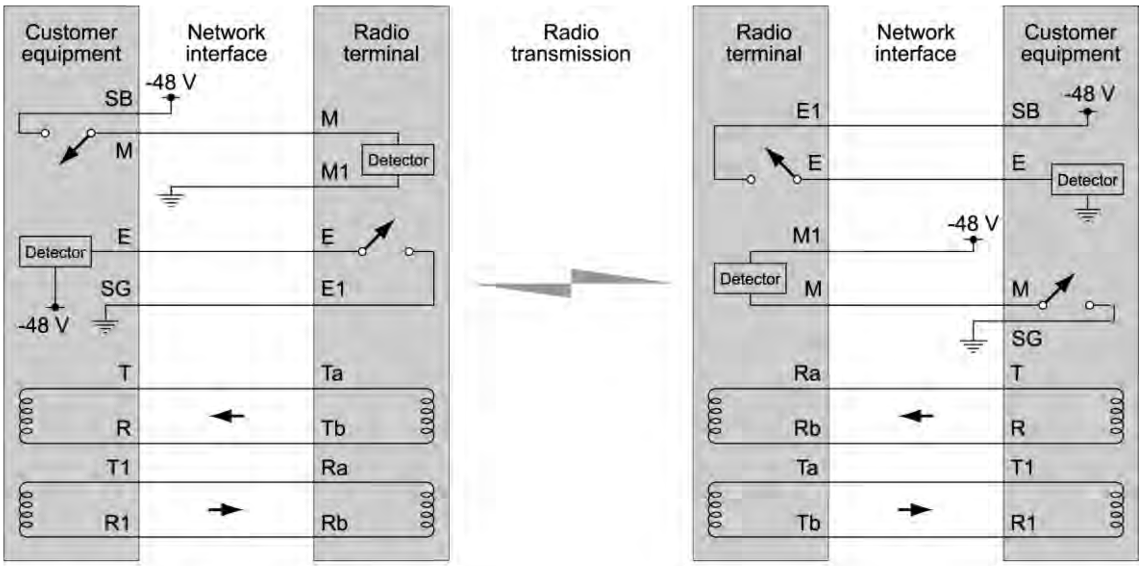
The Q4EM E&M signalling leads are optically isolated, bi-directional lines which can be externally referenced to meet any of the EIA-464 connection types I, II,IV or V (as shown below).

The M1 lead associated with the M wire detector can be externally referenced to earth or battery as required.

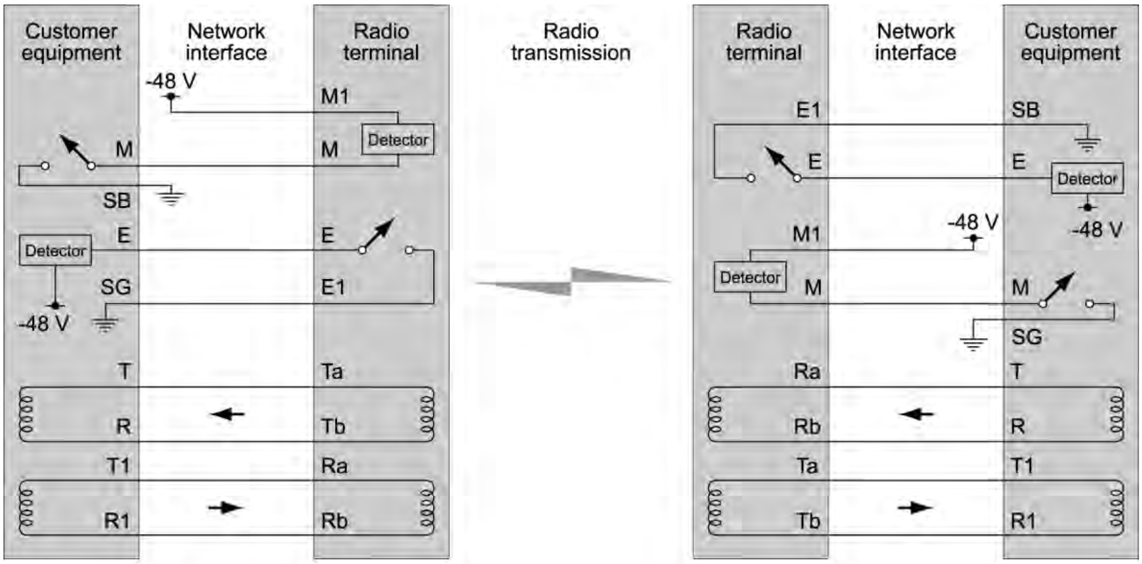
The E1 lead associated with the E wire output can be externally referenced to earth or battery as required.



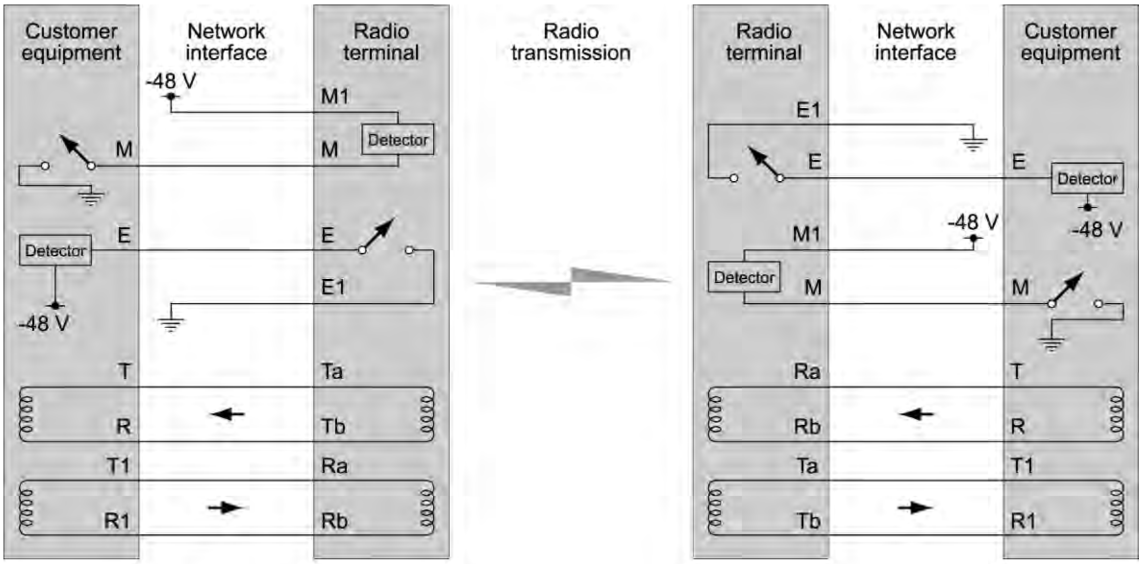
4-Wire E&M Type I



4-Wire E&M Type II

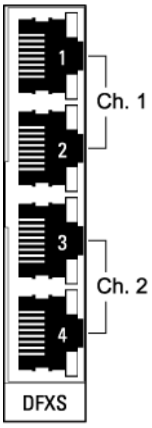


4-Wire E&M Type IV



4-Wire E&M Type V

DFXS Interface Connections



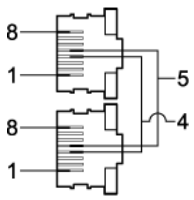
The subscriber interface connects the terminal to the customer's 2 wire telephone via a 2 wire line.

Each 2 wire channel has two access points: one connects to a customer; the other is a local test port.

CAUTION:

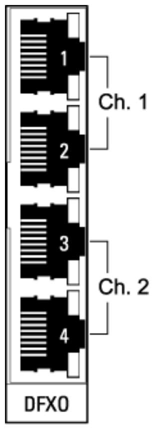
If there is a power failure at either terminal, any telephone connected at the DFXS will not operate.

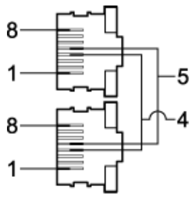
Please ensure that a separate telephone that is not dependent on local power is available for use in an emergency.

RJ-45	Pin number	Pin function	Direction	TIA-568A wire colour
	1	Not used		Green/white
	2	Not used		Green
	3	Not used		Orange/white
	4	Ring	Bi-directional	Blue
	5	Tip	Bi-directional	Blue/white
	6	Not used		Orange
	7	Not used		Brown/white
	8	Not used		Brown

RJ-45 connector LED indicators		
LED	**Status**	**Explanation**
Green	Off	Interface operational but not in service
Green	On	Normal operation
Green	Flashing	Cadenced ringing on line
Yellow	Off	No interface alarm
Yellow	On	Interface alarm
Yellow	Flashing	The interface loopback is active
Both LEDs	Flashing	Loss of CAS signals

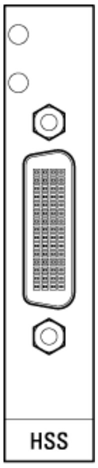
DFXO Interface Connections

	The DFXO interface connects the terminal to the telephone network via a 2 wire line. Each DFXO channel has two access points: one connects to a customer; the other is a local test port.

RJ-45	Pin number	Pin function	Direction	TIA-568A wire colour
	1	Not used		Green/white
	2	Not used		Green
	3	Not used		Orange/white
	4	Ring	Bi-directional	Blue
	5	Tip	Bi-directional	Blue/white
	6	Not used		Orange
	7	Not used		Brown/white
	8	Not used		Brown

RJ-45 connector LED indicators		
LED	**Status**	**Explanation**
Green	Off	Interface operational but not in service
Green	On	Normal operation
Green	Flashing	Cadenced ringing on line
Yellow	Off	No interface alarm
Yellow	On	Interface alarm
Yellow	Flashing	The interface loopback is active
Both LEDs	Flashing	Loss of CAS signals

HSS Interface Connections



The connector on the high-speed synchronous serial interface is a high density LFH-60 (as used on standard Cisco WAN port serial interface cables and equivalents).

The interface specification (X.21 / V.35 etc) is automatically changed by simply changing the type of interface cable connected to the HSS.

LED indicators		
LED	**Status**	**Explanation**
Top green LED	On	Normal operation
Top green LED	Flashing	Loopback in place
Lower green LED	On	Normal operation

Synchronous cable assemblies

RS-449 Serial Cable Assembly for DCE (Part number: Cab Sync 449FC)

Pin number	Pin function	Direction
1	Shield Ground	-
4 22	SD+ SD-	Input Input
5 23	ST+ ST-	Output Output
6 24	RD+ RD-	Output Output
7 25	RS+ RS-	Input Input
8 26	RT+ RT-	Output Output
9 27	CS+ CS-	Output Output
10 37	LL SC	Input _
11 29	DM+ DM-	Output Output
12 30	TR+ TR-	Input Input
13 31	RR+ RR-	Output Output
17 35	TT+ TT-	Input Input
19 20	SG RC	- -

RS-449 Serial Cable Assembly for DTE (Part number: Cab Sync 449MT)

Pin number	Pin function	Direction
1	Shield Ground	_
4 22	SD+ SD-	Output Output
5 23	ST+ ST-	Input Input
6 24	RD+ RD-	Input Input
7 25	RS+ RS-	Output Output
8 26	RT+ RT-	Input Input
9 27	CS+ CS-	Input Input
10 37	LL SC	Output _
11 29	DM+ DM-	Input Input
12 30	TR+ TR-	Output Output
13 31	RR+ RR-	Input Input
17 35	TT+ TT-	Output Output
19 20	SG RC	- -

V.35 Serial Cable Assembly for DCE (Part number: Cab Sync V35FC)

Pin number	Pin function	Direction
A	Frame Ground	
B	Circuit Ground	
C	RTS	Input
D	CTS	Output
E	DSR	Output
F	RLSD	Output
H	DTR	Input
K	LT	Input
P S	SD+ SD-	Input Input
R T	RD+ RD-	Output Output
U W	SCTE+ SCTE-	Input Input
V X	SCR+ SCR-	Output Output
Y AA	SCT+ SCT-	Output Output

V.35 Serial Cable Assembly for DTE (Part number: Cab Sync V35MT)

Pin number	Pin function	Direction
A	Frame Ground	
B	Circuit Ground	
C	RTS	Output
D	CTS	Input
E	DSR	Input
F	RLSD	Input
H	DTR	Output
K	LT	Output
P S	SD+ SD-	Output Output
R T	RD+ RD-	Input Input
U W	SCTE+ SCTE-	Output Output
V X	SCR+ SCR-	Input Input
Y AA	SCT+ SCT-	Input Input

X.21 Serial Cable Assembly for DCE (Part number: Cab Sync X21FC)

Pin number	Pin function	Direction
1	Shield Ground	-
2 9	Transmit+ Transmit-	Input Input
3 10	Control+ Control-	Input Input
4 11	Receive+ Receive-	Output Output
5 12	Indication+ Indication-	Output Output
6 13	Timing+ Timing-	Output Output
8	Circuit Ground	

X.21 Serial Cable Assembly for DTE (Part number: Cab Sync X21MT)

Pin number	Pin function	Direction
1	Shield Ground	-
2 9	Transmit+ Transmit-	Output Output
3 10	Control+ Control-	Output Output
4 11	Receive+ Receive-	Input Input
5 12	Indication+ Indication-	Input Input
6 13	Timing+ Timing-	Input Input
8	Circuit Ground	

RS-530 Serial Cable Assembly for DCE (Part number: Cab Sync 530FC)

Pin number	Pin function	Direction
2 14	BA(A), TXD+ BA(B), TXD-	Input Input
3 16	BB(A), RXD+ BB(B), RXD-	Output Output
4 19	CA(A), RTS+ CA(B), RTS-	Input Input
5 13	CB(A), CTS+ CB(B), CTS-	Output Output
6 22	CC(A), DSR+ CC(B), DSR-	Output Output
1 -	Shield -	
8 10	CF(A), DCD+ CF(B), DCD-	Output Output
15 12	DB(A), TXC+ DB(B), TXC-	Output Output
17 9	DD(A), RXC+ DD(B), RXC-	Output Output
18 7	LL Circuit Ground	Input -
20 23	CD(A), DTR+ CD(B), DTR-	Input Input
24 11	DA(A), TXCE+ DA(B), TXCE-	Input Input
25	TM, not used	Output

RS-530 Serial Cable Assembly for DTE (Part number: Cab Sync 530MT)

Pin number	Pin function	Direction
2 14	BA(A), TXD+ BA(B), TXD-	Output Output
3 16	BB(A), RXD+ BB(B), RXD-	Input Input
4 19	CA(A), RTS+ CA(B), RTS-	Output Output
5 13	CB(A), CTS+ CB(B), CTS-	Input Input
6 22	CC(A), DSR+ CC(B), DSR-	Input Input
1 -	Shield -	
8 10	CF(A), DCD+ CF(B), DCD-	Input Input
15 12	DB(A), TXC+ DB(B), TXC-	Input Input
17 9	DD(A), RXC+ DD(B), RXC-	Input Input
18 7	LL Circuit Ground	Output -
20 23	CD(A), DTR+ CD(B), DTR-	Output Output
24 11	DA(A), TXCE+ DA(B), TXCE-	Output Output
25	TM, not used	Output

Cable WAN Connectors

Cisco LFH-60 cable name	WAN connector	Connector gender	Label on WAN end
449FC	DB-37	female	'to DTE'
449MT	DB-37	male	'to DCE'
V35FC	M34	female	'to DTE'
V35MT	M34	male	'to DCE'
X21FC	DB-15	female	'to DTE'
X21MT	DB-15	male	'to DCE'
530FC	DB-25	female	'to DTE'
530MT	DB-25	male	'to DCE'

QV24 Interface connections

The QV24 is always configured as a DCE:

	RJ45 Pin number	Pin function	Direction	TIA-568A wire colour
	1	RTS	Input	Green / white
	2	DTR	Input	Green
	3	TXD	Input	Orange / white
	4	Ground		Blue
	5	Ground		Blue / white
	6	RXD	Output	Orange
	7	DSR	Output	Brown / white
	8	CTS	Output	Brown

RJ-45 connector LED indicators		
LED	Status	Explanation
Green	On / flashing	Transmit data
Yellow	On / flashing	Receive data

QV24S Interface connections

The QV24S is always configured as a DCE:

	RJ45 Pin number	Pin function	Direction	TIA-568A wire colour
	1	RTS	Input	Green / white
	2	XTXC	Input	Green
	3	TXD	Input	Orange / white
	4	Ground		Blue
	5	Ground		Blue / white
	6	RXD	Output	Orange
	7	RXC	Output	Brown / white
	8	CTS	Output	Brown

RJ-45 connector LED indicators		
LED	Status	Explanation
Green	On / flashing	Transmit data
Yellow	On / flashing	Receive data

16. Alarm Types and Sources

Alarm Types

Transmitter Alarms

Transmitter Alarms for all Frequency Bands

Type	Explanation
tx11VFail	The transmitter 11 VDC power supply has failed
tx28VFail	The transmitter 28 VDC power supply has failed
tx5VFail	The transmitter 5 VDC power supply has failed
txAmplifierBalance	One side of the transmitter amplifier has failed
txEEFail	The transmitter on-board memory has failed
txMibFail	The transmitter MIB is corrupt in EEPROM
txReturnLoss	The transmitter return loss is high
txSynthLD	The transmitter synthesizer frequency is not set
txTSensorFail	The transmitter temperature sensor has failed

Transmitter Alarms for 300, 400, 600, 700, 800, 900, 1400 MHz Frequency Bands

txADCChZeroLo	The transmitter AGC voltage is low
txADCChZeroHi	The transmitter AGC voltage is high
txADCChOneLo	The transmitter Forward Power Monitor reading is low
txADCChOneHi	The transmitter Forward Power Monitor reading is high
txADCChTwoLo	The transmitter Reverse Power Monitor reading is low
txADCChTwoHi	The transmitter Reverse Power Monitor reading is high
txADCChThreeHi	The transmitter temperature is greater than 75°C and the transmitter has shut down
txADCChFourLo	The transmitter synthesizer tuning voltage is low
txADCChFourHi	The transmitter synthesizer tuning voltage is high
txADCChFiveLo	The transmitter 28 VDC power supply voltage is low
txADCChFiveHi	The transmitter 28 VDC power supply voltage is high
txADCChSixLo	The transmitter 11 VDC power supply voltage is low
txADCChSixHi	The transmitter 11 VDC power supply voltage is high
txADCChSevenLo	The transmitter digital 5 VDC power supply voltage is low
txADCChSevenHi	The transmitter digital 5 VDC power supply voltage is high
txADCChEightLo	The transmitter reference 7 VDC power supply voltage is low
txADCChEightHi	The transmitter reference 7 VDC power supply voltage is high
txADCChNineLo	The transmitter VCO voltage is low
txADCChNineHi	The transmitter VCO voltage is high
txADCChElevenHi	The transmitter temperature is greater than 70°C.

Transmitter Alarms for 2000, 2500 MHz Frequency Bands

txADCChZeroLo	The transmitter AGC voltage is low
txADCChZeroHi	The transmitter AGC voltage is high
txADCChOneLo	The transmitter Forward Power Monitor reading is low
txADCChOneHi	The transmitter Forward Power Monitor reading is high
txADCChTwoLo	The transmitter Reverse Power Monitor reading is low
txADCChTwoHi	The transmitter Reverse Power Monitor reading is high
txADCChThreeHi	The transmitter temperature is greater than 75°C and the transmitter has shut down
txADCChFourLo	The transmitter synthesizer tuning voltage is low
txADCChFourHi	The transmitter synthesizer tuning voltage is high
txADCChFiveLo	The transmitter 28 VDC power supply voltage is low
txADCChFiveHi	The transmitter 28 VDC power supply voltage is high
txADCChSixLo	The transmitter 9 VDC power supply voltage is low
txADCChSixHi	The transmitter 9 VDC power supply voltage is high
txADCChSevenLo	The transmitter digital 5 VDC power supply voltage is low
txADCChSevenHi	The transmitter digital 5 VDC power supply voltage is high
txADCChEightLo	The transmitter reference -5 VDC power supply voltage is low
txADCChEightHi	The transmitter reference -5 VDC power supply voltage is high
txADCChNineLo	The transmitter VCO voltage is low
txADCChNineHi	The transmitter VCO voltage is high
txADCChElevenHi	The transmitter temperature is greater than 70°C.

Receiver Alarms

Receiver Alarms for all Frequency Bands

Type	Explanation
rx12VFail	The receiver 12 VDC power supply has failed
rxEEFail	The on-board memory has failed
rxMibFail	The receiver MIB is corrupt in EEPROM
rxOff	The receiver is off
rxRSSIHi	The receiver maximum input level has been exceeded
rxRSSILo	The RSSI is below the alarm threshold setting (see page 80)
rxSynthLD	The synthesizer frequency is not set

Receiver Alarms for 300, 400, 600, 700, 800, 900 MHz Frequency Bands

rxADCChZeroLo	The receiver 3.3 VDC power supply voltage is low
rxADCChZeroHi	The receiver 3.3 VDC power supply voltage is high
rxADCChOneLo	The receiver synthesizer tuning voltage is low
rxADCChOneHi	The receiver synthesizer tuning voltage is high
rxADCChTwoLo	The receiver +12 VDC power supply is low
rxADCChTwoHi	The receiver +12 VDC power supply is high
rxADCChThreeLo	The receiver +5 VDC power supply is low
rxADCChThreeHi	The receiver +5 VDC power supply is high
rxADCChFourLo	The receiver +12 VDC power supply is low (same alarm as TwoLo)
rxADCChFourHi	The receiver +12 VDC power supply is high (same alarm as TwoHi)
rxADCChFiveLo	The receiver VCO voltage is low
rxADCChFiveHi	The receiver VCO voltage is high
rxADCChSevenLo	The receiver RSSI is lower than the normal operating lower limit
rxADCChSevenHi	The receiver RSSI is higher than the normal operating upper limit
rxADCChEightLo	The receiver temperature is greater than 70°C (below spec)
rxADCChEightHi	The receiver temperature is less than -10°C (below spec)

Receiver Alarms for 1400 MHz Frequency Band

rxADCChZeroLo	The receiver 3.3 VDC power supply voltage is low
rxADCChZeroHi	The receiver 3.3 VDC power supply voltage is high
rxADCChOneLo	The receiver synthesizer tuning voltage is low
rxADCChOneHi	The receiver synthesizer tuning voltage is high
rxADCChTwoLo	The receiver -1.5 VDC power supply is low
rxADCChTwoHi	The receiver -1.5 VDC power supply is high
rxADCChThreeLo	The receiver +5 VDC power supply is low
rxADCChThreeHi	The receiver +5 VDC power supply is high
rxADCChFourLo	The receiver +9 VDC power supply is low
rxADCChFourHi	The receiver +9 VDC power supply is high
rxADCChFiveLo	The receiver VCO voltage is low
rxADCChFiveHi	The receiver VCO voltage is high
rxADCChSevenLo	The receiver RSSI is lower than the normal operating lower limit
rxADCChSevenHi	The receiver RSSI is higher than the normal operating upper limit
rxADCChEightLo	The receiver temperature is greater than 70°C (below spec)
rxADCChEightHi	The receiver temperature is less than -10°C (below spec)

Receiver Alarms for 2000, 2500 MHz Frequency Bands

rxADCChZeroLo	The receiver 3.3 VDC power supply voltage is low
rxADCChZeroHi	The receiver 3.3 VDC power supply voltage is high
rxADCChOneLo	The receiver synthesizer tuning voltage is low
rxADCChOneHi	The receiver synthesizer tuning voltage is high
rxADCChTwoLo	The receiver +12 VDC power supply is low
rxADCChTwoHi	The receiver +12 VDC power supply is high
rxADCChThreeLo	The receiver +5 VDC power supply is low
rxADCChThreeHi	The receiver +5 VDC power supply is high
rxADCChFourLo	The receiver +9 VDC power supply is low
rxADCChFourHi	The receiver +9 VDC power supply is high
rxADCChFiveLo	The receiver VCO voltage is low
rxADCChFiveHi	The receiver VCO voltage is high
rxADCChSevenLo	The receiver RSSI is lower than the normal operating lower limit
rxADCChSevenHi	The receiver RSSI is higher than the normal operating upper limit
rxADCChEightLo	The receiver temperature is greater than 70°C (below spec)
rxADCChEightHi	The receiver temperature is less than -10°C (below spec)

MUX Alarms

Type	Explanation
muxInit	A MUX card failed to program
muxMibEEFail	The MIB EEROM is corrupt
muxCharEEFail	The character data is corrupt

Modem Alarms

Type	Explanation
mdLOS	The modem has loss of synchronization with the far end
mdDemodAlignmentLost	The modem is unable to synchronize to the payload framing
mdTdmAlignmentLost	The modem is unable to synchronize to the system bus timing
mdRefAFail	The modem reference clock A has failed
mdRefBFail	The modem reference clock B has failed
mdClkSyncFail	The modem is unable to synchronize to the system clock
mdEEFail	The modem EEPROM is corrupt
mdUCEPresent	The modem has uncorrectable errors

Motherboard Alarms

Type	Explanation
mbFan1Fail	Fan 1 failure
mbFan2Fail	Fan 2 failure
mbCardMismatch	The expected interface card is different to the card that is fitted
mbHwHsc	A MUX card has an unsupported HSC number

QJET Alarms

Type	Explanation
e1AIS	The E1 interface RX input has received an Alarm Indication Signal from the downstream equipment.
e1RAI	The E1 interface RX input has received a Remote Alarm Indication alarm (RAI) from the downstream equipment. A remote alarm indicator signal is sent from the downstream equipment when it has an active LOS or LOF alarm.
e1LOS	The E1 interface Loss Of Signal alarm (LOS)
e1CRC4	The E1 interface Cyclic Redundancy Check 4 alarm indicates a loss of or corrupted CRC data.
e1LOF	The E1 interface Loss Of Frame alignment (LOF)
e1RMAI	The E1 interface RX input has received an RMAI from the downstream equipment. A TS16 remote alarm indicator signal is sent from the downstream equipment when it has an active TS16 LOS or LOF alarm.
e1TS16AIS	The E1 interface RX input has received a TS16 Alarm Indication Signal from the downstream equipment.
e1TS16LOS	The E1 timeslot 16 Loss Of Signal alarm
t1AIS	The T1 interface RX input has received an Alarm Indication Signal from the downstream equipment (AIS Received alarm)
t1RAI	The T1 interface RX input has received a Remote Alarm Indication alarm (RAI) from the downstream equipment.
t1LOS	The T1 interface Loss Of Signal alarm (LOS)
t1LOF	The T1 interface Loss Of Frame alignment (LOF)

DFXO Alarms

Type	Explanation
fxoCodecOvld	The DFXO detected a codec receive signal overload
fxoBillToneOvld	The DFXO detected a billing tone input signal overload (greater than 0.8 Vrms into 200 Ω)
fxoUnplug	The DFXO detected that the exchange line has been unplugged from interface
fxoCurrentOvld	The DFXO Loop current overload detected (greater than 100 mA)

DFXS Alarms

Type	Explanation
fxsCalibError	The phone was off-hook during the DFXS initialization phase (during power up)
fxsDCDCError	The DFXS DC-DC converter has a low battery voltage error
fxsCasLock	The DFXS has a loss of CAS lock

HSS Alarms

Type	Explanation
hssLoss	The HSS has a loss of control pattern
hssRxFifoFull	The HSS RX FIFO has an overrun
hssRxFifoEmpty	The HSS RX FIFO has an underrun
hssTxFifoFull	The HSS TX FIFO has an overrun
hssTxFifoEmpty	The HSS TX FIFO has an underrun
hssRxClockInvalid	The HSS RX clock is invalid
hssTxClockInvalid	The HSS TX clock is invalid

QV24 Alarms

Type	Explanation
v24CtrlLineLoss	The V.24 control lines are not in sync.

External Alarm Inputs

Type	Explanation
externalAlarm1	There has been an alarm on external alarm input 1.
externalAlarm2	There has been an alarm on external alarm input 2.

Remote Terminal Alarms

Type	Explanation
remoteMajorAlarm	There has been a major alarm on the remote terminal.
remoteMinorAlarm	There has been a minor alarm on the remote terminal.

Cross Connect Alarms

Type	Explanation
ccNoBandwidth	There is insufficient bandwidth for the current cross connection configuration.

MHSB Alarms

Type	Explanation
mhsbSwitchToStandby	The terminal has switched from active to standby.

HSD Alarms

Type	Explanation
Mode Switch Software Override	This alarm provides a warning if the SuperVisor 'Active Radio' HSD Control has overwritten the PSC Mode Switch.
Companion Tx Fail	This alarm occurs on Radio A if the Radio B transmitter (HSD Companion) has failed. This alarm could be caused by a missing RF cable between Radio A and Radio B.
hsdCompanionLost	This alarm occurs if there is no traffic from the HSD Companion radio. This alarm could be caused by a missing traffic cable between Radio A PSC card and Radio B PIC card.
pscMuxAlignmentError	This alarm occurs if the TDM mux loses alignment to the TDM bus. This alarm could be caused by a Radio A PSC hardware failure.
pscDemuxAlignmentLost	This alarm occurs if there is a change in state of the PSC Demux alignment. This alarm could be caused by a HSD system receiver signal loss (both Radio A and Radio B).
pscTDMAlignmentLost	This alarm occurs if there is a change in state of the PSC TDM alignment. This alarm could be caused by a HSD system receiver signal loss (both Radio A and Radio B) or a Radio A PSC hardware failure.
hsdParamMismatch	This alarm occurs if there is a parameter setting mismatch between Radio A and Radio B. The Parameter Mismatch alarms only occur if the HSD Control 'Parameter Compare Checking' option is set to 'On'.
hsdPMTxPower	This alarm occurs if there is a parameter mismatch between Radio A and Radio B transmitter power setting.
hsdPMTermRfChWidth	This alarm occurs if there is a parameter mismatch between Radio A and Radio B channel size setting.
hsdPMTxFreq	This alarm occurs if there is a parameter mismatch between Radio A and Radio B transmitter frequency setting.
hsdPMRxFreq	This alarm occurs if there is a parameter mismatch between Radio A and Radio B receiver frequency setting.
hsdPMTermModState	This alarm occurs if there is a parameter mismatch between Radio A and Radio B modulation setting.
hsdPMModemIntlvEna	This alarm occurs if there is a parameter mismatch between Radio A and Radio B modem interleaver setting.

Software Alarms

Type	Explanation
Upload Fail	An Upload Fail alarm occurs if the TFTP Upgrade process fails. This can indicate that the upgrade process cannot find the TFTP server or cannot find the software version number entered.
defaultImageTableUsed	A default image table alarm indicates that the image table has been rebuilt from defaults. This can indicate that an incorrect build of software is running on the terminal.

17. Country Specific Settings

The following table shows the country-specific settings for the DFXO / DFXS interface cards. If the country you want is not listed, contact the local telephone company for assistance.

Country	DFXO / DFXS Termination / balance impedance	DFXO loop current limiter	DFXO on-hook speed	DFXO ringing impedance	DFXO ringing detection threshold
Argentina	600Ω	On	< 500 μs	> 1 MΩ	16 Vrms
Australia	TN12 220Ω + (820Ω ‖ 120nF)	On	26 ms	> 1 MΩ	16 Vrms
Austria	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Bahrain	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Belgium	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Brazil	600Ω	On	< 500 μs	> 1 MΩ	16 Vrms
Bulgaria	220Ω + (820Ω ‖ 120nF)	On	3 ms	> 1 MΩ	16 Vrms
Canada	600Ω	On	< 500 μs	> 1 MΩ	16 Vrms
Chile	600Ω	On	< 500 μs	> 1 MΩ	16 Vrms
China	600Ω and China 200Ω + (680Ω ‖ 100nF)	On	< 500 μs	> 1 MΩ	16 Vrms
Colombia	600Ω	On	< 500 μs	> 1 MΩ	16 Vrms
Croatia	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Cyprus	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Czech Republic	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Denmark	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Ecuador	600Ω	On	< 500 μs	> 1 MΩ	16 Vrms
Egypt	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
El Salvador	600Ω	On	< 500 μs	> 1 MΩ	16 Vrms
Finland	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
France	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Germany	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Greece	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Guam	600Ω	On	< 500 μs	> 1 MΩ	16 Vrms
Hong Kong	600Ω	On	< 500 μs	> 1 MΩ	16 Vrms
Hungary	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Iceland	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
India	600Ω	On	< 500 μs	> 1 MΩ	16 Vrms
Indonesia	600Ω	On	< 500 μs	> 1 MΩ	16 Vrms
Ireland	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Israel	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Italy	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Japan	600Ω	On	< 500 μs	> 1 MΩ	16 Vrms
Jordan	600Ω	On	< 500 μs	> 1 MΩ	16 Vrms
Kazakhstan	600Ω	On	< 500 μs	> 1 MΩ	16 Vrms
Kuwait	600Ω	On	< 500 μs	> 1 MΩ	16 Vrms

Latvia	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Lebanon	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Luxembourg	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Macao	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Malaysia	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Malta	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Mexico	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Morocco	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Netherlands	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
New Zealand	BT3 (370Ω + (620Ω ‖ 310nF))	On	< 500 µs	> 1 MΩ	16 Vrms
Nigeria	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Norway	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Oman	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Pakistan	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Peru	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Philippines	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Poland	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Portugal	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Romania	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Russia	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Saudi Arabia	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Singapore	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Slovakia	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Slovenia	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
South Africa	TBR21 270Ω + (750Ω ‖ 150nF)	On	< 500 µs	> 12 kΩ	16 Vrms
South Korea	600Ω	On	< 500 µs	> 12 kΩ	16 Vrms
Spain	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Sweden	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Switzerland	TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
Taiwan	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Thailand	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
UAE	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
UK	BT Network 320Ω + (1050Ω ‖ 230nF) and TBR21 270Ω + (750Ω ‖ 150nF)	On	3 ms	> 1 MΩ	16 Vrms
USA	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms
Yemen	600Ω	On	< 500 µs	> 1 MΩ	16 Vrms

18. Specifications

RF Specifications

ETSI

Frequency Bands ETSI

Frequency Bands ETSI

Frequency Bands ETSI	**Frequency Band**	**Frequency Tuning Range**	**Synthesizer Step Size**
	300 MHz	330 - 400 MHz	6.25 kHz
	400 MHz	394 - 460 MHz	5.0 kHz
	400 MHz	400 - 470 MHz	6.25 kHz
	600 MHz	620 - 715 MHz	12.5 kHz
	800 MHz	805 - 890 MHz	12.5 kHz
	900 MHz	850 - 960 MHz	12.5 kHz
	1400 MHz	1350 - 1550 MHz	12.5 kHz
	1800 MHz	1700 - 2100 MHz	62.5 kHz
	2000 MHz	1900 - 2300 MHz	62.5 kHz
	2500 MHz	2300 - 2700 MHz	62.5 kHz

Modulation	16 / 32 / 64 / 128 QAM and QPSK (software configurable)
Frequency stability (short term)	< ±1 ppm
Frequency stability (long term)	< ±2 ppm
Antenna connector	N-type female 50 Ω

Note 1 Frequency Ranges	Country specific frequency ranges within the above tuning ranges can be accommodated
Note 2 Modulation	128 QAM is unreleased: Please contact 4RF for availability.
Note 3 Frequency stability	Short term frequency stability is defined as changes in frequency due to environmental effects and power supply variations
	Long term frequency stability is defined as changes in frequency due to aging of crystal oscillators approx over 5 years

Product Range ETSI

The Aprisa XE terminal provides the following ETSI frequency bands / channel sizes:

Link Capacity ETSI

Channel size		QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	Gross		72 kbit/s	96 kbit/s	112 kbit/s	136 kbit/s
	E1		1 timeslot	1 timeslot	1 timeslot	2 timeslots
	Wayside		8 kbit/s	32 kbit/s	48 kbit/s	8 kbit/s
50 kHz	Gross	80 kbit/s	168 kbit/s	208 kbit/s	256 kbit/s	296 kbit/s
	E1	1 timeslot	2 timeslots	3 timeslots	4 timeslots	4 timeslots
	Wayside	16 kbit/s	40 kbit/s	16 kbit/s	0 kbit/s	40 kbit/s
75 kHz	Gross	128 kbit/s	264 kbit/s	312 kbit/s	400 kbit/s	440 kbit/s
	E1	2 timeslots	4 timeslots	4 timeslots	6 timeslots	6 timeslots
	Wayside	0 kbit/s	8 kbit/s	56 kbit/s	16 kbit/s	56 kbit/s
125 kHz	Gross	208 kbit/s	424 kbit/s	536 kbit/s	640 kbit/s	744 kbit/s
	E1	3 timeslots	6 timeslots	8 timeslots	10 timeslots	11 timeslots
	Wayside	16 kbit/s	40 kbit/s	24 kbit/s	0 kbit/s	40 kbit/s
150 kHz	Gross	264 kbit/s	536 kbit/s	672 kbit/s	808 kbit/s	944 kbit/s
	E1	4 timeslots	8 timeslots	10 timeslots	12 timeslots	14 timeslots
	Wayside	8 kbit/s	24 kbit/s	32 kbit/s	40 kbit/s	48 kbit/s
200 kHz	Gross	336 kbit/s	680 kbit/s	840 kbit/s	1024 kbit/s	1168 kbit/s
	E1	5 timeslots	10 timeslots	13 timeslots	16 timeslots	18 timeslots
	Wayside	16 kbit/s	40 kbit/s	8 kbit/s	0 kbit/s	16 kbit/s
250 kHz	Gross	408 kbit/s	824 kbit/s	1032 kbit/s	1240 kbit/s	1448 kbit/s
	E1	6 timeslots	12 timeslots	16 timeslots	19 timeslots	22 timeslots
	Wayside	24 kbit/s	56 kbit/s	8 kbit/s	24 kbit/s	40 kbit/s
500 kHz	Gross	792 kbit/s	1592 kbit/s	1992 kbit/s	2392 kbit/s	2792 kbit/s
	E1	12 timeslots	24 timeslots	31 timeslots	1 E1	1 E1
	Wayside	24 kbit/s	56 kbit/s	8 kbit/s	304 kbit/s	704 kbit/s
1.0 MHz	Gross	1624 kbit/s	3256 kbit/s	4072 kbit/s	4888 kbit/s	5704 kbit/s
	E1	25 timeslots	1 E1	1 E1	2 E1s	2 E1s
	Wayside	24 kbit/s	1168 kbit/s	1984 kbit/s	712 kbit/s	1528 kbit/s
1.35 MHz	Gross	2200 kbit/s	4408 kbit/s	5512 kbit/s	6616 kbit/s	7720 kbit/s
	E1	1 E1	2 E1s	2 E1s	3 E1s	3 E1s
	Wayside	112 kbit/s	232 kbit/s	1336 kbit/s	352 kbit/s	1456 kbit/s
1.75 MHz	Gross	2872 kbit/s	5752 kbit/s	7192 kbit/s	8632 kbit/s	10072 kbit/s
	E1	1 E1	2 E1s	3 E1s	4 E1s	4 E1s
	Wayside	784 kbit/s	1576 kbit/s	928 kbit/s	280 kbit/s	1720 kbit/s
3.5 MHz	Gross	5720 kbit/s	11448 kbit/s	14312 kbit/s	17176 kbit/s	20040 kbit/s
	E1	2 E1s	5 E1s	6 E1s	8 E1s	9 E1s
	Wayside	1544 kbit/s	1008 kbit/s	1784 kbit/s	472 kbit/s	1248 kbit/s
7.0 MHz	Gross	11832 kbit/s	23672 kbit/s	29592 kbit/s	35512 kbit/s	41432 kbit/s
	E1	5 E1s	11 E1s	14 E1s	17 E1s	19 E1s
	Wayside	1392 kbit/s	704 kbit/s	360 kbit/s	16 kbit/s	1760 kbit/s
14 MHz	Gross	23992 kbit/s	47992 kbit/s	59992 kbit/s	65464 kbit/s	65400 kbit/s
	E1	11 E1s	22 E1s	28 E1s	28 E1s	28 E1s
	Wayside	1024 kbit/s	2056 kbit/s	1528 kbit/s	7000 kbit/s	6936 kbit/s

Notes

The capacities specified are for Unframed E1 and so require 2088 kbit/s to transport via the radio.

The management ethernet capacity must be subtracted from the gross capacity (default 64 kbit/s).

See Product Range table for Channel Size / Frequency Band cross reference

Receiver Sensitivity ETSI

Channel size	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	NA	-105 dBm	-102 dBm	-99 dBm	-96 dBm
50 kHz	-109 dBm	-103 dBm	-100 dBm	-97 dBm	-94 dBm
75 kHz	-107 dBm	-101 dBm	-98 dBm	-95 dBm	-92 dBm
125 kHz	-105 dBm	-99 dBm	-96 dBm	-93 dBm	-90 dBm
150 kHz	-104 dBm	-98 dBm	-95 dBm	-92 dBm	-89 dBm
200 kHz	-102 dBm	-96 dBm	-93 dBm	-90 dBm	-87 dBm
250 kHz	-101 dBm	-95 dBm	-92 dBm	-89 dBm	-86 dBm
500 kHz	-99 dBm	-93 dBm	-90 dBm	-87 dBm	-84 dBm
1.0 MHz	-96 dBm	-90 dBm	-87 dBm	-84 dBm	-81 dBm
1.35 MHz	-95 dBm	-89 dBm	-86 dBm	-83 dBm	-80 dBm
1.75 MHz	-94 dBm	-88 dBm	-85 dBm	-82 dBm	-79 dBm
3.5 MHz	-90 dBm	-84 dBm	-81 dBm	-78 dBm	-75 dBm
7.0 MHz	-87 dBm	-81 dBm	-78 dBm	-75 dBm	-72 dBm
14 MHz	-84 dBm	-78 dBm	-75 dBm	-72 dBm	-69 dBm

Notes

Typical performance specified at the antenna port for 10^{-6} BER.

The receiver is typically 1 dB more sensitive for a BER of 10^{-3}.

NA (Not Available)

Transmitter Power ETSI

Frequency Band	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
300 MHz	21 to 35 dBm	17 to 31 dBm	16 to 30 dBm	15 to 29 dBm	15 to 29 dBm
400 MHz	21 to 35 dBm	17 to 31 dBm	16 to 30 dBm	15 to 29 dBm	15 to 29 dBm
600 MHz	21 to 35 dBm	17 to 31 dBm	16 to 30 dBm	15 to 29 dBm	15 to 29 dBm
800 MHz	21 to 35 dBm	17 to 31 dBm	16 to 30 dBm	15 to 29 dBm	15 to 29 dBm
900 MHz	21 to 35 dBm	17 to 31 dBm	16 to 30 dBm	15 to 29 dBm	15 to 29 dBm
1400 MHz	21 to 35 dBm	17 to 31 dBm	16 to 30 dBm	15 to 29 dBm	15 to 29 dBm
1800 MHz	21 to 35 dBm	17 to 31 dBm	16 to 30 dBm	15 to 29 dBm	15 to 29 dBm
2000 MHz	20 to 34 dBm	17 to 31 dBm	16 to 30 dBm	15 to 29 dBm	15 to 29 dBm
2500 MHz	20 to 34 dBm	17 to 31 dBm	16 to 30 dBm	15 to 29 dBm	15 to 29 dBm

System Gain ETSI

Channel Size	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	NA	136 dB	132 dB	128 dB	125 dB
50 kHz	144 dB	134 dB	130 dB	126 dB	123 dB
75 kHz	142 dB	132 dB	128 dB	124 dB	121 dB
125 kHz	140 dB	130 dB	126 dB	122 dB	119 dB
150 kHz	139 dB	129 dB	125 dB	121 dB	118 dB
200 kHz	137 dB	127 dB	123 dB	119 dB	116 dB
250 kHz	136 dB	126 dB	122 dB	118 dB	115 dB
500 kHz	134 dB	124 dB	120 dB	116 dB	113 dB
1.0 MHz	131 dB	121 dB	117 dB	113 dB	110 dB
1.35 MHz	130 dB	120 dB	116 dB	112 dB	109 dB
1.75 MHz	129 dB	119 dB	115 dB	111 dB	108 dB
3.5 MHz	125 dB	115 dB	111 dB	107 dB	104 dB
7.0 MHz	122 dB	112 dB	108 dB	104 dB	101 dB
14 MHz	119 dB	109 dB	105 dB	101 dB	98 dB

Notes

Typical performance specified at the antenna port for 10^{-6} BER.

The system gain is typically 1 dB greater for a BER of 10^{-3}.

Figures decrease by 1 dB for the 2000 and 2500 MHz bands at QPSK.

System Gain = maximum transmit power - receiver sensitivity

NA (Not Available)

Link Delays ETSI

Note: The default Modem Interleaver Mode setting is on for channel sizes of 250 kHz and greater and off for channel sizes of 200 kHz and less (see 'Modem Interleaver Mode' on page 72).

Typical 1+0, MHSB end-to-end link delay - interleaver off

Channel size	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	NA	51.8 ms	40.6 ms	35.7 ms	30.3 ms
50 kHz	46.2 ms	24.3 ms	20.2 ms	16.9 ms	15.0 ms
75 kHz	30.4 ms	16.2 ms	14.0 ms	11.4 ms	10.6 ms
125 kHz	22.3 ms	12.1 ms	10.0 ms	8.6 ms	7.0 ms
150 kHz	15.9 ms	8.8 ms	7.3 ms	6.4 ms	5.7 ms
200 kHz	12.8 ms	7.2 ms	6.2 ms	5.3 ms	4.9 ms
250 kHz	10.8 ms	6.2 ms	5.3 ms	4.6 ms	4.2 ms
500 kHz	6.3 ms	3.9 ms	3.4 ms	3.1 ms	2.8 ms
1.0 MHz	3.8 ms	2.6 ms	2.3 ms	2.2 ms	2.1 ms
1.35 MHz	3.1 ms	2.3 ms	2.1 ms	2.0 ms	1.9 ms
1.75 MHz	3.1 ms	2.3 ms	2.1 ms	2.0 ms	1.9 ms
3.5 MHz	2.0 ms	1.7 ms	1.6 ms	1.6 ms	1.6 ms
7.0 MHz	1.7 ms	1.5 ms	1.5 ms	1.5 ms	1.4 ms
14 MHz	1.5 ms	1.4 ms	1.4 ms	1.4 ms	1.4 ms

Typical 1+0, MHSB end-to-end link delay - interleaver on

	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	NA	153.6 ms	118.9 ms	103.5 ms	86.9 ms
50 kHz	138.8 ms	70.5 ms	57.9 ms	47.8 ms	41.8 ms
75 kHz	90.3 ms	46.1 ms	39.5 ms	31.4 ms	28.8 ms
125 kHz	65.6 ms	33.7 ms	27.3 ms	23.1 ms	17.8 ms
150 kHz	45.8 ms	23.7 ms	19.3 ms	16.4 ms	14.3 ms
200 kHz	36.5 ms	19.0 ms	15.8 ms	13.2 ms	11.8 ms
250 kHz	30.4 ms	16.0 ms	13.1 ms	11.2 ms	9.8 ms
500 kHz	16.5 ms	9.0 ms	7.5 ms	6.5 ms	5.7 ms
1.0 MHz	8.8 ms	5.1 ms	4.3 ms	3.9 ms	3.5 ms
1.35 MHz	6.8 ms	4.1 ms	3.6 ms	3.2 ms	2.9 ms
1.75 MHz	5.6 ms	3.5 ms	3.1 ms	2.8 ms	2.9 ms
3.5 MHz	3.5 ms	2.4 ms	2.2 ms	2.1 ms	2.0 ms
7.0 MHz	2.4 ms	1.9 ms	1.8 ms	1.7 ms	1.7 ms
14 MHz	1.9 ms	1.6 ms	1.6 ms	1.5 ms	1.5 ms

Notes	The end to end link delays are measured from E1 / T1 interface to E1 / T1 interface The delay figures are typical and can vary when the system re-synchronizes NA (Not Available)

Typical HSD end-to-end link delay - interleaver on

	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	NA	305.4 ms	223.2 ms	202.2 ms	NA
50 kHz	247.1 ms	142.0 ms	122.1 ms	95.2 ms	NA
75 kHz	185.3 ms	95.8 ms	82.8 ms	67.0 ms	NA
125 kHz	NA	NA	NA	NA	NA
150 kHz	93.3 ms	47.3 ms	39.5 ms	33.7 ms	NA
200 kHz	75.6 ms	38.9 ms	32.7 ms	25.5 ms	NA
250 kHz	63.6 ms	32.8 ms	25.2 ms	21.6 ms	NA
500 kHz	34.0 ms	17.0 ms	14.8 ms	11.4 ms	NA
1.0 MHz	16.9 ms	9.5 ms	8.0 ms	6.5 ms	NA
1.35 MHz	NA	NA	NA	NA	NA
1.75 MHz	9.9 ms	5.1 ms	4.9 ms	4.4 ms	NA
3.5 MHz	5.5 ms	3.5 ms	3.1 ms	3.1 ms	NA
7.0 MHz	3.6 ms	2.5 ms	2.3 ms	2.3 ms	NA
14 MHz	2.4 ms	2.0 ms	2.0 ms	2.0 ms	NA

Notes	The end to end link delays are measured from E1 / T1 interface to E1 / T1 interface
	The delay figures are typical and can vary when the system re-synchronizes
	NA (Not Available)

FCC

Frequency Bands FCC

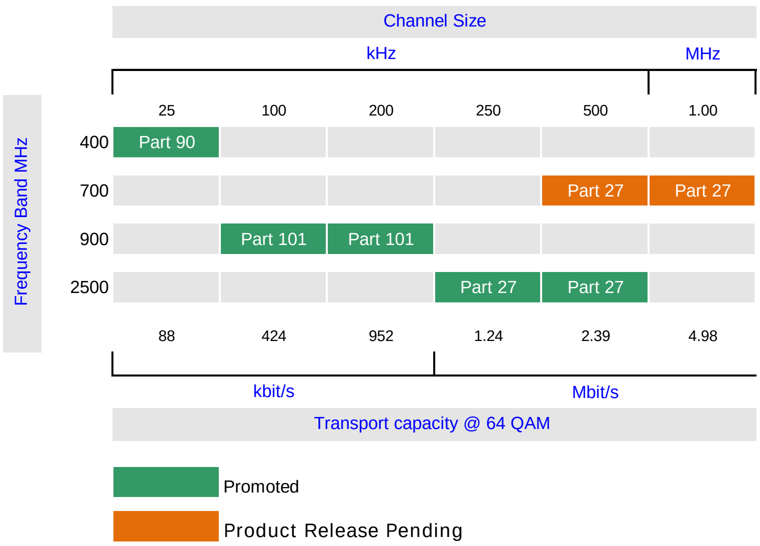
Frequency Bands FCC	Frequency Band	Frequency Tuning Range	Synthesizer Step Size
	400 MHz	421 - 512 MHz	6.25 kHz
	700 MHz	698 - 806 MHz	12.5 kHz
	900 MHz	928 - 960 MHz	12.5 kHz
	2500 MHz	2314 - 2350 MHz	62.5 kHz

Modulation	16 / 32 / 64 / 128 QAM and QPSK (software configurable)
Frequency stability (short term)	< ±1 ppm
Frequency stability (long term)	< ±2 ppm
Antenna connector	N-type female 50 Ω

Note 1 Frequency bands	Contact 4RF for other frequency band options
Note 2 Modulation	128 QAM is unreleased: Please contact 4RF for availability.
Note 3 Frequency stability	Short term frequency stability is defined as changes in frequency due to environmental effects and power supply variations
	Long term frequency stability is defined as changes in frequency due to aging of crystal oscillators approx over 5 years

Product Range FCC

The Aprisa XE terminal provides the following FCC frequency bands / channel sizes:



Link Capacity FCC

Channel size		QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	Gross		56 kbit/s	72 kbit/s	88 kbit/s	104 kbit/s
	T1		0 timeslots	1 timeslot	1 timeslot	1 timeslot
	Wayside		56 kbit/s	8 kbit/s	24 kbit/s	40 kbit/s
100 kHz	Gross	136 kbit/s	280 kbit/s	352 kbit/s	424 kbit/s	608 kbit/s
	T1	2 timeslots	4 timeslots	5 timeslots	6 timeslots	9 timeslots
	Wayside	8 kbit/s	24 kbit/s	32 kbit/s	40 kbit/s	32 kbit/s
200 kHz	Gross	312 kbit/s	632 kbit/s	792 kbit/s	952 kbit/s	1112 kbit/s
	T1	4 timeslots	9 timeslots	12 timeslots	14 timeslots	17 timeslots
	Wayside	56 kbit/s	56 kbit/s	24 kbit/s	56 kbit/s	24 kbit/s
250 kHz	Gross	408 kbit/s	824 kbit/s	1032 kbit/s	1240 kbit/s	1448 kbit/s
	T1	6 timeslots	12 timeslots	16 timeslots	19 timeslots	22 timeslots
	Wayside	24 kbit/s	56 kbit/s	8 kbit/s	24 kbit/s	40 kbit/s
500 kHz	Gross	792 kbit/s	1592 kbit/s	1992 kbit/s	2392 kbit/s	2792 kbit/s
	T1	12 timeslots	1 T1	1 T1	1 T1	1 T1
	Wayside	24 kbit/s	8 kbit/s	408 kbit/s	808 kbit/s	1208 kbit/s
1.0 MHz	Gross	1656 kbit/s	3320 kbit/s	4152 kbit/s	4984 kbit/s	5816 kbit/s
	T1	1 T1	2 T1s	2 T1s	3 T1s	3 T1s
	Wayside	72 kbit/s	152 kbit/s	984 kbit/s	232 kbit/s	1064 kbit/s

Notes

The capacities specified are for Unframed T1 and so require 1584 kbit/s to transport via the radio.

The management ethernet capacity must be subtracted from the gross capacity (default 64 kbit/s).

See Product Range table for Channel Size / Frequency Band cross reference

Receiver Sensitivity FCC

Channel Size	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	NA	-105 dBm	-102 dBm	-99 dBm	-96 dBm
100 kHz	-106 dBm	-100 dBm	-97 dBm	-94 dBm	-91 dBm
200 kHz	-102 dBm	-96 dBm	-93 dBm	-90 dBm	-87 dBm
250 kHz	-101 dBm	-95 dBm	-92 dBm	-89 dBm	-86 dBm
500 kHz	-99 dBm	-93 dBm	-90 dBm	-87 dBm	-84 dBm
1.0 MHz	-96 dBm	-90 dBm	-87 dBm	-84 dBm	-81 dBm

Notes

Typical performance specified at the antenna port for 10^{-6} BER.

The receiver is typically 1 dB more sensitive for a BER of 10^{-3}.

Transmit Power FCC

Frequency Band	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
400 MHz	NA	17 to 31 dBm	16 to 30 dBm	15 to 29 dBm	15 to 29 dBm
700 MHz	21 to 35 dBm	17 to 31 dBm	16 to 30 dBm	15 to 29 dBm	15 to 29 dBm
900 MHz	15 to 29 dBm	15 to 29 dBm	15 to 29 dBm	15 to 29 dBm	15 to 29 dBm
2500 MHz	15 to 29 dBm	15 to 29 dBm	15 to 29 dBm	15 to 29 dBm	15 to 29 dBm

System Gain FCC

400 MHz, 700 MHz, 900 MHz

Channel Size	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	NA	136 dB	132 dB	128 dB	125 dB
100 kHz	135 dB	129 dB	126 dB	123 dB	120 dB
200 kHz	131 dB	125 dB	122 dB	119 dB	116 dB
500 kHz	134 dB	124 dB	120 dB	116 dB	113 dB
1.0 MHz	131 dB	121 dB	117 dB	113 dB	110 dB

2500 MHz

	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
250 kHz	130 dB	124 dB	121 dB	118 dB	115 dB
500 kHz	128 dB	122 dB	119 dB	116 dB	113 dB

Notes

Typical performance specified at the antenna port for 10^{-6} BER.

The system gain is typically 1 dB greater for a BER of 10^{-3}.

System Gain = maximum transmit power - receiver sensitivity

Link Delays FCC

Note: The default Modem Interleaver Mode setting is on for channel sizes of 250 kHz and greater and off for channel sizes of 200 kHz and less (see 'Modem Interleaver Mode' on page 72).

Interleaver off

Channel size	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	NA	64.4 ms	52.3 ms	44.2 ms	38.5 ms
100 kHz	28.8 ms	15.3 ms	12.7 ms	10.9 ms	8.2 ms
200 kHz	15.9 ms	8.8 ms	7.3 ms	6.4 ms	5.1 ms
250 kHz	11.2 ms	6.6 ms	5.4 ms	5.0 ms	4.2 ms
500 kHz	5.9 ms	3.5 ms	3.4 ms	3.2 ms	2.8 ms
1.0 MHz	3.8 ms	2.6 ms	2.3 ms	2.2 ms	2.1 ms

Interleaver on

Channel size	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	NA	191.6 ms	154.1 ms	129.1 ms	111.2 ms
100 kHz	85.3 ms	43.6 ms	35.3 ms	29.7 ms	21.4 ms
200 kHz	45.8 ms	23.7 ms	19.3 ms	16.4 ms	12.3 ms
250 kHz	33.2 ms	17.5 ms	14.3 ms	12.1 ms	9.8 ms
500 kHz	17.5 ms	9.3 ms	8.0 ms	6.9 ms	5.7 ms
1.0 MHz	8.8 ms	5.1 ms	4.3 ms	3.9 ms	3.5 ms

Notes

The end to end link delays are measured from E1 / T1 interface to E1 / T1 interface

The delay figures are typical and can vary when the system re-synchronizes

Industry Canada

Frequency Bands IC

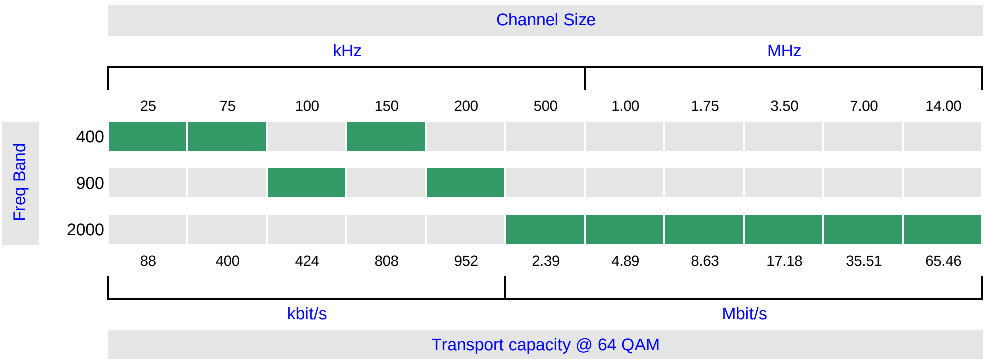
Frequency Bands IC	Frequency Band	Frequency Tuning Range	Synthesizer Step Size
	400 MHz	400 - 470 MHz	6.25 kHz
	900 MHz	928 - 960 MHz	12.5 kHz
	2000 MHz	1900 - 2300 MHz	62.5 kHz

Modulation	16 / 32 / 64 / 128 QAM and QPSK (software configurable)
Frequency stability (short term)	< ±1 ppm
Frequency stability (long term)	< ±2 ppm
Antenna connector	N-type female 50 Ω

Note 1	Frequency bands	Contact 4RF for other frequency band options
Note 2	Modulation	128 QAM is unreleased: Please contact 4RF for availability.
Note 3	Frequency stability	Short term frequency stability is defined as changes in frequency due to environmental effects and power supply variations Long term frequency stability is defined as changes in frequency due to aging of crystal oscillators approx over 5 years

Product Range IC

The Aprisa XE terminal provides the following Industry Canada frequency bands / channel sizes:



Link Capacity IC

Channel size		QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	Gross	NA	56 kbit/s	72 kbit/s	88 kbit/s	NA
	T1		0 timeslots	1 timeslot	1 timeslot	
	Wayside		56 kbit/s	8 kbit/s	24 kbit/s	
75 kHz	Gross	128 kbit/s	264 kbit/s	312 kbit/s	400 kbit/s	440 kbit/s
	T1	2 timeslots	4 timeslots	4 timeslots	6 timeslots	6 timeslots
	Wayside	0 kbit/s	8 kbit/s	56 kbit/s	16 kbit/s	56 kbit/s
100 kHz	Gross	136 kbit/s	280 kbit/s	352 kbit/s	424 kbit/s	608 kbit/s
	T1	2 timeslots	4 timeslots	5 timeslots	6 timeslots	9 timeslots
	Wayside	8 kbit/s	24 kbit/s	32 kbit/s	40 kbit/s	32 kbit/s
150 kHz	Gross	264 kbit/s	536 kbit/s	672 kbit/s	808 kbit/s	944 kbit/s
	T1	4 timeslots	8 timeslots	10 timeslots	12 timeslots	14 timeslots
	Wayside	8 kbit/s	24 kbit/s	32 kbit/s	40 kbit/s	48 kbit/s
200 kHz	Gross	312 kbit/s	632 kbit/s	792 kbit/s	952 kbit/s	1112 kbit/s
	T1	4 timeslots	9 timeslots	12 timeslots	14 timeslots	17 timeslots
	Wayside	56 kbit/s	56 kbit/s	24 kbit/s	56 kbit/s	24 kbit/s
500 kHz	Gross	792 kbit/s	1592 kbit/s	1992 kbit/s	2392 kbit/s	2792 kbit/s
	T1	12 timeslots	1 T1	1 T1	1 T1	1 T1
	Wayside	24 kbit/s	8 kbit/s	408 kbit/s	808 kbit/s	1208 kbit/s
1.0 MHz	Gross	1624 kbit/s	3256 kbit/s	4072 kbit/s	4888 kbit/s	5704 kbit/s
	T1	1 T1	2 T1s	2 T1s	3 T1s	3 T1s
	Wayside	40 kbit/s	88 kbit/s	904 kbit/s	136 kbit/s	952 kbit/s
1.75 MHz	Gross	2872 kbit/s	5752 kbit/s	7192 kbit/s	8632 kbit/s	10072 kbit/s
	T1	1 T1	3 T1s	4 T1s	5 T1s	6 T1s
	Wayside	1288 kbit/s	1000 kbit/s	856 kbit/s	712 kbit/s	568 kbit/s
3.5 MHz	Gross	5720 kbit/s	11448 kbit/s	14312 kbit/s	17176 kbit/s	20040 kbit/s
	T1	3 T1s	7 T1s	9 T1s	10 T1s	12 T1s
	Wayside	968 kbit/s	360 kbit/s	56 kbit/s	1336 kbit/s	1032 kbit/s
7.0 MHz	Gross	11832 kbit/s	23672 kbit/s	29592 kbit/s	35512 kbit/s	41432 kbit/s
	T1	7 T1s	14 T1s	18 T1s	22 T1s	26 T1s
	Wayside	744 kbit/s	1496 kbit/s	1080 kbit/s	664 kbit/s	248 kbit/s
14 MHz	Gross	NA	47992 kbit/s	59992 kbit/s	65464 kbit/s	65400 kbit/s
	T1		30 T1s	32 T1s	32 T1s	32 T1s
	Wayside		472 kbit/s	9304 kbit/s	14776 kbit/s	14712 kbit/s

Notes	The capacities specified are for Unframed T1 and so require 1584 kbit/s to transport via the radio.
	The management ethernet capacity must be subtracted from the gross capacity (default 64 kbit/s).
	See Product Range table for Channel Size / Frequency Band cross reference
	NA (Not Available)

Receiver Sensitivity IC

Channel size	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	NA	-105 dBm	-102 dBm	-99 dBm	NA
75 kHz	-107 dBm	-101 dBm	-98 dBm	-95 dBm	-92 dBm
100 kHz	-106 dBm	-100 dBm	-97 dBm	-94 dBm	-91 dBm
150 kHz	-104 dBm	-98 dBm	-95 dBm	-92 dBm	-89 dBm
200 kHz	-102 dBm	-96 dBm	-93 dBm	-90 dBm	-87 dBm
500 kHz	-99 dBm	-93 dBm	-90 dBm	-87 dBm	-84 dBm
1.0 MHz	-96 dBm	-90 dBm	-87 dBm	-84 dBm	-81 dBm
1.75 MHz	-94 dBm	-88 dBm	-85 dBm	-82 dBm	-79 dBm
3.5 MHz	-90 dBm	-84 dBm	-81 dBm	-78 dBm	-75 dBm
7.0 MHz	-87 dBm	-81 dBm	-78 dBm	-75 dBm	-72 dBm
14 MHz	NA	-78 dBm	-75 dBm	-72 dBm	-69 dBm

Notes

Typical performance specified at the antenna port for 10^{-6} BER.

The receiver is typically 1 dB more sensitive for a BER of 10^{-3}.

NA (Not Available)

Transmitter Power IC

Frequency Band	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
400 MHz	15 to 35 dBm	15 to 31 dBm	15 to 30 dBm	15 to 29 dBm	15 to 29 dBm
900 MHz	15 to 29 dBm	15 to 29 dBm	15 to 29 dBm	15 to 29 dBm	15 to 29 dBm
2000 MHz	20 to 34 dBm	17 to 31 dBm	16 to 30 dBm	15 to 29 dBm	15 to 29 dBm

System Gain IC

Channel Size	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	NA	136 dB	132 dB	128 dB	NA
75 kHz	142 dB	132 dB	128 dB	124 dB	121 dB
100 kHz	135 dB	129 dB	126 dB	123 dB	120 dB
150 kHz	139 dB	129 dB	125 dB	121 dB	118 dB
200 kHz	131 dB	125 dB	122 dB	119 dB	116 dB
500 kHz	133 dB	124 dB	120 dB	116 dB	113 dB
1.0 MHz	130 dB	121 dB	117 dB	113 dB	110 dB
1.75 MHz	128 dB	119 dB	115 dB	111 dB	108 dB
3.5 MHz	124 dB	115 dB	111 dB	107 dB	104 dB
7.0 MHz	121 dB	112 dB	108 dB	104 dB	101 dB
14 MHz	NA	109 dB	105 dB	101 dB	98 dB

Notes

Typical performance specified at the antenna port for 10^{-6} BER.

The system gain is typically 1 dB greater for a BER of 10^{-3}.

System Gain = maximum transmit power - receiver sensitivity

NA (Not Available)

Link Delays IC

Note: The default Modem Interleaver Mode setting is on for channel sizes of 250 kHz and greater and off for channel sizes of 200 kHz and less (see 'Modem Interleaver Mode' on page 72).

Interleaver off

Channel size	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	NA	49.6 ms	39.4 ms	34.9 ms	NA
75 kHz	35.5 ms	19.0 ms	16.8 ms	13.6 ms	10.6 ms
100 kHz	28.8 ms	15.3 ms	12.7 ms	10.9 ms	8.2 ms
150 kHz	17.5 ms	10.1 ms	8.5 ms	7.1 ms	5.7 ms
200 kHz	15.9 ms	8.8 ms	7.3 ms	6.4 ms	5.1 ms
500 kHz	6.3 ms	3.5 ms	3.4 ms	3.2 ms	2.8 ms
1.0 MHz	3.8 ms	2.6 ms	2.3 ms	2.2 ms	2.1 ms
1.75 MHz	3.1 ms	2.3 ms	2.1 ms	2.0 ms	1.9 ms
3.5 MHz	2.6 ms	2.0 ms	1.8 ms	1.8 ms	1.7 ms
7.0 MHz	2.0 ms	1.7 ms	1.6 ms	1.6 ms	1.6 ms
14 MHz	NA	1.6 ms	1.5 ms	1.5 ms	1.5 ms

Interleaver on

Channel size	QPSK	16 QAM	32 QAM	64 QAM	128 QAM
25 kHz	NA	164.7 ms	127.7 ms	111.8 ms	NA
75 kHz	103.7 ms	53.2 ms	45.8 ms	36.4 ms	28.8 ms
100 kHz	85.3 ms	43.6 ms	35.3 ms	29.7 ms	21.4 ms
150 kHz	51.4 ms	26.8 ms	21.9 ms	18.6 ms	14.3 ms
200 kHz	45.8 ms	23.7 ms	19.3 ms	16.4 ms	12.3 ms
500 kHz	16.5 ms	9.3 ms	8.0 ms	6.9 ms	5.7 ms
1.0 MHz	8.8 ms	5.1 ms	4.3 ms	3.9 ms	3.5 ms
1.75 MHz	6.8 ms	4.1 ms	3.6 ms	3.2 ms	2.9 ms
3.5 MHz	5.1 ms	3.2 ms	2.8 ms	2.6 ms	2.4 ms
7.0 MHz	3.5 ms	2.4 ms	2.2 ms	2.1 ms	2.0 ms
14 MHz	NA	2.1 ms	1.9 ms	1.8 ms	1.8 ms

Notes	The end to end link delays are measured from E1 / T1 interface to E1 / T1 interface
	The delay figures are typical and can vary when the system re-synchronizes
	NA (Not Available)

Receiver Performance

Maximum input level	-20 dBm
Dynamic range	58 to 87 dB (at 10^{-6} BER) depending on modulation type and channel size
C/I ratio (carrier to interference ratio)	C/I ratio = C_{dB} - I_{dB}
Co-channel	better than 16 dB at QPSK
	better than 20 dB at 16 QAM
	better than 23 dB at 32 QAM
	better than 27 dB at 64 QAM
	better than 30 dB at 128 QAM
1st adjacent channel	better than -5 dB
2nd adjacent channel	better than -30 dB

Notes Typical performance specified at the antenna port for 10^{-6} BER.
The dynamic range is typically 2 dB greater for a BER of 10^{-3}.

Duplexers

Code	Frequency Band	Option	TX / RX Min Split	Passband	Lo Band	Hi Band	Mounting
A0	300 MHz	Standard	9.45 MHz	2 MHz	330 - 400 MHz	330 - 400 MHz	External
A1	300 MHz	Option 1	5 MHz	0.5 MHz	330 - 400 MHz	330 - 400 MHz	External
A2	300 MHz	Option 2	20 MHz	3.5 MHz	330 - 400 MHz	330 - 400 MHz	External
B0	400 MHz	Standard	9.45 MHz	2 MHz	400 - 470 MHz	400 - 470 MHz	External
B1	400 MHz	Option 1	5 MHz	0.5 MHz	400 - 470 MHz	400 - 470 MHz	External
B2	400 MHz	Option 2	20 MHz	3.5 MHz	400 - 470 MHz	400 - 470 MHz	External
C0	400 MHz	Standard	3 MHz	0.5 MHz	470 - 492 MHz	473 - 495 MHz	External
D0	600 MHz	Standard	45 MHz	7 MHz	620 - 715 MHz	620 - 715 MHz	Internal
E0	700 MHz	Standard	30 MHz	7 MHz	698 - 806 MHz	698 - 806 MHz	Internal
F0	800 MHz	Standard	40 MHz	7 MHz	805 - 890 MHz	805 - 890 MHz	Internal
G0	900 MHz	Standard	40 MHz	7 MHz	850 - 960 MHz	850 - 960 MHz	Internal
G1	900 MHz	Option 1	9 MHz	1.5 MHz	928 - 960 MHz	928 - 960 MHz	External
G2	900 MHz	Option 2	9 MHz	1 MHz	928 - 960 MHz	928 - 960 MHz	Internal
G3	900 MHz	Option 3	5.5 MHz	0.5 MHz	900 - 960 MHz	900 - 960 MHz	External
G4	900 MHz	Option 4	3.6 MHz	0.5 MHz	900 - 960 MHz	900 - 960 MHz	External
H0	1400 MHz	Standard	48 MHz	7 MHz	1350 - 1550 MHz	1350 - 1550 MHz	Internal
H1	1400 MHz	Option 1	23.5 MHz	7 MHz	1350 - 1550 MHz	1350 - 1550 MHz	Internal
K0	1800 MHz	Standard	47.5 MHz	14 MHz	1700 - 2100 MHz	1700 - 2100 MHz	Internal
I0	2000 MHz	Standard	91 MHz	14 MHz	1900 - 2300 MHz	1900 - 2300 MHz	Internal
J0	2500 MHz	Standard	74 MHz	14 MHz	2300 - 2700 MHz	2300 - 2700 MHz	Internal
J1	2500 MHz	Option 1	32 MHz	4 MHz	2314 - 2318 MHz	2346 - 2350 MHz	Internal

Notes All duplexers are bandpass
Contact 4RF for other duplexer options

Interface Specifications

Ethernet Interface

General	Interface	RJ-45 * 4 (Integrated 4-port switch)
	Cabling	CAT-5 UTP, supports auto MDIX (Standard Ethernet)
	Maximum line length	100 metres on cat-5 or better
	Bandwidth allocation	n x 8 kbit/s up to maximum available. n x 64 kbit/s is recommended for terminals with higher channel size (> 500 kHz, 32 QAM).
	Ethernet capacity	The ethernet capacity maximum is determined by the lesser of the available radio link capacity or 50 Mbit/s.
	Maximum packet size	'Standard' Ethernet packets: max 1518 octets Tagged and double-tagged packets: max 1526 octets
	Data buffer size	Up to 256 frames
	Address table size	2048 IP addresses
	WAN protocol	HDLC
	Ethernet mode	10Base-T or 100Base-TX Full duplex or half duplex (Auto-negotiating and auto-sensing)
	VLAN tagging	IEEE 802.1Q VLAN tagging
	QoS	IEEE 802.1p Ipv4 TOS DiffServ Ipv6 traffic class
	Spanning Tree	Forwards 802.1D Spanning Tree Protocol packets up to 1526 bytes in length.
Diagnostics	Green LED	On: Ethernet signal received Flashing: Indicates data traffic present on the interface

Note: Do not connect Power over Ethernet (PoE) connections to the Aprisa XE Ethernet ports as this will damage the port.

QJET Quad E1 / T1 Interface

General	Standard	G.703 and G.704
	Interface	RJ-45
	Line termination impedance	E1 120 Ω balanced T1 100 Ω balanced
	Maximum line length	E1 typically up to 1.7 km (43 dB of loss at 1024 kHz in standard 0.4 mm^2 cable). T1 typically up to 1.7 km (36 dB of loss at 772 kHz in standard 0.4 mm^2 cable).
	Bandwidth allocation	Framed E1s require a link bandwidth of 2048 kbit/s. Unframed E1s require a link bandwidth of 2088 kbit/s. Framed T1s require a link bandwidth of 1544 kbit/s. Unframed T1s require a link bandwidth of 1584 kbit/s.
	Line code	E1 HDB3 or AMI T1 B8ZS or AMI
	Tx Waveform Shaper (T1 only)	0 ~ 133 ft 133 ~ 266 ft 266 ~ 399 ft 399 ~ 533 ft 533 ~ 655 ft
	Stability	±50 ppm
	Jitter performance	G.823 (sections 2 & 3)
Diagnostics	Green LED	On: Interface is operational and in service Off: No 2 Mbit/s input signal Flashing: The interface loopback is active.
	Yellow LED	On: Alarm Off: No alarm

Q4EM Quad 4 Wire E&M Interface

General	Audio	64 kbit/s (PCM A-Law as per ITU G.711) 32, 24 and 16 kbit/s (ADPCM as per ITU G.726 and ANSI TI.303)
	E&M signalling	8 kbit/s per port
	Maximum line length	400 metres
Analogue	Transmission performance characteristics	ITU G.712 E4 for an operating level range of -14 dBr to +4 dBr for a G.711 64 kbit/s coded channel
	Input level range	-14.0 dBr to +4.0 dBr in 0.5 dB steps
	Output level range	-14.0 dBr to +4.0 dBr in 0.5 dB steps
	Default output level	0 dBr
	Default input level	0 dBr
	Maximum level	+3.14 dBm0
	Port impedance	600 Ω
	Return loss	better than 25 dB over the frequency range 200 - 3600 Hz
	Transformer isolation	3.88 kV
	End to end gain Frequency response	0 dB ± 0.1 dB (300-3000 Hz) 0 dB ± 0.5 dB (250-3400 Hz)
	Audio line protection	Secondary protection
	Signal to total distortion	> 30 dB (0 dBm0 to -30 dBm0) > 22 dB (-45 dBm0)

Signalling	E&M	Mode independent (external power supply / ground reference required)
	Pulse distortion	4:1 multiplexed < 2.250 ms Non-multiplexed ≤ 250 μs
	M loop current	5.0 to 6.5 mA (constant current)
	M detection voltage	9 VDC
	M maximum voltage	60 VDC
	E circuit impedance	45 Ω closed > 100 kΩ open
	Maximum E circuit current	100 mA
	E maximum voltage	60 V
	E&M circuit protection	E: Current limited to 120 mA, overvoltage to 350 V M: Current limited to 6.5 mA, overvoltage to 100 V
Diagnostics	Green LED	Off: No external source applied to M wire On: External source applied to M wire Flashing: The interface loopback is active
	Yellow LED	Off: E wire relay contact open On: E wire relay contact closed

DFXO Dual Foreign Exchange Office Interface

General	Audio	64 kbit/s (PCM as per ITU G.711) 32, 24 and 16 kbit/s (ADPCM as per ITU G.726 and ANSI TI.303)
	Signalling allocation	8 or 32 kbit/s allocated for CAS (multiplexed / non multiplexed)
	Companding	A-Law or µ-Law
	Maximum line length	600 metres (2000 feet) on 0.4 mm / 26 AWG copper pair
	Calling line ID (CLI)	Support provided for ETSI: EN 300 659-1 & 2 and BT: SIN 227 and 242
	Fax	Conforms to G3 standard for 64 kbit/s PCM and 32 kbit/s ADPCM compression
Analogue	Transmission performance characteristics	ITU G.712 E2 for an operating level range of -6 dBr to +1 dBr for a G.711 64 kbit/s coded channel
	Input level range	-10 dBr to +1.0 dBr in 0.5 dB steps
	Output level range	-10 dBr to +1.0 dBr in 0.5 dB steps
	Default Input level	-4.0 dBr
	Default Output level	-1.0 dBr
	Maximum level	+3.14 dBm0
	Line impedance / Hybrid balance impedance options	600 Ω 900 Ω 600 Ω + 2.16 µF 900 Ω + 2.16 µF 270 Ω + 750 Ω || 150 nF (TBR-21) 220 Ω + 820 Ω || 120 nF (TN12) 370 Ω + 620 Ω || 310 nF (BT3) 320 Ω + 1050 Ω || 210 nF (BT Network) 200 Ω + 680 Ω || 100 nF (China)
	Return Loss	better than 12 dB 300 Hz to 600 Hz better than 15 dB 600 Hz to 3400 Hz
	Trans hybrid loss	better than 13 dB 300 Hz to 3400 Hz better than 17 dB 500 Hz to 2500 Hz (with matched external line and hybrid balance impedance)
	Common mode rejection ratio	better than 40 dB 50 Hz to 3800 Hz better than 46 dB 600 Hz to 3400 Hz
	Echo Canceller	provides up to 64 ms of echo cancellation reduces the echo by more than 15 dB at an input signal level of –10 dBm0.

Signalling	DTMF dialing	Standard DTMF dialing over the voice channel
	Pulse dialing	Transparent decadic signalling at 7 - 14 PPS with break period limits of 60 - 73 %
	Pulse distortion	4:1 multiplexed < 2.250 ms Non-multiplexed ≤ 250 μs
	Reversals	Line polarity reversal detection
	Loop current limit	maximum of 60 mA with Loop Current Limiter On maximum of 160 mA with Loop Current Limiter Off
	Metering level sensitivity	12 kHz / 16 kHz billing tone detection with a selectable level sensitivity of -17dBm to -40 dBm in 1dB steps into 200 Ω (60 mV rms to 5 mV rms into 200 Ω).
	Metering level maximum	The maximum level of metering signal the DFXO can tolerate without voice band interference is 0.8 Vrms into 200 Ω.
	Loop resistance on-hook	>1 MΩ
	Ringing detection threshold	Three selectable options of 16 Vrms, 26 Vrms and 49 Vrms ± 20 %.
	Ringing detection frequency	15 to 50 Hz sine wave
	Ringing input impedance	Two selectable options of >1 MΩ and >12 kΩ
	Ringing DC offset range tolerance	0 to -75VDC
	Ringing input voltage maximum	up to 100 Vrms
	Ringing cadence limits	min / max Ringing ON: 270 ms / 10 secs Ringing OFF: 180 ms / 4 secs
	Ringing cadence distortion	< 40 ms cadence error on both ring and silent periods
Physical	Physical interface	Dual RJ-45 per port (1 line port, 1 monitor port)
Diagnostics	Green LED	Off: Interface operational but not in service On: Interface in service Flashing: Cadenced ringing on line
	Yellow LED	Off: No interface alarm On: Interface alarm Flashing: The interface loopback is active

DFXS Dual Foreign Exchange Subscriber Interface

General	Audio	64 kbit/s (PCM as per ITU G.711) 32, 24 and 16 kbit/s (ADPCM as per ITU G.726 and ANSI TI.303)
	Signalling Allocation	8 or 32 kbit/s allocated for CAS (multiplexed / non multiplexed)
	Compression coding	A-Law or µ-Law
	Maximum line length	600 metres (2000 feet) on 0.4 mm / 26 AWG copper pair
	Calling line ID (CLI)	Support provided for ETSI: EN 300 659-1 & 2 and BT: SIN 227 and 242
	Fax	Conforms to G3 standard for 64 kbit/s PCM and 32 kbit/s ADPCM compression
Analogue	Transmission performance characteristics	ITU G.712 E2 for an operating level range of -6 dBr to +2.0 dBr for a G.711 64 kbit/s coded channel
	Input level range	-9.0 dBr to +2.0 dBr in 0.5 dB steps
	Output level range	-9.5 dBr to +2.5 dBr in 0.5 dB steps
	Default Input level	+1.0 dBr
	Default Output level	-6.0 dBr
	Maximum level	+3.14 dBm0
	Line impedance / Hybrid balance impedance options	600 Ω 900 Ω 600 Ω + 2.16 µF 900 Ω + 2.16 µF 220 Ω + (820 Ω || 120 nF) (TN12) 270 Ω + (750 Ω || 150 nF) (TBR21) 370 Ω + (620 Ω || 310 nF) (BT3)
	Return Loss	better than 12 dB 300 Hz to 600 Hz better than 15 dB 600 Hz to 3400 Hz
	Trans hybrid loss	better than 13 dB 300 Hz to 3400 Hz better than 17 dB 500 Hz to 2500 Hz (with matched external line and hybrid balance impedance)
	Common mode rejection ratio	better than 40 dB 50 Hz to 3800 Hz better than 46 dB 600 Hz to 3400 Hz

Signalling	Feed voltage output	-48 V (160 + 160 Ω voltage source current limited)
	Loop current limit	35 mA ± 10 %.
	Seize signal	Loop start only (no ground start)
	Loop detect threshold	9 to 12 mA (step function between on hook and off hook)
	Loop non-seizure current	> 6 mA (step function between on hook and off hook)
	Loop release threshold	> 4 mA
	DTMF dialing	Standard DTMF dialing over the voice channel
	Pulse dialing	Transparent decadic signalling at 7 - 14 PPS with break period limits of 60 - 73 % (with loop current > 23 mA)
	Pulse distortion	4:1 multiplexed < 2.250 ms Non-multiplexed ≤ 250 μs
	Reversals output	Line polarity reversal output (optional)
	Metering output frequency	12 kHz / 16 kHz ± 0.5 %.
	Metering output voltage	Four selectable output voltages of 100 mV, 200 mV, 300 mV and 400 mV rms into 200 Ω ± 20 % sourced via the Line Impedance setting but limited to a maximum open circuit voltage of 1 Vrms.
	Metering output distortion	Billing tone total distortion < 5 %.
	Ringer waveform	Sinusoidal with a maximum total distortion of 10% (into 3 REN load)
	Ringer voltage (open circuit)	Five selectable ringer output voltages sourced via an internal ringing resistance of 178 Ω per port. The ringing output is a composite balanced AC ringing voltage with a differential DC offset voltage. 60 Vrms + 0 VDC 55 Vrms + 10 VDC 50 Vrms + 18 VDC 45 Vrms + 22 VDC 40 Vrms + 24 VDC Both the DC and AC components have a tolerance of ± 5%.
	Ringer output frequency	Three selectable options of 17, 25 or 50 Hz ± 5%
	Ringer output power	60 Vrms source into a load of 2 REN 45 Vrms source into a load of 3 REN (1 REN ≈ 6930 Ω in series with 8 μF)
	Ring trip	Ring trip will ocurr in < 150 ms following DC loop of > 20 mA
	Ring trip immunity	Ring trip will not ocurr if the DFXS outputs ringing into a load of 500 Ω in series with 4.4μF or less.
Physical	Physical interface	Dual RJ-45 per port (1 line port, 1 monitor port)
	Line protection	Secondary protection (4RF recommends the use of external primary protection in lightning prone areas)
Diagnostics	Green LED	Off: Interface operational but not in service On: Interface in service Flashing: Cadenced ringing on line
	Yellow LED	Off: No interface alarm On: Interface alarm Flashing: The interface loopback is active

QV24 Quad V.24 Serial Data Interface

General	Interface	ITU-T V.24 / EIA/TIA RS-232E
	Interface direction	DCE only
	Bandwidth allocation	8 to 120 kbit/s in 8 kbit/s steps (dependent on rate selected)
	Control line allocation	8 kbit/s
	Maximum line length	10 metres
	Data clamp	Mark hold when out of sync.
	Control line clamp	Off when loss of sync.
	Clock	Internally generated from 2.048 MHz system clock (synchronized at both ends)
Async parameters	Transparent mode	Operation is completely transparent but limited to 0-600 bit/s
	Standard mode data bits	7 or 8 bits
	Standard mode parity	Transparent (enable / disable)
	Standard mode stop bits	1 or 2 bits
	Asynchronous Data rates	300, 600, 1200, 2400, 4800, 7200, 9600, 12800, 14400, 19200, 23040, 28800, 38400, 57600 and 115200 bit/s
Control signals	End-to-end	CTS to RTS, DSR to DTR
Diagnostics	Green LED	Indicates RX data traffic present
	Yellow LED	Indicates TX data traffic present

QV24S Quad V.24 Serial Data Interface

General	Interface	ITU-T V.24 / EIA/TIA RS-232E
	Interface direction	DCE only
	Bandwidth allocation	8 to 120 kbit/s in 8 kbit/s steps (dependent on rate selected)
	Control line allocation	8 kbit/s
	Maximum line length	10 metres
	Data clamp	Mark hold when out of sync.
	Control line clamp	Off when loss of sync.
	Synchronous Data rates	300, 600, 1200, 2400, 4800, 9600 and 19200 bit/s
Control signals	End-to-end	CTS to RTS
Diagnostics	Green LED	Indicates RX data traffic present
	Yellow LED	Indicates TX data traffic present

HSS Single High Speed Synchronous Data Interface

General	Interfaces	ITU-T V.35 ITU-T X.21 EIA RS-449 EIA RS-530
	Bandwidth allocation	8 to 2048 kbit/s in 8 kbit/s steps (dependent on rate selected) 8 kbit/s for control lines
	Maximum line length	3 metres
	Clock	Internally generated from 2.048 MHz system clock (synchronized at both ends) on DCE to DCE mode. Clock provided by external DCE when in DTE mode. Remote DCE outputs clock-timed by incoming clock at DTE.
Diagnostics	Top Green LED	On: Normal operation Flashing: Loopback
	Lower Green LED	On: Normal operation

External Alarm Interfaces

Alarm inputs	Detector type	Isolated current detectors
	Detection current	5.0 to 6.5 mA (constant current)
	Detection voltage	9 to 60 VDC or AC rms
Alarm outputs	Contact type	Isolated semiconductor relay type contacts
	Maximum current	100 mA
	Maximum voltage	0 to 60 VDC or AC rms
	Ouput impedance	45 Ω closed > 100 kΩ open
Overall	Latency	The latency for an alarm presented on an external alarm input to the alarm being output on an external alarm output is < 2 seconds

Auxiliary Interfaces

Management	Configuration and management	Embedded web server and / or SNMP accessed via Ethernet interface or across link
Test points	RSSI	Front panel test point for measuring the RSSI voltage

Power Specifications

AC Power Supply

Nominal voltage	Input voltage range	Maximum Power input	Max VA	Frequency
115 VAC	103 - 127 Vrms	180 W	400 VA	47 - 63 Hz
230 VAC	207 - 254 Vrms	180 W	400 VA	47 - 63 Hz

DC Power Supply

Nominal voltage	Input voltage range	Maximum Power input	Maximum input current	Recommended DC breaker rating
+12 VDC LP	10.5 to 18 VDC	53 W	5 A	8 A
±12 VDC	10.5 to 18 VDC	180 W	18 A	25 A
±24 VDC	20.5 to 30 VDC	180 W	8 A	10 A
±48 VDC	40 to 60 VDC	180 W	4 A	5 A

Power Consumption

Terminal Type	**Power Consumption** (min – max)
Standard Aprisa XE 1+0 terminal	34 to 170 W Input power (dependent on the transmitter output power, the interface cards fitted and the power supply option)
Standard Aprisa XE 1+1 terminal	74 to 375 W Input power (dependent on the transmitter output power, the interface cards fitted, the number of trib switches and the power supply option)
Standard Aprisa XE HSD terminal	68 to 286 W Input power (dependent on the transmitter output power, the interface cards fitted and the power supply option)

Power Consumption Model

An Aprisa XE Power Consumption model program called XEpower is on the Aprisa XE CD. This program shows the typical power consumption for any product configuration. Java 1.6 is required to be installed on your PC to run this program.

Standard Aprisa XE 1+0 terminal – 48 VDC

These power consumption figures represent the typical power drawn by a single standard 1400 MHz 1+0 terminal measured at the input to a ± 48 VDC power supply.

Power Consumption (min – max)	40 to 150 W Input power (dependent on interface cards fitted and transmitter output power level)
Terminal only:	
TX power of + 20 dBm	44 W
TX power of + 25 dBm	54 W
TX power of + 30 dBm	61 W
TX power of + 35 dBm	64 W
Interface cards:	
QJET four port E1 card	2.3 W (four ports operating)
Q4EM four port 4W E&M card	0.6 W (all states)
QV24 four port V.24 card	0.2 W (all states)
DFXO two port 2W FXO card	0.7 W (all states)
DFXS two port 2W FXS card	One DFXS card installed with both ports idle (on hook): 2.5 W Plus: 1.9 W / line off-hook (200 ohm copper loop plus 450 ohm telephone) 1.0 W / line ringing (60 Vrms 25Hz source via 100 ohm copper loop into a 1 REN load) 1.5 W / line ringing (45 Vrms 25Hz source via 100 ohm copper loop into a 3 REN load)
HSS single port high speed data	1.0 W (all states)
MHSB:	
Tributary and RF switch	13 W not switched
	25 W switched

Low Power Aprisa XE 1+0 terminal – 12 VDC

These power consumption figures represent the typical power drawn by a single low power 1400 MHz 1+0 terminal measured at the input to a low power +12 VDC power supply.

Power Consumption (min – max)	34 to 53 W Input power (dependent on interface cards fitted and transmitter output power level)
Terminal only:	
TX power of + 20 dBm	34 W
TX power of + 24 dBm	40 W
Interface cards:	
QJET four port E1 card	1.9 W (four ports operating)
Q4EM four port 4W E&M card	0.53 W (all states)
QV24 four port V.24 card	0.15 W (all states)
DFXO two port 2W FXO card	0.56 W (all states)
DFXS two port 2W FXS card	One DFXS card installed with both ports idle (on hook): 2.1 W Plus: 1.6 W / line off-hook (200 ohm copper loop plus 450 ohm telephone) 0.8 W / line ringing (60 Vrms 25Hz source via 100 ohm copper loop into a 1 REN load) 1.2 W / line ringing (45 Vrms 25Hz source via 100 ohm copper loop into a 3 REN load)
HSS single port high speed data	0.85 W (all states)

Protection System Specifications

MHSB Protection

MHSB switches	Switching time	< 25 ms from detection of alarm condition
	Switch hysteresis	30 seconds (to prevent switching on short alarm transients)
	RF path restore time	< 10 seconds
RF switch	TX relay / cable loss	≤ 1.0 dB
	RX splitter / cable loss	≤ 4.0 dB
	Total system loss	System gain reduced by a maximum of 5 dB
Tributary switch	Ports	8

HSD Protection

TX path	TX relay / cable loss	≤ 1.0 dB
Switching times	Transmit path	< 25 ms from detection of alarm condition
	Receive path	Hitless

General Specifications

Environmental

Operating range	-10 to +50° C
Storage range	-20 to +70° C
Humidity	Maximum 95% non-condensing
Acoustic noise emission	59 dBA (A-weighted Sound Power Level)

Mechanical

Height	Standard terminal 2 U high (internal duplexer) 3 – 4 U high (depending on external duplexer type) MHSB terminal 6 U high (internal duplexer) 7 – 8 U high (depending on external duplexer type) HSD terminal 4 U high (internal duplexer) 6 – 8 U high (depending on external duplexer type)
Width	19-inch rack mount 434 mm (without mounting brackets attached) 483 mm (with mounting brackets attached)
Depth	372 mm
Colour	Pure black
Weight	Standard terminal 8 kg (internal duplexer) 9 - 12 kg (depending on external duplexer type) MHSB terminal 25 kg (internal duplexer) 26 – 29 kg (depending on external duplexer type) HSD terminal 17 kg (internal duplexer) 19 – 24 kg (depending on external duplexer type)

ETSI Compliance

Radio	EN 301 751, EN 300 630 EN 302 217 Parts 1, 2.1, and 2.2
EMI/EMC	EN 301 489 Parts 1 & 4
Safety	EN 60950 CSA 253147 applicable for AC, 48 VDC and 24 VDC product variants
Environmental	ETS 300 019 Class 3.2

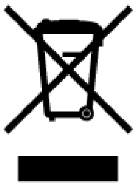
19. Product End Of Life

End-of-Life Recycling Programme (WEEE)

The WEEE Directive concerns the recovery, reuse, and recycling of electronic and electrical equipment. Under the Directive, used equipment must be marked, collected separately, and disposed of properly.

4RF Limited has implemented an end-of-life recycling programme to manage the reuse, recycling, and recovery of waste in an environmentally safe manner using processes that comply with the WEEE Directive (EU Waste Electrical and Electronic Equipment 2002/96/EC).

The WEEE Symbol Explained



This symbol appears on Electrical and Electronic Equipment (EEE) as part of the WEEE (Waste EEE) directive. It means that the EEE may contain hazardous substances and must not be thrown away with municipal or other waste.

WEEE Must Be Collected Separately

You must not dispose of electrical and electronic waste with municipal and other waste. You must separate it from other waste and recycling so that it can be easily collected by the proper regional WEEE collection system in your area.

YOUR ROLE in the Recovery of WEEE

By separately collecting and properly disposing of WEEE, you are helping to reduce the amount of WEEE that enters the waste stream.

One of the aims of the WEEE directive is to divert EEE away from landfill and encourage recycling. Recycling EEE means that valuable resources such as metals and other materials (which require energy to source and manufacture) are not wasted. Also, the pollution associated with accessing new materials and manufacturing new products is reduced.

EEE Waste Impacts the Environment and Health

Electrical and electronic equipment (EEE) contains hazardous substances which have potential effects on the environment and human health. If you want environmental information on the Aprisa XE terminal, contact us (on page 19).

20. Abbreviations

ADC	Analogue to Digital Converter
ADPCM	Adaptive Differential Pulse Code Modulation
ADSL	Asymmetrical Digital Subscriber Line
AGC	Automatic Gain Control
AMP	Amplifier
BER	Bit Error Rate
CAS	Channel Associated Signalling
CPE	Customer Premises Equipment
CLI	Calling Line Identification
DAC	Digital to Analogue Converter
dB	Decibels
dBc	Decibels relative to carrier power
dBm	Decibels relative to 1 mW
dBr	Decibels relative to the transmission reference point
DCE	Data Communications Equipment
DTE	Data Terminal Equipment
DTI	Digital Trunk Interface
E&M	Ear and Mouth
EMC	Electro-Magnetic Compatibility
EMI	Electro-Magnetic Interference
ESD	Electro-Static Discharge
ETSI	European Telecommunications Standards Institute
FAS	Frame Alignment Signal (E1 frame)
FEC	Forward Error Correction
FFE	Feed Forward Equalizer
F/W	Firmware
FXO	Foreign Exchange Office
FXS	Foreign Exchange Subscriber
GSM	Global System for Mobile communications
HSC	Hardware Software Compatibility
HSS	High-Speed Synchronous Serial
H/W	Hardware
IC	Integrated Circuit
IF	Intermediate Frequency
IP	Internet Protocol
I/O	Input/Output
ISP	Internet Service Provider
kbit/s	Kilobits per second
kHz	Kilohertz
LAN	Local Area Network
LED	Light Emitting Diode
LOS	Loss of Signal
mA	Milliamps
MAC	Media Access Control
Mbit/s	Megabits per second
MHSB	Monitored Hot Standby
MHz	Megahertz
MIB	Management Information Base
MTBF	Mean Time Between Failures
MTTR	Mean Time To Repair
ms	milliseconds
NFAS	Not Frame Alignment Signal (E1 frame)
NMS	Network Management System
OSI	Open Systems Interconnection
PABX	Private Automatic Branch Exchange
PBX	Private Branch Exchange
PC	Personal Computer
PCM	Pulse Code Modulation
PCA	Printed Circuit Assembly
PLL	Phase Locked Loop
POP	Point of Presence
POTS	Plain Old Telephone Service
ppm	Parts Per Million
PSTN	Public Switched Telephone Network
PMR	Public Mobile Radio

QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
RAI	Remote Alarm Indicator
RF	Radio Frequency
RoHS	Restriction of Hazardous Substances
RSSI	Received Signal Strength Indication
RX	Receiver
SNMP	Simple Network Management Protocol
SNR	Signal to Noise Ratio
SWR	Standing Wave Ratio
TCP/IP	Transmission Control Protocol/Internet Protocol
TCXO	Temperature Compensated Crystal Oscillator
TETRA	Terrestrial Trunk Radio
TFTP	Trivial File Transfer Protocol
TMR	Trunk Mobile Radio
TX	Transmitter
UTP	Unshielded Twisted Pair
VAC	Volts AC
VCO	Voltage Controlled Oscillator
VDC	Volts DC
VoIP	Voice over Internet Protocol
WEEE	Waste Electrical and Electronic Equipment

21. Acknowledgments and Licensing

The Aprisa XE product software runs the GNU Linux Operating System and incorporates several other packages in accordance with the free software philosophy.

The following list identifies the licensed software used:

BusyBox

Description: Tiny versions of common UNIX utilities

Reference: http://busybox.net/

License Type: GNU General Public License (GPL)

DropBear SSH Server

Description: Small and secure SSH Server

Reference: http://matt.ucc.asn.au/dropbear/

License Type: MIT Style License

GoAhead WebServer 2.1

Description: Embedded Web Server

Reference: http://webserver.goahead.com/

License Type: Private License

Linux Kernel

Description: Linux Kernel version 2.4.26

Reference: http://www.kernel.org/

License Type: GNU General Public License (GPL)

Net-SNMP

Description: Various tools relating to SNMP

Reference: http://www.net-snmp.org/

License Type: CMU/UCD and BSD License

uClibc

Description: C library for embedded Linux systems

Reference: http://uclibc.org/

License Type: GNU Lesser General Public License (LGPL)

U-Boot

Description: Bootloader

Reference: http://u-boot.sourceforge.net/

License Type: GNU General Public License (GPL)

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The following copyright notices are included for packages not covered by the GPL:

Dropbear SSH Server (MIT License)

Dropbear—a SSH2 server

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Net-SNMP

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GoAhead WebServer (Private License)

GoAhead WebServer

22. Commissioning Form

APRISA XE COMMISSIONING FORM

Site name		
Terminal name		
IP address	A:	B:
Serial number	A:	B:
Installation date		
Channel size		
Remote site name		
Remote terminal name		
Remote IP address	A:	B:
RX frequency		
TX frequency		
TX power		
Modulation		
RSSI		
Fade margin		
SNR		
BER		period
Cross-connection configuration file saved		☐
Notes		
Name		
Signature		
Date		

23. Index

Q

R

S

T

U

V

W

X